Initial Environmental Examination

March 2013

BAN: Urban Public and Environment Health Sector Development Program: Rajshahi Secondary Transfer Stations

Prepared by the Local Government Division, Ministry of Local Government, Rural Development and Cooperatives, Government of the People's Republic of Bangladesh for the Asian Development Bank

CURRENCY EQUIVALENTS

(as of 8 April 2013)

Currency unit	–	Taka (Tk)
Tk.1.00	=	$0.01281
$1.00	=	Tk. 78.075

ABBREVIATIONS

ADB	–	Asian Development Bank
BBS	–	Bangladesh Bureau of Statistics
BCC	–	Behavior Change Communication
BOD	–	Biochemical Oxygen Demand
CC	–	City Corporations
CCPIU	-	City Corporations Program Implementation Units
COD	–	Chemical Oxygen Demand
DES	–	Domestic Environmental Specialist
DLS	-	Department of Livestock Services
DO	–	Dissolved Oxygen
DoE	–	Department of Environment
DSC	–	Design, Supervision, and Construction Consultant
DWASA	–	Dhaka Water Supply and Sewerage Authority
EA	–	executing agency
ECC	–	Environmental Clearance Certificate
EIA	–	Environmental Impact Assessment
EMP	–	Environmental Management Plan
EU	–	European Unions
HDPE	–	High Density Poly-Ethylene
IEE	–	Initial Environmental Examination
IES	–	International Environmental Specialist
IMA	–	Independent Monitoring Agency
LGD	–	Local Government Division
LGRDC	–	Ministry of Local Government, Rural Development and Cooperatives
NGO	–	nongovernmental organization
OM	–	Operations Manual
O&M	–	operation and maintenance
PPTA	–	Project Preparation Technical Assistance
RCC	–	Rajshahi City Corporation
RF	–	Resettlement Framework
RP	–	Resettlement Plan
SCMO	–	Safeguards and Community Mobilization Officer
SIEE	–	Summary Initial Environmental Examinations
SO	–	Safety Officer
STS	–	Secondary Transfer Stations
ToR	–	Terms of Reference
UPEHSDP	–	Urban Public and Environmental Health Sector Development Program
UPEHU	–	Urban Public and Environmental Health Unit
WMD	-	Waste Management Department

WEIGHTS AND MEASURES

ha	–	hectare
km	–	kilometer
m	–	Meter
Mm	–	millimeter
km/h	–	kilometer per hour

NOTE

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.

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I. INTRODUCTION

A. Purpose of the Report

1. With nearly 30% of the country's total population (around 140 million) currently living in urban areas along with a predicted to rise to 50% in the next 25 years and still a higher rate of urbanization than the previous ones, Bangladesh is beset with a situation of continued deterioration in the overall and general state of urban public and environmental health. Such a situation has its root in the existing services overwhelmed by continued influx of ever-increasing number of people in the urban areas and growth of slums and squatter settlements currently accommodating over 35% of the urban population. Disease prevention and health promotion in urban areas encompass a range of issues including water and sanitation, waste management, food safety, healthcare, awareness-raising, etc. These are all the responsibility of the city corporations and municipalities under the authority of the Local Government Division (LGD) of the Ministry of Local Government, Rural Development and Cooperatives (LGRDC). Most of these services are under-provided, particularly to the poor.

2. The Bangladesh Urban Public and Environmental Health Sector Development Program (UPEHSDP) aims to establish a sustainable approach to public and environmental health at national level to guide and support city corporations and municipalities in improving the quality of life and economic status of urban residents, especially the poor. This will be achieved by a range of measures, including: (i) creating an Urban Public and Environmental Health Unit (UPEHU) under LGD with a mandate to improve public health; (ii) improving staff and financial resources to enable city corporations and municipalities fulfill their responsibilities in public and environmental health; (iii) improving management of solid waste and hospital waste through municipality-managed public-private partnerships and other mechanisms; and (iv) improving food safety by providing food testing laboratories, food inspection services and sanitary slaughterhouses.

3. The program is being supported by ADB through: (i) a program loan to implement policy measures in institutional strengthening, financial reform, public/ environmental health strategies, governance and service delivery; and (ii) a sector loan, funding investments in municipal and hospital waste management, food safety, and pro-poor integrated services (water supply, sanitation, nutrition/ food security, and health of the urban poor). LGD of the MOLGRDC has been the Executing Agency (EA), whereas the six city corporations (Dhaka, Chittagong, Sylhet, Barisal, Khulna and Rajshahi) have been the implementing agencies. The Program is being implemented over a period of seven years (2010-2016) in the main urban areas of the country.

4. UPEHSDP has been classified by ADB as environmental assessment category B (some negative impacts but less significant than category A). The impacts of activities under the program loan, therefore, need to be reviewed by an Environmental Assessment of the Policy Matrix. The sector loan will be implemented via a series of subprojects, providing infrastructure and other improvements in a particular sector (waste management, food safety, etc). Four sample subprojects were developed by a Project Preparation Technical Assistance (PPTA) study and the environmental impacts of these were assessed by Initial Environmental Examinations (IEE) (or Environmental Reviews for Category C subprojects). Studies were conducted according to ADB Environment Policy (2002) and Environmental Assessment Guidelines (2003). Current IEE had been in line with the Environmental Assessment and Review Framework (EARF) developed for the purpose in 2009 and assessment of environmental impacts previously conducted on the above four sample subprojects developed through the PPTA study.

5. This Initial Environmental Examination (IEE) has been undertaken to (i) assess the extent and magnitude of impacts that the proposed Rajshahi Secondary Transfer Stations subproject in Rajshahi City Corporation area have on the overall environment within and around the subproject site; (ii) propose mitigation measures in respect of adverse impacts, enhancement of beneficial impacts; and (iii) formulate an Environment Management Plan (EMP).

B. Extent of IEE Study

6. Bangladeshi law and ADB policy require that the environmental impacts of development projects are identified and assessed as part of the planning and design process, and that action is taken to reduce those impacts to acceptable levels. This is done through the environmental assessment process, which has become an integral part of lending operations and project development and implementation worldwide.

1. ADB Policy

7. ADB's Environment Policy requires that environmental issues are taken into account in all aspects of the Bank's operations, and the requirements for Environmental Assessment are described in Operations Manual (OM) 20: Environmental Considerations in ADB Operations (2003). This states that ADB requires environmental assessment of all project loans, program loans, sector loans, sector development program loans, financial intermediation loans and private sector investment operations.

8. The nature of the 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 categories:

(i) **Category A.** Projects that could have significant environmental impacts. An Environmental Impact Assessment (EIA) is required.
(ii) **Category B.** Projects that could have some adverse environmental impacts, but of less significance than those for category A. An Initial Environmental Examination (IEE) is required to determine whether significant impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.
A Category B project may be classified as B-sensitive if it involves environmentally sensitive activities. Such projects require IEE, but have the same requirements for disclosure and Environmental Management Plans as Category A.
(iii) **Category C.** Projects those are unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are reviewed.

9. For Category B projects the Draft IEE reports, Summary IEE (SIEE) and any other reports prepared to comply with ADB procedure (in this case the EA of the Policy Matrix) are reviewed by ADB's Regional Department Sector Division and Social and Environmental Safeguards Division. They are also reviewed in-country by the Executing Agency, and additional comments may be sought from project affected people and other stakeholders. All comments are incorporated in preparing final documents, which are reviewed by the Executing Agency and the national environmental protection agency (in this case the Department of Environment, DoE). The EA then officially submits the reports to ADB for consideration by the Board of Directors.

2. National Law

10. **Environmental Assessment, Protection, and Pollution Control.** The main provisions for environmental protection and pollution control in Bangladesh are contained in the Environmental Conservation Act (ECA) of 1995 and the Environmental Conservation Rules (ECR) of 1997. These legislations also provide the principal mechanism for assessing and mitigating the environmental impacts of projects, both existing and proposed. Projects are classified as green, orange or red depending on their location and environmental impacts. Secondary Transfer Stations are not included explicitly in the categorization of projects provided in Schedule 1 of the law; however, "Waste incinerator" is listed under Red Category. But the STS are definitely not having such potential for creating environmental pollution as the waste incinerators. So these may be considered to fall under Category Orange – B.

11. Rule 7 states that the proponent of such projects must obtain a Location Clearance Certificate and an Environmental Clearance Certificate (ECC) from the Department of Environment (DoE). For Orange-B category projects this requires submission to the relevant DoE Divisional Officer of the following:

(i) Completed Application for Environmental Clearance Certificate, and the appropriate fee, shown in Schedule 13 of the Rules;
(ii) Report on the feasibility of the project;
(iii) Report on the IEE for the project, and its Process Flow Diagram, Layout Plan;
(iv) Report on the Environmental Management Plan;
(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).

12. As part of the Environmental Clearance Certificate application, a detailed Environmental Impact Assessment and environmental management plans satisfactory to the Department of Environment must be prepared. During the process of preparing the 2009 Environmental Planning Document, DoE was consulted and it was indicated that ADB IEE, SIEE, Resettlement Framework and other reports prepared during project preparation would be acceptable to DoE as fulfilling many of their national EIA requirements. However, they will review IEEs upon further submission by LGD. All projects are to submit any further materials, if any, as per requirement of DoE toward obtaining the Environmental Clearance Certificate.

13. The Rajshahi Secondary Transfer Stations subproject is considered to have some potential for environmental impacts therefore must conduct an IEE and prepare EMPs acceptable to DoE as part of the ECC application. Under the ECR DoE has 30 days to respond from the receipt of the ECC application for an Orange-B category project.

14. **Other Policies, Plans, and Strategies.** In addition to ECA and ECR, there are a numbers of other policies, plans and strategies which are applicable to the subproject. These are National 3R (Reduce, reuse, recycle) Strategy for Waste Management 2010, The Local Government (City Corporation) Act 2009, and Medical Waste Management Rules 2008.

15. The National Building Code 2006 and National Labor Act 2006 have defined certain measures to ensure proper safety and work environment as well as the compensation measures to the laborers. By national law, in order to be compensated, Contractors must follow these safety provisions and compensation arrangements. The implementing agency must ensure that

the appropriate occupational health and safety provisions have been included in the bidding documents and are being implemented by Contractor. As per the Safe Drinking Water Supply and Sanitation Policy 1998, provision for arsenic free drinking water and adequate sanitation will have to be ensured. The water quality needs to be monitored to ensure that the supplied water is safe for drinking.

16. The summary of environmental regulations and mandatory requirements for the proposed subproject is shown in **Table 1.**

Table 1: Summary of Environmental Regulations and Mandatory requirements for the Rajshahi STS Subproject

Acts/ Guidelines	Purpose	Applicability to the Subproject
Environmental Conservation Act, 1995 and Environmental Conservation Rules, 1997	- main provisions for environmental protection and pollution control in Bangladesh - provides the principal mechanism for assessing and mitigating the environmental impacts of projects, both existing and proposed - projects are classified as green, orange or red depending on their location and environmental impacts	- STSs are not included explicitly in the categorization of projects provided in Schedule 1 of the law; however, "Waste incinerator" is listed under Red Category. But the STS are definitely not having such potential for creating environmental pollution as the waste incinerators. So these may be considered to fall under Category Orange – B. - Rule 7 states a Location Clearance Certificate and an Environmental Clearance Certificate (ECC) must be obtained from the Department of Environment (DoE). - Recommends standards for disposal of different types of waste.
National 3R (Reduce, reuse, recycle) Strategy for Waste Management, 2010	- The national 3R Goal for waste management is to achieve complete elimination of waste disposal on open dumps, rivers, flood plains by 2015 through mandatory segregation of waste at source as well as to create a market for recycled products and provide incentives for recycling of waste. - The main objective of the 3R Strategy is to delineate ways and means of achieving national 3R goals through providing a uniform guideline for all stakeholders.	- Source segregation is mandatory and gave directives to municipalities to pursue organic waste-recycling projects through composting, refuse derived fuel, and biogas via Public Private Partnerships (PPPs). - It makes clear that medium to large-scale organic waste-recycling projects will be implemented and managed by the private sector. Moreover, the strategy makes recommendations concerning issues such as tipping fees and access to municipal land for recycling projects.
Local Government (City Corporation) Act, 2009	This Act was incorporated under Bangladesh Gazette on 15 October 2009. The act contains four sub-clauses regarding waste collection and management, which have been depicted as follows:	Construction of STS is necessary infrastructure to fulfill the responsibility of the City Corporations for collection, transportation and disposal of municipal solid wastes. Municipal solid waste will be collected in

Acts/ Guidelines	Purpose	Applicability to the Subproject
	– City Corporation will take all necessary steps to collect and dispose waste from all the roads, toilets, drains, structures and areas under its jurisdiction – The occupiers of all the structures and spaces within the jurisdiction of the City Corporation will be responsible for removing waste from their possession under the control and supervision of the Corporation. – Corporation will make arrangement for waste collection containers or other type of bins at different places of the city, and wherever such containers or bins are placed, the Corporation will ask the occupiers of the neighboring houses, structures and spaces to dump their wastes into these containers or bins through issuance of a general notice. – All the wastes removed or collected by or under direction of the staff of the Corporation as well as the wastes stored in the containers or bins established by the Corporation will be treated as the property of the City Corporation.	these STSs for onward transportation to the landfill site of the City Corporation outside the city.
Medical Waste Management Rules 2008	The main objective is to control overall management including collection, treatment and disposal of medical waste in Bangladesh.	STSs will not be used for collection of medical waste; these hazardous wastes will be collected, transported and disposed of separately by special arrangement.

C. Scope of the Study

17. This is the IEE for the Rajshahi Secondary Transfer Stations subproject. It discusses the environmental impacts and mitigation measures relating to the location, design, construction and operation of all physical works proposed under this subproject. This IEE report will clarify the situation to the Department of Environment and fulfill the requirement for obtaining Location Clearance Certificate and an Environmental Clearance Certificate (ECC) from DOE. This report will identify the potential environmental impacts due to implementation of the subproject and will suggest appropriate mitigation measures.

II. DESCRIPTION OF THE PROJECT

A. Type, Category and Need

18. This is a subproject in the field of solid waste management, and as explained above it has been classified by ADB as Category B because it is not expected to have major negative environmental impacts. Under ADB procedures such developments require an IEE to identify and mitigate the impacts, and to determine whether further study or a more detailed EIA may be required.

19. Improvements in solid waste management facilities are needed in Rajshahi and in other urban areas in Bangladesh because present services are inadequate. The main problems are that:

(i) Although house-to-house waste collection by NGOs or CBOs is available in most urban areas, slum dwellers still mainly dispose of garbage on open spaces;
(ii) Secondary waste collection has not expanded in line with the primary collection service because of inadequate cost recovery and insufficient public or private investment;
(iii) The interface between private sector primary collection and municipality-run secondary collection systems is also inefficient mainly because of a lack of mechanization.

20. UPEHSDP will address these issues by providing new mechanized Secondary Transfer Stations (STS) in Rajshahi, which may then be replicated in other urban centers through further subprojects.

B. Location, Size and Implementation Schedule

21. The Rajshahi STS subproject consists of 6 Secondary Transfer Stations (STSs) on small plots of Government land beside roads in different parts of the city; photographs of the proposed site are attached as Annex 2.

22. Locations of all the subprojects are shown in the following map (Fig 1). Since all these subprojects are located on Government owned land RCC does not need to acquire any land for the purpose. Locations of these STS sites are described in the following paragraphs. It may be mentioned here that as per requirement of the EARF selection criteria #14 for waste management, none of these 6 STSs described under Paragraphs 23 to 28 below are located within 30 meters of residences, schools, and churches. This will be again ensured during actual handing over of the layout plan and site to the contractor before the starting of construction activities.

23. STS site 1: This STS is located in W-5 opposite to Walton show room, south side of city bypass road, near court railway station in Mouza Haragram – 51; and RS Dag #2552 and Khatian #2.

24. STS site 2: This STS site is located in W-10 near Bohorompur city by pass moore, east side of crossing of Luxmipur road with city bypass, over the drain near boundary wall of Medical college, Mouza Luxmipur - 7; RS Dag #2406 & 2408, Khatian # 1 & 1/3.

25. STS site 3: This STS site is located in front of Terokhadia women sports complex, beside the road towards landfill site, Ward #14, Mouza Bohorompur - 77; RS dag #201, Khatian #1.

26. STS site 4: This STS is located in W-16 beside Suzadullah College, over wide drain in front of Rashik Composting Plant, Mouza Sopura - 79; RS Dag #413, Khatian #1.

27. STS site 5: This STS site is located in W-27 in front of Talaimari Adarsha School, west of RUET boundary wall, Mouza Ramchandrapur - 143; RS Dag #931, Khatian #92.

28. STS site 6: This STS site is located in W-28 in front of radio relay center, south of Rajshahi University, 50 feet east of Kazla water pump, Mouza Motihar - 141; RS Dag #443, Khatian #2.

29. Preliminary design of Rajshahi STS subproject has begun in the middle of 2012 and has been completed by the end of the year. As this subproject will be implemented on the basis of turnkey contract, the detailed design will be done by the contractor, and the IEE/ EMP will be updated at the time of detailed design and will be revised by the Design and Supervision Consultants (DSC) team. Construction of the civil works and procurement of equipment would take around 8 months. So the operation of the STSs should therefore begin in late 2013 or early 2014.

C. Description of the Project

30. The following preliminary design criteria formed the basis for selection of Secondary Transfer Stations and secondary collection/ haulage services:

- Development on a site 15 meters by 10 meters (150 m^2);
  - (i) Enclosed hall building with three roller shutter access points from the road;
  - (ii) Containers placed in pits equipped allowing primary collection rickshaws to empty collected waste by gravity into the containers;
  - (iii) Two pit or one pit system depending on population to be served and available land area;
  - (iv) Transfer of wastes directly into large capacity transfer containers through use of an electric hoist mounted onto two ceiling I-beams;
  - (v) Weighing the containers in the pits, thus allowing for maximum loads in each container without under-or-overloading.
  - (vi) Loading of containers directly onto transfer vehicles that have only a light weight tipping frame body, thus maximizing permitted waste loads.
  - (vii) Storage of full containers at any one time within the transfer station, allowing for daytime collection and night time transfer where there are traffic congestion problems.
  - (viii) Covering of full containers during storage/ transport to limit the potential for littering and release of odors.
  - (ix) High pressure water on site in order to keep the small transfer station clean and hygienic. At one time each day, the STS should be completely empty, allowing for a full wash down.
  - (x) Adaptation of available container and vehicle types to suit the purposes of waste transfer efficiency (e.g. use of a standard 4 x 2 (single rear axle, four wheels, two-wheel drive) truck fitted with a skeleton tipping frame so that a 16 tonne Gross

Vehicle Weight (GVW) truck can carry an 8 tonne payload without any overloading. Container capacity 26 m.

(xi) Alternatively, for longer haul distances, use of a 6 x 4 (double rear axle) trucks of 28,000 kg GVW and a payload of up to 18 tonnes. Container capacity can be up to 36 m.

(xii) Containers designed to resist 'anaerobic crevice corrosion', which is the main corrosion problem of vehicle bodies and manufactured from CorTen steel to further resist corrosion.

(xiii) Where the STS is located in an area with high-rise buildings, the space above the STS can be used for residential or office purposes as long as operational/ management controls are sufficiently in place to limit noise, littering and odor.

31. Implementation of small transfer stations is anticipated to lead to a 50% reduction in operating cost of secondary collection services per tonne. This will free up significant resources to expand the coverage and quality of secondary collection services, as well as to pay for the operating and maintenance costs of the integrated waste treatment and disposal facility.

32. Electrical, mechanical machineries and equipment are also included in the subproject to operate the STS to modern sanitary standards.

33. Figures 2 to 13 provide preliminary site layout plans including the North and East Coordinates as well as the tentative plans of the 6 STSs.

Fig 1: Location Plan for 6 STSs in Rajshahi CC

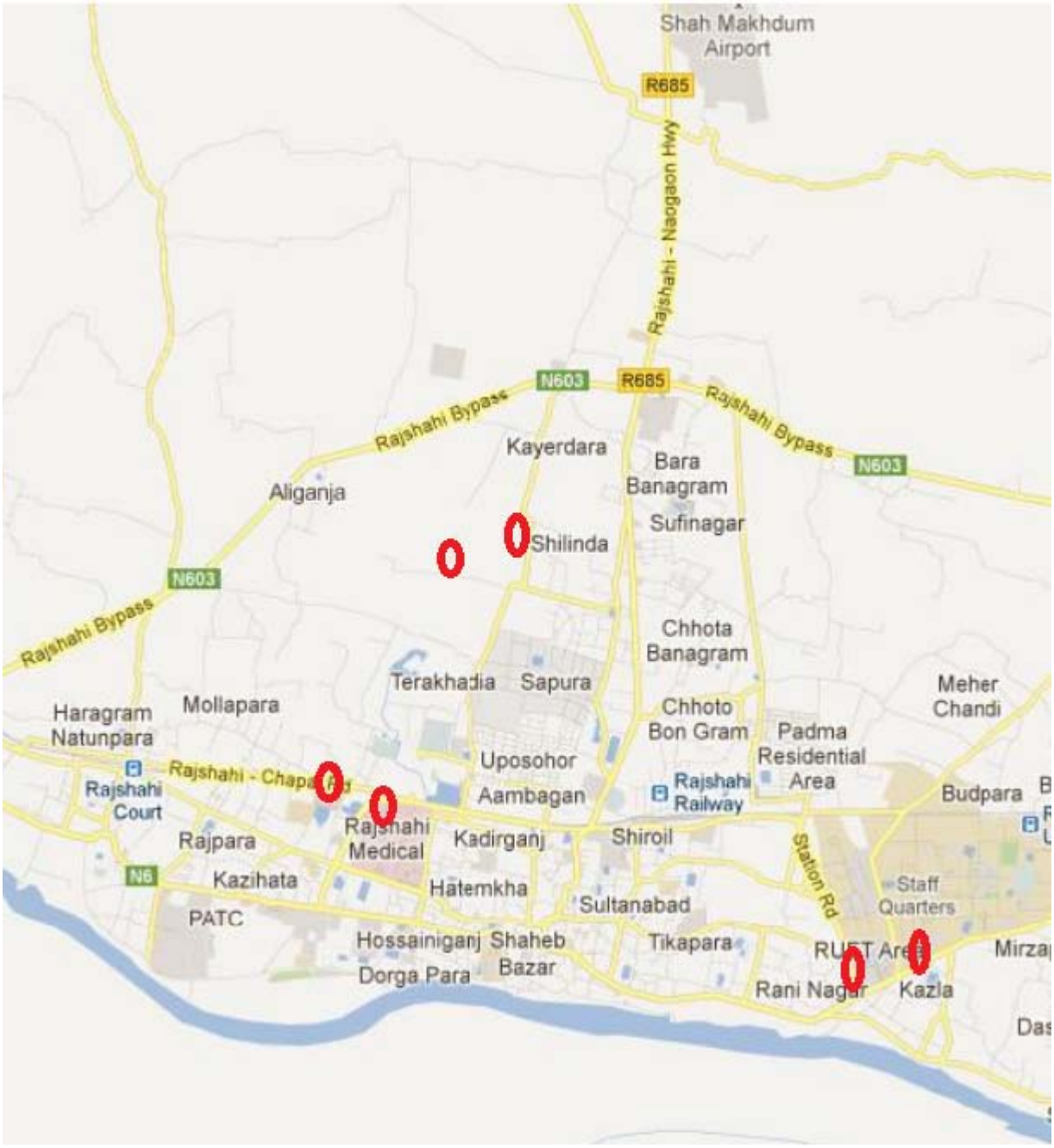


Fig 2: STS – 1 Court Station Walton Showroom Layout Plan (24°22'45"N, 88°33'58"E)

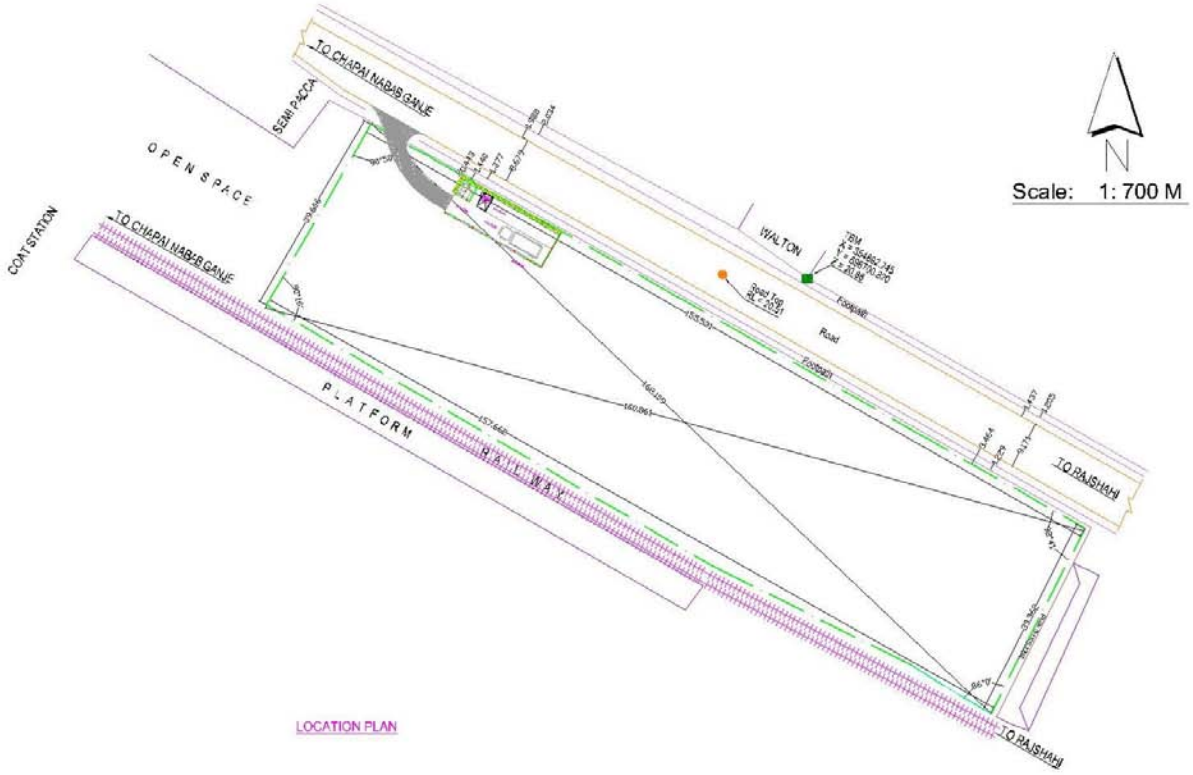


Fig 3: STS – 1 Court Station Walton Showroom Preliminary Plan

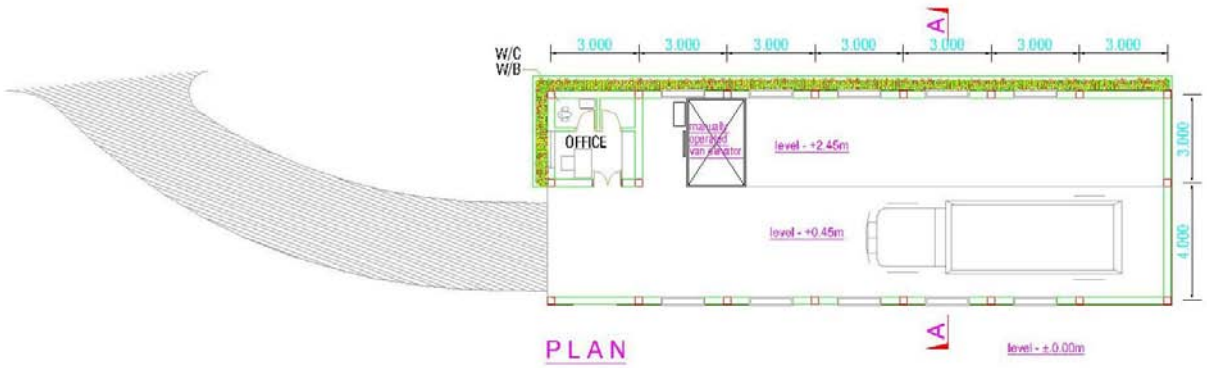


Fig 4: STS – 2 Rajshahi Medical College Layout Plan (24°22'35"N, 88°35'9"E)

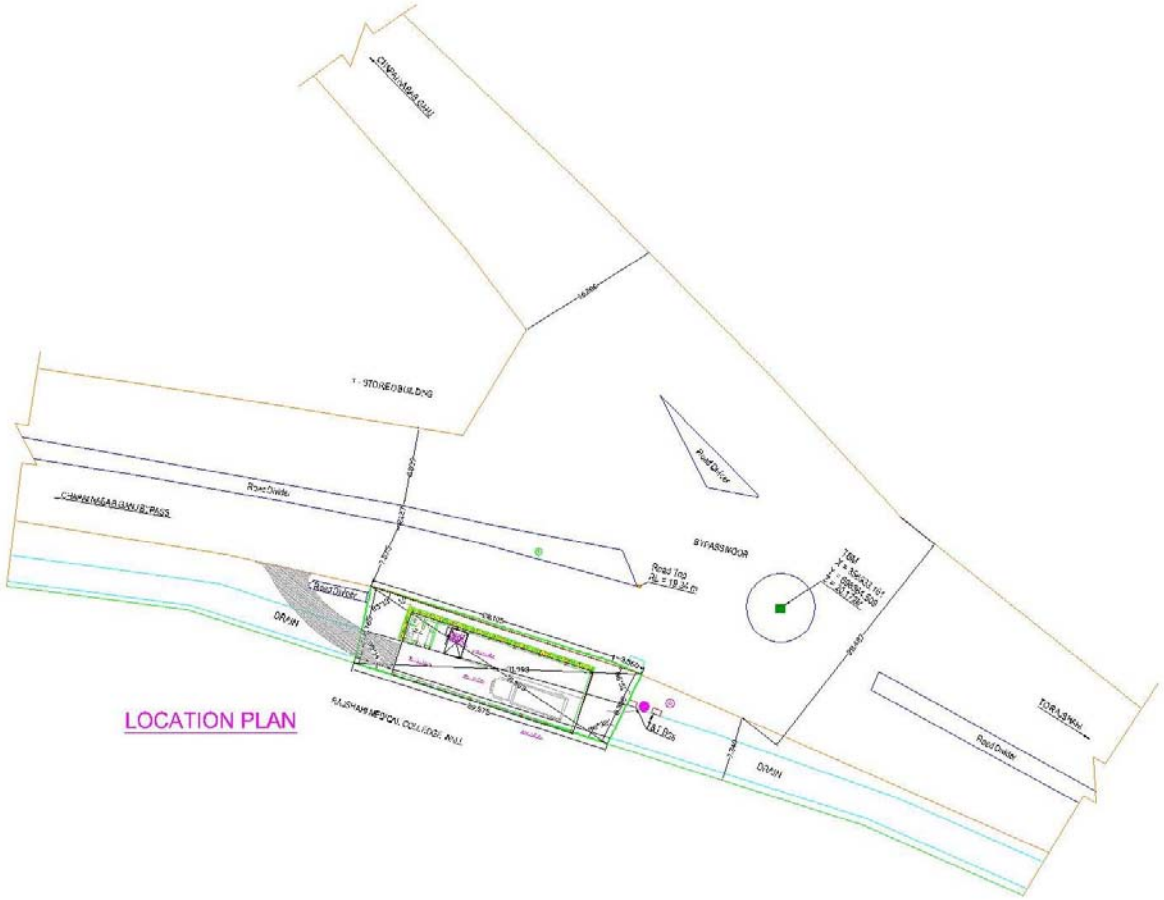


Fig 5: STS – 2 Rajshahi Medical College Preliminary Plan

Fig 6: STS – 3 Terokhadia Women Sports Complex Layout Plan (24°22'51"N, 88°35'16"E)

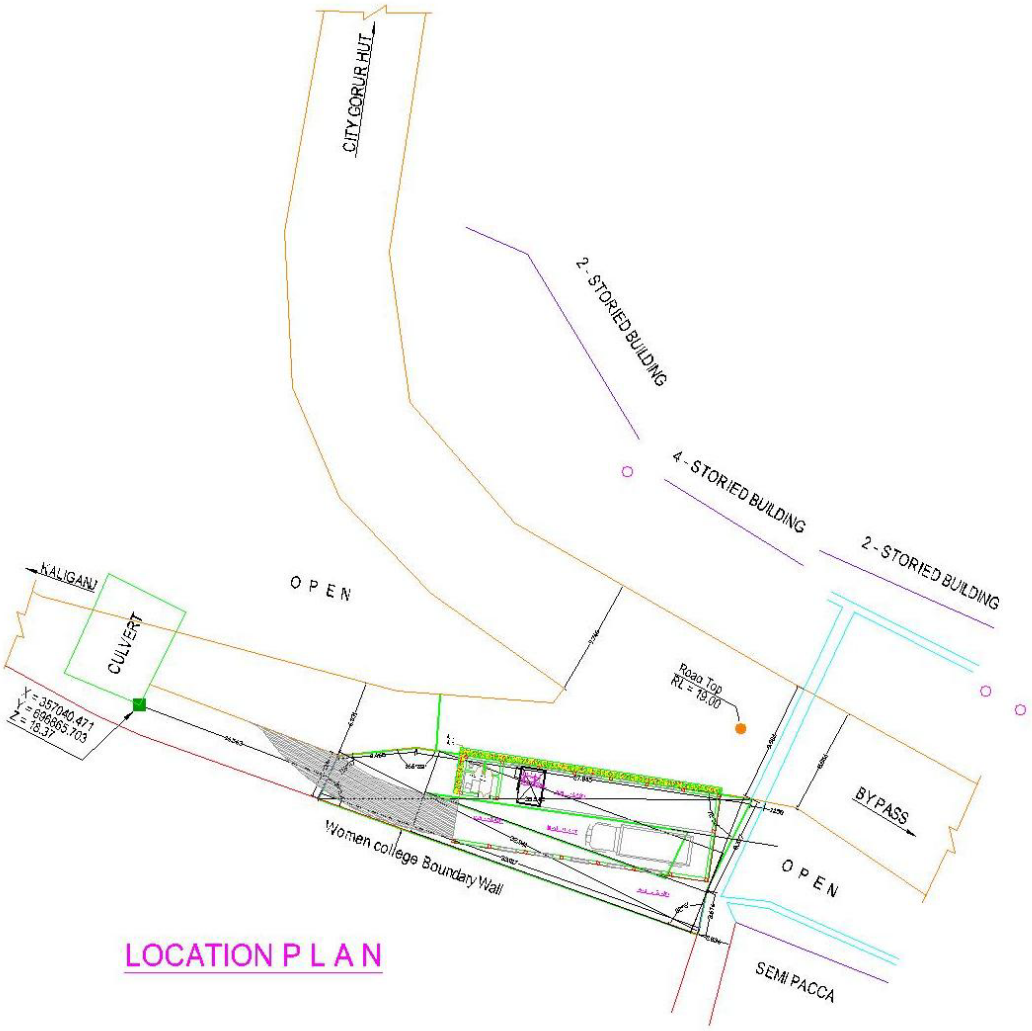


Fig 7: STS – 3 Terokhadia Women Sports Complex Preliminary Plan

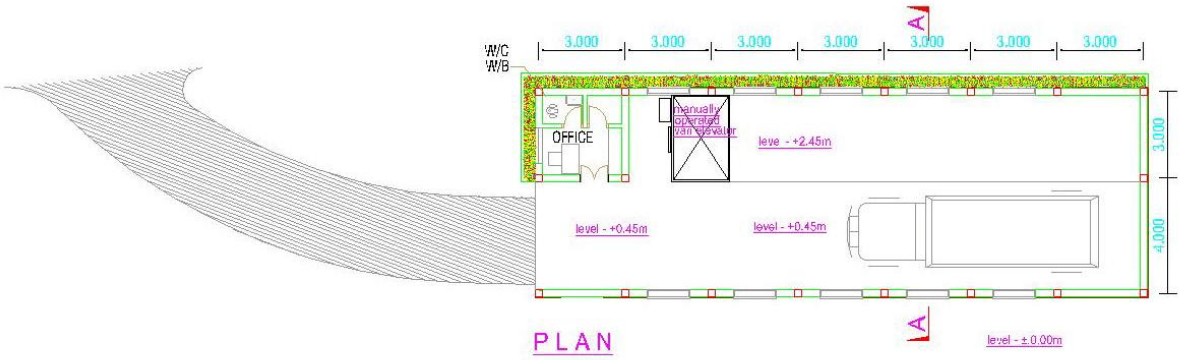


Fig 8: STS – 4 Rashik Composting Plant Layout Plan(24°23'28"N, 88°35'16"E)

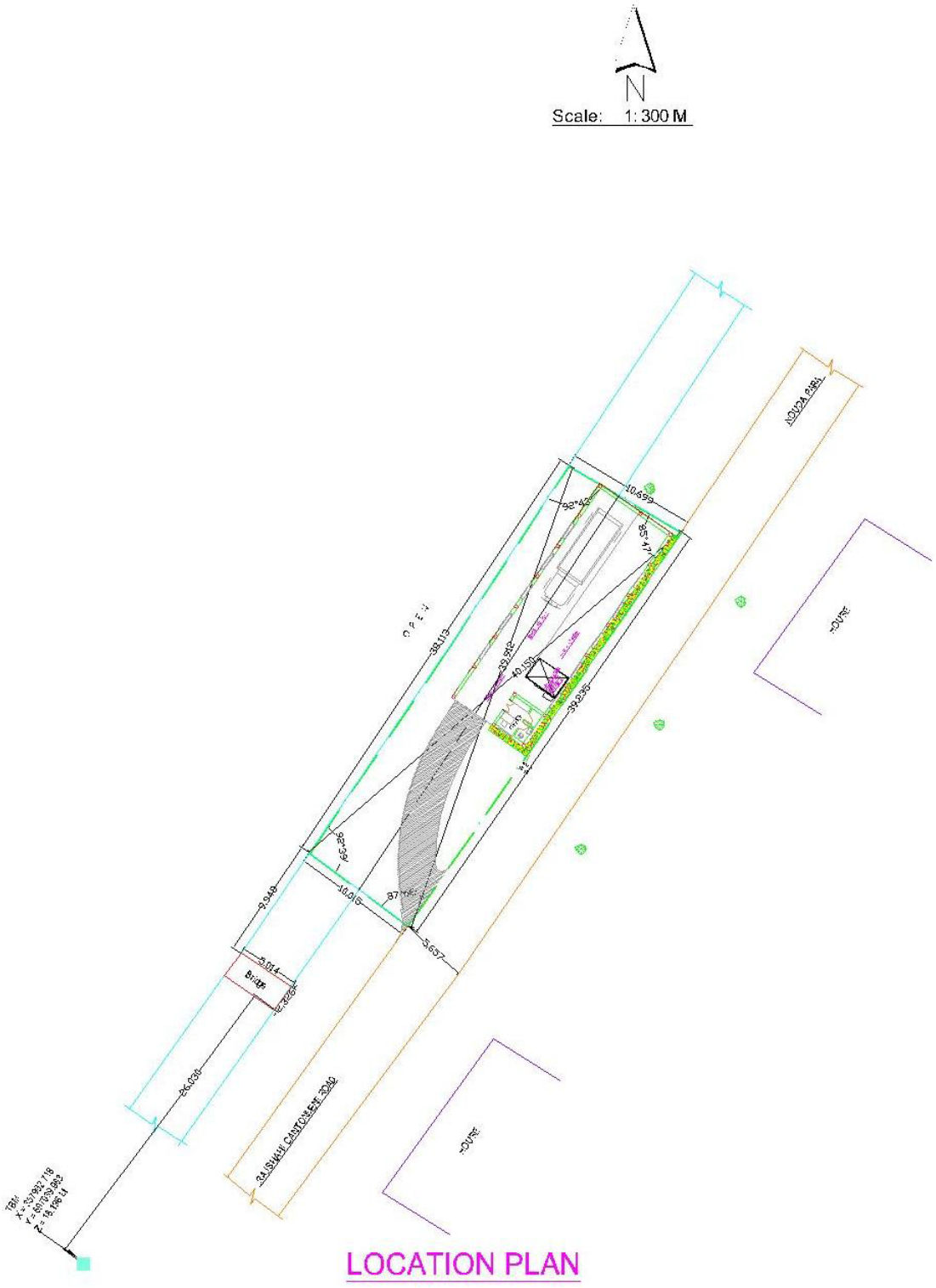


Fig 9: STS – 4 Rashik Composting Plant Preliminary Plan

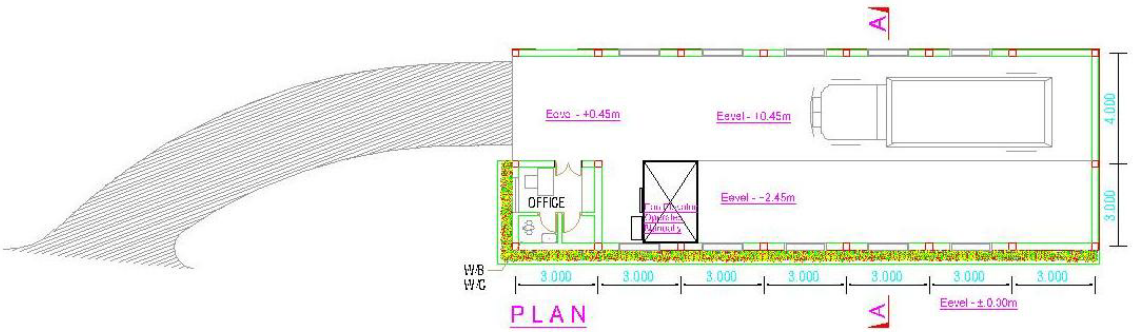


Fig 10: STS – 5 Talaimari Adarsha School Layout Plan (24°21'53"N, 88°37'33"E)

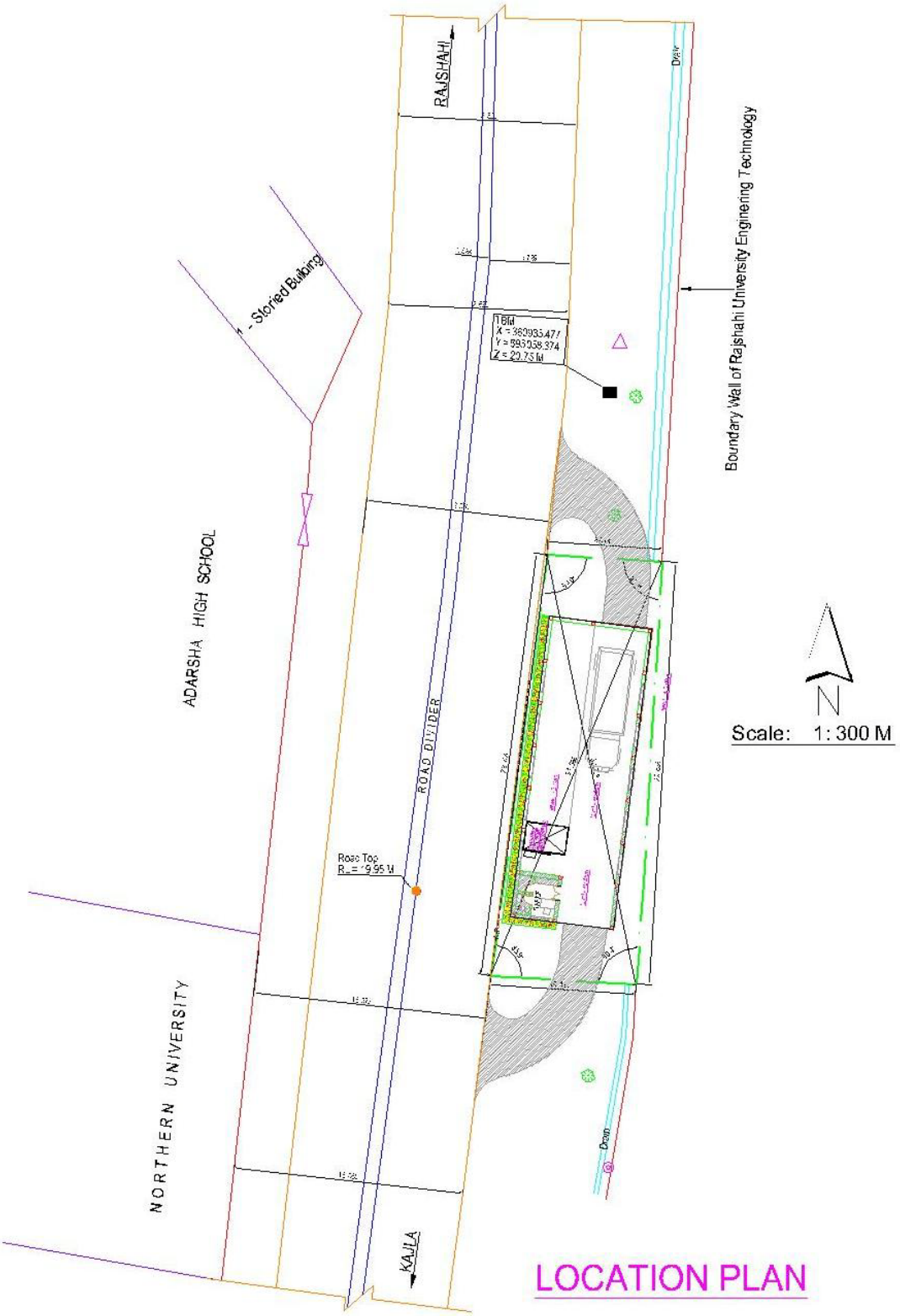


Fig 11: STS – 5 Talaimari Adarsha School Preliminary Plan

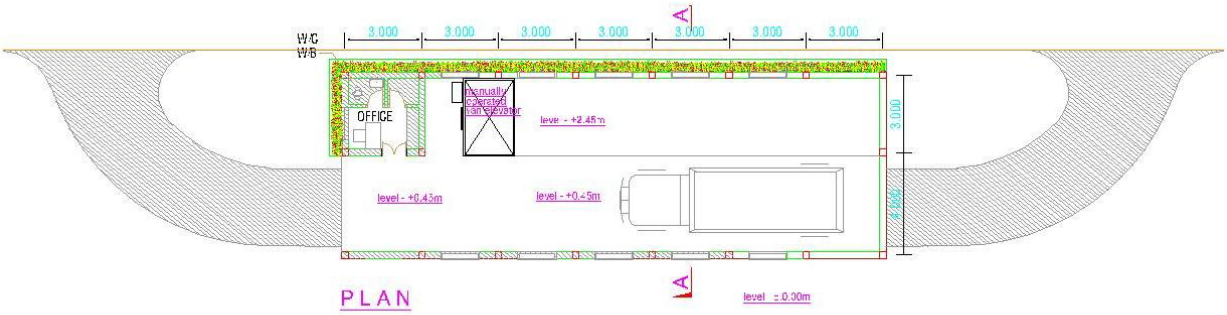


Fig 12: STS – 6 Kazla Water Pump Layout Plan (24°21'54"N, 88°38'7"E)

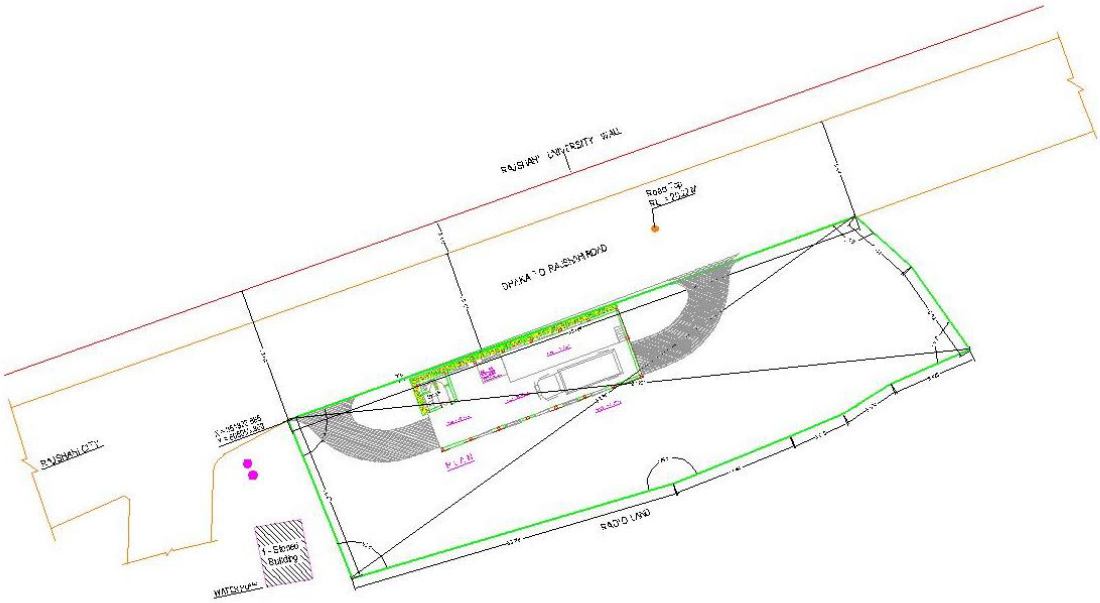
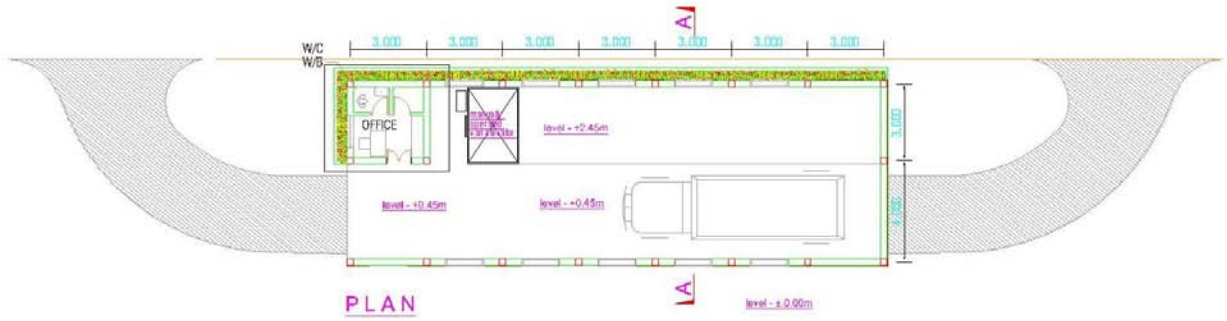


Fig 13: STS – 6 Kazla Water Pump Preliminary Plan



III. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources

1. Topography and Soils

34. The part of Bangladesh to which the silk city of Rajshahi belongs is dominated by the rivers Padma, Mahananda, Baral and Barnai rivers and their tributaries, which drain large quantities of water from the Himalayan Mountains into the Bay of Bengal, through a complex delta system of tidal tributaries and creeks, formed by sediment deposited by the rivers. This sub-region stretches between the Old Himayalan Piedmont Plain in the west and the right bank of the N – S flowing Brahmaputra in the east. An elongated outlier representing the floodplain of the ancient Teesta extends up to Sherpur (Bogra district) in the south. Most of the land is shallowly flooded during monsoons. The southern portion is located in the Ganges river floodplain. The Ganges channel is constantly shifting within its active floodplain, eroding and depositing large areas of new char land each flood season, but it is less braided than that of the Brahmaputra – Jamuna. Ganges alluvium is calcareous when deposited, but most basin clays and some older ridge soils have been decalcified and acidified in their upper layers; lime is found only in the subsoil or substratum of such soils. Clay soils predominate in basins and on the middle parts of most ridges, with loamy soils (and occasionally sands) occurring mainly on ridge crests.

35. Figure 14 representing the bio-ecological regions of Bangladesh shows the Teesta Floodplain (4a) where the north western region, accommodating the city of Rajshahi, belongs. The Barind area is located just in the north of Rajshahi city.

2. Climate

36. The climate in the subproject area is dry and sub-tropical, with a typical three season pattern. During the winter season (November-February), cool winds blow from the north-east. The weather is cool and dry. Rainfall, however, shows variations over the last decade (2002-2011) between 507 mm in June 2004 and 0 mm in December 2002. Average minimum temperatures show, over the same period, variation between 3.4°C in January 2003 and 25.6^{o}C in July 2010. Similarly, the maximum yearly temperature also varies like 38.0°C in March 2011 and 42.8°C in June 2005. Rainfall also increases, and this period is characterized by unstable weather. The monsoon begins in May-June as hot air rises over the Indian subcontinent, creating low pressure areas into which rush the cooler moisture-laden winds from the Indian Ocean and the Bay of Bengal. Around 70-80% of the annual rain falls during this time. The rain is often accompanied by strong winds, sometimes exceeding 100 km/h. Temperature and rainfall both decline post-monsoon, returning rapidly to the winter lows.

37. Wind data from the Bangladesh Meteorological Department Climate Division suggests that wind directions vary month-to-month in Rajshahi, though predominantly in the NW, S, and NE directions. As the STS' will be contained within tall walled structures and cleaned daily, windborne odor will get minimized.

38. Although weather patterns are broadly similar throughout the country, differences in topography, winds and other factors produce some quite marked local variations. This is particularly evident in the annual rainfall of around 1,786 mm in 2004 (last ten years' maximum) and 792 mm in 2010 (last ten years' minimum) in Rajshahi. Relative humidity, average dry bulb temperature, maximum and minimum temperatures and rainfall patterns are represented as

under based on the raw data obtained from the Bangladesh Meteorological Department (Fig 15, 16, 17, 18 and 19)[1].

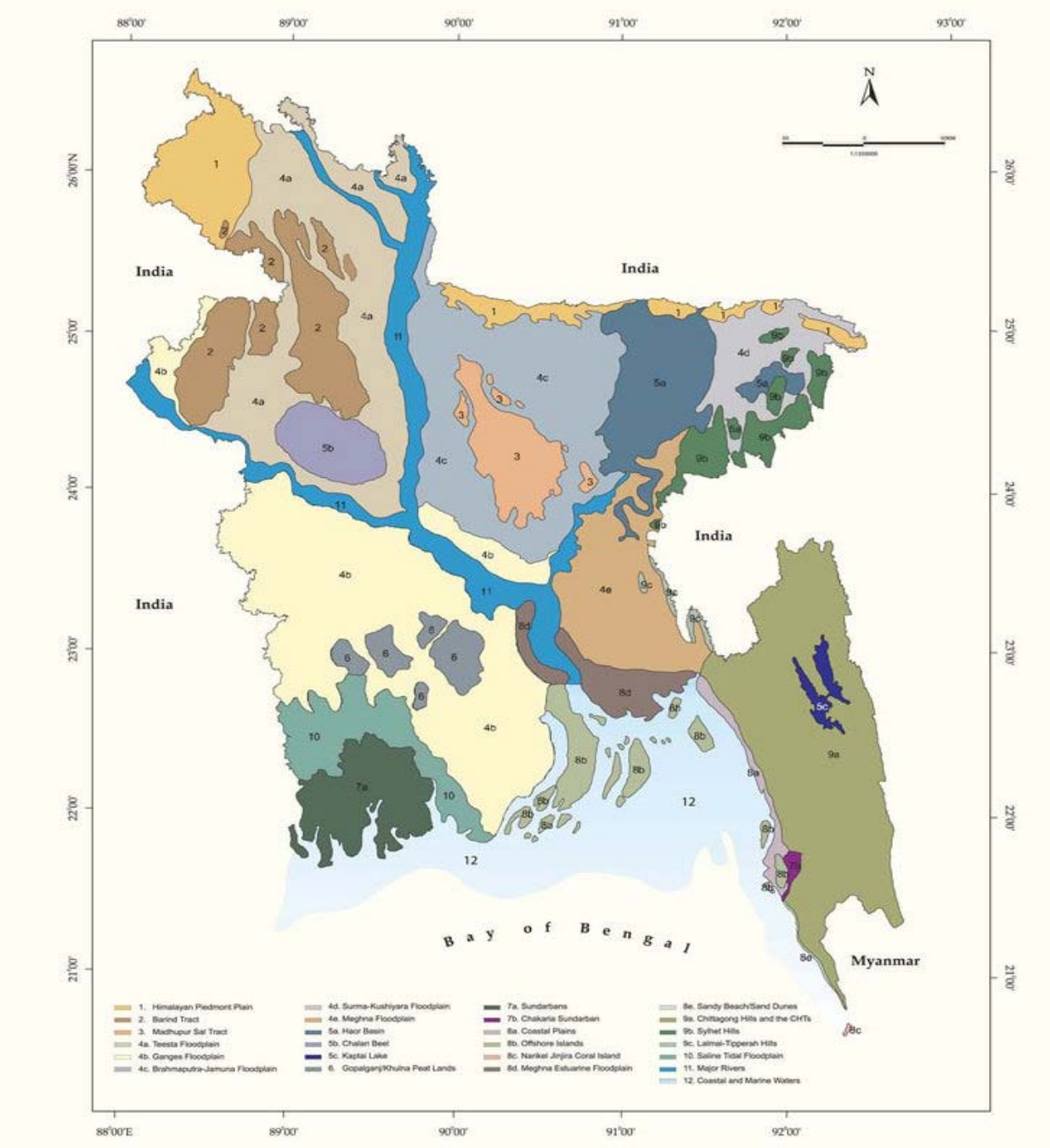


Fig 14: Bio-ecological map of Bangladesh

Source: Internet

[1] Source of raw data (Fig.15,16,17,18 and 19): Bangladesh Meteorological Department, April, 2012.

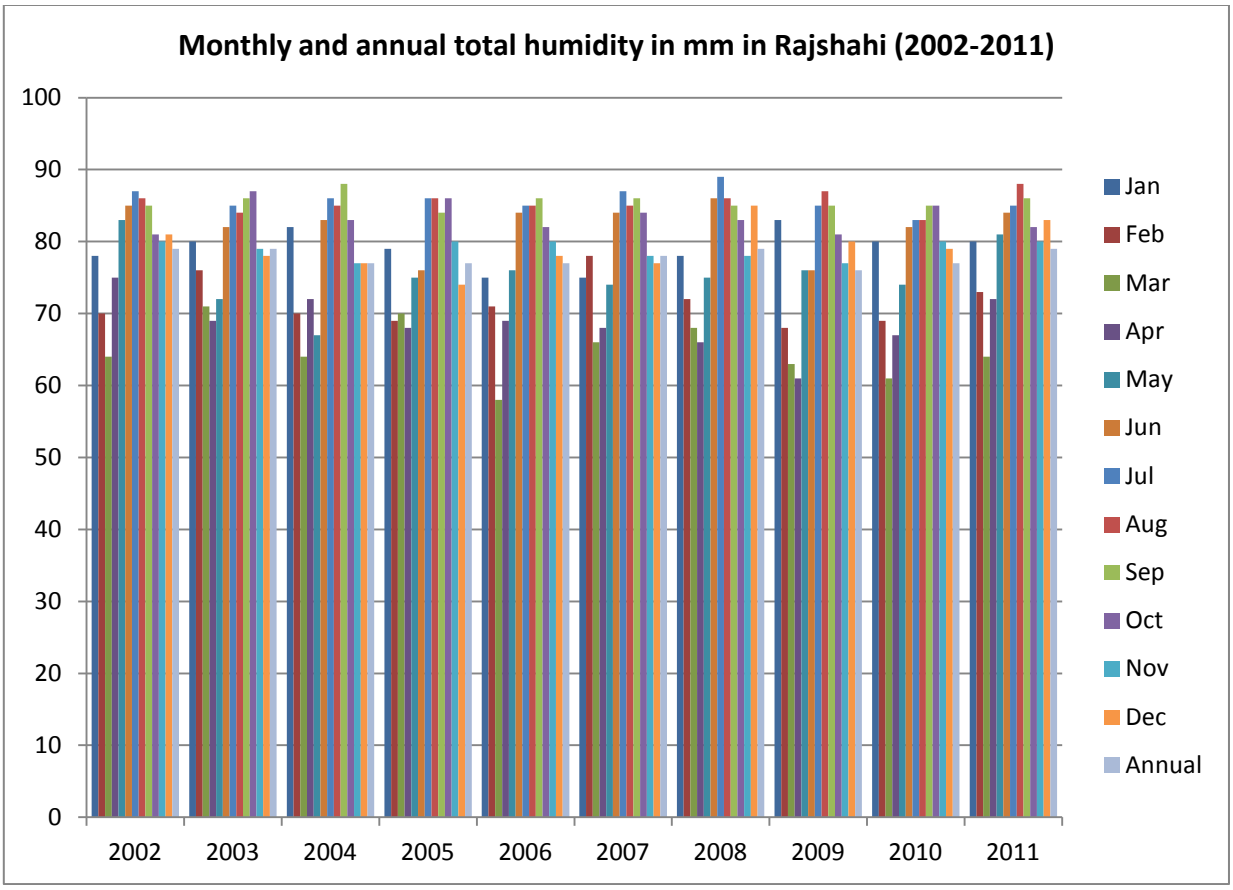


Fig 15: Monthly and annual humidity (%) in Rajshahi (2002-2011)

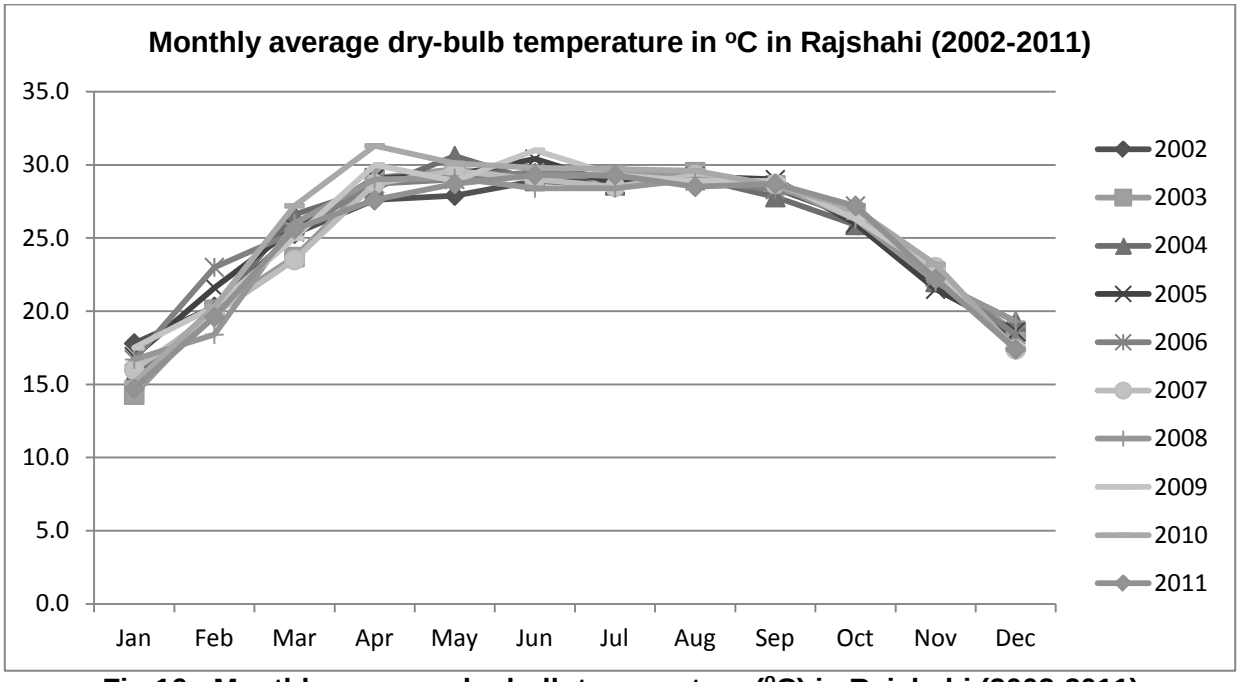


Fig 16: Monthly average dry bulb temperature (°C) in Rajshahi (2002-2011)

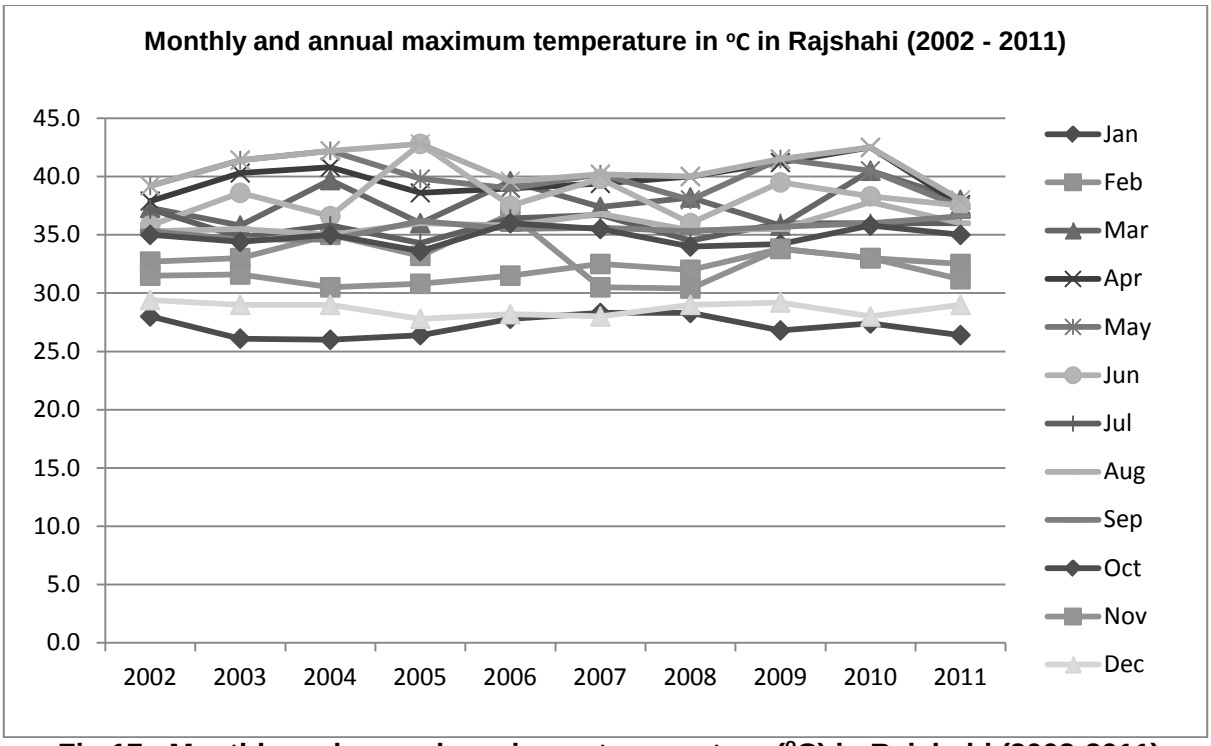


Fig 17: Monthly and annual maximum temperature (°C) in Rajshahi (2002-2011)

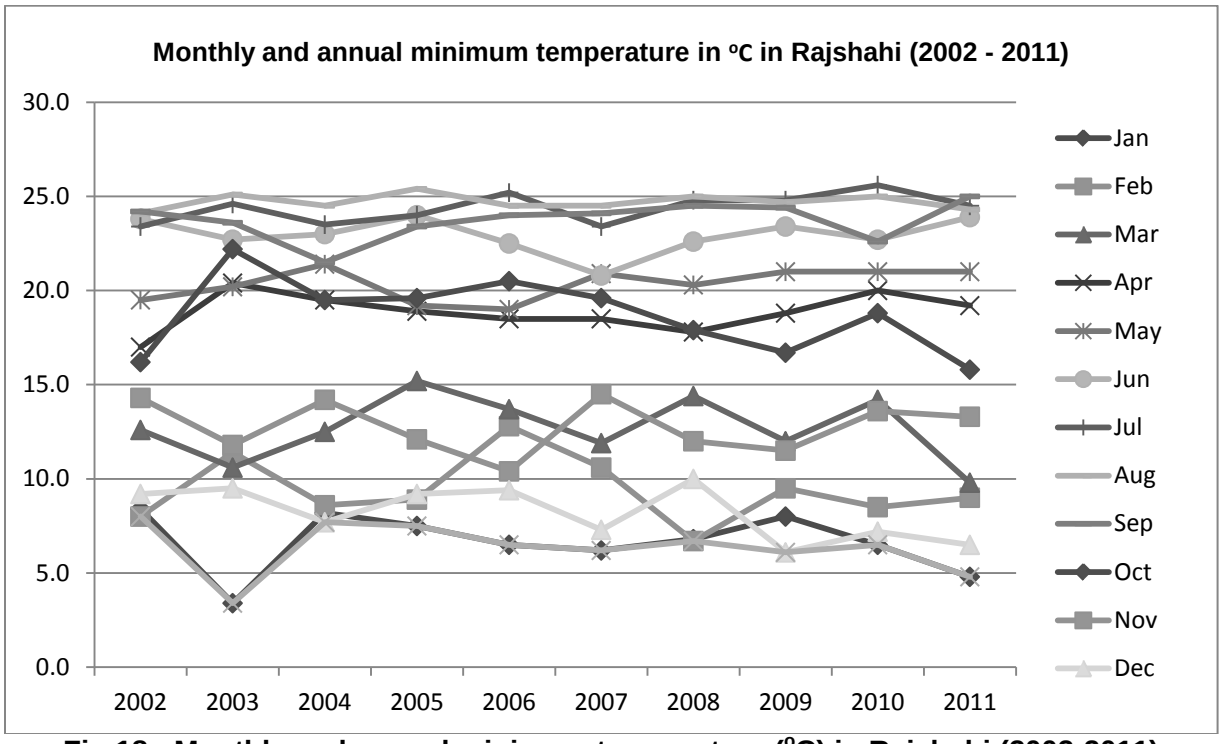


Fig 18: Monthly and annual minimum temperature (°C) in Rajshahi (2002-2011)

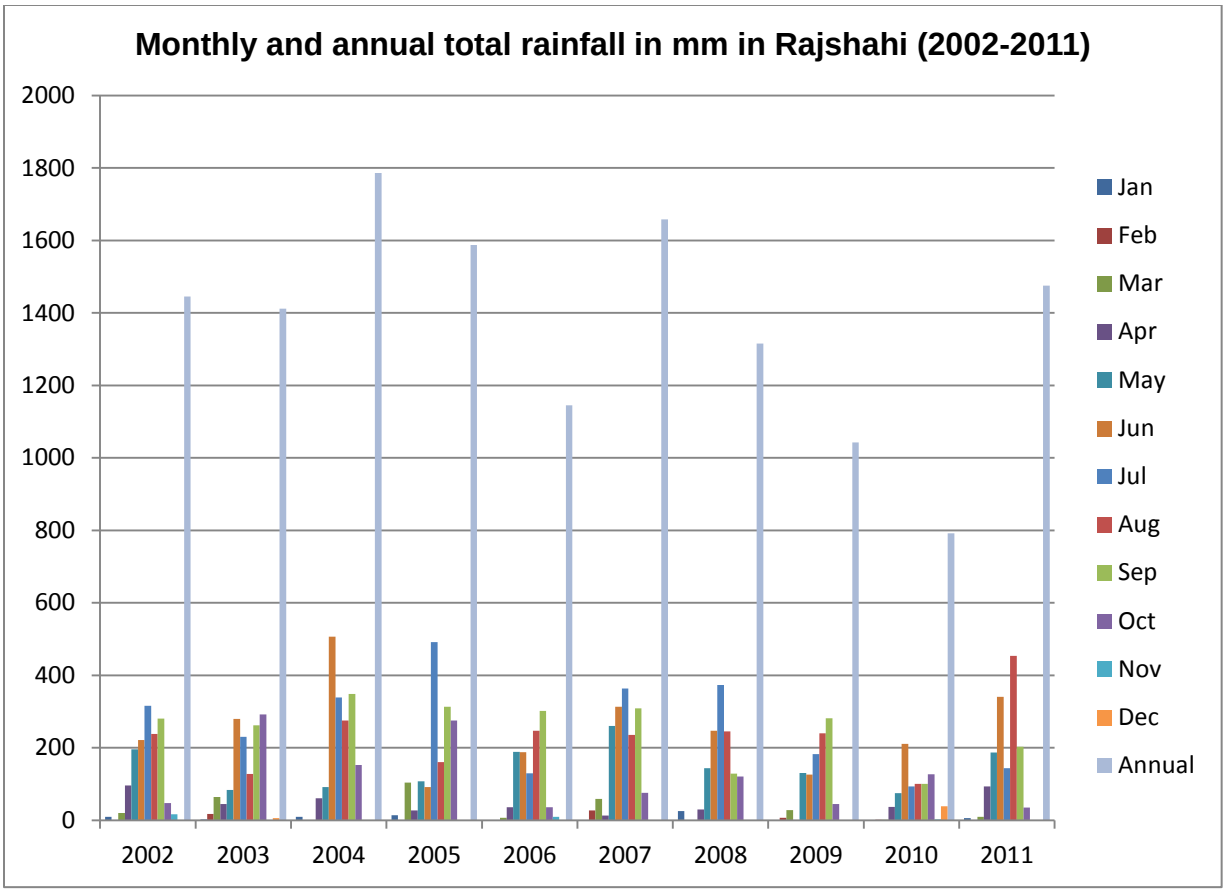


Fig 19: Monthly and annual total rainfall (mm) in Rajshahi (2002-2011)

3. Air Quality

39. Air quality is generally good in rural Bangladesh, where there are few industries and low densities of people and vehicles. The situation is very different in the cities, where urbanization, industrialization and overcrowding create major air quality problems. In 1988 the World Bank estimated that 15,000 deaths per year and a million cases of major illness are caused by air pollution in Dhaka, Chittagong and Rajshahi.

32. The main atmospheric pollutants are those produced by vehicles and industries and in particular by the burning of fuels. These include particulate matter, hydrocarbons, carbon dioxide, carbon monoxide, sulfur dioxide, oxides of nitrogen, lead, ammonia and hydrogen sulfide. Many of these cause respiratory problems in humans, plus other diseases if substances accumulate in the tissues. The main causes of the poor air quality are:

(i) Poor roads and traffic management leading to severe traffic congestion;
(ii) Use of high sulfur diesel by buses and trucks, and inadequate control of emissions;
(iii) Heavy industrialization, and use of cheaper high-sulfur fuels (coal, wood and tyres) by smaller industries like brick kilns; and
(iv) Poor solid waste management, so burning is the common method of treating garbage.

40. Surveys by the DoE show levels of Suspended Particulate Matter (SPM) and sulfur dioxide (SO2) in Rajshahi and other cities that exceed Bangladesh Air Quality Standards, and levels of atmospheric lead that are above World Health Organization (WHO) standards. These should fall over the next few years however, as laws are enforced reducing the number of two-stroke vehicles, and consumers change to vehicles using lower cost unleaded petrol and compressed natural gas. As the proposed Rajshahi landfill site is located in a rural agricultural setting, the air quality is generally good.

4. Surface Water

41. Most of Bangladesh lies within the floodplains of the Ganges, Jamuna and Meghna rivers, which drain a catchment of around 1.72 million km^2 in India, Nepal, China, Bhutan and Bangladesh. Only 8% of the catchment is within Bangladesh, and because of its topography, flood-risk and population density, the quality and quantity of surface waters are major issues for the country. Rajshahi lies in the North Western Region of Bangladesh, and it is situated on the bank of river Padma. All rivers in the region show large seasonal variations in flow, and discharge in the Jamuna for example fluctuates between <5,000 cumecs in the dry season to a maximum of around 67,000 cumecs in the monsoon.

42. Like other towns and cities of Bangladesh, the Rajshahi city dwellers, too, use both surface and groundwater as a source of domestic water. Principal difference lies in use of supply water based on treatment with some application of chlorine in Rajshahi and other population centers. Pollution of rivers is a major problem, because of the discharge of industrial wastewater and inadequate sewerage.

43. During the preparation of Master Plan, Structure Plan and Detailed Area Plan of Rajshahi Metropolitan City (2004), detailed samples were analyzed to get first hand information about the quality of surface water around Rajshahi. Table 2 below presents that result in detail. According to ECR 1997, standard for inland surface water to be used by various process and cooling industries should have pH (6.5 – 8.5), BOD (10 mg/l or less), DO (5 mg/l or more) and total coliform number/100 ml (5000 or less). In Table 3, Dargapara point of Padma river is located near the proposed site for slaughterhouse and has the following parameter values: pH (8.4 to 8.7), DO (7.0), Fecal Coliform (200 in summer and >250 in rainy season). After careful consideration, it is clear that this water can be used for water source if proper treatment is ensured. Alternatively, the safer source will be the groundwater from well dug inside the proposed site.

Table 2: Surface Water Quality in Rajshahi Area during the Summer, Rainy and Autumn Seasons

Sl. No.	Location	Date & Time	Seasons	PH	Turbidity JTU	DO mg/L	Cl	Total Hardness	Ca. H	Mg. H	Fe	Mn	F.C
1.	Talaimari point Padma river water	11.05.02 9:05AM	Summer	8.7	12		20	53	-	-	0.5	0.05	70
		21.08.02 12:05PM	Rainy	8.5	80	7.0	10	36	30	6	6.5	0.22	>200
2.	Dargapara point Padma river	11.05.02 9:30AM	Summer	8.7	15		22	64	-	-	0.3	0.04	200
		21.08.0	Rainy	8.4	80	7.0	10	35	29	6	9	0.2	>25

Sl. No.	Location	Date & Time	Seasons	PH	Turbidity JTU	DO mg/L	Cl	Total Hardness	Ca. H	Mg. H	Fe	Mn	F.C
	water	2 12:25PM										4	0
3.	Central park point Padma river water	11.05.02 9:45AM	Summer	8.7	12		20	54	-	-	0.3	0.04	100
		21.08.02 12:45PM	Rainy	8.4	85	8.0	11	41	32	9	8.5	0.26	>200
4.	Naohata Bridge Barannai river	11.05.02 11:45AM	Summer	7.6	50		25	40	-	-	2.7	0.04	200
		21.08.02 10:00AM	Rainy	7.8	75	6.0	13	46	24	22	3	0.02	>200
5.	By pass road beel (Tikri beel)	11.05.02 12:30PM	Summer	8.6	22		85	106	-	-	0.3	0.05	200
		21.08.02 9:45PM	Rainy	7.4	10	5.0	43	99	64	35	0.6	0.77	>200
6.	Naohata Area (Tikri para) pond water	21.08.02 10:30AM	Rainy	7.8	10		32	114	80	34	0.4	0.12	>300
7.	Sopura Industrial Area pond water	21.08.02 11:00AM	Rainy	7.9	10		87	52	35	17	0.3	0.02	>300
8.	Kadirganj Area pond water	21.08.02 11:20PM	Rainy	8.0	12		65	74	38	36	2	0.50	>300
9.	Sonadighi Area pond water	21.08.02 11:45AM	Rainy	8.6	20		102	49	34	15	0.45	0.02	>300
10.	Bhatapara point pond water	21.08.02 1:00PM	Rainy	8.0	20		77	72	58	14	0.8	0.10	>300
11.	Shibpur Beel	08-08-02 10.10 AM	Rainy	7.2	-	5.0	-						
		30-09-02 11.05AM	Autumn	7.9	26.5		20	126	99	27	0.34	0.20	200
12.	Foliar Beel	08-08-02	Rainy	8.1	-	9.0	-						

Sl. No.	Location	Date & Time	Seasons	PH	Turbidity JTU	DO mg/L	Cl	Total Hardness	Ca. H	Mg. H	Fe	Mn	F.C
		12.10PM											
		30-09-02 12.35PM	Autumn	7.8	34.5		32	126	99	27	0.30	0.17	400
13.	Belpukuria pond	30-09-02 11.15AM	Autumn	7.8	14.5		40	100	77	23	0.67	0.10	200
14.	Katakhali Khal at Harian	30-09-02 11.30AM	Autumn	7.3	24.8		40	127	102	25	0.72	0.30	50
15.	Kazla pond	30-09-02 11.55AM	Autumn	8.0	15.8		120	136	109	27	1.96	0.79	150
16.	Champa pukur pond	30-09-02 12.15PM	Autumn	7.8	13.0		44	133	102	31	1.06	0.43	70
17.	Pora beel near Kayra	30-09-02 1.00PM	Autumn	7.8	31.5		36	133	106	27	0.39	0.15	60
Bangladesh Standard for Drinking Water				6.5 - 8.5	10	6.0	150 - 600	200-500			0.3-1.0	0.10	0

44. The distance of the proposed STSs and effluent discharge point to the river Padma is variable because 6 STSs are located in different places in the city. The leachate from the individual STSs will not be very big quantity if cleaned everyday on a regular basis and it will be allowed to drain through the drainage system of the RCC.

5. Groundwater

28. There are three main aquifers in the central region of Bangladesh:

(i) An upper (composite) aquifer, which can reach depths of 50 m and is covered with an upper silty clay layer of less than 20 m;
(ii) A middle (main) aquifer of fine to heavy sands, which is generally 10-60 m thick and in most areas is hydraulically connected with the composite aquifer above; and
(iii) A deep aquifer of medium, medium-to-fine or medium-to-coarse sand, which is generally found at depths below 100 m.

45. Ground water quality of Rajshahi City Corporation area is poor. For high amount of manganese as well as iron and hardness, the city dwellers face very bad situation during drinking of water. This water is even not suitable for bathing. For high manganese, iron and hardness, the hair gets clumsy and it is necessary to use soap and shampoo regularly. Loosing of hair is also reported. Ground water of 25 pumps of Rajshahi City Corporation was collected and analyzed by Bangladesh Arsenic Mitigation Water Supply Project. From their analysis it was found that 24 pumps out of 25 contained a higher amount of manganese than drinking water

permissible limit of Bangladesh. However, iron concentration exceeds the standard only in five pumps. Outside Rajshahi City Corporation, except Charghat area, iron concentration of some ground water sources of Paba and Puthia exceeds the WHO and Bangladesh Standard for drinking water. Manganese is high in all three areas. However, the hardness is above the WHO Standard but below the Bangladesh Standard. The chloride in ground water is low in the context of pollution. Not hardness, manganese and iron only but also the ground water arsenic contamination is a major concern in the project area. WATSAN Partnership Project (2001) identified many arsenic contaminated tube-wells in the western, northern and eastern parts of Rajshahi City Corporation area.[2]

46. Elsewhere in the country, domestic water in urban areas is mainly abstracted from the surface and middle aquifers, which in many cases (including Rajshahi, Khulna and Barisal) are contaminated by naturally-occurring arsenic, iron and aluminum, plus sewage bacteria, pesticides and industrial chemicals. Groundwater tables often fall by several meters in the dry season, exacerbated by excessive drawdown by tube-wells. Supply of potable water is an increasing problem for the water and sewerage authorities because of the depleting supplies and source contamination.

47. Supply of potable water is an increasing problem for the water and sewerage authorities because of the depleting supplies and source contamination. Water for the STSs will initially be sourced from city corporation supply but provision will be kept for digging well within the site for construction of STSs. The necessary clearance for digging well will be taken from the RCC.

6. Geology and Seismology

48. Most geological features of southern Asia were formed 54-38 million years ago in the Eocene Period, when the Indo-Australian tectonic plate moved northwards and collided with the Eurasian and East Asian Plates, forming the Himalayan Mountains where the plates overlap. Then in the Oligocene (38-26 million years ago) the north-eastern part of the Indian landmass fractured and sank below sea level, forming the Bengal Basin between outcropping older rocks in the west and east. Surrounded by high ground, with the sea in the south, and crossed by the Ganges and Brahmaputra rivers that formed at this time, the Basin gradually filled with sediment transported by the rivers. Subsequently the sediments have been eroded during periods of high sea level, and covered by more recent alluvial deposits when sea level has dropped.

49. With one of the world's major subduction faults in the north and a major transform fault in the Arkan Yomas to the east (where plate boundaries collide), the Bengal Basin is in one of the most active tectonic and seismic areas in the world. The National Seismic Zoning Map (Fig 20) produced by the Geological Survey of Bangladesh (GSB), divides the country into three regions: a high risk zone between Mymensingh and Sylhet in the north and north-east; a medium risk zone stretching diagonally from Rajshahi in the north-west through Dhaka and Comilla to Chittagong and Cox's Bazar in the south-east; and a low-risk zone in the south and south-west, around Khulna and Barisal. In the medium risk zone, shocks of moderate intensity are possible, with a probable maximum magnitude of 6-7 on the Richter scale. Seismic events in Bangladesh are relatively infrequent but historically have been severe. The Assam earthquake of 1897 was the largest in the region's history, when a force of 8.7 on the Richter scale caused extensive damage across Assam, Bengal and Bihar.

[2] Study by DDCL during preparation of Master Plan for RCC.

Fig 20: National Seismic Zoning Map of Bangladesh

Source: Internet

50. The National Seismic Zoning Map (Fig 20) of Bangladesh clarifies the seismological status of the various region of the country. The city of Rajshahi falls within the low-risk zone. The earthquake risk factor for this zone – 1 is 0.075, while the risk factors for zone – 2 and zone – 3 are 0.15 and 0.25 respectively.

B. Ecological Resources

1. Habitats

51. The main physical features of Bangladesh are its mainly flat and low-lying topography, the dominant presence of the major rivers that drain enormous catchments in surrounding countries, a seasonal monsoon that swells river volumes for several months each year, and the resulting floods that inundate large areas of land. It is not surprising therefore that those aquatic habitats are the country's most important ecological resources.

52. There is a wide array of aquatic habitats throughout the country: natural and man-made, permanent and ephemeral, of varying sizes and characteristics. The rivers and floodplains are the most important, as they support species that are exploited by man, are the most productive of the habitats, and attract other important species, such as birds. However, as in other environmental sectors, the rapid urbanization and industrialization of the country and its expanding population (particularly the urban poor who use natural resources to supplement both food and income) have brought large scale damage and degradation to these areas.

53. Both terrestrial and aquatic habitats exist in the Rajshahi City Corporation area. Terrestrial habitat dominates the aquatic habitat for much coverage of land by high land and medium high land. The highlands, homesteads and roads act as a habitat for terrestrial flora and fauna. However, the aquatic habitats include rivers, khals, beels, ponds, and borrow pits.

2. Rivers

54. Most rivers in Bangladesh suffer under the influence of man, from the disposal of solid and liquid waste in urban and industrial areas around Rajshahi and the other cities and towns, and from the diversion of water upstream for irrigation and/ or power generation.

55. Three main rivers around Rajshahi City Corporation area are Padma in south, Barnai in north and Baral in east. Padma, once a mighty river in Bangladesh is now calm, due to Farakka Barrage upstream constructed by the Indian Government to divert the water of Padma river to Hoogli river. The water flow of Padma river is about 30,000 cusec in lean period and 300,000 – 750,000 cusec during flood period. The maximum discharges of Baral and Barnai rivers are 20,500 cusec and 20,000 cusec respectively. Major natural khals in the project area are Duari khal, Barajal river, Hojakhal, and Katakhali khal. Some important beels are Shilinder beel, Tikure beel, Duari beel and Foliar beel.

56. The Rajshahi STSs will be located in different parts of the Rajshahi city. Leachate from the STSs will be allowed to fall in the surface drains of the RCC. There will be no direct discharge of any effluent from the STSs to the river. Based on the environmental assessment conducted during project preparation, main use of the river is fishing and transportation of passengers and goods by different kinds of river vessels, and downstream users of the river include fishermen as well as residents of the Rajshahi city and other villages.

3. Floodplains and Fisheries

57. Floodplains are the natural lowlands alongside rivers, which are inundated each year in the monsoon as the increased volumes of water overflow river banks. These zones are important ecologically as they are the areas into which the adults of many species of fish migrate to breed. Floodplains are rich in nutrients from the inundated soil and decaying vegetation, and are also rich in food in the form of dead insects, soil invertebrates, and aquatic plankton that frequently bloom under such conditions. They are also protected from the strong currents in the main river, so are ideal areas for young fish to feed and grow, before entering the main river when water levels decrease. These areas also frequently attract large numbers of water birds, to feed on the juvenile fish in the shallow waters.

58. This area falls under the AEZ- 10: Active Ganges Floodplain and AEZ – 11: High Ganges River Floodplain. Major land types and extent in AEZ – 10 are HL (12%), MHL (33%) and MLL (18%); and in case of AEZ – 11, these are HL (43%), MHL (32%) and MLL (12%).[3] AEZ – 10 occupies unstable alluvial land within and adjoining Ganges river. It has irregular relief of broad and narrow ridges and depressions. The area has complex mixtures of calcareous sandy, silty and clayey alluvium. The General Soil Types predominantly include Calcareous Alluvium and Calcareous Brown Floodplain soils. Soils are low in organic matter and slightly alkaline in reaction. General fertility level is medium with high CEC but deficient in N, P and Zn contents. Boron status is medium.

59. AEZ - 11 includes the western part of the Ganges River Floodplain which is predominantly high land and medium highland. Most areas have a complex relief of broad and narrow ridges and inter-ridge depressions, separated by areas with smooth, broad ridges and basins. There is an overall pattern of olive-brown silt loams and silty clay loams on the upper parts of floodplain ridges and dark grey mottled brown, mainly clay soils on ridge sites and in basins. Most ridge soils are calcareous throughout. General Soil Types predominantly include Calcareous Dark Grey Floodplain soils and Calcareous Brown Floodplain soils. Organic matter content in the brown ridge soils is low but higher in the dark grey soils. Soils are slightly alkaline in reaction. General fertility level is low although CEC is medium and K-bearing minerals are medium to high but the Zn and B status is low to medium.

60. Elsewhere in the country floodplains have been similarly affected by flood protection schemes, land reclamation and urban development, and there is little doubt that such areas are far less productive than they once were. Even in the more rural areas the quality of floodplains is degraded, in this case by agricultural development, which exposes floodwaters to pesticides and fertilizers in the soil and crops.

61. The Rajshahi STSs are located in different parts within the city. There is city protection embankment in the northern bank of the Padma river, which protects the city from flooding. Padma river bank protection revetment was constructed in the year 2008 to stop bank erosion. However, the Bangladesh Water Development Board (BWDB) authority suggested that the structures built outside the city protection embankment should be designed considering the highest flood level of (+) 19.50 meters PWD (Public Works Department).

[3] HL = High Land, MHL = Medium High Land and MLL = Medium Low Land.

4. Other Aquatic Habitats

62. There are a variety of other aquatic habitats throughout the country, and in urban areas these include man-made lakes in residential neighborhoods, permanent and ephemeral pools in natural lowlands (known as *bheels*), and flooded borrow pits excavated for building material. These are generally of little ecological value as the water is frequently polluted, and these areas are often characterized by dense growths of the water hyacinth *Echicornica crassipes*, which out-competes other plants through its rapid growth, although species such as water chestnut, helenca (*Alternanthera philoxeroides*), kalmi (*Ipomoea aquatica*) and lotus can be seen in some places.

63. In the subproject area of influence, there are aquatic species that were ascertained in different studies in the recent past. There are 265 species of fishes under 154 genera and 55 families in the inland waters of Bangladesh (Rahman, 2005)[4]. Islam and Hossain (1983)[5] provided an account of 110 species of fishes of the river Padma near Rajshahi. Bhuiyan *et al*. (1992)[6] listed 133 species inhabiting the freshwater fishes of Rajshahi district. IUCN (1998)[7] reported that roughly 56 freshwater fish species out of 265 species are critically endangered and 50 species of fishes have become rare which were found abundant in last decades in their research covered areas in Bangladesh.

5. Terrestrial Ecology

64. The city of Rajshahi is almost denuded of the trees and vegetation that once had beautified and made its environment congenial to terrestrial ecology specific of this area. Only the mango and lichi trees are seen as special plants in this region. Rapid and continuous growth in the city population has encouraged various land-grabbers and mushroom growth of land development firms with a resultant erasure of wetlands, trees, greeneries, vegetation and forest lands in and around the city and replaced by widespread concrete jungles in the name of high-rise buildings.. The urban terrestrial fauna is very limited as a result, and mainly consists of animals able to live close to man, such as lizards and geckoes, scavenging birds like house sparrow and crows, mice, rats and other rodents, plus jackal, mongoose, squirrel and monkeys. There is a wider range of species in the farming areas, but even these are mainly animals that are commonly found close to man, such as cattle egrets.

65. Based on findings during the site visits in the preparatory phase, an estimated 7 numbers of trees are present in the STSs sites in front of Talaimari Adarsha School and Kazla Water Pump. All these trees are owned by the Rajshahi City Corporation. The actual requirement for tree-cutting will be finalized during the detailed design stage. Permit/ clearance for tree-cutting will be obtained from the RCC before any removal of trees in the area.

6. Protected Areas and Endangered Species

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[4] Rahman A K A (2005), Freshwater Fishes of Bangladesh (2nd Edition); Zoological Society of Bangladesh, Dhaka, 394 pp.

[5] Islam M S and Hossain M A (1983) An account of the fishes of the Padma river near Rajshahi, Raj. Fish Bull. 1(2): 1-31.

[6] Bhuiyan A S, Islam M N and Hossain T (1992) A checklist of the fishes of Rajshahi, The Rajshahi University Studies Part B, XX, pp. 287 – 306.

[7] IUCN (1998) Major conservation issues of the 1990s: Results of the World Conservation Congress workshops. 203pp.

66. Important conservation areas are invariably well away from centers of inhabitation for obvious reasons. Nevertheless there are certain areas in the towns and cities that are protected because of their ecological or scientific interest. These are mainly created by man and are intended primarily for entertainment and leisure purposes (such as zoo gardens, civic parks and children's gardens), and are of little interest in terms of nature conservation or species diversity. Rajshahi is well known for its archaeological and protected sites of tourist destination and famous landmarks. Notable places include: (i) Sompur Bihar, a large Buddhist monastery; (ii) Varendra Research Museum, one of the foremost museums specializing in history of ancient Bengal; (iii) Mohasthangar, home to archeological sites of Hindu, Buddhist and Muslim periods; (iv) Puthia Temple Complex and Palaces, the palaces of old *Jamidars*, some Kilometers drive from Rajshahi city; (v) Bagha Mosque, in Bagha thana of Rajshahi District; (vi) Dighapatia Palace, palace of the famous Queen of Dighapatia, located in Natore district; (vii) Kushumba Mosque, Naogaon, (viii) Shona Mosque, Chapai Nawabgonj, and (ix) Chalan Beel, the largest water body in Bangladesh, spreading in Natore and Pabna districts.

67. There are no protected areas within or adjacent to the STSs sites. The nearest protected area of Varendra Research Museum is about 2 kms from the proposed STS site located in the northern boundary wall of the Medical College. There are some endangered species in the Padma river as discussed in the previous paragraph under aquatic habitats. Flora and fauna found in the STSs sites are those commonly found in developed and urban areas.

C. Economic Development

1. Industry

65. Rajshahi is not an industrial city. Three major industries are Rajshahi Jute Mills, Rajshahi Textile Mills and Rajshahi Sugar Mills. Two mills are located in the eastern side of Rajshahi City at Katakhali area. Rajshahi Silk Mills is located in the western side of Central Bus Stand at Sheroil. Three cold storages are located in the northern side of Rajshahi City Corporation area near Naohata, along Rajshahi –Naogaon Road.

66. Brickfields are scattered in and around the Rajshahi City Corporation area. There are 66 brickfields in the Rajshahi metropolitan area and 45 in the existing Rajshahi Development Authority boundary. A high number, 30 brickfields are located only in Parilla UP, 12 in Haragram and 8 in Harian UP. Brickfields cause severe air pollution in the Rajshahi City Corporation area, particularly in these three UPs. The people have reported reduction of mango and boro production. Brickfields are also responsible for changing the natural topography of earth surface by soil collection. Valuable topsoil is being lost due to soil collection from fertile agricultural land.

2. Infrastructure

67. Infrastructure is a major problem in all towns and cities in Bangladesh, where many facilities are inadequate to serve the needs of such a large population, after decades of under-funding and neglect. Dhaka is the only area in Bangladesh with a sewer system and this serves only 20% of the population and the sewers are blocked and leaking in many places. Throughout the rest of the country people use a variety of methods including septic tanks, pit latrines, and open defecation. Septic tanks malfunction because of inadequate design, construction or maintenance, or because the high water table impedes the soak-away function. Many buildings, including high-rise developments, have no sanitation system at all, and discharge their effluent into lakes, rivers, drainage ditches or onto open ground, causing unsightly areas, health risks and water pollution.

68. In Rajshahi urban areas, solid waste management is the responsibility of the Rajshahi city corporation; and in most locations NGOs or CBOs operates the primary collection service, removing waste from houses and businesses each day, mainly on cycle-rickshaws. These carry waste to Secondary Transfer Stations (STS) at various locations around the town, from where it is carried for final disposal by vehicles operated by the Rajshahi City Corporation. There is no properly designed and operated sanitary landfill area for the Rajshahi City Corporation. The Rajshahi City Corporation at present dumping the waste in the landfill site located in the northern side of Rajshahi bypass road. There has been some limited and minor development of this landfill site under the STIFPP – II of LGED[8]. The process of disposal is by open dumping with little or no management or pest control, and as a result these areas are highly insanitary and hazardous to public and environmental health. There is no effective medical waste treatment facility run by the Rajshahi City Corporation. But new initiatives have been taken to construct sanitary landfill site including facilities for management of medical waste under the present program of UPEHSDP. After implementation of UPEHSDP, it will be possible to utilize these facilities for safe disposal of domestic wastes, slaughterhouse wastes as well as other hazardous wastes from the RCC.

69. In the existing landfill site in Rajshahi, there is no compost plant although there are some compost plants within the city but with small capacities and poor and unhygienic management. It is expected that new compost plant will be installed in the sanitary landfill site to be developed under the UPEHSDP. At present, there are some modern type transfer stations in RCC area implemented under the STIFPP but the collection and transportation of solid waste will be improved substantially after implementation of the 6 STSs proposed in this subproject.

3. Transportation

70. Rajshahi city has a good network of road, railway and air communication with other parts of Bangladesh. Inter-district buses ply along 20 routes and intra-district buses another 12 routes daily. It has a good bus communication with major towns and cities of Bangladesh such as Chapai Nawabganj, Naogaon, Natore, Bogra, Rangpur, Dinajpur, Pabna, Kustia, Jessore, Khulna, Sirajganj, Tangail, Mymensingh, Dhaka and Chittagong. Air-conditioned buses are in operation between Dhaka and Rajshahi daily. Dhaka Rajshahi air transport started in 1984. But at present, it is not in operation because of various reasons. Rajshahi is also linked to other parts of Bangladesh with rail communication. Inter-city trains and many mail and local trains ply between Rajshahi and other towns.

71. Local communication in Rajshahi City area is still outdated. Rickshaw is the main vehicle for local communication. There is no available town service bus in this city. Only one double-decker moves between Court to Baneshwar, but irregularly. A few numbers of baby-taxis and some tempos also ply from Court to Bus Stand, Ghorehanga Moar to Naohata and Shaheb Bazar to Katakhali route. During office period, many people are found to use bicycle to reach the offices and working places.

4. Land Use

[8] Secondary Town Integrated Flood Protection Project phase II of Local Government Engineering Department; some secondary transfer stations (STS) and development of waste disposal sites by construction of peripheral embankment with brick soling, approach road for the site, etc. were relevant to solid waste management of RCC.

72. In most urban areas the expansion has been inadequately planned and controlled, because of ineffective planning and inadequate policing of the planning laws and implementation of the land use policies. As a result, inappropriate mixes of land uses are commonplace (e.g. residential and industrial), and areas have grown without the provision of supporting infrastructure (water, sanitation, schools, hospitals, etc). Planning problems are compounded by natural and anthropogenic factors, which include: seasonal flooding, which limits the use of large areas; population expansion, which puts a high demand on land; and the high proportion of urban poor, who have little alternative but to erect makeshift shelters on vacant land, increasing the slum areas.

73. The urbanization pattern of Rajshahi City is characterized by haphazard growth. Land use follows a similar general pattern in most towns and cities, with mainly urban uses in the centre and residential in the outskirts. The town centre normally houses the main business and commercial districts, and contains shops and offices lining the roads, often in high-rise developments. There are also service industries in these areas, including restaurants, convenience stores, vehicle repair etc, plus residential units, often above the shops and offices. The urban fringe generally contains the better quality residential developments, and there are also shops and retail outlets, but less industry. There is also some agriculture in the outskirts, particularly in the more rural parts of the city.

74. The proposed sites for all 6 STSs are on the land owned by the RCC and Government of Bangladesh, and at present in 3 cases being used as temporary dumping places for municipal solid wastes collected from the locality. These are STSs near Medical College, in front of Rashik Composting Plant and Talaimari Adarsha School. The remaining 3 STSs are at present free from any dumping of solid waste. All these STSs are located on the sides of wide roads, and part of the road width is being used for construction of STSs.

5. Power Sources and Transmission

75. The sole Government authority for generation of electricity is the Bangladesh Power Development Board (BPDB). Major agencies in distribution of electricity include the BPDB itself and the Rural Electrification Board (REB). There are a few other specialized power distribution agencies such as the Dhaka Electric Supply Authority (DESA) and Dhaka Electric Supply Company (DESCO) for Dhaka or the Rajshahi Electric Supply Company (RESCO) for Rajshahi. The power division of the Ministry of Energy and Mineral Resources is the umbrella organization that controls power generation, transmission and distribution. An Independent Power Project (IPP) of the ministry is under implementation for improvement in generation and distribution of electricity by Government and private agencies. BPDB operates 22 power stations with a total installed capacity of 3,150 mw. The new 15 stations include 2 barge-mounted plants (one at Khulna and the other at Sikalbaha) and 13 conventional ones at Ashuganj, Sylhet, Fenchuganj, Ghorasal, Haripur, Raozan, Baghabari, Bheramara, Saidpur, Barisal, Rangpur, Bhola, and Chittagong.

76. Power is provided to most urban areas through a network of electricity pylons and poles, mainly located beside roadways. This provides connections to individual houses, and revenue collection is by individual household meters. Generation is insufficient to offer a continuous supply, and the providers operate a system of “load-shedding” whereby they turn off the supply for 1-2 hours each day to conserve the resource. Hotels, businesses and the more wealthy residents increasingly use their own generators to augment the supply from the national grid.

77. Power problem in the Rajshahi region has turned acute over a couple of years as there is a gap between the supply and demand. Regular activities in public and private offices and commercial establishments are routinely hampered because of a shortfall of about 20 MW of power each day on average. The region accommodates more than 1crore population leading to an average daily demand of about 100MW of power, while the supply hovers between 75 MW and 85 MW. As a result the Power Development Board (PDB) has to go for load shedding everyday in a cyclic order in the region and the city. Rural electrification Board provides electricity to the areas other than PDB Circle. Two 50KV power stations already built at Katakhali to meet the growing electricity demand of the city.

78. The proposed sites of the STSs are located within the city area. Power supply for the sites will be possible by extension of the existing facility to the site by installation of few electric poles as per design requirements.

6. Other Economic Development

79. Apart from the usual agricultural products of Bangladesh, such as rice, wheat, potatoes and lentils, Rajshahi and its neighboring regions are specially suited from various crops such as Watermelons, Sugarcanes, Mangoes and Lichies. Rajshahi Krishi Unnayan Bank, a nationalized bank with its head office at Rajshahi is working in a mission to help the agriculture sector of Rajshahi & Rangpur division.

80. In spite of being an important city and located on a riverbank, industrial development in Rajshahi has not taken place to any great extent. Though locals have claimed that this is due to lack of attention from the central government in Dhaka, business community of the city is also responsible for lack of initiative to build industries in the private sector. In the 60's an *Industrial Park* had been established in Rajshahi, which is now mainly home to industries producing products of the famous Rajshahi silk. Rajshahi is also home to number of jute mills, textile mills, a sugar mill and mango based industries. No doubt there will be rapid industrial development in Rajshahi if gas is supplied through pipeline which the people of Rajshahi have been demanding for a long time. The Government has taken steps to supply gas to Rajshahi quickly and a project towards this end has already begun.

81. There is a potential for tourism in the bank of river Padma. The RCC authority has already developed some spots and arranged for public facilities, which has been appreciated by the people. It might also be possible to develop agro-based cottage and medium-sized industries in certain farming areas.

D. Social and Cultural Resources

1. Population and Communities

82. The population of the greater Rajshahi area is 615,616. Of them, 339,932 live in the RCC area, about 55% of the total population and the second highest, 31.63% live in Paba area. The population density in RCC is 3,514 per Sq. Km., which is three times higher than Paba, 2.48 times than Puthia and 2.15 times than Charghat thana. The male-female ratio in urban area (RCC) is 102.69:100 and 107.85:100 in rural area. The population growth rate in the greater Rajshahi area is 1.46. Household size in RCC is 5.31 and 4.51 in rural area; those are slightly lower than the country average of 5.5.

83. From sample survey[9] it is found that a major portion of population is within 0-14 years of age. In urban area (RCC), 27.3% population is within this age group whereas in rural area it is 33.6%. Other major age groups are 15-19 and 20-24. These two age groups comprise of 11.60% and 11.70% in urban area, and 10.60% and 9.60% in rural area. However, the percentage of higher age (59+) people is very low, only 5.60% in urban area and 5.20% in rural area. 47.20% people are married in urban area and 48.11% people are married in rural area.

84. In Rajshahi district, the total population is 2,595,197, of which number of Muslims is 2,430,194 (93.64%), Hindus 122,394 (4.72%), Christian 27,830 (1.07%), Buddhist 134 (0.01%) and others 14,645 (0.56%).[10]

2. Health Facilities

85. Rajshahi city is a very important place for treatment of patients of the entire division, especially people from remote areas who cannot afford their journey to the capital city of Dhaka. Generally, people tend to visit qualified or competent health service providers, but it is also a common tendency to prefer sources, which are cheaper or free of charges. Government health centres can provide low cost health services, but the quality of services is not up to the mark. Low income of the people is a bar to avail of the advantages of improved healthcare facilities available in the private sector. Government hospitals are still important places for treatment particularly for the low income people.

86. Health facilities are available in all four thanas of Paba, Boalia, Charghat and Puthia in Greater Rajshahi Metropolitan area. In Charghat and Puthia, people get health services from Union Health Complex and Thana Health Complex. However, the city dwellers mainly rely on Rajshahi Medical College (RMC) for health services. Complicated patients from the rural area of RDA come to the RMC for better treatment. Even patients from northern other districts come to this hospital.

87. Besides RMC, other hospitals like TB Hospital, Infectious Diseases Hospital, Christian Mission Hospital, City Hospital, etc. provide health services to the people. Health service facility to the government employees is provided by the Police Hospital, BDR Hospital and Combined Military Hospital. Rajshahi University has its own health service system for students, teachers and employees. Family planning and immunization facilities exist more or less in all hospitals.

88. Public health facilities provide good service, but many are under staffed and under resourced, and ratios of beds per numbers of population are inadequate. Facilities are significantly better in the private sector, but care is expensive, and out of reach of any but the wealthier citizens.

3. Educational Facilities

89. Rajshahi is an important educational center in Bangladesh. Major educational institutes include: Rajshahi University, Rajshahi University of Engineering & Technology, Rajshahi Medical College, Rajshahi College, Rajshahi cadet college, New Government Degree College, Rajshahi Government City College, Rajshahi Government Women's College, Teacher's Training College, Rajshahi Collegiate School and College (The oldest of the region), Silk Research and Training Institute, Rajshahi Polytechnic Institute, Rajshahi Mohila Polytechnic Institute, Asian University

[9] Field survey by Master Plan Preparation Consultants.
[10] Bureau of Statistics data for 2011.

of Bangladesh - Rajshahi Campus, Islami Bank Medical College, Project Headway English Training Institute Uposhahar, University of Information Technology and Sciences, Rajshahi Campus, Barendra College, Shah Mokhdum College, Institute of Forest, Birkutsha Abinash School and College – Bagmara – Rajshahi, Northern University Bangladesh - Rajshahi Campus, Adarsha College – Katakhali, Shardah Government Pilot High School, Shaleha Shah Mohammad high School and Bangladesh Polytechnic Institute.

90. In Rajshahi, total numbers educational institutions are: Kindergartens (41), Primary Schools (911), Junior High Schools ((30), Secondary High Schools (215), Colleges (63), Universities (2) and Madrasahs (489).

4. Socio-economic conditions

91. Rajshahi is the biggest city in northern Bangladesh and it is the heart of divisional administration. Offices of most of the regional headquarters are located here. Government offices and semi-government organizations are the main employment sources, 27.8% in Rajshahi City Corporation area and 12.9% in rural area. Due to location of this city at the western edge of Bangladesh, industries, non-government and commercial offices have not grown well like Dhaka and Chittagong. Industries make up employment only 0.8%, both in rural and urban area. Rajshahi is famous for its high number of educational organizations. Government offices, Rajshahi University, BIT, Rajshahi Medical College (RMC), other technical and general colleges play important roles for employment in the project area.

92. Around the RMC at Laxmipur, many private clinics, diagnostic centers and hospitals have grown up. These organizations have also created job opportunity for many people. Transportation sector is also another employment area in Rajshahi. Rajshahi has good bus communication linkage with Dhaka, Bogra, Pabna, Jessore, Natore, Rangpur, Naogaon, Chapai Nawabganj and to local thanas. Many people are directly or indirectly involved in transportation sector. Major industries in the project area are Rajshahi Jute Mills, Rajshahi Sugar Mills, Rajshahi Cotton Mills, Rajshahi Silk Industry and some cold storages. Employment opportunity is very limited (0.8%) in these few industrial units. Business is the second main employment sector in Rajshahi city. A large number of people are involved in business, 26.9% in urban area and 23.3% in rural area. Shaheb Bazar is the main commercial hub of Rajshahi city. Poor people are mainly rickshaw/ van pullers (2.7% in urban area and 5.2% in rural area) and day laborers. Many poor women work in students' mess and in the house of rich people. Some poor women are engaged in selling smuggled sugar, clothes, stainless plate, etc. in the project area. However, outside Rajshahi City Corporation, agriculture is the main sector of employment and income.

93. In general, the trend for rural-urban migration is largely a result of a lack of secure employment and sustenance in the rural areas, so people move to the cities where they believe there are better job opportunities. As noted above these rarely materialize and the end result is an increase in the urban poor, and an expansion of the slums. More than 82% of the population of Bangladesh lives on less than $2 per day, and such people are mainly the urban poor and the rural poor. Slum dwellers in the towns and cities include people who are in regular employment, plus large numbers who are unemployed and who obtain an income from the streets where they can. Employed slum dwellers work mainly in construction or in factories, or as domestic servants, rickshaw operators, street vendors, etc.

94. Waste pickers are observed at the existing dumping site and consist of male, females, and children. This is often their primary source of livelihood made from recycling waste.

5. Physical and Cultural Heritage

95. The main cultural monument in Rajshahi City Corporation area is Mazar-e-Sharif of Hazrat Shah Makdum (R) at Darga Para of Rajshahi City. Everyday many people visit this shrine. There are about 20 historical places and tourists' spots in the city boundary according to the Authority of Varendra Museum, Rajshahi.

96. Some cultural heritage and monuments like Sompur Buddha Bihar, Kushumba masjid, Bagha Shahi Mosque and Choto Shona Masjid are located at the adjacent districts of Naogaon and Chapai Nawabganj. However, both national and foreign tourists use Rajshahi City as terminal point to visit these places.

97. Rajshahi is famous for its characteristic sweetmeats, not to be found anywhere else in the country. These special preparations include Roshkodom, Khaja, Raghobshahi and Kachagolla (Natore is especially famous for this particular sweetmeat). Along with neighbouring Chapai Nababganj, Rajshahi is the home of the region's best mangoes and lichis. Rajshahi is also the home of Barendra Museum which is famous for its collection of local sculpture and other artefacts dating from medieval times, and of Rajshahi silk, the finest silk produced in Bangladesh.

6. Indigenous Peoples

98. The majority of Bangladesh's people are Bengalis, and approximately 2.5 million are indigenous peoples belonging to 45 different ethnic groups**.** These peoples are concentrated in the north, and in the Chittagong Hill Tracts (CHT) in the south-east of the country. Their historical background, economic activities, social structure, religious beliefs and festivals make them distinctive. There is no specific pocket in the Rajshahi City Corporation where indigenous people can be found; rather they have mixed with other people of the community. Within the Rajshahi City Corporation, they are getting similar facilities as other citizens there; but they are not having enough opportunities within their own community because mainly of the isolated locations in different rural areas.

99. Environmental degradation has made their lives even more difficult. They have become the victims of the negative impacts of modernization, as they lack the education and awareness to be able to harness and enjoy the positive benefits that Bangladesh's economic growth has created.

IV. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

100. The present report assesses the impacts of the proposed activities on various environmental attributes of the project site.

101. **Methodology.** Issues for consideration have been raised by the following means: (i) input from interested and affected parties, if any; (ii) desktop research of information relevant to the proposed project; (iii) site visit and professional assessment by environment specialist engaged by the implementing agency; and (iv) evaluation of proposed design scope and potential impacts based on the environment specialist's past experience. Categorization of the project and formulation of mitigation measures have been guided by ADB's REA Checklist for Urban Development (Annex 1) and ADB Environment Policy.

A. Location and Design Impacts

102. In the case of this subproject there are few impacts that can clearly be said to result from the design or location. This is because:

(i) The infrastructure involves relatively straightforward construction at few single small sites, so it is unlikely that there will be major impacts when the facility is built;
(ii) The proposed locations of the STSs are in areas where the RCC authority is already using part of it for dumping municipal solid waste and it will be stopped temporarily before the actual construction works will start and also there are no sensitive areas or receptors nearby; and
(iii) If the STSs operate in the manner intended it should be hygienic and well managed facility that functions with few emissions and without major negative impacts.

103. Planning principles and design considerations have been reviewed and incorporated into the site planning process whenever possible. The concepts considered in design of the STSs are:

(i) All the STSs should be adequate in size to accommodate solid waste collected from the target area.
(ii) All the STSs should be provided with safe water.
(iii) Water points, hoses and cleaning equipment must be provided in sufficient numbers. Cleaning program must be performed regularly.
(iv) Industrial three phase electricity should be supplied and a standby generator installed.
(v) Each STS should have its own drain and all drains must be accessible for cleaning for efficient waste water system.
(vi) The STSs should be protected by fencing to keep out from trespassing animals specially dogs/ cats etc.
(vii) Strict enforcement of relevant national rules in solid waste management.
(viii) STSs of RCC could be managed by private organizations/ parties through competitive bidding process following government public-private partnership guideline.
(ix) Techniques, installation, management and training should be focused on minimization of water consumption, minimization of energy use, minimization of emission to air and minimization of noise.
(x) Future extensions or possibilities to add some other installation should be kept in mind during the design and during the period of built.

104. Interested contractors will bid based on the concept and details included in the bid documents. The bidders will be advised to make their own diligence study prior to the bidding. Necessary documents and studies will be made available to them for their evaluation. It will be up to the bidders to maximize the use of resources made available to them.

105. No impact is anticipated due to the location as the proposed sites are owned by the Rajshahi City Corporation. A Resettlement Plan by the RCC authority has been developed to compensate, restore, or relocate any building/ infrastructure that will be affected by the subproject.

B. Construction Impacts

106. **Construction method.** The work comprises the construction of 6 Secondary Transfer Stations. The following are the scope of work:

(i) Preparation of the ground by forming to level and grade and excavating locally for foundations or, if necessary, by excavating unsuitable fill material and replacing with imported compacted backfill.
(ii) Shaping of ground to suit footings and floor slab layout and falls and to allow exterior ground drainage.
(iii) Laying and backfilling over underground and under floor drains.
(iv) Boxing foundations and placing reinforcing with column starter bars.
(v) Pouring of slab and footings and curing.
(vi) Construction of unreinforced masonry infill panels.
(vii) Placing reinforcing, boxing, and pouring columns.
(viii) Placing reinforcing for lintel beams and pouring concrete.
(ix) Casting in bolts and anchor plates as necessary in the columns and lintels.
(x) Fabrication and fixing roof trusses and bracing.
(xi) Placing and fixing purlins.
(xii) Fixing roof cladding, gutters and downpipes.
(xiii) Wall framing with cladding panels and insect mesh as necessary.
(xiv) Fixing of external rails for sliding doors.
(xv) Placing and fixing internal beams for rails plus fitting rails and hangers.
(xvi) Constructing weather covers for sliding door rails.
(xvii) Hanging of hinged doors.
(xviii) Internal wall and floor plastering as required.
(xix) Painting as required.
(xx) Electrical Services.
(xxi) Supply and/ or manufacture and installation of mechanical equipment.
(xxii) Construction of external effluent disposal system.
(xxiii) Construction of solid waste disposal systems.

107. As explained above the lands on which the STSs are to be built are currently being used as temporary solid waste dumping sites. These are generally open spaces beside the main roads and easily accessible by the trucks used for onward transportation of the wastes to the sanitary landfill sites. So during construction, there will be some very minor impacts on the people and there will be no issue of resettlement of affected persons.

108. Most of the site will be excavated to around 1.50 meter to create the cavities for the foundations of the buildings and paved areas. This will be done by backhoe digger and the excavated sand and soil will be loaded into trucks and transported to the municipal landfill for disposal.

109. All of the buildings and other structures will have Reinforced Cement Concrete (RCC) foundations, so metal reinforcing bars will be put into position in the cavities by hand. Concrete (mixed on site) will then be poured into the cavities to form the foundations and floors of the buildings and other structures and the paved surfaces of the roads.

110. The above-ground RCC elements will then be created by enclosing lengths of metal reinforcing in wooden shuttering and pouring in concrete, which sets to form the structure. This is then repeated in the next portion of reinforcing and so on to create the completed structure. The brick walls of the STS area, toilets and boundary wall will then be created between the RCC supports by masons laying bricks and mortar by hand. Surfaces will be finished by plastering or

tiling, and corrugated iron roofing will be applied and connected up by hand. Doors, windows, electrical fittings and pipe-work for water supply and drainage will also be added by craftsmen and laborers.

111. All materials will be brought to site on small trucks and offloaded and positioned by hand, and a small crane will be used for any heavier elements such as the steel supports and reinforcing bars, doors and the metal gates for the entrance to the site. All debris will be cleared at the end of construction by loading into a truck and depositing at the municipal landfill. Disposal sites for excavated soils and contaminated materials will be identified and agreed upon with the DoE before the commencement of any civil works.

112. 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.

113. **Screening Out Areas of No Significant Impact.** From the descriptions given it is clear that implementation of this subproject will not have major environmental impacts because the construction work is relatively small scale and straightforward, and will all be conducted at only 6 small sites within the RCC. Because of this there are several aspects of the environment that are not expected to be affected by the construction process and these can be screened out of the assessment at this stage as required by ADB procedure. These are shown in **Table 3**, with an explanation of the reasoning in each case. These environmental sectors have thus been screened out and will not be mentioned further in assessing the impacts of the construction process.

Table 3: Fields in which construction is not expected to have significant impacts

Field	Rationale
Climate	Short-term production of dust is the only effect on atmosphere
Geology and seismology	Excavation will not be large enough to affect these features
Forests, wildlife, endangered species, protected areas	There are no forests, protected nature conservation areas or important habitats or species at or near this site
Coastal resources	Rajshahi STS sites are far from the sea and also these are generally deep inside the city and such small structures will not affect the coastal resources
Agriculture, tourism	There is no agriculture or tourism at or near these sites
Population and communities	Construction will not affect population numbers, location or composition
Health and education facilities	There are no schools, clinics, hospitals, etc at or near these sites
Physical or cultural heritage	There are no culturally important buildings or locations at or near these sites
Indigenous Peoples (IP)	The proposed sites are not used by indigenous peoples or minority communities
Archaeology, paleontology	No material of archaeological or paleontological significance has been found by previous construction projects in these areas
Ecological value	There are no protected areas in the vicinity of these sites and no special ecological interest exists within the boundary of the sites under consideration. Construction should therefore have no ecological impacts.

114. **Impacts due to excavations.** Excavating the foundations for the buildings, roads, walkways and other structures on sites will produce around 900 m^3 of waste soil and stone. This is a relatively small quantity so it can be taken to the municipal disposal site without special precautions to reduce the amount of dumping. The material could be put to beneficial use if it was utilized at the landfill to cover waste, so arrangements should be made by the Contractors

with the landfill operators to deposit the waste in a suitable location where it can be used for this purpose. In any case, disposal sites for excavated soils and contaminated materials will be identified and agreed upon with the DoE before the commencement of the excavation activities.

115. Excavation is likely to be conducted in the dry season to avoid the difficult conditions that can occur when earthworks are carried out during rain. Precautions will therefore be needed to limit dust so that it does not affect surrounding areas or workers on site. Another physical impact associated with large-scale excavation is the effect on drainage and the local water table if groundwater and/ or surface water collect in the cavities as they are dug.

116. **Impacts due to alteration of the site.** The presence of diggers, trucks and other vehicles and machinery and the developing structures as they are created will gradually alter the landscapes of these sites. However most of these areas are generally not very “busy” visually and there are no features of any special landscape interest at or around the site, so it should not be necessary to mask the construction site from view by erecting screens.

117. **Impacts on site-specific economy.** All of the construction related to this subproject will be conducted on land that is at present owned by the Rajshahi City Corporation and being used as solid waste dumping and storage sites. So there will be some temporary impacts on the waste collection system of the Rajshahi City Corporation as well the income of people who are engaged in picking recyclable materials due to construction of this subproject.

118. Construction work can provide short-term socio-economic gains for local communities if contractors employ local people in the workforce. To ensure that these benefits are directed to communities that are most affected by the work, contractors are often encouraged to employ people who live in the immediate vicinity of construction sites. This is possible in this case because of the presence of inhabitation in the locality, so the contractor should offer employment to any persons who are willing to work on the present site (in breaking bricks and in other activities) and who are not already employed by some other company. Such persons are economically disadvantaged and this would be improved by even a relatively short period of temporary employment.

119. **Impacts on utilities.** There are some temporary infrastructures on the land in some of the STS sites (power lines, and possibly also water supply pipes) so there could be minor economic impacts from the disruption of supply of these facilities due to damage during construction.

120. **Impacts on accessibility.** Excavation work can also have economic impacts if heavy vehicles carrying materials to site and transporting excavated waste to the disposal site cause significant disruption of traffic, particularly where work is conducted in an urban environment such as this. However any such impacts should not be significant in this case, because dump trucks normally have a capacity of 25-30 m^3 so the disposal of 900 m^3 of soil and stone will require a relatively small number of truck movements: around 30.

121. **Impacts on social and cultural resources.** Construction activities inevitably produce noise and dust, and these plus the visual appearance of the site and restrictions in access caused by excavation and the presence of vehicles and machinery, are generally the factors that disturb people who live or work in the vicinity. These should however not be major problems in this case as there are no people living on or near this site and the people who work there are already well adapted to this type of disturbance. The construction work is also small in scale, so

it should not be necessary to apply measures to reduce noise, dust or other disturbance, beyond the dust suppression measures.

122. There are no major permanent public buildings at or near the site, and given the current land-use there are unlikely to be any locations that are of any special social or cultural importance to the community (shrines, meeting places, etc). This should be confirmed by consulting laborers who work on the site during the detailed design stage and in the unlikely event that there are such locations; assistance should be given in relocating the site and any associated artifacts.

123. **Impacts on health and safety.** As is usual on construction sites, the health and safety of workers will need to be protected by measures which the contractor will be required to produce and apply. As adjacent areas are heavily used for the storage and processing of building materials, the contractor should also include measures to assure the safety of the public.

C. Operation and Maintenance Impacts

124. For the first 2 years of operations of the STSs, the Contractor will manage the operations and maintain[11] the facility by itself or through a Contractor and if required, modify, repair or otherwise make improvements to the STS. The Contractor, in consultation with Rajshahi City Corporation, will also develop a manual for the regular and preventive maintenance of the STSs.

125. The Contractor will be required to keep the STSs 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 roads to the STSs.

126. Sufficient, safe, potable and constant supply of fresh water will be made available at adequate pressure throughout the premises. 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.

127. **Land contamination.** STSs do not contaminate the land the way other industrial operations can. The main reason for this is that STSs do not use any chemicals that can have any detrimental effect on the environment. The wastes originating from STSs help enrich the soil and make it more productive. Most land contamination is an aesthetics issue rather than one relating to pollution.

128. **Generation of Waste Materials and By-Products.** In general, pollutants generated from STSs include: wastewater from toilet and cleaning of premises, and leachate.

129. **Water contamination.** The wastes from STSs can end up in water bodies, polluting water resources. The main pollutants are wastewater from toilets and from cleaning of the premises, and the leachate from the stored solid waste in the STS. The quantity of leachate becomes more in the rainy season. No chemicals are used in STSs. 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.

[11] 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 STSs.

130. **Generation of Wastewater.** The liquid wastes of STS are high in Biochemical Oxygen Demand (BOD). But the quantity will be small and it will be allowed to drain through the existing municipal covered surface drains.

131. **Odor.** The tropical climate of Bangladesh enhances the process of degeneration of any organic material remaining in the solid waste collected from the locality. Therefore, the STS premises always give a particular stink. Excessive odor is a nuisance to locals and attracts vermin and scavengers.

132. **Noise.** Noise from the establishment can be a nuisance for communities living in the immediate vicinity of the STS. Major sources of noise are the chaos created by the laborers working in the operation of the site and heavy vehicular movement to transport solid waste from the STS.

133. **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.

134. When the STS begins to function, it is expected to provide a modern sanitary facility for the workers and staff as well as systematic handling and transportation 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 4 below, with an explanation of the reasoning in each case. These factors are thus screened out of the impact assessment and will not be mentioned further.

Table 4: Fields in which operation and maintenance of the completed STS is not expected to have significant impacts

Field	Rationale
Geology, seismology	Operating a STS should not affect these factors
Forests, wildlife, endangered species, protected areas	There are no forests, protected nature conservation areas or important habitats or species at or near the site
Coastal resources	Rajshahi STS sites are far from the sea and also these are deep inside the city and such a small structure will not affect the coastal resources
Tourism, population and communities, health and education facilities	There are no tourist attractions, inhabited areas or health/ education facilities near the STS sites
Physical or cultural heritage, archaeology, paleontology	There are also no areas of social, cultural or historical interest or importance near the sites
Indigenous Peoples	There are no IP or minority communities near the sites

D. Mitigation Measures

135. There are no impacts that are significant or complex in nature, or that need an in-depth study to assess the impact. Thus, the subproject is unlikely to cause significant adverse impacts. The potential adverse impacts that are associated with design, construction, and O&M can be mitigated to acceptable levels with the following mitigation measures (Table 5).

Table 5: Recommended Mitigation Measures

Parameter	Mitigation Measures
Planning phase	
Updating of safeguard documents	- As this subproject will be implemented on the basis of turnkey contract, the detailed design will be done by the contractor, and the IEE/ EMP will be updated at the time of

Parameter	Mitigation Measures
	detailed design and will be revised by the DSC team.
Capacity Building	- Develop and submit for approval a capacity building and training program to ensure (i) all STS workers are trained to the highest standards available in Bangladesh and given refresher training at least annually; and (ii) Rajshahi City Corporation and UPEHU staffs are given a high level of training and other support sufficient to achieve the expected standards.
Work schedule	- Ensure careful planning and scheduling of the activities. - Prepare a traffic management plan and road safety plan.
Barricades and warning signs	- Use easily transportable barricades and warning signs such as those made of high reflector plastic materials. - Also use aluminized rolled warning signs to warn the public.
Workers	- Employ workers with adequate experience, training, and know-how. It is always advantageous for the contractor to employ workers with adequate experience, training, and know-how in the line of work that they are doing. These people are usually reliable and can be counted upon to exercise good judgment in the field.
Community and public awareness	- Establish extensive coordination with Rajshahi City Corporation, Design and Supervision Consultants (DSC), Department of Environment, operators of landfill sites - A massive information campaign must precede any construction activity in order to make the public aware of the extent of the problem that might be present during the period of construction. - Open liaison channels should be established between Rajshahi City Corporation, the contractors, and interested and affected parties such that any queries, complaints, or suggestions can be dealt with quickly and by the appropriate persons.
Legislation, permits, and agreements	- In all instances, Rajshahi City Corporation, contractors and consultants must remain in compliance with relevant local and national legislation. - A copy of the IEE must be kept on-site and disclosed in Rajshahi City Corporation, Local Government Division, Ministry of Local Government, Rural Development and Cooperatives, and ADB websites. - Ensure Environmental Clearance is obtained prior to award of turnkey contract.
Access to site	- Access to site will be via existing roads. The contractor will need to ascertain the existing condition of the roads and repair damage due to construction.
Setting up of construction camp[12]	- Choice of site for the contractor's camp requires the DSC environment management specialist's permission and must take into account location of local residents, businesses, and existing land uses. A site plan must be submitted to the environment management specialist for approval. - If the contractor chooses to locate the camp site on private land, he must get prior permission from the environment management specialist and the landowner. - 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 should be encouraged.
Establishing equipment lay-down and storage area[13]	- Storage areas should be secure so as to minimize the risk of crime. They should also be safe from access by children, animals, etc. - The contractor should submit a method statement and plans for the storage of hazardous materials (fuels, oils, and chemicals) and emergency procedures.
Materials management – sourcing[14]	- The contractor should prepare a source statement indicating the sources of all materials (including topsoil, sands, natural gravels, crushed stone, asphalt, clay liners, etc), and submit these to the environment management specialist for approval prior to commencement of any work.
Education of site staff on general and environmental conduct[15]	- Ensure that all site personnel have a basic level of environmental awareness training. - Staff operating equipment (such as excavators, loaders, etc.) should be adequately trained and sensitized to any potential hazards associated with their task. - No operator should be permitted to operate critical items of mechanical equipment without having been trained by the contractor.

[12] Careful planning of the construction camp can ensure that time and costs associated with environmental management and rehabilitation is reduced

[13] Storage areas can be hazardous and unsightly and can cause environmental pollution if not designed and managed carefully.

[14] Materials must be sourced in a legal and sustainable way to prevent offsite environmental degradation.

[15] These points need to be made clear to all staff on site before the project begins.

Parameter	Mitigation Measures
	- All employees must undergo safety training.
Construction phase	
Excavated materials	- Hauling vehicles must always be present at the excavation site. - The contractor can process the excavated materials and use these as selected backfill materials. - If excavated materials are not suitable for reuse, the contractor should deposit these in an area designated by Rajshahi City Corporation. - Coordinate with the landfill operators for the disposal of excavated materials. - Identify and obtain clearance from DoE for disposal sites of excavated soils and contaminated materials. - Obtain from the environment management specialist approval for disposal of excavated materials. - Remove waste rapidly by loading material onto trucks as soon as it is excavated; - Cover or damp down working areas and stockpiled soil in dry, windy weather; and - Use tarpaulins to cover loose material during transportation to and from the site. - Maintain record of excavated materials, disposal dates, and methods. - Conduct the work in the dry season will reduce these impacts, and as the excavation in this case is shallow and small in scale there should be no impact on the water table.
Hauling of Construction Materials	- The contractor must maintain all the materials necessary in his inventory so that these can be easily hauled to the construction site when needed. - Advance signage for affected parking areas must indicate duration and alternative parking arrangements.
Access	- The contractor should make available in his stock steel plates and wooden planks which will be deployed on top of excavations to provide temporary access to buildings, street crossings, and other areas where these will be necessary. - Advance road signage must indicate the road detour and alternative routes. Provide sign boards for pedestrians to inform them of nature and duration of construction works and contact numbers for concerns/ complaints.
Occupational health and safety	- Employ workers with adequate experience, training, and know-how. - These workers should be led by an experienced supervisor or engineer, who will provide the leadership in daily activities. - 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 should 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. - The contractor must monitor the performance of construction workers to ensure that the points relayed during their induction have been properly understood and are being followed. If necessary, a translator should be called to the site to further explain aspects of environmental or social behavior that are unclear. - The rules that are explained in the worker conduct section must be followed at all times.
Community health and safety	- Contractor's activities and movement of staff will be restricted to designated construction areas. - Should the construction staff be approached by members of the public or other stakeholders, staff should assist them in locating the environment management specialist or contractor, or provide a number through which they may contact the environment management specialist or contractor. - The conduct of the construction staff when dealing with the public or other stakeholders should be in a manner that is polite and courteous at all times. Failure to adhere to this requirement may result in the removal of staff from the site by the environment management specialist. - Disruption of access for local residents, commercial establishments, institutions, etc. must be minimized and must have the environment management specialist's permissions. - Provide walkways and metal sheets where required to maintain access for people and vehicles. - Consult businesses and institutions regarding operating hours, and factor this in work schedules.

Parameter	Mitigation Measures
	- The contractor is to inform neighbors in writing of disruptive activities at least 24 hours beforehand. This can take place by way of leaflets placed in the postboxes giving the environment management specialist's and contractor's details or other method approved by the environment management specialist. - Provide sign boards for pedestrians to inform them of nature and duration of construction works and contact numbers for concerns/complaints. - The contractor will ensure that there is provision of alternate access to business establishments during the construction, so that there is no closure of these shops or any loss of clientage. - The contractor will ensure that any damage to properties and utilities will be restored or compensated to pre-work conditions. - Lighting on the construction site should be pointed downwards and away from oncoming traffic and nearby houses. - The site must be kept clean to minimize the visual impact of the site. - If screening is being used, this must be moved and re-erected as the work front progresses. - Machinery and vehicles are to be kept in good working order for the duration of the project to minimize noise nuisance to neighbors. - Notice of particularly noisy activities must be given to residents/businesses adjacent to the construction site. Examples of these include: noise generated by jackhammers, diesel generator sets, excavators, etc. - Noisy activities must be restricted to the times given in the project specification or general conditions of contract. - The environment management specialist and contractor are responsible for ongoing communication with those people who are interested in or affected by the project. - A complaints register (refer to the grievance redressal mechanism) should be housed at the site office. This should be in carbon copy format, with numbered pages. Any missing pages must be accounted for by the contractor. This register is to be tabled during monthly site meetings. - 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 should immediately take the necessary remedial action on any complaints/ grievances 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.
Community and public awareness	- Storage facilities and other temporary structures on-site should be located such that they have as little visual impact on local residents as possible. - Special attention should be given to the screening of highly reflective materials on site. - In areas where the visual environment is particularly important (e.g. along commercial/ tourism routes) 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.
Construction camps and storage areas	- The contractor is to ensure that open areas or the surrounding bushes are not being used as toilet facility. - The contractor should ensure that all litter is collected from the work and camp areas daily. - Bins and/or skips should be emptied regularly and waste should be disposed of at the pre-approved site. Waybills for all such disposals are to be kept by the contractor for review by the environment management specialist. - The contractor should ensure that his camp and working areas are kept clean and tidy at all times. - After construction work, all structures comprising the construction camp are to be removed from site or handed over to the property owner/community as per mutual agreement (if established on private/community land). - The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc. and these should be cleaned up. - All hardened surfaces within the construction camp area should be ripped, all imported

Parameter	Mitigation Measures
	materials removed, and the area should be top soiled and regressed. - The contractor must arrange the cancellation of all temporary services.
Dust and air pollution	- Vehicles travelling to and from the construction site must adhere to speed limits so as to avoid producing excessive dust. - Access and other cleared surfaces, including backfilled trenches, must be dampened whenever possible and especially in dry and windy conditions to avoid excessive dust. - Vehicles and machinery are to be kept in good working order and to meet manufacturer's specifications for safety, fuel consumption, etc. - The contractor is to have the equipment seen to as soon as possible should excessive emissions be observed,
Noise levels	- Noise-generating equipment must be fitted with silencers. - If a worker is exposed to noise above a noise exposure limit, the contractor must investigate options for engineered noise control such as using low-noise excavators, jackhammers, drills, and power generators. - 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.
Utilities	- Prepare a list of affected utilities and operators - Prepare a contingency plan to include actions to be done in case of unintentional interruption of services.
Water quality	- Every effort should be made to ensure that any chemicals or hazardous substances do not contaminate the soil or water on-site. - Care must be taken to ensure that runoff from vehicle or plant washing does not enter the surface/ground water. - Site staff should not be permitted to use any stream, river, other open water body, or natural water source adjacent to or within the designated site for the purposes of bathing, washing of clothing, or for any construction or related activities. Municipal water (or another source approved by the environment management specialist) should instead be used for all activities such as washing of equipment or disposal of any type of waste, dust suppression, concrete mixing, compacting etc. - All concrete mixing must take place on a designated, impermeable surface. - No vehicles transporting concrete to the site may be washed on-site. - No vehicles transporting, placing, or compacting asphalt or any other bituminous product may be washed on-site. - All substances required for vehicle maintenance and repair must be stored in sealed containers until they can be disposed of or removed from the site. - Hazardous substance/ materials are to be transported in sealed containers or bags.
Waste management	- Wastes must be placed in the designated skips/bins which must be regularly emptied. These should remain within demarcated areas and should be designed to prevent wastes from being blown out by wind. - Littering on-site is forbidden and the site should be cleared of litter at the end of each working day/night period. - Recycling is to be encouraged by providing separate receptacles for different types of wastes and making sure that staff is aware of their uses. - All waste must be removed from the site and transported to a disposal site or as directed by the environment management specialist. Waybills proving disposal at each site should be provided for the environment management specialist's inspection. - Construction rubble should be disposed of in pre-agreed, demarcated spoil dumps that have been approved by the environment management specialist, or at disposal sites.
Conservation of natural environment	- As the work front progresses; the contractor is to check that vegetation clearing has the prior permission of the environment management specialist. - Only trees that have been marked beforehand are to be removed, if cutting of trees is required. - Clean the entire area and maintain immediately after completion of the construction activities to make sure that existing tranquility of the surrounding area is not disturbed in any way.
Cultural and historical environment	- Consult laborers who work on the site during the detailed design stage and in the unlikely event that there are social and cultural resources in the site; assistance should be given in relocating the site and any associated artifacts. - All the staff and laborers of the contractor are to be informed about the possible items of historical or archaeological value, which include old stone foundations, tools, clayware,

Parameter	Mitigation Measures
	jewelry, remains, fossils etc. - If something of this nature is uncovered, Department of Archaeology should be contacted and work should be stopped immediately.
Safeguards supervisors	- The contractor should appoint one environment safeguard supervisor who will be responsible for assisting the contractor in implementation of EMP, coordinating with the DSC, consultations with interested/ affected parties, reporting, and grievance redressal on a day-to-day basis. The resettlement issue will be resolved before the site will be handed over to the Contractor for construction activities.
Operation and maintenance phase	
General	- Develop O&M Manuals to include all aspects of the management and operation of the STS - Train all STS workers to the highest standards available in Bangladesh and given refresher training at least annually - Control access for public/personnel; - Lock rooms or cages for waste storage; - Separate entrance and exit ensuring segregation of livestock and carcass product, to prevent cross contamination and ensure that animals do not see others being slaughtered; - Ensure proper functioning of refrigeration to maintain the cold chain from point of slaughter to dispatch; - Clean toilets daily; - Provide clean hand washing areas adequate soap and towels; - Provide clothing and laundry service for workers; and - Clean facility after the work of each day. The waste storage area and other adjacent areas should be sprinkled or sprayed regularly with disinfectants to avoid any spread of disease. - Insert plates and stops to prevent vermin from gaining access to the building. Where insect screening is required, this should consist of nylon insect mesh securely fixed to 150 × 50 reinforcing mesh with galvanized tie wire. Edges should be finished with a screw fixed beading strip where possible (all galvanized). - Audit implementation of O&M procedures at regular intervals (by an Independent Monitoring Agency)
Land contamination	- Do not store wastes outside the STS premises to avoid issues of aesthetic nature
Wastewater	- After treatment, the discharge standards need to be followed similar to the standards mentioned in Schedule 10 of the ECR 1997 for inland water discharge
Odor	- Audit odor to identify and characterize sources and determine any action required. - Store wastes properly inside the premises, preferably in an aerated area to minimize biodegradation and foul odor - Vendors should be asked to pick up waste on a daily basis to minimize degradation and odor - Enclose wastes and by-products during transport, loading/unloading and storage - Carry out frequent cleaning of material storage areas to prevent odor
Noise	- Activities and vehicle movements should be avoided after hours. - Vehicles should be fitted with silencers. - Vehicles and machinery are to be kept in good working order.

136. Rajshahi City Corporation will be responsible for operating the STSs and will be given support by the project in the form of staff training and financial assistance. ADB, LGD, Urban Public and Environment Health Unit (UPEHU) will need to ensure that the budget for such support is sufficient to ensure that the management and operation of the facility is to the expected high standard and that the elements listed above are provided.

137. The successful operation of the STSs in the manner intended should bring significant benefits to the citizens by keeping the environment cleaner than before. The facility should also provide an opportunity for saving some money for Rajshahi City Corporation because it would reduce the expenditure of RCC up to about 50% in collection and transportation of solid waste. And the RCC should re-invest this amount in staff training and equipment for the STSs, and ultimately in establishing similar facilities elsewhere in the city.

138. Citizens will also gain from improved health as they will lose fewer working days through illness and will spend less on healthcare. In time there will be wider improvements in quality of life at various locations in the city as the general environment and public health near existing STSs will greatly improve as the practices of throwing garbage here and there will decline.

V. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

A. Project Stakeholders

139. Primary stakeholders are:

(i) Companies that operate on the proposed STSs sites;
(ii) People who work at the site, either employed by a company or self-employed;
(iii) Companies and workers operating in areas adjacent to the STSs sites;
(iv) Workers and companies operating at STSs elsewhere in Rajshahi; and
(v) Companies and private individuals who are benefitted from the existing STSs.

140. Secondary stakeholders are:

(i) LGD as the Executing Agency and UPEHU as implementer;
(ii) Other government institutions whose remit includes areas or issues affected by the project (City Corporations, Planning Authorities, Department of Public Health Engineering, Local Government Engineering Department, Ministry of Finance, Ministry of Health, Ministry of Environment, Roads and Highways Department, etc);
(iii) NGOs, CBOs and other representatives of persons who may be affected by the project;
(iv) The beneficiary community in general; and
(v) The ADB.

B. Consultation and Disclosure

141. LGD/ UPEHU will extend and expand the consultation and disclosure process significantly during implementation of UPEHSDP. The UPEHU will appoint an experienced NGO to handle this key aspect of the program, who will conduct a wide range of activities in the target urban areas to ensure that the needs and concerns of stakeholders are registered, and are addressed in project design, construction or operation where appropriate. The program of activities will be developed during the detailed design stage, and is likely to include the following:

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

143. Consultation during construction:
(i) Public meetings with major stakeholders to discuss and plan work programs and allow issues to be raised and addressed once construction has started; and
(ii) Smaller-scale meetings to discuss and plan construction work with primary stakeholders to reduce disturbance and other impacts, and provide a mechanism

through which affected persons can participate in project monitoring and evaluation.

144. Project disclosure:

(i) Public information campaigns (via newspaper, TV and radio) to explain the project to the urban populations and prepare them for any disruption they may experience once the construction program is underway;

(ii) Public disclosure meetings at key stages to inform the public of progress and future plans, and to provide copies of summary documents in the Bangla language; and

(iii) Formal disclosure of completed project reports by making copies available at convenient locations in each target town, informing the public of their availability, and providing a mechanism through which comments can be made.

C. Public Consultations Conducted

145. Different techniques of consultation with stakeholders were used by the PPTA Consultants during the planning stage of project preparation (interviews, public meetings, group discussions, etc). A questionnaire was designed and environmental information was collected. Apart from this, a series of public consultation meetings were conducted during the project preparation. Various forms of public consultations (consultation through ad hoc discussions on-site) have been used to discuss the project and involve the community in planning the project design and mitigation measures. Issues discussed and feedback received along with details of date, time, location, and list of participants are given in Annex 3.

VI. ENVIRONMENTAL MANAGEMENT PLAN

A. Implementation Arrangement

146. Figure 21 is an organization chart showing how the project will be managed and implemented.

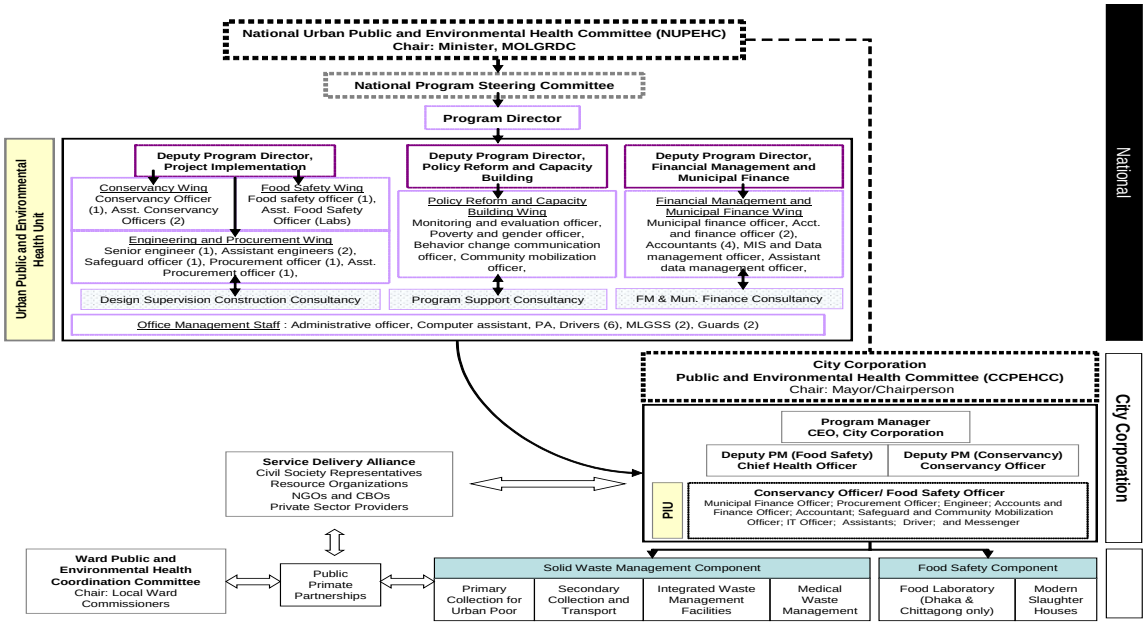


Fig 21: Organization Chart for UPEHSDP

147. **Local Government Division/Urban Public and Environmental Health Unit**. LGD of the Ministry of Local Government, Rural Development and Cooperatives (LGRDC) will be the executing agency (EA) for UPEHSDP providing overall guidance for program implementation. LGD will have the overall responsibility to plan, organize, manage, supervise, coordinate and monitor the progress achieved. LGD will establish a support unit called the Urban Public and Environmental Health Unit (UPEHU) who will be responsible for day-to-day program implementation and will be headed by a full-time program director. UPEHU will function as the Program Management Unit (UPEHU), with responsibility for day-to-day implementation. A Safeguards Officer (SO) to coordinate resettlement and environmental safeguards for UPEHSDP will be part of the Policy and Program Wing of the UPEHU. Through the SO, the UPEHU will ensure environmental compliance with ADB policy and national law across the entire program. This includes: (i) pre-approving final IEEs prior to submission to ADB for review and approval, and (ii) assisting in resolution of complaints and grievances related to IEE implementation not resolved at the CCPIU level.

148. **City Corporations/Program Implementation Units.** City Corporation Project Implementation Units (CCPIUs) will be established in each City Corporation. The CCPIUs will include a Safeguards and Community Mobilization Officer (SCMO) who will receive training from the International Environmental Specialist (IES) and Domestic Environmental Specialist (DES) who will be assigned to work with the CCPIU staff to help monitor subprojects and to transfer implementation capability to the CCPIU team. The SCMO will work closely with the IRS and DRS in planning, implementing, and monitoring all project activities. The CCPIUs will: (i) screen and categorize sub-projects; (ii) assist in, public meetings and other consultation with stakeholders; (iii) facilitate activities of the IES/ DES in applying for Location and Environmental Clearances (LCs/ECs).

149. **Environmental Specialists.** A Design, Supervision, and Construction Consultant Team (DSC) will be contracted to assist the UPEHU and CCPIUs in implementing and managing the investment subprojects including environmental planning. Towards this, International and Domestic Environmental Specialists (IES and DES) within DSC will prepare IEEs in accordance with both ADB and Government of Bangladesh (GoB) policies during the feasibility and detailed design stage, and supervise contractors, with support from CCPIUs, during the construction process. The IES and DES will work in close coordination with UPEHU and CCPIUs. They will coordinate with the SO in the UPEHU to ensure all IEEs comply with ADB and GoB rules and guidelines. The IES and DES will also provide necessary training to CCPIUs to facilitate their monitoring of environmental impacts during construction and operation. It will provide support ensuring that all tasks of the CCPIU with regard to environmental implementation and monitoring are achieved. The IES and DES, in coordination with the contractors, will revise this IEE during detailed design stage and will ensure revised/updated IEE is approved by ADB and disclosed in LGD/ UPEHU and ADB websites.

150. **Contractors.** The Contractor shall at its own cost and expense:

(i) Design, construct, supply, manage and maintain the STSs, in accordance with the provisions of the contract, good industry practice and applicable Laws;
(ii) Observe and fulfill the environmental and other requirements as specified in the IEE/ EMP and under all applicable laws and applicable permits at all time during the service delivery period;

(iii) Apply for and obtain all necessary clearances and/ or approvals for the construction of the STSs from all the concerned governmental agencies;
(iv) Coordinate with DSC IES and DES on updating the IEE/EMP based on detailed designs;
(v) Procure and maintain in full force and effect, as necessary, appropriate proprietary rights, licenses, contracts and permissions for materials, methods, processes and systems used in or incorporated into the subproject;
(vi) Provide all assistance to the Project Manager as may be reasonably required for the performance of its duties and services under this subproject;
(vii) Provide to DSC IES and DES reports on a regular basis during the service delivery period in accordance with the provisions of the contract;
(viii) Appoint, supervise, monitor and control the activities of sub-contractors under their respective project contracts as may be necessary;
(ix) Make efforts to maintain harmony and good industrial relations amongst the personnel employed by Rajshahi City Corporation in connection with the performance of the contractor's obligations under the contract;
(x) Develop, implement and administer a surveillance and safety program for the STSs and the users thereof and the contractors' personnel engaged in the provision of any services under any of the project contracts including correction of safety violations and deficiencies, and taking of all other actions necessary to provide a safe and hygienic environment in accordance with applicable laws and good industry practice;
(xi) Be responsible for safety, soundness and durability of the STSs, including all structures forming part thereof;
(xii) Ensure that the STSs sites remains free from all encroachments and take all steps necessary to remove encroachments, if any;
(xiii) Remove promptly from the STSs site all surplus construction machinery and materials, waste materials (including, without limitation, hazardous materials and waste water), rubbish and other debris and keep the area in a neat, clean and hygienic condition and in conformity with the applicable Laws and applicable Permits.

B. Capacity Building

151. A training program has been developed to build the capability of EA, city corporations, and CCPIUs. This will be conducted by the DSC and contractors. The contractor will be required to (i) conduct environmental awareness and orientation of workers prior to deployment to work sites; (ii) train STSs workers to the highest standards available in Bangladesh and given a refresher training at least annually during the service delivery period; and (iii) provide EA, CCPIUs, UPEHU, etc. a high level of training and other support sufficient to achieve the expected standards.

152. The suggested outline of the training program is presented in Table 6. The capacity building and training program will be updated during the detailed design stage to incorporate the contractors output.

Table 6: Indicative Capacity Building and Training Program for STSs Subproject

Description	Contents	Schedule	Participants
To be conducted by DSC			
Program 1 Orientation workshop	**Module 1 – Orientation** ADB Safeguards Policy Statement Bangladeshi Environmental Laws and Regulations	1 day	EA, LGD, UPEHU, and city corporation officials involved in the project implementation

Description	Contents	Schedule	Participants
	Module 2 – Environmental Assessment Process 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		CCPIUs
Program 2 Orientation program/ workshop for contractors and supervisory staff	Environmental issues during construction Implementation of EMP Monitoring of EMP implementation Reporting requirements	1 day	CCPIUs contractors
To be conducted by contractors			
Program 3 Orientation and safety Issues	STSs implementation activities detailed in drawings; safeguard policy requirements as per ADB and Government of Bangladesh rules; safety instructions and use of PPEs[16] by the staff and workers	1 day	Staff and workers of the Contractor
Program 4 Action plan for implementation of the STSs	Detailed action plan for implementation of the subproject in a timely and qualitative manner	1 day	Staff and workers of the Contractor

C. Environmental Management Action Plan

153. The EMP will guide the environmentally sound construction of the subproject and ensure efficient lines of communication between the CCPIUs, DSC, and contractors. The EMP identifies activities according to the following three phases: (i) site establishment and preliminary activities, including finalizing IEE/EMP; (ii) construction stage; and (iii) post-construction/ operational stage. Table 7 outlines the mitigation measures and persons responsible for implementation and monitoring. The EMP will be updated by DSC during the detailed design stage. Note that the final IEE/EMP should be reviewed and cleared by the EA and ADB at time of detailed design and prior to commencement of construction work.

154. **Environmental monitoring program.** Prior to commencement of any civil work, the contractors will submit a compliance report[17] to the DSC ensuring that all identified pre-

[16] **Personal protective equipment** (**PPE**) refers to protective clothing, helmets, goggles, or other garment or equipment designed to protect the wearer's body from injury. The hazards addressed by protective equipment include physical, electrical, heat, chemicals, biohazards, and airborne particulate matter. Protective equipment may be worn for job-related occupational safety and health purposes, as well as for sports and other recreational activities. "Protective clothing" is applied to traditional categories of clothing, and "protective gear" applies to items such as pads, guards, shields, or masks, and others.

[17] This compliance report will include information on (i) barricades and warning signs; (ii) area for setting up of construction camps; (iii) methodology for surveys; (iv) area for establishing lay-down and storage; (v) sources of materials; (vi) records of environmental awareness, safety training, and orientation of workers prior to deployment to work sites; (vii) contact information of the environmental and resettlement supervisors; and (viii) construction method statement.

construction environmental impact mitigation measures as detailed in the EMP will be undertaken. The DSC will review the report, and thereafter CCPIUs will allow commencement of civil works. CCPIUs and the DSC will be responsible for monitoring.

Table 7: Environmental Management Action Plan

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
Planning phase						
Updating of safeguard documents	- As this subproject will be implemented on the basis of turnkey contract, the detailed design will be done by the contractor, and the IEE/ EMP will be updated at the time of detailed design and will be revised by the DSC team.	DSC with input from the contractor	CCPIU	Updated IEE/EMP	---	ADB Environment Policy EARF ECR 1997
Capacity Building	- Develop and submit for approval a capacity building and training program to ensure (i) all STSs workers are trained to the highest standards available in Bangladesh and given refresher training at least annually; and (ii) Rajshahi City Corporation and UPEHU staff are given a high level of training and other support sufficient to achieve the expected standards.	Contractors	DSC CCPIU	Capacity building and training program	---	EARF All applicable laws and regulations
Work schedule	- Ensure careful planning and scheduling of the activities. - Prepare a traffic management plan and road safety plan.	Contractors	DSC CCPIU	Plan and schedules	Prior to approval of detailed design documents	Detailed Design documents
Barricades and warning signs	- Use easily transportable barricades and warning signs such as those made of high reflector plastic materials. - Also use aluminized rolled warning signs to warn the public.	Contractors	DSC CCPIU	Lists and samples of warning signs and barricades	Prior to approval of detailed design documents	Detailed design documents
Workers	- Employ workers with adequate experience,	Contractors	DSC CCPIU	Workers list (for internal	Prior to approval of	Detailed Design documents

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	training, and know-how. It is always advantageous for the contractor to employ workers with adequate experience, training, and know-how in the line of work that they are doing. These people are usually reliable and can be counted upon to exercise good judgment in the field.			monitoring)	detailed design documents	
Community and public awareness	- Establish extensive coordination with Rajshahi City Corporation, Design and Supervision Consultants (DSC), Department of Environment, operators of landfill sites - A massive information campaign must precede any construction activity in order to make the public aware of the extent of the problem that might be present during the period of construction. - Open liaison channels should be established between Rajshahi City Corporation, the contractors, and interested and affected parties such that any queries, complaints, or suggestions can be dealt with quickly and by the appropriate persons.	Contractors	DSC CCPIU	Communication and participation strategy	Prior to approval of detailed design documents	Detailed Design documents
Legislation, permits, and agreements	- In all instances, Rajshahi City Corporation, contractors and consultants must remain in compliance with relevant local and national legislation. - A copy of the IEE must be kept on-site and disclosed in Rajshahi City Corporation, LGD, Ministry of Local	Contractor	DSC CCPIU	All applicable permits and approvals	Prior to start of civil works and as necessary	Ensure location clearance and ECC from DoE as per guidance provided in ECR 1997 is obtained prior to award of turnkey contract

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	Government, Rural Development and Cooperatives, and ADB websites.					
Access to site	- Access to site will be via existing roads. The contractor will need to ascertain the existing condition of the roads and repair damage due to construction.	Contractor	DSC CCPIU	Traffic management plan	Prior to approval of detailed design documents	No complaints received Minimal traffic disturbance
Setting up of construction camp	- Choice of site for the contractor's camp requires the DSC environment management specialist's permission and must take into account location of local residents, businesses, and existing land uses. A site plan must be submitted to the environment management specialist for approval. - If the contractor chooses to locate the camp site on private land, he must get prior permission from the environment management specialist and the landowner. - 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 should be encouraged.	Contractor	DSC CCPIU	Location plan	Prior to approval of detailed design documents	Approved location plan Construction method No complaints received
Establishing equipment lay-down and storage area	- Storage areas should be secure so as to minimize the risk of crime. They should also be safe from access by children, animals, etc.	Contractor	DSC CCPIU	Location plan	Prior to approval of detailed design documents	Approved location plan Construction method No complaints

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	- The contractor should submit a method statement and plans for the storage of hazardous materials (fuels, oils, and chemicals) and emergency procedures.					received
Materials management – sourcing	- The contractor should prepare a source statement indicating the sources of all materials (including topsoil, sands, natural gravels, crushed stone, asphalt, clay liners, etc), and submit these to the environment management specialist for approval prior to commencement of any work.	Contractor to submit sources of materials to DSC	DSC CCPIU	Lists of sources	Prior to approval of detailed design documents	Section 6 of contract All applicable permits (e.g. from Mining Department for quarries, borrow pits, sands and gravel)
Education of site staff on general and environmental conduct[18]	- Ensure that all site personnel have a basic level of environmental awareness training. - Staff operating equipment (such as excavators, loaders, etc.) should be adequately trained and sensitized to any potential hazards associated with their task. - No operator should be permitted to operate critical items of mechanical equipment without having been trained by the contractor. - All employees must undergo safety training.	Contractor	DSC CCPIU	Records of training	Prior to start of civil works and every new employee	Revised/Updated IEE/EMP (capacity building)
Construction phase						
Excavated materials	- Hauling vehicles must always be present at the excavation site.	Contractor	DSC	Construction method statement	As work progresses	Construction method Detailed design

[18] These points need to be made clear to all staff on site before the project begins.

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	- The contractor can process the excavated materials and use these as selected backfill materials. - If excavated materials are not suitable for reuse, the contractor should deposit these in an area designated by Rajshahi City Corporation. - Coordinate with the landfill operators for the disposal of excavated materials. - Obtain from the environment management specialist approval for disposal of excavated materials. - Remove waste rapidly by loading material onto trucks as soon as it is excavated; - Cover or damp down working areas and stockpiled soil in dry, windy weather; and - Use tarpaulins to cover loose material during transportation to and from the site. - Maintain record of excavated materials, disposal dates, and methods. - Conduct the work in the dry season will reduce these impacts, and as the excavation in this case is shallow and small in scale there should be no impact on the water table.					documents Identify and obtain clearance from DoE for disposal sites of excavated soils and contaminated materials
Hauling of Construction Materials	- The contractor must maintain all the materials necessary in his inventory so	Contractor	DSC	Construction method statement	As work progresses	Construction method Detailed design

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	that these can be easily hauled to the construction site when needed. - Advance signage for affected parking areas must indicate duration and alternative parking arrangements.					documents
Access	- The contractor should make available in his stock steel plates and wooden planks which will be deployed on top of excavations to provide temporary access to buildings, street crossings, and other areas where these will be necessary. - Advance road signage must indicate the road detour and alternative routes. Provide sign boards for pedestrians to inform them of nature and duration of construction works and contact numbers for concerns/complaints.	Contractor	DSC	Construction method statement	As work progresses	Construction method Detailed design documents Zero complaints from community/sensitive receptors
Occupational health and safety	- Employ workers with adequate experience, training, and know-how. - These workers should be led by an experienced supervisor or engineer, who will provide the leadership in daily activities. - 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;	Contractor	DSC	Occupational health and safety plan Number of accidents and work-related injuries Complaints from community	As work progresses	Construction method Detailed design documents Zero accident and work-related injuries Zero complaints from community and workers

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	(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 should 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. - The contractor must monitor the performance of construction workers to ensure that the points relayed during their induction have been properly understood and are being followed. If necessary, a translator should be called to the site to further explain aspects of environmental or social behavior that are unclear. - The rules that are explained in the worker conduct section must be followed at all times.					
Community health and safety	- Contractor's activities and movement of staff will be restricted to designated	Contractor	DSC	Complaints from community	As work progresses	Zero complaints from community and workers

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	construction areas. - Should the construction staff be approached by members of the public or other stakeholders, staff should assist them in locating the environment management specialist or contractor, or provide a number through which they may contact the environment management specialist or contractor. - The conduct of the construction staff when dealing with the public or other stakeholders should be in a manner that is polite and courteous at all times. Failure to adhere to this requirement may result in the removal of staff from the site by the environment management specialist. - Disruption of access for local residents, commercial establishments, institutions, etc. must be minimized and must have the environment management specialist's permissions. - Provide walkways and metal sheets where required to maintain access for people and vehicles. - Consult businesses and institutions regarding operating hours, and factor this in work schedules. - The contractor is to inform neighbors in writing of disruptive activities at least 24 hours beforehand. This			Activities based on the communication and participation strategy		

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	can take place by way of leaflets placed in the postboxes giving the environment management specialist's and contractor's details or other method approved by the environment management specialist. - Provide sign boards for pedestrians to inform them of nature and duration of construction works and contact numbers for concerns/complaints. - The contractor will ensure that there is provision of alternate access to business establishments during the construction, so that there is no closure of these shops or any loss of clientage. - The contractor will ensure that any damage to properties and utilities will be restored or compensated to pre-work conditions. - Lighting on the construction site should be pointed downwards and away from oncoming traffic and nearby houses. - The site must be kept clean to minimize the visual impact of the site. - If screening is being used, this must be moved and re-erected as the work front progresses. - Machinery and vehicles are to be kept in good working order for the duration of the project to minimize noise					

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	nuisance to neighbors. - Notice of particularly noisy activities must be given to residents/businesses adjacent to the construction site. Examples of these include: noise generated by jackhammers, diesel generator sets, excavators, etc. - Noisy activities must be restricted to the times given in the project specification or general conditions of contract. - The environment management specialist and contractor are responsible for ongoing communication with those people who are interested in or affected by the project. - A complaints register (refer to the grievance redressal mechanism) should be housed at the site office. This should be in carbon copy format, with numbered pages. Any missing pages must be accounted for by the contractor. This register is to be tabled during monthly site meetings. - 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					

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	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 should 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.					
Community and public awareness	- Storage facilities and other temporary structures on-site should be located such that they have as little visual impact on local residents as possible. - Special attention should be given to the screening of highly reflective materials on site. - In areas where the visual environment is particularly important (e.g. along commercial/ tourism routes) 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.	Contractor	DSC	Complaints from community Activities based on the communication and participation strategy	As work progresses	Zero complaints from community and workers

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
Construction camps and storage areas	- The contractor is to ensure that open areas or the surrounding bushes are not being used as toilet facility. - The contractor should ensure that all litter is collected from the work and camp areas daily. - Bins and/or skips should be emptied regularly and waste should be disposed of at the pre-approved site. Waybills for all such disposals are to be kept by the contractor for review by the environment management specialist. - The contractor should ensure that his camp and working areas are kept clean and tidy at all times. - After construction work, all structures comprising the construction camp are to be removed from site or handed over to the property owner/community as per mutual agreement (if established on private/community land). - The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc. and these should be cleaned up. - All hardened surfaces within the construction camp area should be ripped, all imported materials removed, and the area should be top soiled and regressed. - The contractor must arrange the cancellation of	Contractor	DSC	Approved location plan Complaints from community	As work progresses	Approved location plan Zero complaints from community and workers

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	all temporary services.					
Dust and air pollution	- Vehicles travelling to and from the construction site must adhere to speed limits so as to avoid producing excessive dust. - Access and other cleared surfaces, including backfilled trenches, must be dampened whenever possible and especially in dry and windy conditions to avoid excessive dust. - Vehicles and machinery are to be kept in good working order and to meet manufacturer's specifications for safety, fuel consumption, etc. - The contractor is to have the equipment seen to as soon as possible should excessive emissions be observed,	Contractor	DSC	Vehicle emission testing records Complaints from community	As work progresses	No visible increase in dust and particulate matters Zero complaints from community
Noise levels	- Noise-generating equipment must be fitted with silencers. - If a worker is exposed to noise above a noise exposure limit, the contractor must investigate options for engineered noise control such as using low-noise excavators, jackhammers, drills, and power generators. - 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	Contractor	MASC environment management specialist	Complaints from community Noise level monitoring record	As work progresses	ECR 1997

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	protection.					
Utilities	- Prepare a list of affected utilities and operators - Prepare a contingency plan to include actions to be done in case of unintentional interruption of services.	Contractor	DSC	Number of affected utilities Length of time to restore disrupted services	As work progresses	No disrupted service
Water quality	- Every effort should be made to ensure that any chemicals or hazardous substances do not contaminate the soil or water on-site. - Care must be taken to ensure that runoff from vehicle or plant washing does not enter the surface/ground water. - Site staff should not be permitted to use any stream, river, other open water body, or natural water source adjacent to or within the designated site for the purposes of bathing, washing of clothing, or for any construction or related activities. Municipal water (or another source approved by the environment management specialist) should instead be used for all activities such as washing of equipment or disposal of any type of waste, dust suppression, concrete mixing, compacting etc. - All concrete mixing must take place on a designated, impermeable surface. - No vehicles transporting concrete to the site may be	Contractor	DSC	Complaints from community Waste disposal manifest/record	As work progresses	No visible increase in water pollution due to the project Zero complaints from community

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	washed on-site. - No vehicles transporting, placing, or compacting asphalt or any other bituminous product may be washed on-site. - All substances required for vehicle maintenance and repair must be stored in sealed containers until they can be disposed of removed from the site. - Hazardous substance/ materials are to be transported in sealed containers or bags.					
Waste management	- Wastes must be placed in the designated skips/bins which must be regularly emptied. These should remain within demarcated areas and should be designed to prevent wastes from being blown out by wind. - Littering on-site is forbidden and the site should be cleared of litter at the end of each working day/night period. - Recycling is to be encouraged by providing separate receptacles for different types of wastes and making sure that staff is aware of their uses. - All waste must be removed from the site and transported to a disposal site or as directed by the environment management specialist. Waybills proving disposal at each site should be provided	Contractor	DSC	Complaints from community Waste disposal manifest/record	As work progresses	No dumped wastes and litter at work sites at all times Zero complaints from community

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	for the environment management specialist's inspection. - Construction rubble should be disposed of in pre-agreed, demarcated spoil dumps that have been approved by the environment management specialist, or at disposal sites.					
Conservation of natural environment	- As the work front progresses; the contractor is to check that vegetation clearing has the prior permission of the environment management specialist. - Only trees that have been marked beforehand are to be removed, if cutting of trees is required. - Clean the entire area and maintain immediately after completion of the construction activities to make sure that existing tranquility of the surrounding area is not disturbed in any way.	Contractor	DSC	Vegetation clearing	As required	Only allowed trees/vegetation to be cleared
Cultural and historical environment	- Consult laborers who work on the site during the detailed design stage and in the unlikely event that there are social and cultural resources in the site; assistance should be given in relocating the site and any associated artifacts. - All the staff and laborers of the contractor are to be informed about the possible items of historical or	Contractor	DSC	Chance finds	As necessary	All chance finds shall be reported and turned over to the Department of Archaeology.

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	archaeological value, which include old stone foundations, tools, clayware, jewelry, remains, fossils etc. - If something of this nature is uncovered, Department of Archaeology should be contacted and work should be stopped immediately.					
Safeguards supervisors	- The contractor should appoint one environment safeguard supervisor who will be responsible for assisting the contractor in implementation of EMP, coordinating with the DSC, consultations with interested/affected parties, reporting, and grievance redressal on a day-to-day basis.	Contractor	DSC	Hiring and actual work	As work progresses	Continuous work output and reporting records
Operation and maintenance phase						
General	- Develop O&M Manuals to include all aspects of the management and operation of the STSs - Train all STS workers to the highest standards available in Bangladesh and given refresher training at least annually - Control access for public/personnel; - Clean toilets daily; - Provide clean hand washing areas adequate soap and towels; - Provide clothing and laundry service for workers; and - Clean facility after the work of each day. The waste storage area and other	Contractor (up to service delivery period) Rajshahi City Corporation	Rajshahi City Corporation (up to service delivery period) Independent Monitoring Agency	Specifications in the O&M Manual Public health survey (5 years)	As determined in the O&M Manual	As specified in the O&M Manual and all applicable laws and regulations

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	adjacent areas should be sprinkled or sprayed regularly with disinfectants to avoid any spread of disease. - Audit implementation of O&M procedures at regular intervals (by an Independent Monitoring Agency)					
Land contamination	- Do not store wastes outside the STSs premises to avoid issues of aesthetic nature	Contractor (up to service delivery period) Rajshahi City Corporation	Rajshahi City Corporation (up to service delivery period) Independent Monitoring Agency	Specifications in the O&M Manual	As determined in the O&M Manual	As specified in the O&M Manual and all applicable laws and regulations
Wastewater	- After treatment, the discharge standards need to be followed similar to the standards mentioned in Schedule 10 of the ECR 1997 for inland water discharge	Contractor (up to service delivery period) Rajshahi City Corporation	Rajshahi City Corporation (up to service delivery period) Independent Monitoring Agency	Specifications in the O&M Manual	As determined in the O&M Manual	ECR 1997 (Rule 13: The standard limits of the discharge of liquid wastes shall be determine in accordance with the standards specified in Schedule 10)
Other wastes	- All other wastes arising in the STSs should be properly graded and disposed of by appropriate methods. - Disposed into a solid waste bin (skip) and immediately transport out of the STSs in a closed wheel-barrow or similar other device.	Contractor (up to service delivery period) Rajshahi City Corporation	Rajshahi City Corporation (up to service delivery period) Independent Monitoring Agency	Specifications in the O&M Manual	As determined in the O&M Manual	As specified in the O&M Manual and all applicable laws and regulations
Odor	- Audit odor to identify and characterize sources and determine any action required. - Carry out frequent cleaning of material storage areas to prevent odor	Contractor (up to service delivery period) Rajshahi City Corporation	Rajshahi City Corporation (up to service delivery period) Independent Monitoring Agency	Specifications in the O&M Manual	As determined in the O&M Manual	As specified in the O&M Manual and all applicable laws and regulations
Noise	- Activities and vehicle movements should be	Contractor (up to service delivery	Rajshahi City Corporation (up to	Specifications in the O&M	As determined in the O&M	As specified in the O&M Manual and all

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	avoided after hours. - Vehicles should be fitted with silencers. - Vehicles and machinery are to be kept in good working order.	period) Rajshahi City Corporation	service delivery period) Independent Monitoring Agency	Manual	Manual	applicable laws and regulations
Water use	- Minimize water use through dedicated metering of water consumption	Contractor (up to service delivery period) Rajshahi City Corporation	Rajshahi City Corporation (up to service delivery period) Independent Monitoring Agency	Specifications in the O&M Manual	As determined in the O&M Manual	As specified in the O&M Manual and all applicable laws and regulations
Health, hygiene, and safety	- STS workers should undergo regular medical check-up - STS workers should be provided with protective gear like head cover, gloves, etc - Provide training on safety to staff to avoid accidents - Regularly monitor the STSs to ensure compliance with occupational health and safety rules	Contractor (up to service delivery period) Rajshahi City Corporation	Rajshahi City Corporation (up to service delivery period) Independent Monitoring Agency	Specifications in the O&M Manual	As determined in the O&M Manual	As specified in the O&M Manual and all applicable laws and regulations

D. Reporting

155. The DSC will submit monthly monitoring reports to CCPIU, and the CCPIU will send semiannual monitoring reports to ADB. ADB will post the environmental monitoring reports on its website.

E. Environmental Costs

156. The contractor's cost for site establishment, preliminary activities, construction, defect liability activities, and environmental mitigation measures related to EMP implementation during planning, design, construction, and operations will be incorporated into the contractual agreements and engineers costs, which will be binding on him for implementation.

157. The mitigation measures during the operation phase (after the service delivery period) are again of good operating practices, which will be the responsibility of the implementing agency (Rajshahi City Corporation). All monitoring during the operation and maintenance phase will be conducted by Rajshahi City Corporation; therefore, there are no additional costs.

158. The activities identified in the EMP mainly include site inspections and informal discussions with workers and local community, and this will be the responsibility of CCPIU with the assistance of DSC, costs of which are part of project management.

159. Table 8 presents the estimated cost to implement the EMP. The EMP and the costs for the EMP implementation will be updated during detailed engineering design. The figures show that the total cost of environmental management and monitoring for all subprojects in Rajshahi is Tk 22.5 million. This includes: the cost of the Independent Monitoring Agency, which will spend one week every month for five years, monitoring the operation of the STS. It includes the cost of all surveys (long-term bi-annual wastewater monitoring will be done by DOE and test costs borne by operator according to DOE fee rates as per Schedule 14 of the ECR, 1997) and other expenses associated with implementing the EMP for this subproject during project implementation. It also includes the cost of the long-term survey of public health proposed in the EMP for this subproject.

Table 8: Environmental Management and Monitoring Costs for Rajshahi STSs

Item	Quantity	Unit Cost (TK.)	Total Cost (TK.)	Sub-total
1. Monitoring during Construction (1.5 years)				
Domestic Environmental Specialist	1 x 6 month	300,00019	1,800,000	
Survey Expenses	Lump Sum	2,000,000	2,000,000	3,800,000
2. Monitoring during Operation (5 years)				
Independent Monitoring Expert	5 x 3 month	300,000	4,500,000	
Supporting Staff	5 x 3 month	200,000	3,000,000	
Survey Expenses	Lump Sum	5,000,000	5,000,000	12,500,000
3. IEEs/EIAs required by ADB policy & national law				
Domestic Environmental Specialist	1 x 12 month	300,000	3,600,000	
Expenses (surveys, consultation, disclosure)	Lump Sum	1,000,000	1,000,000	4,600,000
4. Survey of Public Health (5 years)				

[19] Unit cost of domestic consultants is based on current rates and includes fee, travel, accommodation and subsistence.

Item	Quantity	Unit Cost (TK.)	Total Cost (TK.)	Sub-total
Domestic Consultant	5 x ½ month	300,000	750,000	
Supporting Staff	5 x ½ month	200,000	500,000	
Other Expenses	Lump Sum	500,000	350,000	1,600,000
TOTAL COST (TK.)				**22,500,000**

VII. FINDINGS AND RECOMMENDATIONS

A. Findings

160. The process described in this document has assessed the environmental impacts of all elements of the infrastructure proposed under the Rajshahi STSs subproject. Potential negative impacts were identified in relation to the design, construction and operation of the infrastructure, and mitigation measures have been developed to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects of program development, and as a result some measures have already been included in the outline designs for the infrastructure. These include:

(i) Ensuring that the site selected for the STS is owned by the Government and does not contain any residential property, to avoid the need to relocate households; and

(ii) Selecting a site that is in an uninhabited area where there are no sensitive receptors because the people in the goat/ cattle market do not stay there permanently. The tin-shed located in the corner will be dismantled by the own initiative of the RCC before the construction activities begins.

161. This means that the number of impacts and their significance has already been reduced by amending both the design and location of elements of the subproject.

162. Regardless of these and various other actions taken during the IEE process and in developing the subproject, there will still be impacts on the environment when the infrastructure is built and when it is operating. This is mainly because a functioning STS can have major negative impacts on public health and safety, and environmental quality, if it is not operated to the highest professional standards. Because of these factors the most significant impacts are on the physical environment and the human environment.

163. In the construction phase there are not expected to be major negative impacts because the construction work is relatively small scale and straightforward and will be conducted at a single site. Other mitigation and enhancement measures are included in the EMP, which also shows the location of the impact, the body responsible for the mitigation, and the program for its implementation.

164. Operation and maintenance of the completed STSs will be the responsibility of the contractor up to the end of the service delivery period and afterwards, the Rajshahi City Corporation. It will be vital that the facility operates to the highest professional standards because if this is not the case it could easily replicate the practices and effects that are common at existing STSs and *ad hoc* solid waste dumping places in the city. These include impacts on:

(i) **Worker health and safety.** if equipment, procedures and hygiene are inadequate;

(ii) **Environmental quality.** if solid waste is not properly collected and transported on a daily basis.

165. The IEE includes a number of measures relating to the design to ensure that the facility operates to a high standard and avoids these and other impacts. The main measures are that:

(i) All aspects of management and operation should be set out in O&M manuals prepared by an international expert in STSs management;
(ii) Implement of the procedures is checked and audited by an Independent Monitoring Agency every month for the first five years;
(iii) All workers are trained to the highest available standards and re-trained annually;
(iv) Ensuring sufficient training and financial support to the Rajshahi City Corporation to achieve expected standards.

166. If these and the other mitigation measures recommended by the IEE are implemented, then the STSs should operate without significant negative impacts. Public health should therefore improve and there will also be economic benefits for the people in general because there will be less possibility of getting sick and subsequent absence of the workers in offices and factories. In time there should also be improvements in environmental quality around existing STSs as these practices

167. Mitigation will be assured by a program of environmental monitoring conducted during both construction and operation to ensure that all measures are provided as intended, and to determine whether the environment is protected as envisaged. This will include observations on and off site, document checks, and interviews with workers and beneficiaries during the construction stage, and weekly monitoring of all practices at the STSs for the first five years of operation, by the IMA. Any requirements for remedial action will be reported to LGD/ UPEHU and ADB. There will also be a longer-term survey to monitor the expected improvements in public health.

168. Finally, stakeholders were involved in developing the IEE through face-to-face discussions on site and a large public meeting held in the town, after which views expressed were incorporated into the IEE and the planning and development of the project. The IEE and other documents will be made available at public locations in the town and summaries will be disclosed to a wider audience via the ADB website. The consultation process will be continued and expanded during project implementation, when a nationally-recognized NGO will be appointed to handle this key element to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation.

B. Recommendations

169. There are two straightforward but essential recommendations that need to be followed to ensure that the environmental impacts of the project are successfully mitigated. These are that LGD/ UPEHU should ensure that:

(i) All mitigation, compensation and enhancement measures proposed in this IEE report (Table 7) are implemented in full, as described in this document; and
(ii) The EMP of this report is updated during detailed design and also implemented in full during construction and operation period.
(iii) A copy of the EMP shall be kept on-site during the construction and operation period at all times.

(iv) 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.

VIII. CONCLUSIONS

170. The environmental impacts of the proposed STSs subprojects in the Rajshahi City have been assessed according to ADB guidelines and results reported in this IEE. The potential adverse environmental impacts are related to the (i) construction period, which can be minimized by the mitigating measures and environmentally sound engineering and construction practices; and (ii) operation period, which can be managed by the mitigation measures and environmentally sound O&M practices. Therefore, as per ADB Environment Policy, the project is classified as environmental category B and does not require further environmental impact assessment.

171. In relation to Bangladeshi ECR 1997, the Rajshahi STSs subproject is considered to have some potential for environmental impacts and can be classified as Orange – B category. The environmental impacts can be mitigated by the measures mentioned in this IEE and EMP. So this IEE document will be sufficient and acceptable to DoE as part of the ECC application and further study for impact assessment will not be necessary.

ANNEX 1: ADB Rapid Environmental Assessment Checklist

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area…			
▪ Densely populated?		**X**	
▪ Heavy with development activities?		**X**	The STS sites are located in city corporation and Government owned lands. At present these are being used for dumping of municipal solid wastes.
▪ Adjacent to or within any environmentally sensitive areas?			
• Cultural heritage site		**X**	
• Protected Area		**X**	
• Wetland		**X**	
• Mangrove		**X**	
• Estuarine		**X**	
• Buffer zone of protected area		**X**	
• Special area for protecting biodiversity		**X**	
• Bay		**X**	
B. Potential Environmental Impacts Will the Project cause…			
▪ impacts on the sustainability of associated sanitation and solid waste disposal systems and their interactions with other urban services.		**X**	
▪ deterioration of surrounding environmental conditions due to rapid urban population growth, commercial and industrial activity, and increased waste generation to the point that both manmade and natural systems are overloaded and the capacities to manage these systems are overwhelmed?		**X**	
▪ degradation of land and ecosystems (e.g. loss of wetlands and wild lands, coastal zones, watersheds and forests)?		**X**	
▪ dislocation or involuntary resettlement of people?		**X**	There will be no dislocation or involuntary resettlement of people.
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable group?		**X**	
▪ degradation of cultural property, and loss of cultural heritage and tourism revenues?		**X**	
▪ occupation of low-lying lands, floodplains and steep hillsides by squatters and low-income groups, and their exposure to increased health hazards and risks due to pollutive industries?		**X**	
▪ water resource problems (e.g. depletion/degradation of		**X**	

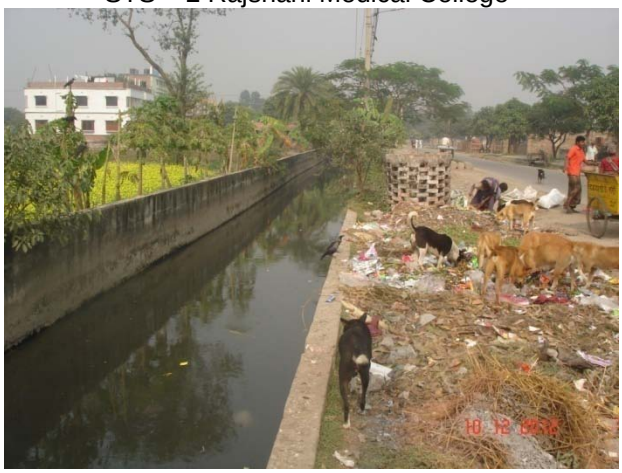
Screening Questions	Yes	No	Remarks
available water supply, deterioration for surface and ground water quality , and pollution of receiving waters?			
▪ air pollution due to urban emissions?	**X**		During construction activities for hauling of materials and operations of excavation equipment; During operations, odor from the solid wastes due to agitation and mixing
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical and biological hazards during project construction and operation?	**X**		During construction activities – occupational health and safety due to physical hazards; During construction activities – occupational health and safety due to physical and biological hazards
▪ road blocking and temporary flooding due to land excavation during rainy season?		**X**	
▪ noise and dust from construction activities?	**X**		During construction phase only
▪ traffic disturbances due to construction material transport and wastes?	**X**		During construction phase only
▪ temporary silt runoff due to construction?	**X**		During construction phase only
▪ hazards to public health due to ambient, household and occupational pollution, thermal inversion, and smog formation?		**X**	
▪ water depletion and/or degradation?		**X**	
▪ overpaying of ground water, leading to land subsidence, lowered ground water table, and salinization?		**X**	
▪ contamination of surface and ground waters due to improper waste disposal?	**X**		During construction phase only
▪ pollution of receiving waters resulting in amenity losses, fisheries and marine resource depletion, and health problems?		**X**	
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		**X**	
▪ social conflicts if workers from other regions or countries are hired?		**X**	
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during operation and construction?		**X**	
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		**X**	

ANNEX 2: Photographs of the Proposed STS Sites and the Surrounding Areas

STS – 1 Court Station Walton Showroom

STS – 2 Rajshahi Medical College

STS – 3 Terokhadia Women Sports Complex



STS – 4 Rashik Composting Plant

STS – 5 Talaimari Adarsha School

STS – 6 Kazla Water Pump

ANNEX 3: Records of Public Consultations Conducted

The stakeholders' consultation meeting was held in front of Rashik Composting Plant, Terokhadia, Rajshahi at 12-00 Noon on 10 December 2012 with local people and Rajshahi City Corporation (RCC) officials.

The meeting was held with local people and Conservancy Officer Monitoring (Mr. Jhantu) of RCC. Among the local people, most of them were laborers and engaged in loading and unloading of solid waste in the temporary dumping place who participated actively in the consultation.

Meeting at STS near Rashik Composting Plant

The Environment and Safeguard Specialist of Package-C Consultants welcomed all participants in the meeting and explained goals and objectives of the project. He told that the Government of Bangladesh through the RCC has undertaken a project to construct one modern slaughterhouse, one sanitary land fill and 6 secondary transfer stations in RCC area to keep the city free from environmental pollution. This project will benefit the local people by improving the environmental conditions.

It was known from the discussion that the land proposed for construction of the Secondary Transfer Station (STS) is owned by the Railway authority of Government of Bangladesh. It is a quite big area and it will be sufficient for construction of a standard size STS as per design adopted in UPEHSDP It is at present temporarily being used as a place for dumping municipal solid waste collected from the locality. The participant from the RCC clearly stated that the area proposed for construction of STS will be kept free from any dumping of solid waste by the own initiative of the RCC during the construction activities by the contractor in the site.

It was disclosed in the meeting that the project would be implemented soon and the local people would get benefit of getting employment as soon as the construction works would start. They also expressed their willingness to get long-term deployment after the implementation of the STS. It was disclosed to the participants that the local people would get preference during selection of staff and workers for running the STS in a sustainable manner.

The participants were convinced that the socio-economic and environmental condition of the local people and the locality would be definitely better after implementation of the subproject and they showed their willingness to cooperate whole heartedly during construction and operation and maintenance phase of the STS.

There were no issues left for discussion and the meeting was closed with a vote of thanks to all participants.

Ministry of Local Government, Rural Development and Cooperatives
Urban Public and Environmental Health Sector Development Project (UPEHSDP)

Attendance Sheet

Time: 12-00 Noon Date: 10/12/2012

Place of meeting: Terokhadia STS site at Rajshahi **Union:** W-14 **Thana:** Boalia

Serial Number	Name of Participant	Father's/ Husband's Name	Address	Mobile Number	Signature
1	Md. Faruk Ahmed Babor	Md. Hazrat Ali	Terokhadia	01840781000	
2	Sumon Ali	Lookman Hossain	Deenanagar	01917230310	
3	Nuruzzaman	Babu	Koyerdara	01191409863	
4	Asik	Babu	Koyerdara	01191409863	
5	Monzur	Saju	Asam Colony	01715974816	
6	Md. Amzad Sheikh	Mirza Alauddin	Koyerdara	01765700091	
7	Sonia	Md. Iqbal	Choto Bonogram	-	
8	Guljan	Yusuf	Koyerdara	-	
9	Md. Gulzar Hossain	Md. A. Halim	Sopura Match Factory	01929437335	
10	Asad	Sultan Sheikh	Bokhtirabad	-	
11	Mustak Hossain	Late A. Rashid	Housing Estate	01919098898	

Ministry of Local Government, Rural Development and Cooperatives
Urban Public and Environmental Health Sector Development Project (UPEHSDP)

Attendance Sheet

Time: 12-00 NOON Date: 10/12/2012

Place of meeting: Tero Khadia STS side, Rajshahi Union: W-14 Thana: Boalia/Rajpara

Serial Number	Name of Participant	Father's/ Husband's Name	Address	Mobile Number	Signature
1	[illegible]	[illegible]	[illegible]	01840781000	[illegible]
2	[illegible]	[illegible]	[illegible]	01917-230316	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	01765700071	[illegible]
7	[illegible]	[illegible]	[illegible]	—	[illegible]
8	[illegible]	[illegible]	[illegible]	—	[illegible]
9	[illegible]	[illegible]	[illegible]	01924937335	[illegible]
10	[illegible]	[illegible]	[illegible]	—	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]