

Initial Environmental Examination

March 2013

BAN: Urban Public and Environment Health Sector Development Program: Dhaka 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
DCC	-	Dhaka City Corporation
DES	–	Domestic Environmental Specialist
DLS	-	Department of Livestock Services
DO	–	Dissolved Oxygen
DoE	–	Department of Environment
DSC	–	Design, Supervision, and Construction Consultant
DSCC	–	Dhaka South City Corporation
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	–	Reinforced Cement Concrete
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.

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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 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 Dhaka Secondary Transfer Stations subproject in Dhaka 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 Dhaka 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 Dhaka STS Subproject

Acts/ Guidelines	Purpose	Applicability to the Subproject
Environmental Conservation Act, 1995 and Environmental Conservation Rules, 1997	<ul style="list-style-type: none"> - 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 	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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. 	<ul style="list-style-type: none"> - 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
	<ul style="list-style-type: none"> – 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 Dhaka 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 Dhaka 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 Dhaka, which may then be replicated in other urban centers through further subprojects.

B. Location, Size and Implementation Schedule

21. The Dhaka STS subproject consists of 12 Secondary Transfer Stations (STSs) on small plots of Government land beside roads in different parts of the city; photographs of the proposed sites 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 DCC 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 12 STSs described under Paragraphs 23 to 34 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 west end and south side of 100 feet wide Jashimuddin Road of Uttara Residential Area, W-1; this unpaved portion of the road has been handed over to Dhaka City Corporation by Rajuk.

24. STS site 2: This STS site is located in east side of the main road towards Tongi, W-1, in front of the Uttara RAJUK College, near the BDR Bazaar; in the east side of Dhaka Mymensingh road, this part of the road is known as service road adjacent to the main road.

25. STS site 3: This STS site is located in Golar Tek, Mirpur; Mouza - Johurabad, JL- 226, Dag #292 and 209, in the south west corner of Shahid Buddhijibi Koborosthan and in the east of the existing entrance gate to the Idgah field.
26. STS site 4: This STS is located in Karwan Bazar, W-26, city survey mouza – Kawranbazar, JL – 7, Sheet – 3, Dag #616; about 200 meter south east of city corporation local office; the site is inside the rectangular bounded area and in the south east corner; Khawza Hotel is in the east of the bounded area.
27. STS site 5: This STS site is located in W-34 in the western side of Berry Bandh Mohammadpur; Zaker Dairy Firm is located in the north west side, Bismillah Auto is in the eastern side of Berry Bandh in the same location; Mohammadi Housing Limited, a planned housing area is in the east of this site.
28. STS site 6: This STS site is located in Mouza - Raj Mushori, JL #255, W - 14, Z – 3; east side of Berry Bandh Rayer Bazar, in front of Akash Auto Motor Workshop, 295/14 Sikdar Tally Office Rayer Bazar.
29. STS site 7: This STS site is located in the east side of Berry Bandh Hazaribag attached to Progoti Diary farm; W - 22, Z – 3; opposite to RS CNG pump.
30. STS site 8: This site is located in the east side of Berry Bandh Hazaribag; W - 22, Z – 3; Matador Plastic Factory is in the western side of the Berry Bandh in the same location.
31. STS site 9: This STS site is located in south east of Jurain Kabarosthan; Mouza - Jurain Kabarosthan, JL #337, Sheet - 1, CS - 9 (part), W - 54, Z – 5.
32. STS site 10: This STS site is located in Jatrabari crossing in the north side of Demra road; W - 48, Z - 5, land in the west of office for Ward - 41 and public toilet.
33. STS site 11: This STS site is located in the west of Golapshah Mazar in Gulistan; W - 20, Z - 1, open land in the Usmani Udyan north of Golapshah mosque.
34. STS site 12: This STS site is located in front of Dhaka Medical College and part of it in the Dhaka University (DU) playground; in the north of the road; Land of DU and Dhaka City Corporation, W - 1, Z – 1.
35. Preliminary design of Dhaka 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

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

- (i) Development on a site 15 meters by 10 meters (150 m²);
- (ii) Enclosed hall building with three roller shutter access points from the road;
- (iii) Containers placed in pits equipped allowing primary collection rickshaws to empty collected waste by gravity into the containers;
- (iv) Two pit or one pit system depending on population to be served and available land area;
- (v) Transfer of wastes directly into large capacity transfer containers through use of an electric hoist mounted onto two ceiling I-beams;
- (vi) Weighing the containers in the pits, thus allowing for maximum loads in each container without under-or-overloading.
- (vii) Loading of containers directly onto transfer vehicles that have only a light weight tipping frame body, thus maximizing permitted waste loads.
- (viii) 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.
- (ix) Covering of full containers during storage/ transport to limit the potential for littering and release of odors.
- (x) 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.
- (xi) 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.
- (xii) 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.
- (xiii) 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.
- (xiv) 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.

37. 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.

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

39. Figures 2 to 25 provide preliminary site layout plans including the North and East Coordinates as well as the tentative plans of the 12 STSs.

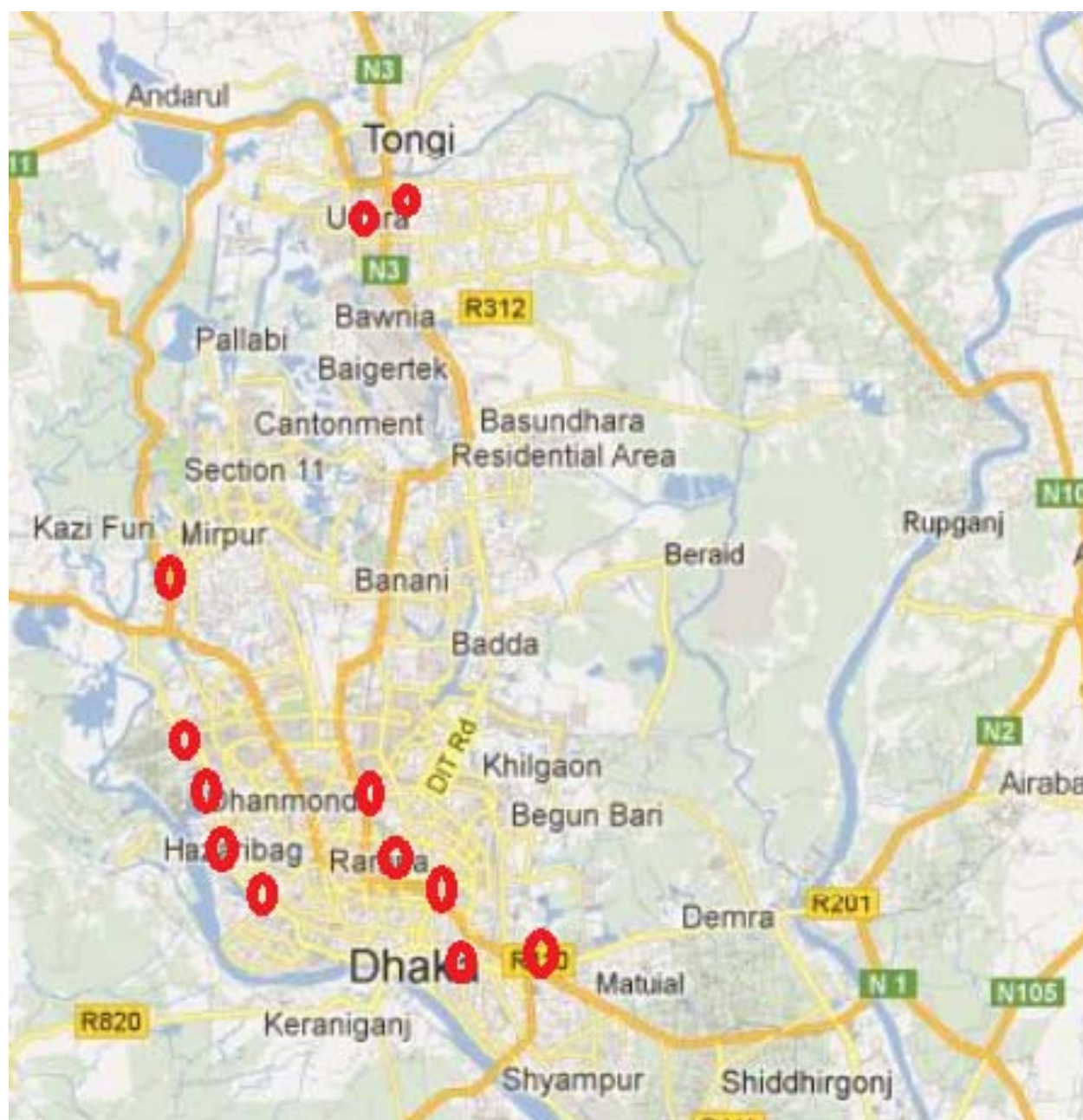


Fig 1: Location Plan for 12 STSs in Dhaka CC

Fig 2: STS – 1 Uttara Jasimuddin Road Layout Plan (23°51'40"N, 90°23'39"E)

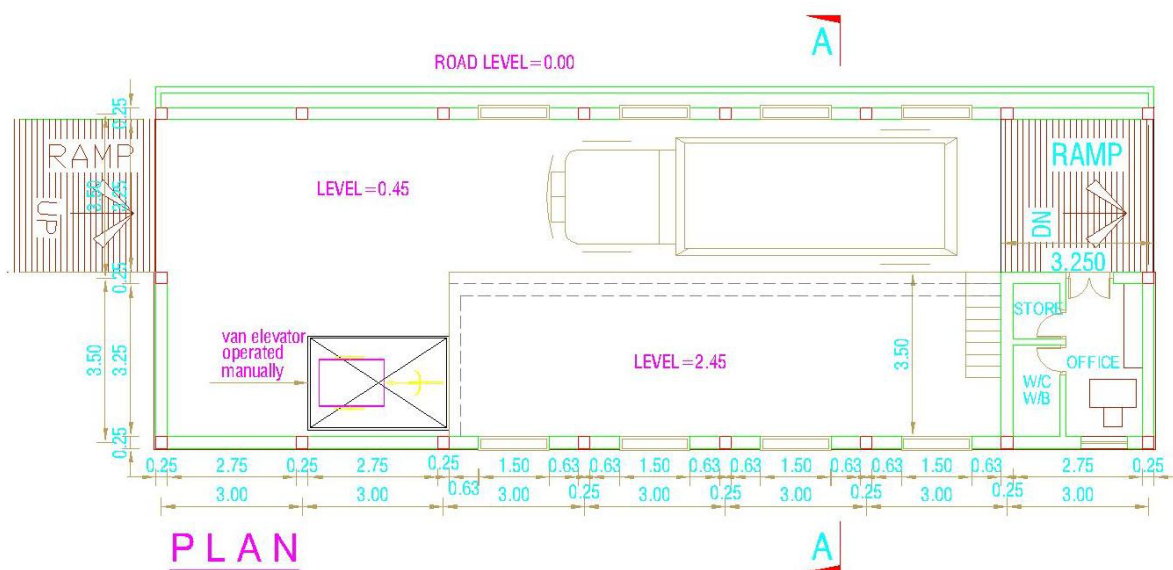


Fig 3: STS – 1 Uttara Jasimuddin Road Preliminary Plan



Fig 4: STS – 2 Uttara Rajuk College Layout Plan (23°52'13"N, 90°24'2"E)

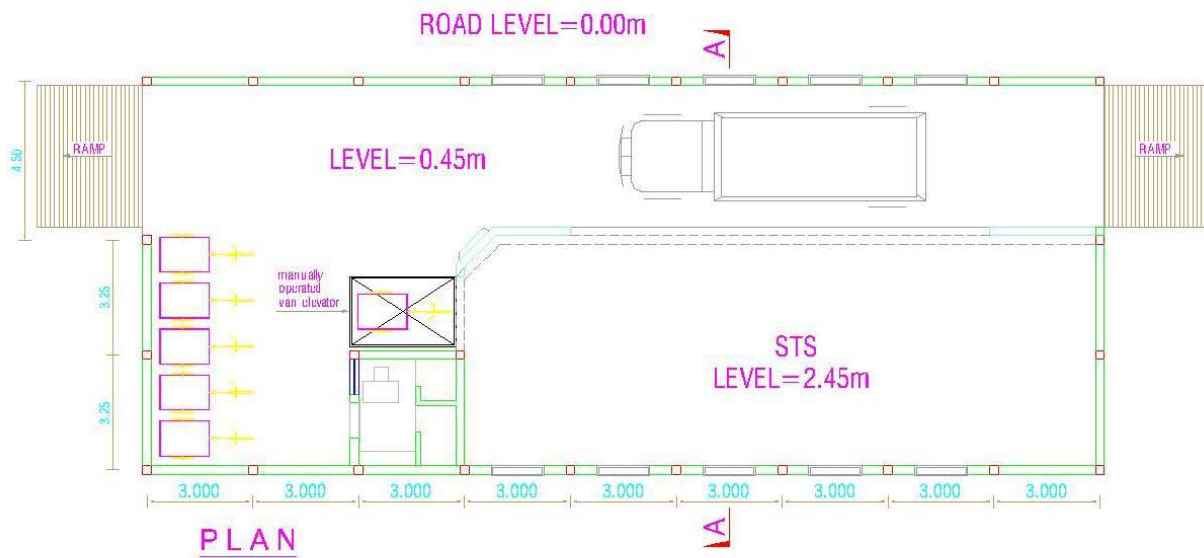


Fig 5: STS – 2 Uttara Rajuk College Preliminary Plan

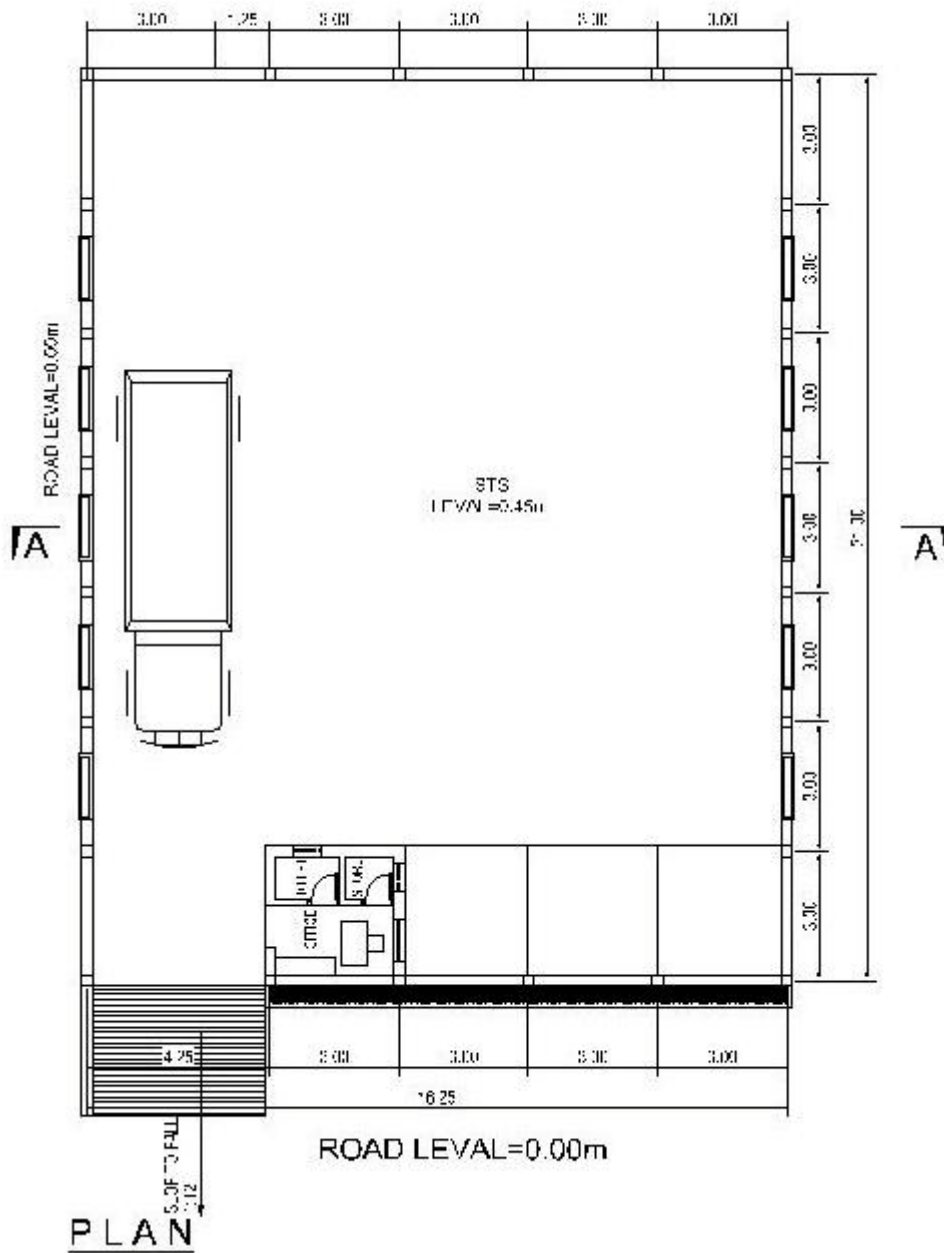
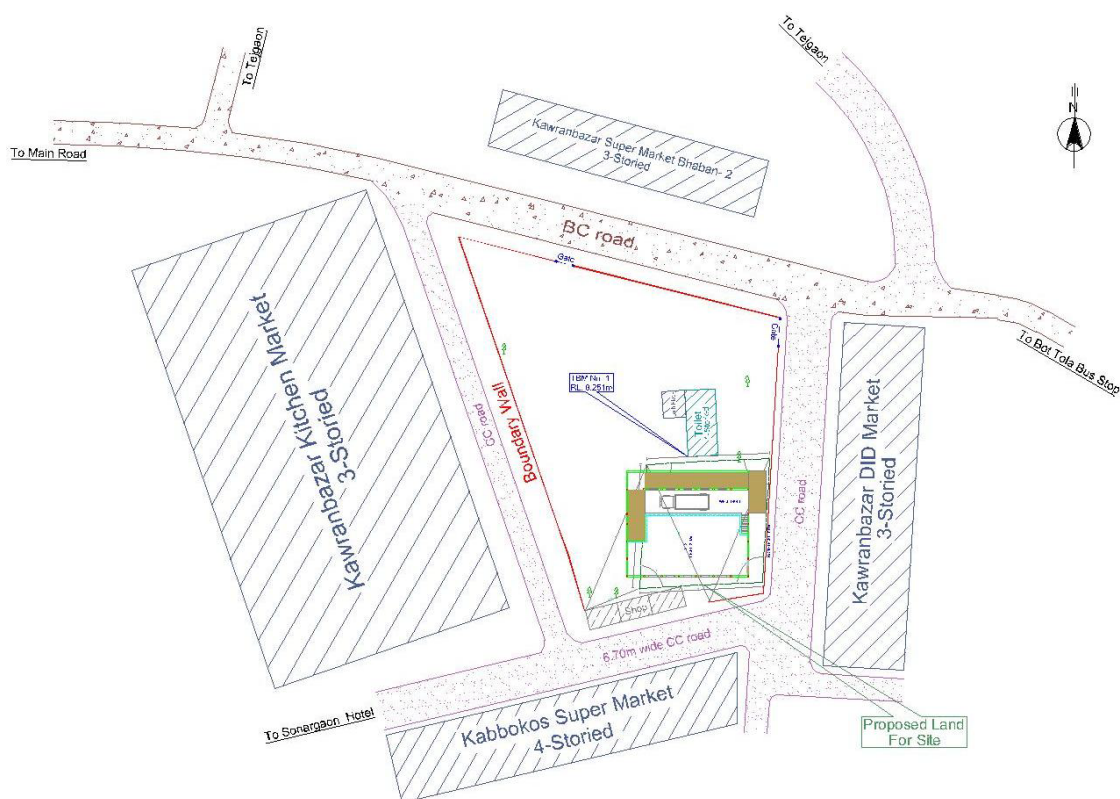


Fig 7: STS – 3 Golar Tek Mirpur Preliminary Plan



LOCATION PLAN

Fig 8: STS – 4 Kawran Bazar Layout Plan (23°45'7"N, 90°23'41"E)

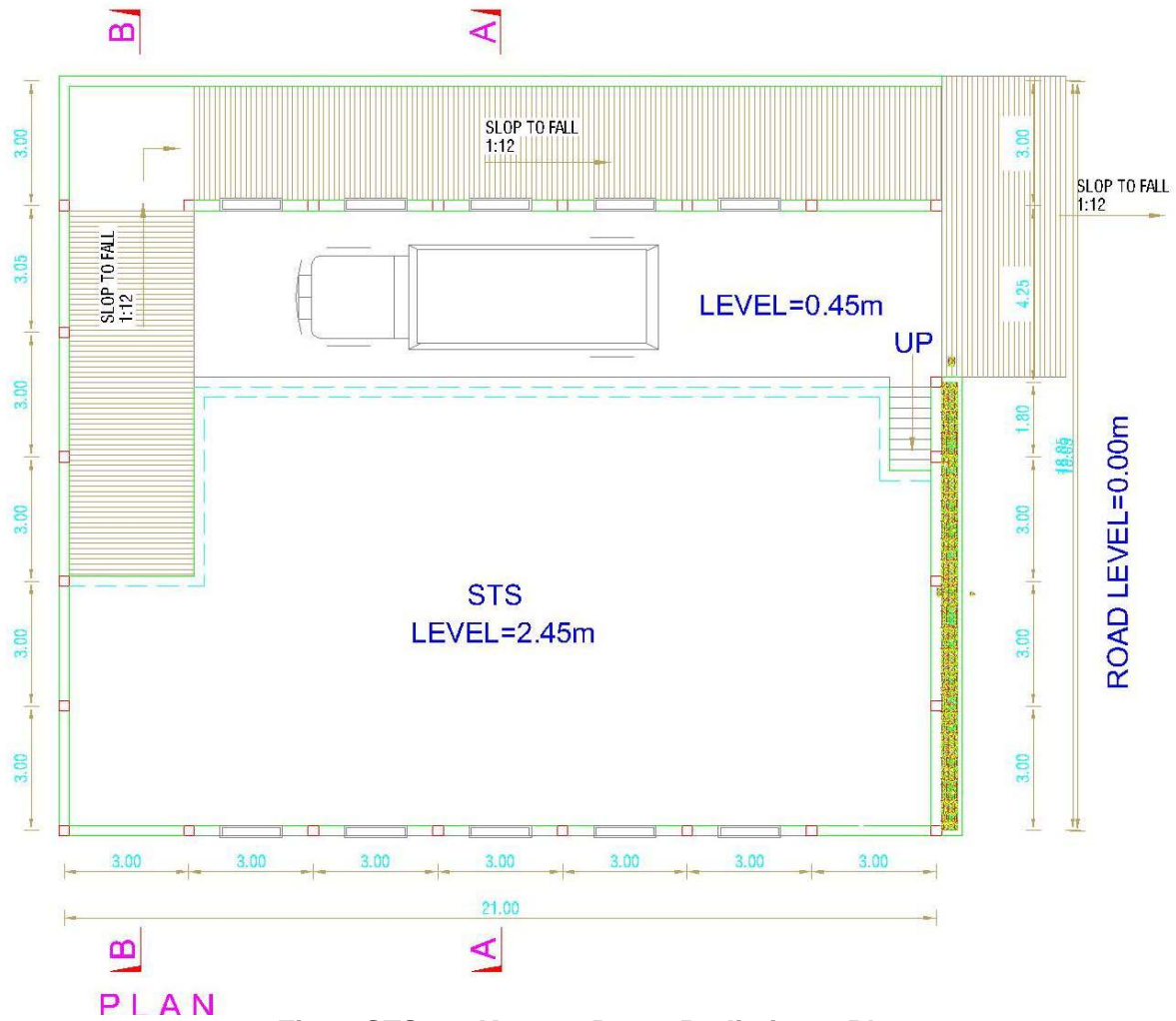


Fig 9: STS – 4 Kawran Bazar Preliminary Plan

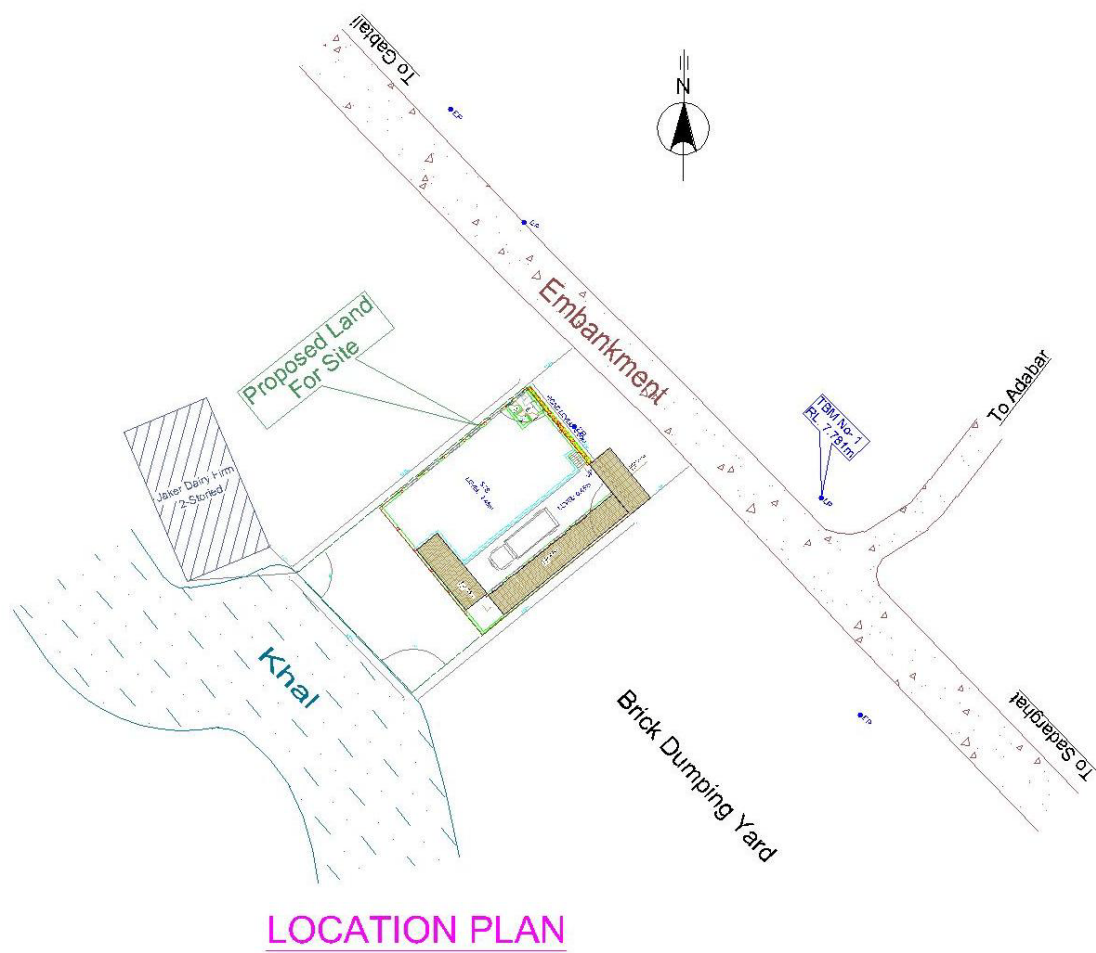


Fig 10: STS – 5 Berry Bandh Mohammadpur Layout Plan (23°45'34"N, 90°21'10"E)

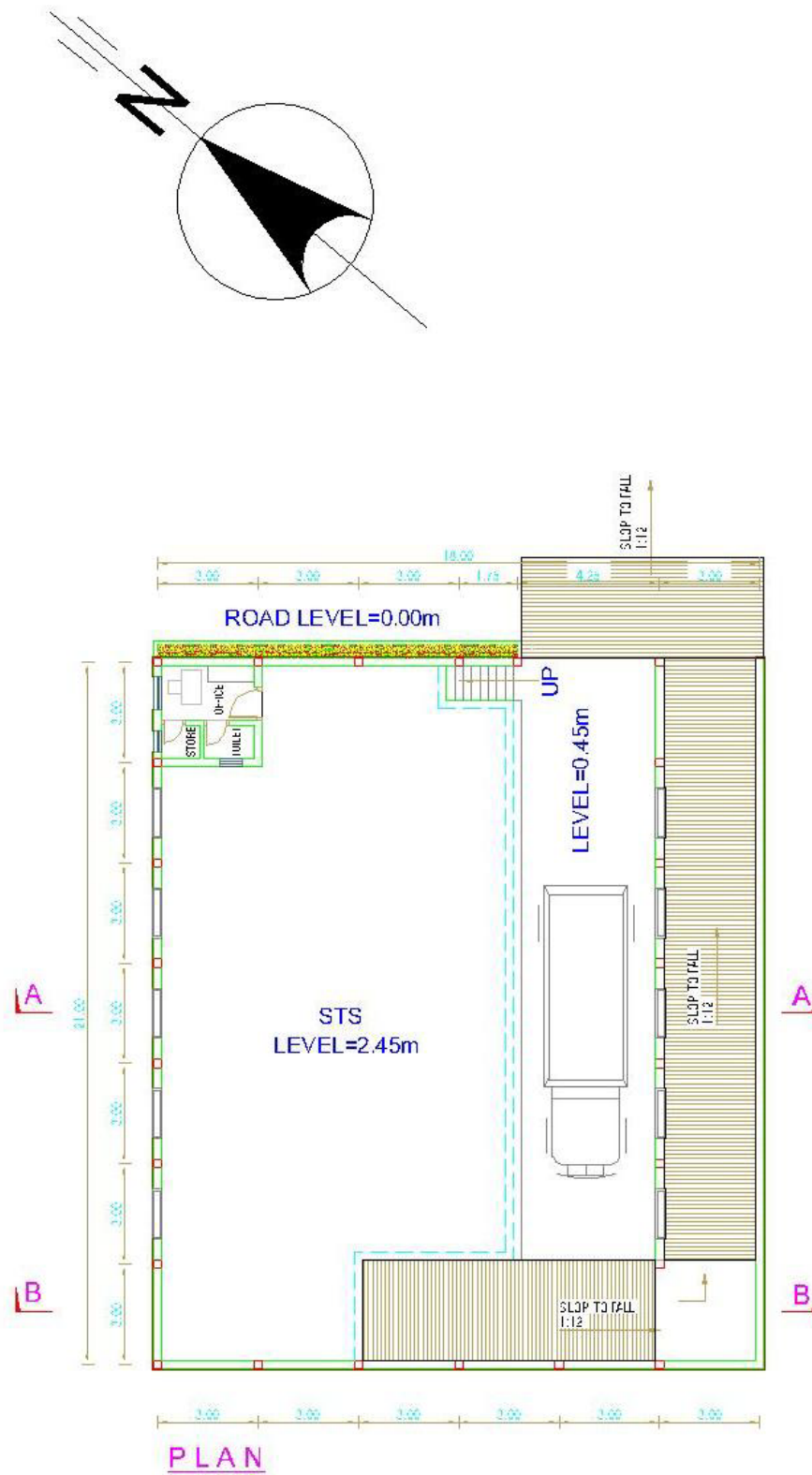


Fig 11: STS – 5 Berry Bandh Mohammadpur Preliminary Plan

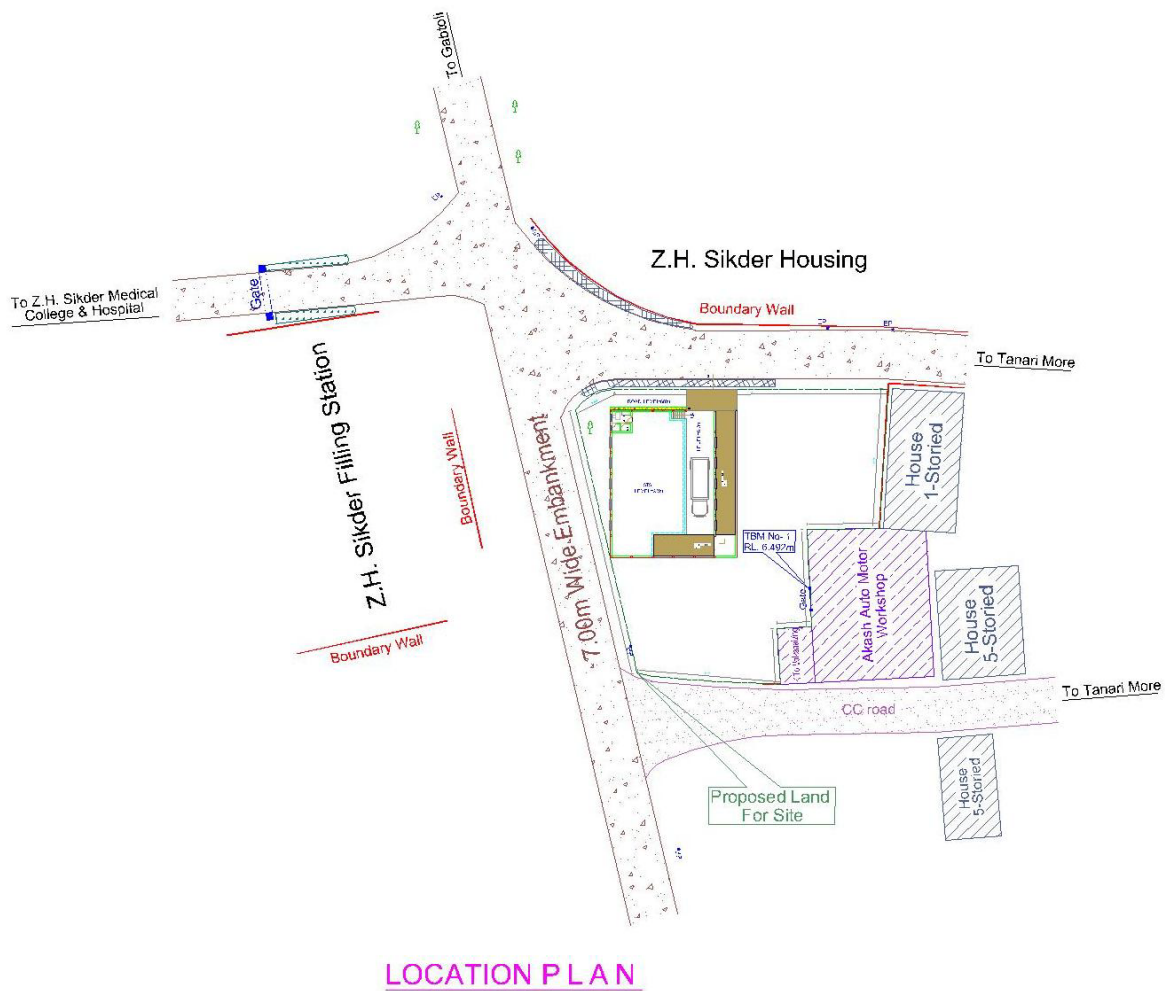


Fig 12: STS – 6 Berry Bandh Rayer Bazar Layout Plan (23°44'25"N, 90°21'39"E)

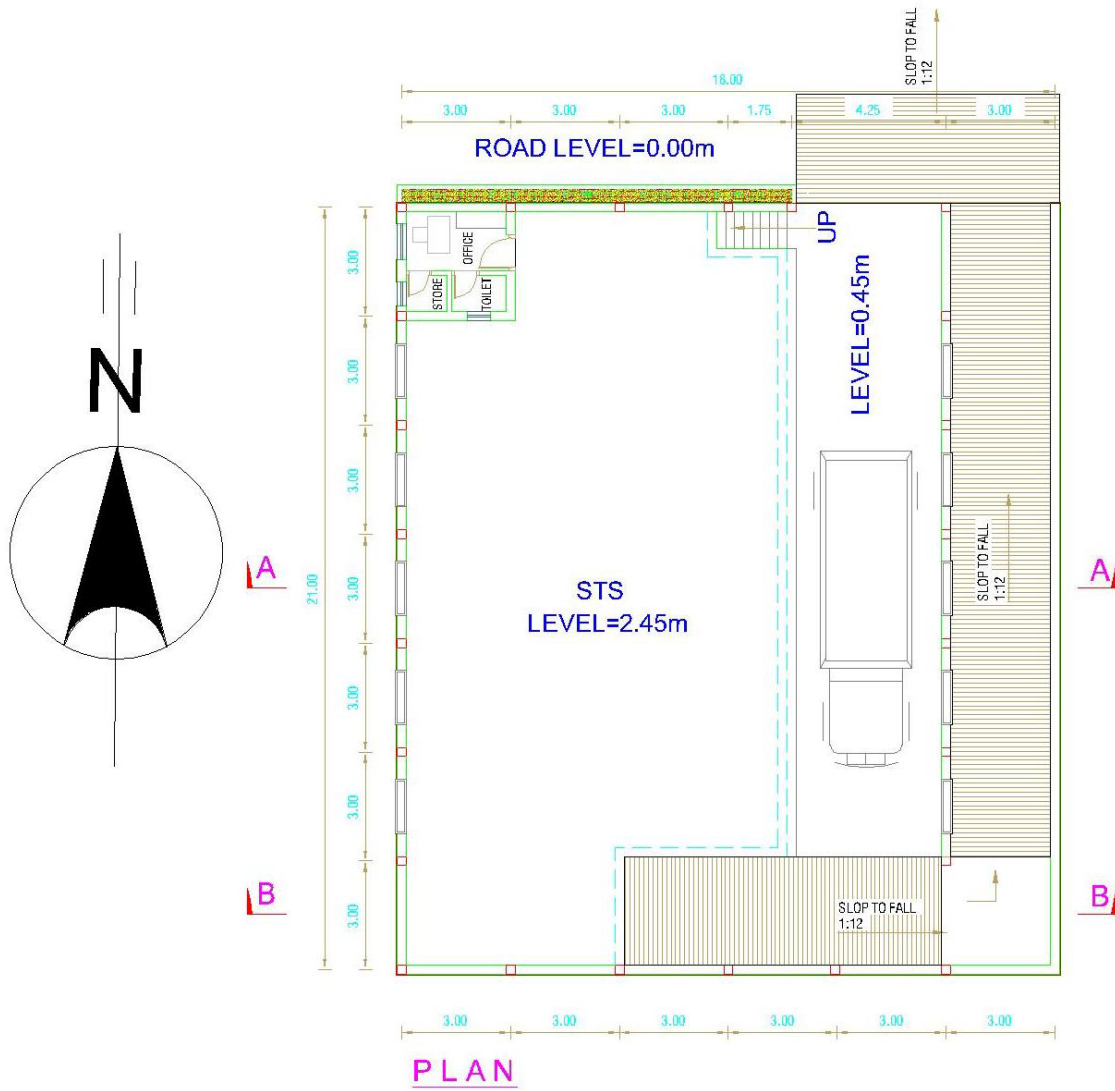


Fig 13: STS – 6 Berry Bandh Rayer Bazar Preliminary Plan

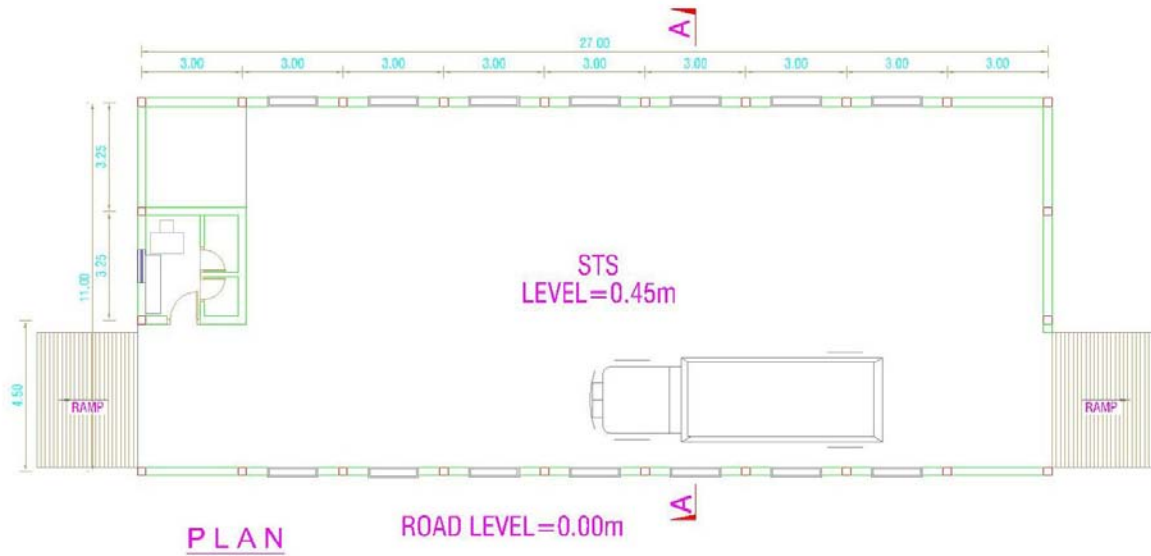


Fig 15: STS – 7 Berry Bandh Hazaribag Progoti Preliminary Plan

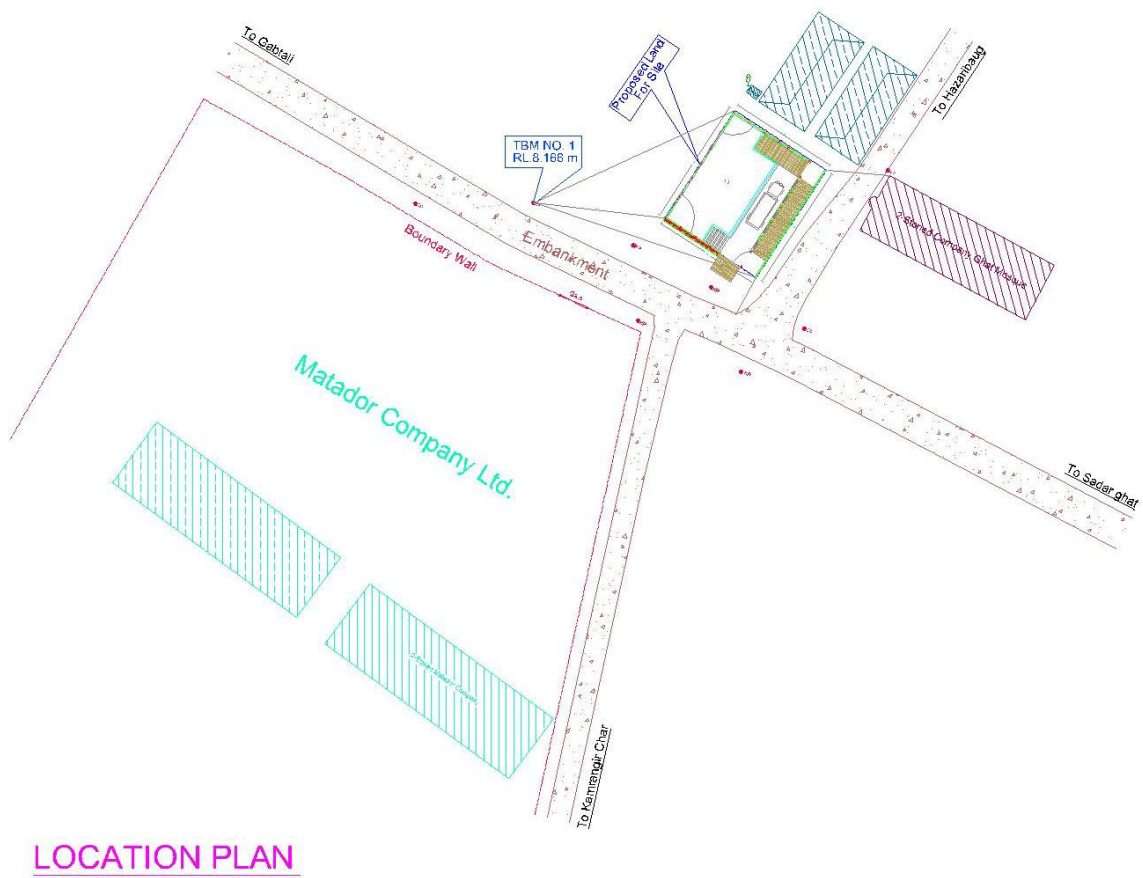


Fig 16: STS – 8 Berry Bandh Hazaribag Matador Layout Plan (23°43'39"N, 90°22'2"E)

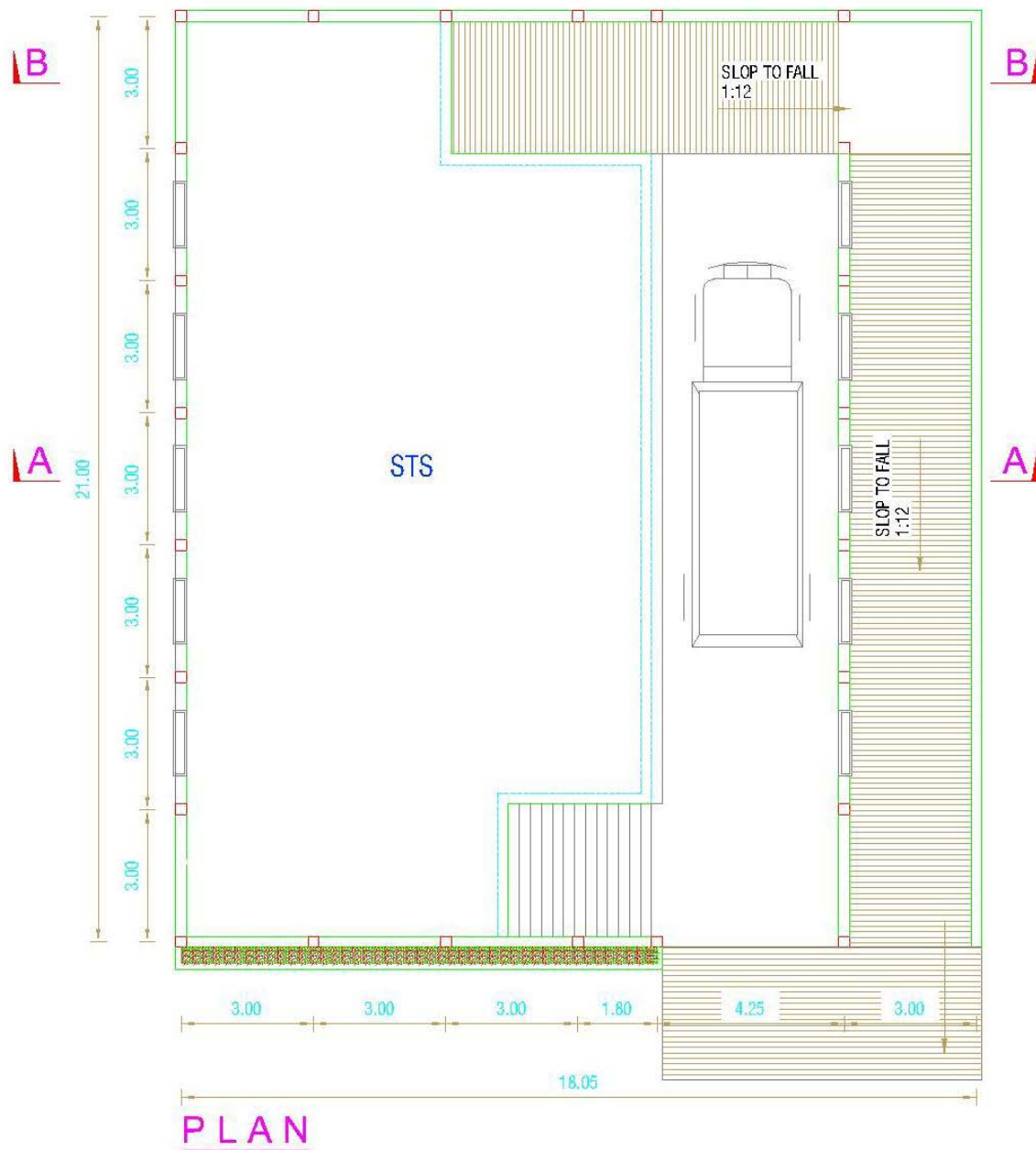


Fig 17: STS – 8 Berry Bandh Hazaribag Matador Preliminary Plan

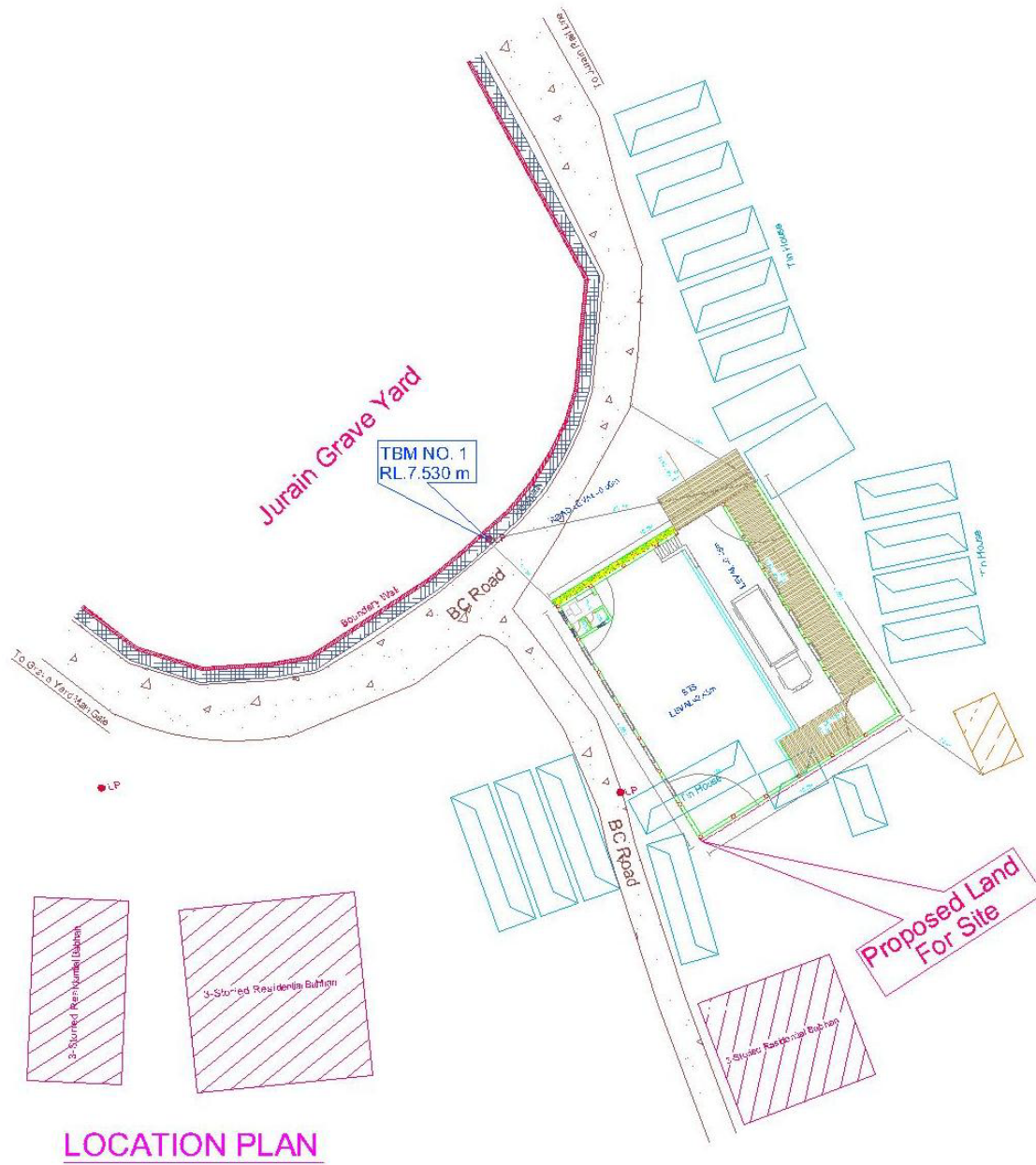


Fig 18: STS – 9 Jurain Kabarosthan Layout Plan (23°41'42"N, 90°25'44"E)

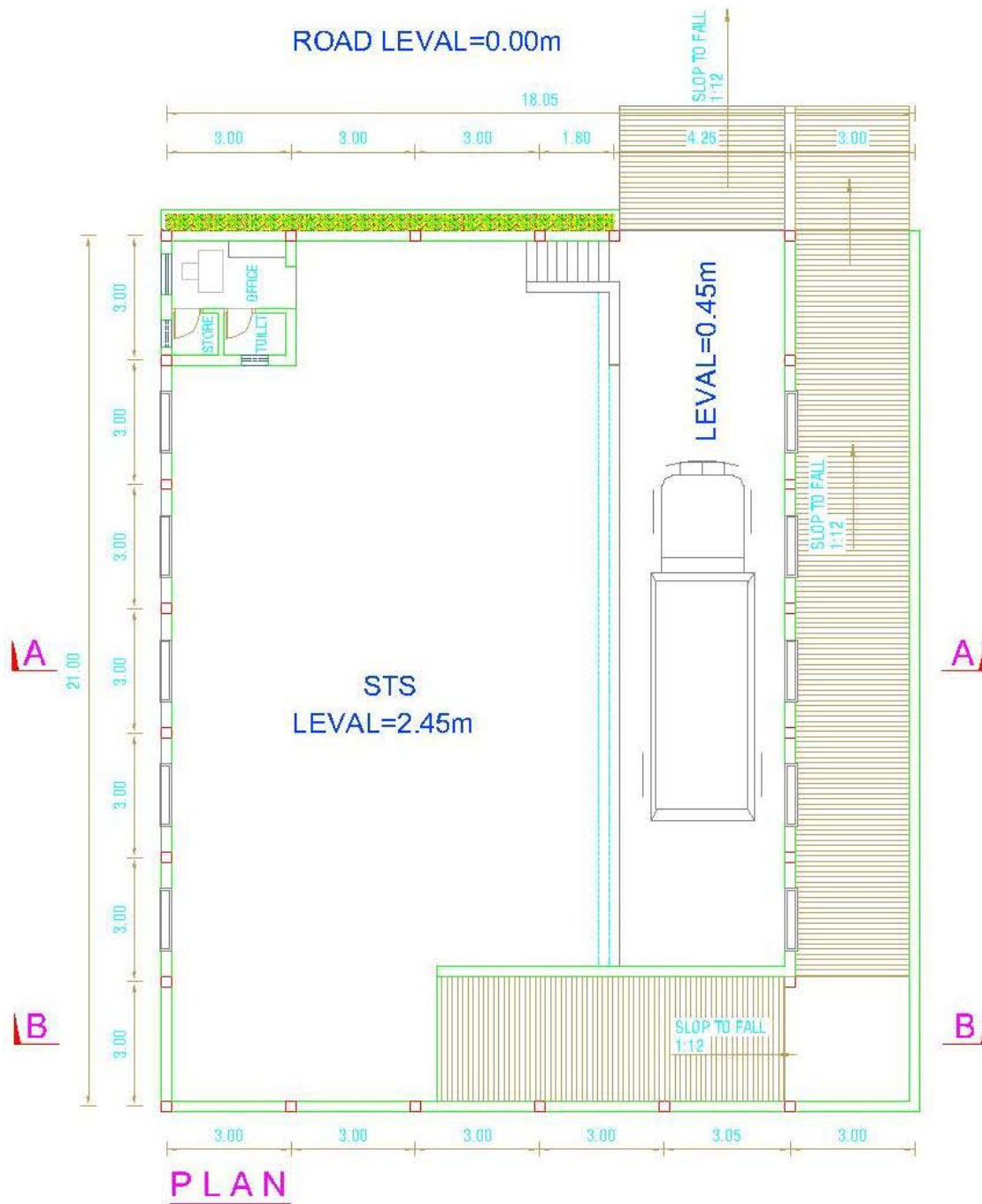


Fig 19: STS – 9 Jurain Kabarosthan Preliminary Plan

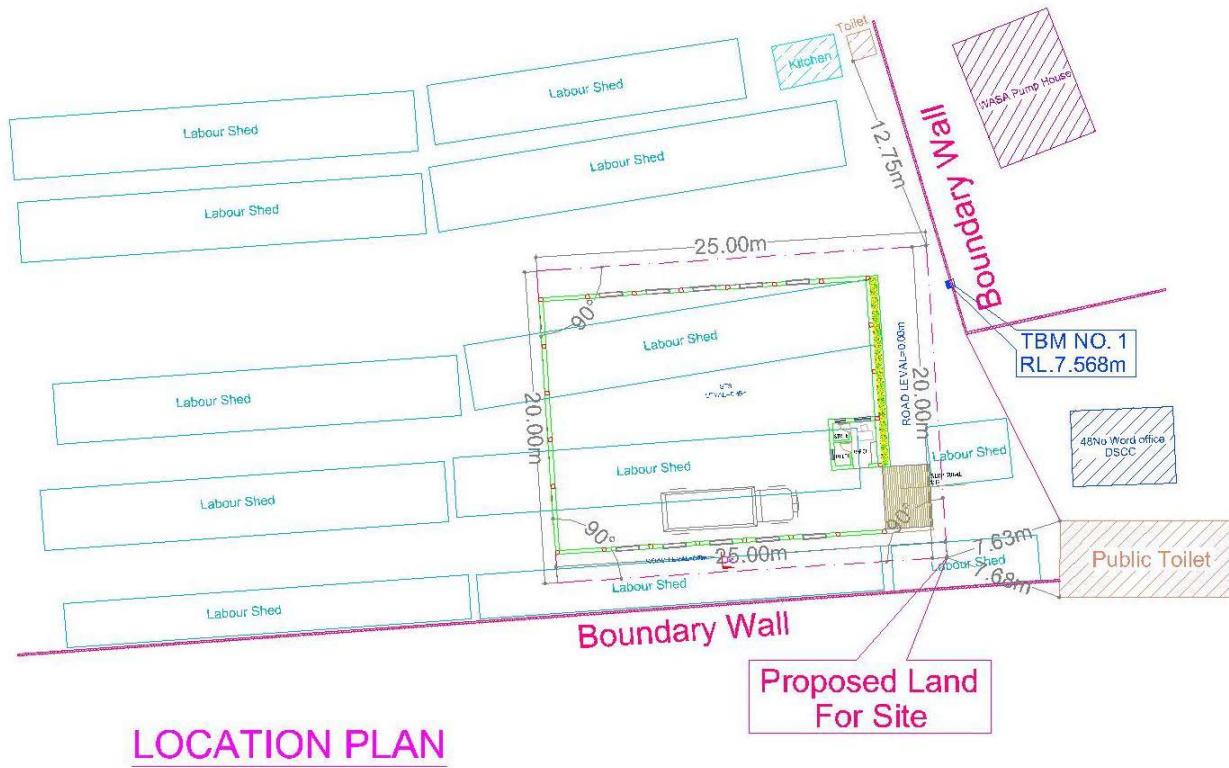


Fig 20: STS – 10 Jatrabari Crossing Layout Plan (23°42'38"N, 90°26'6"E)



Fig 22: STS – 11 Golapshah Mazar Gulistan Layout Plan (23°43'32"N, 90°24'38"E)

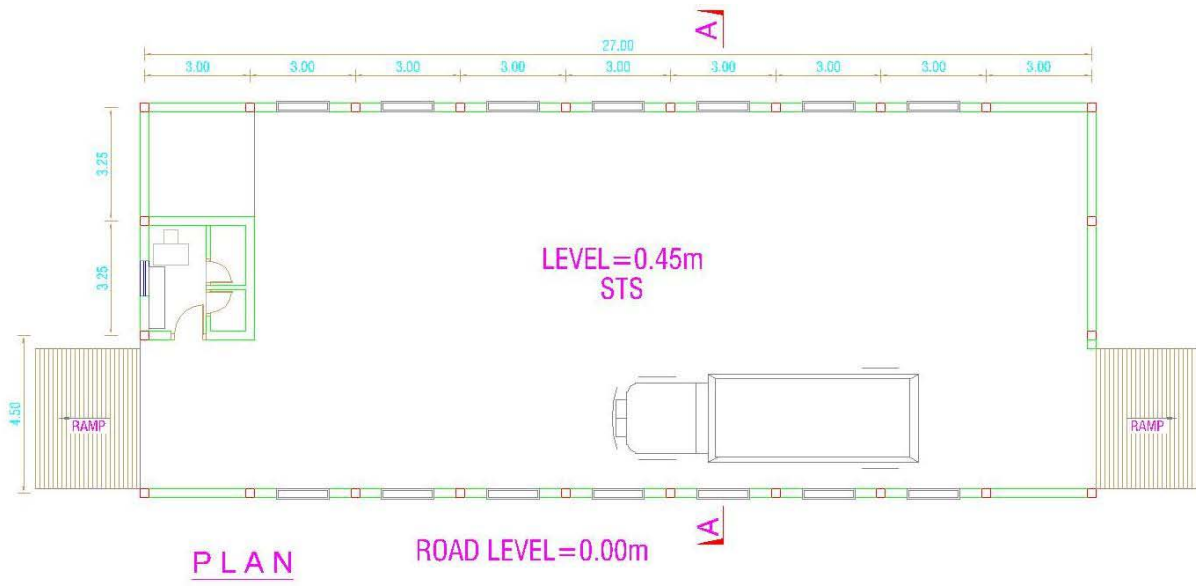


Fig 23: STS – 11 Golapshah Mazar Gulistan Preliminary Plan

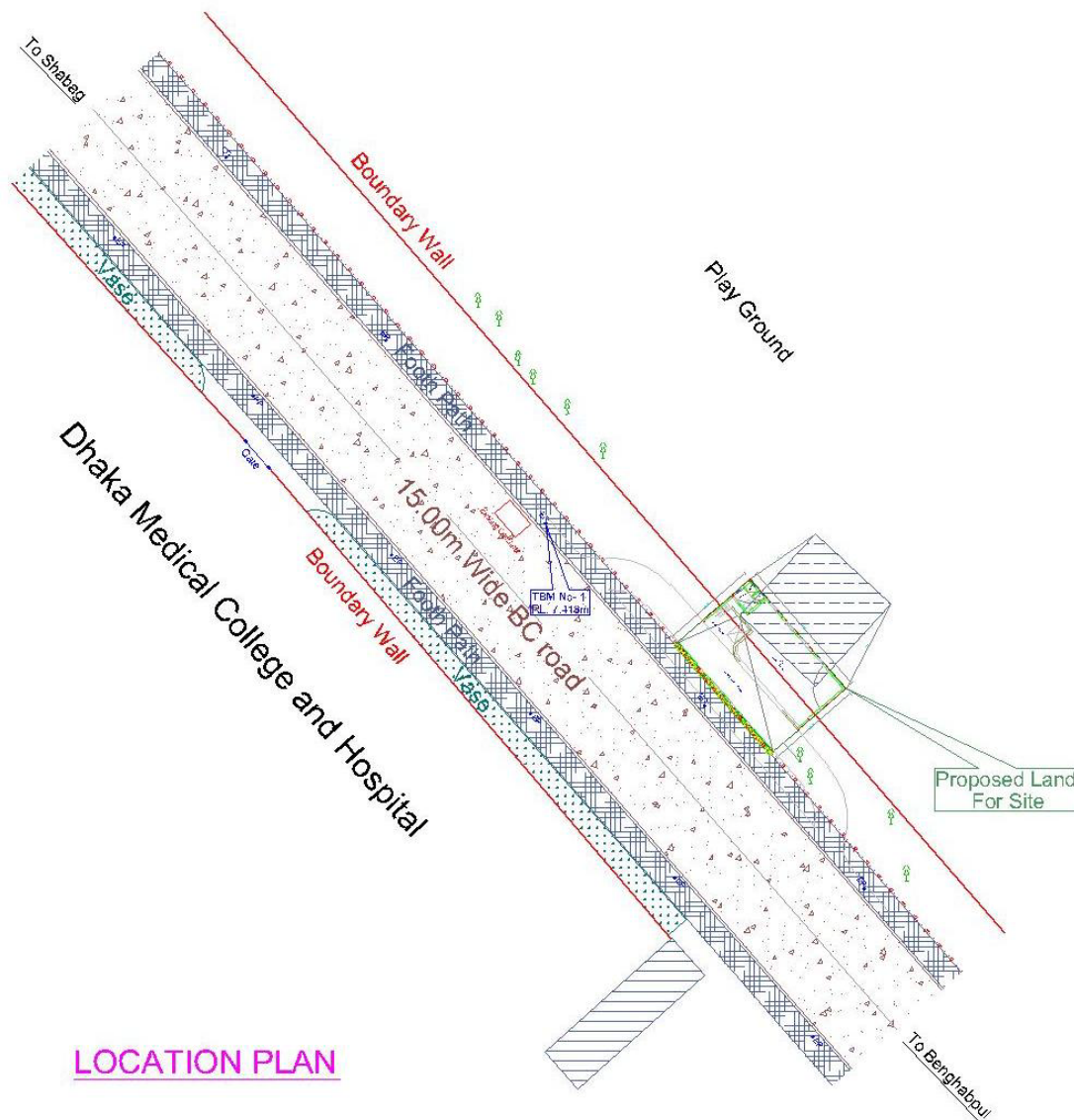


Fig 24: STS – 12 DMC Dhaka University Playground Layout Plan (23°43'35"N, 90°23'55"E)



Fig 25: STS – 12 DMC Dhaka University Playground Preliminary Plan

III. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources

1. Topography and Soils

40. The part of Bangladesh to which the capital city of Dhaka belongs is dominated by the rivers Ganges, Jamuna and Meghna, 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. Known as a composite of Brahmaputra-Jamuna Floodplain and Madhupur Sal Tract, this part – the central region – is composed of flat and low lying land, which floods extensively in the rainy season and red textured highlands.

41. Much of Bangladesh lies on the Gangetic-Bengal Plain, and is flat and low lying particularly around the delta, which floods extensively in the rainy season. North of Dhaka the land gradually begins to rise, towards the foothills of the Himalayas in the north. The influence of the rivers is evident in the soils, which are almost entirely alluvial and generally fertile in the central plains, with a predominantly loam and silt consistency. In the northern and eastern hills, soils are well drained, coarse and loamy, and closer to the sea the land is often saline, particularly in the dry season.

42. Figure 26 representing the bio-ecological regions of Bangladesh shows the Brahmaputra-Jamuna Floodplain (4c) where the central region, accommodating the city of Dhaka, belongs. This region of Bangladesh comprises the most productive ecosystems of the world.

2. Climate

43. The climate in the subproject area is humid 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 (2001-2011) between 116 mm in November, 2002 and 0 mm in February, 2011. Average temperatures

show, over the same period, variation between 23.4°C in November, 2005 and 17.3°C in January, 2011. Temperatures start to rise in March and reach the annual maximum of around 39.9°C in April-May, when daytime temperatures can reach up to 40°C. 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.

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

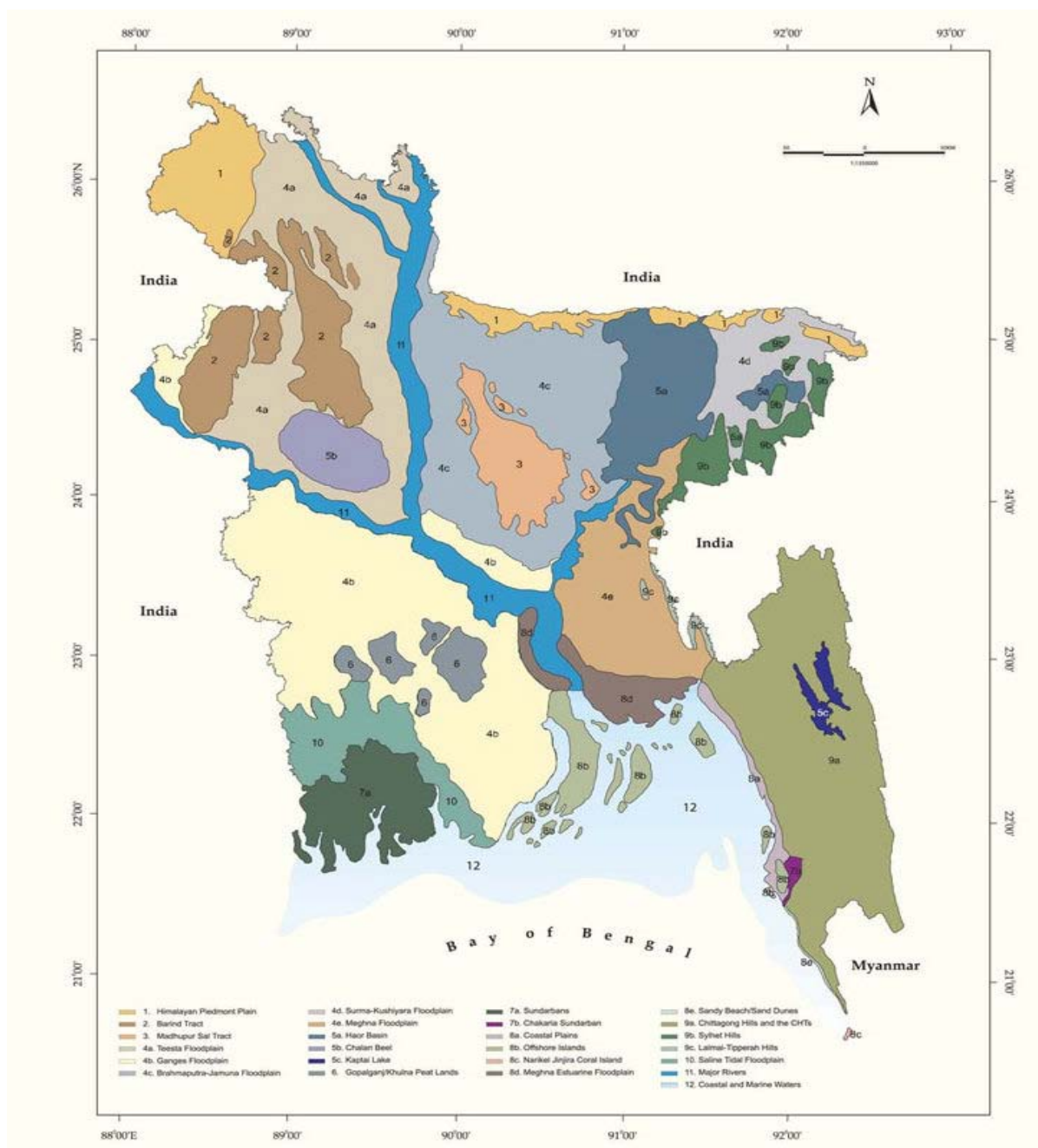


Fig 26: Bio-ecological map of Bangladesh

Source: Internet.

14. 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 1,776 mm (in 2011) in Dhaka. 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 27, 28, 29, 30 and 31)¹.

¹ Source of raw data (Fig. 27,28,29,30 and 31): Bangladesh Meteorological Department, July, 2012.

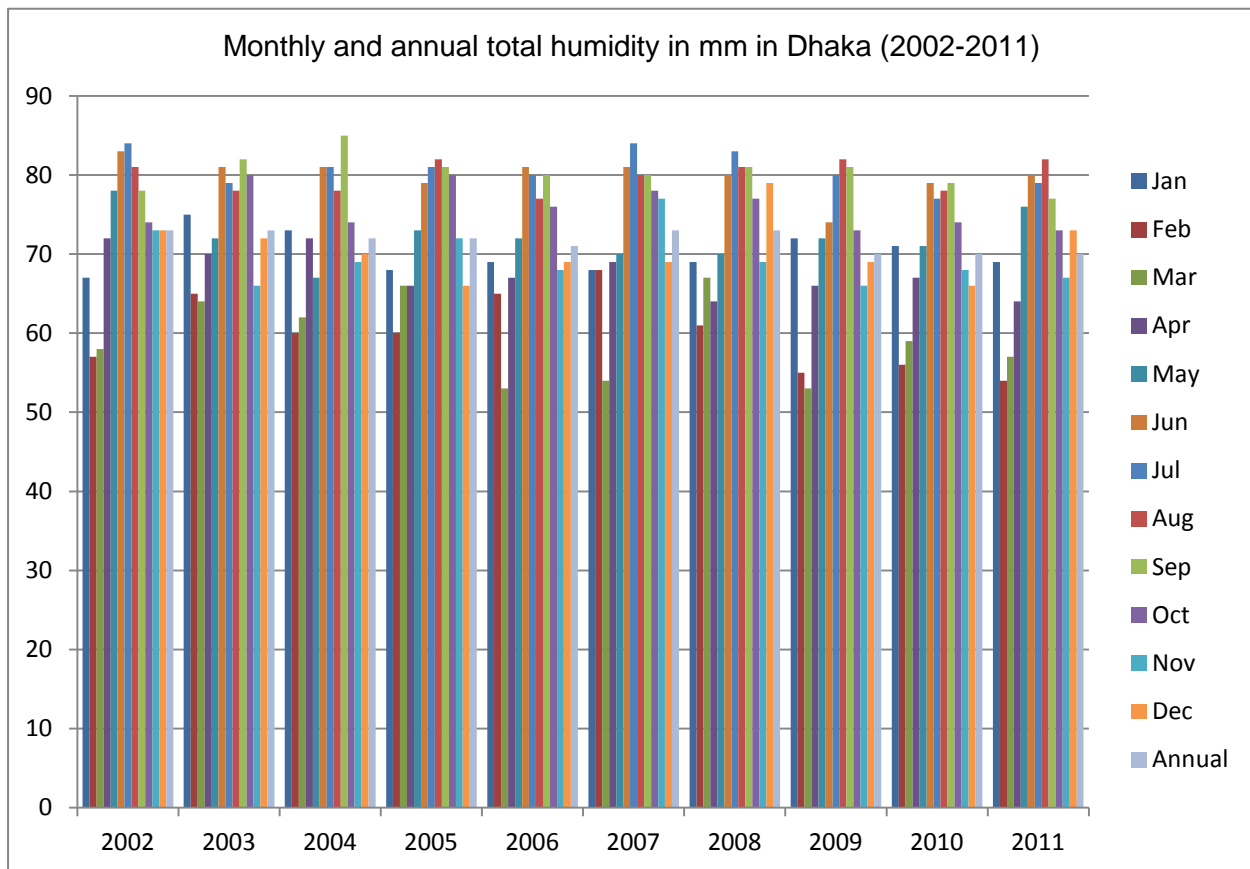


Fig 27: Monthly and annual humidity (%) in Dhaka (2002-2011)

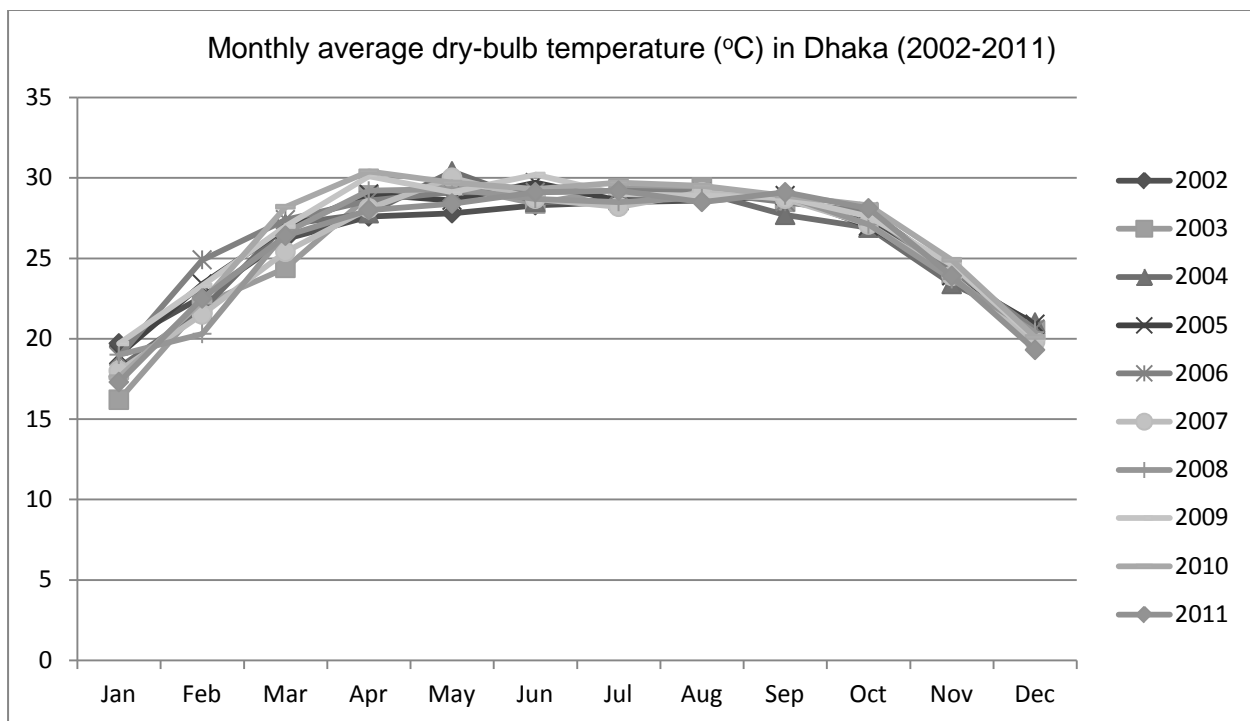


Fig 28: Monthly average dry bulb temperature (°C) in Dhaka (2002-2011)

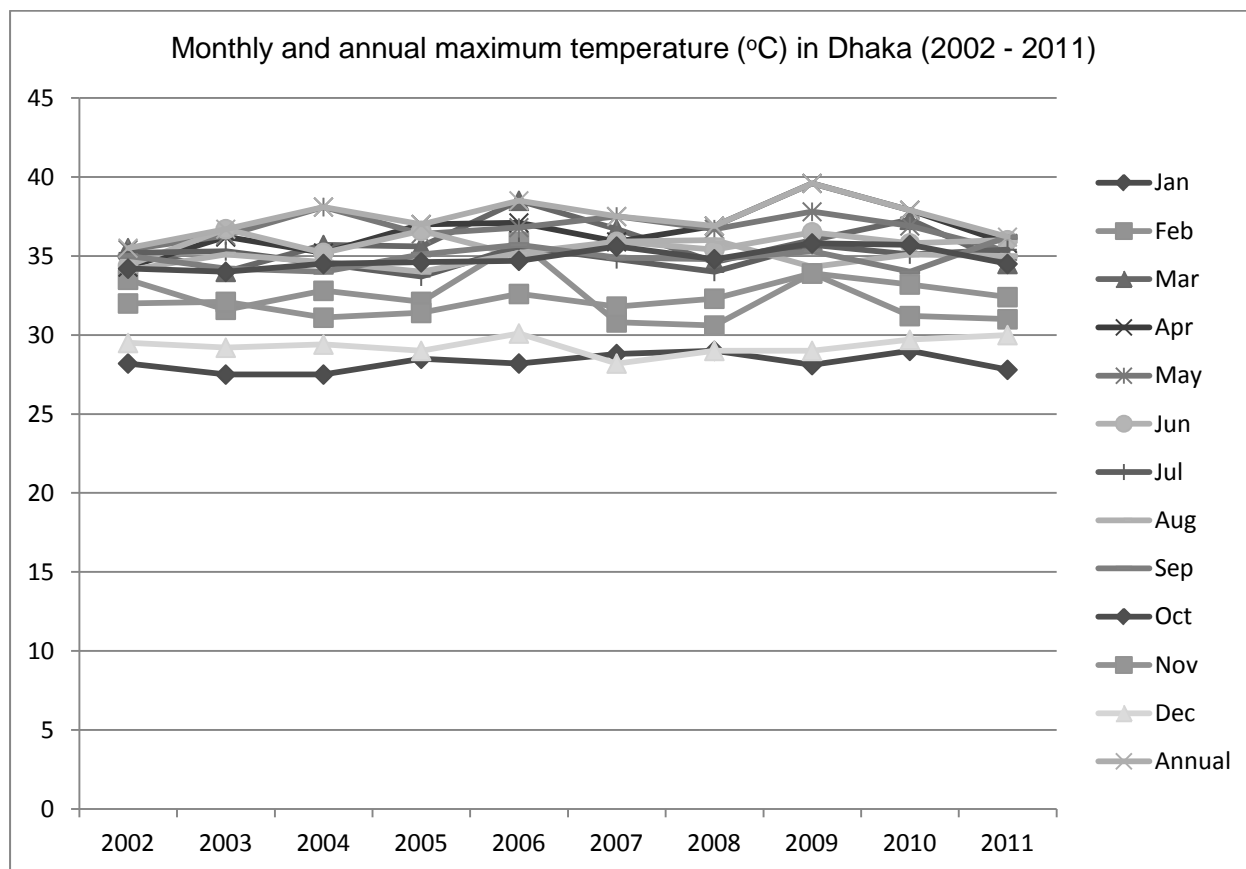


Fig 29: Monthly and annual maximum temperature (°C) in Dhaka (2002-2011)

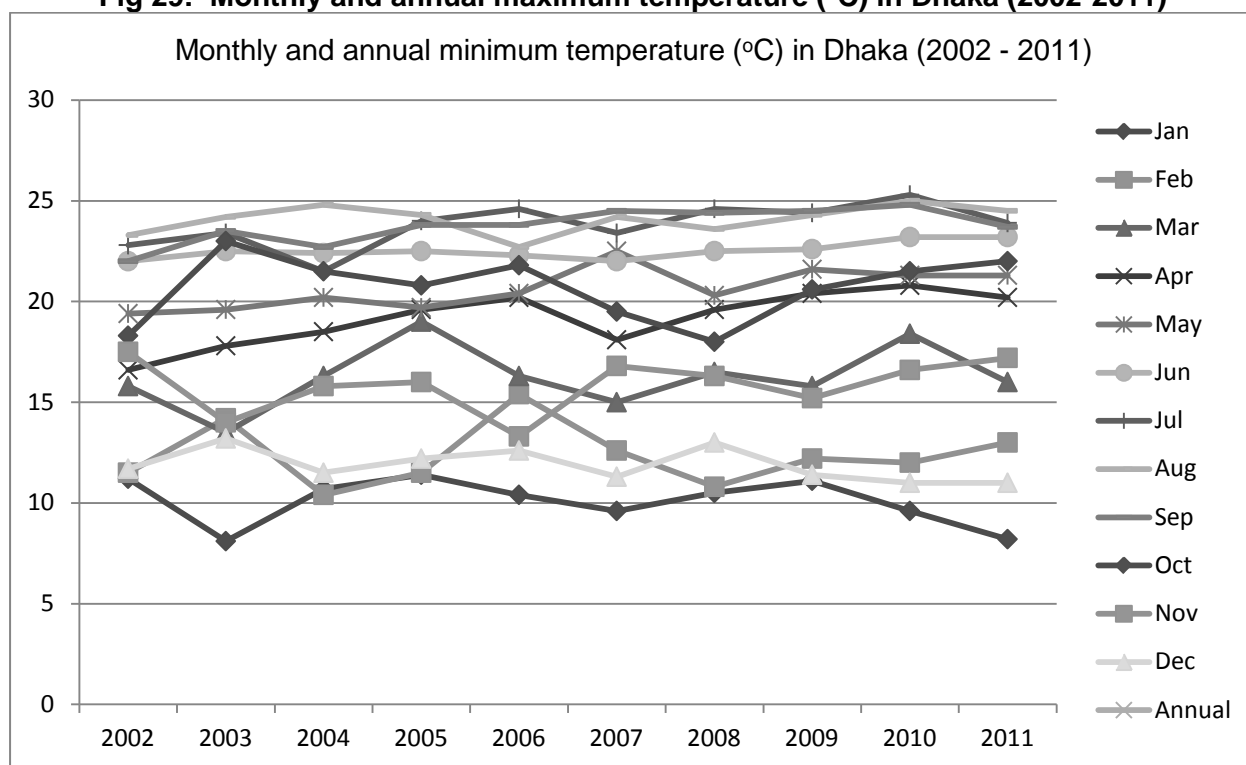


Fig 30: Monthly and annual minimum temperature (°C) in Dhaka (2002-2011)

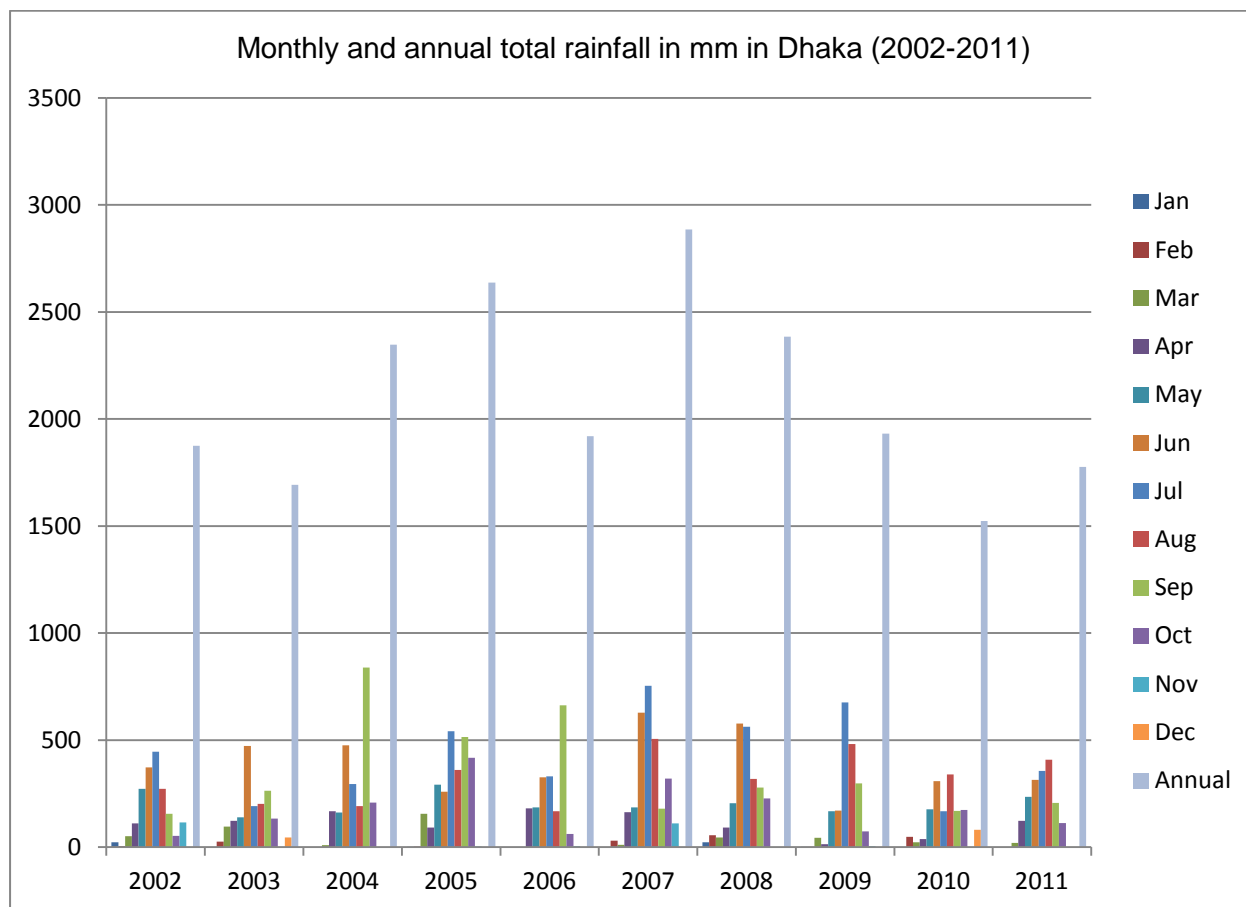


Fig 31: Monthly and annual total rainfall (mm) in Dhaka (2002-2011)

3. Air Quality

45. 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.

46. Surveys by the DoE show levels of Suspended Particulate Matter (SPM) and sulfur dioxide (SO₂) in Khulna 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 existing landfill sites of Dhaka are located in Matuail and Aminbazar and in a rural agricultural setting, the air quality is generally good.

4. Surface Water

47. Most of Bangladesh lies within the floodplains of the Ganges, Jamuna and Meghna rivers, which drain a catchment of around 1.72 million km² 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. Dhaka lies in the North Central Region, which is bounded by the Jamuna River to the west, Padma to the south and the Meghna in the east. 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.

28. Like other towns and cities of Bangladesh, the Dhaka 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 Dhaka and other population centers. Pollution of rivers is a major problem, because of the discharge of industrial wastewater and inadequate sewerage. The DoE has identified 450 polluting industrial units in Dhaka (196 tanneries, 129 textile producers, 38 engineering factories, and plants manufacturing pesticides, chemicals, fertilizers, pulp and paper), many of which discharge untreated wastewater to the rivers. The sewerage system covers only 20% of the city population, and 50% of people use septic tanks, 20% pit latrines and 10% use open latrines and other unsanitary methods.

29. Water quality of the river Buriganga at various locations during the month of January, 2011 is as under (Table-2):

Table-2: Surface water quality of the river Buriganga during the month of January 2011

Location	pH	Chloride (mg/l)	T. Alkalinity (mg/l)	TS (mg/l)	TDS (mg/l)	SS (mg/l)	DO (mg/l)	BOD ₅ at 20 ⁰ C, 5 days	COD (mg/l)
Mirpur Bridge	6.9	34	180	470	420	50	00	22	56
Hazaribagh	7.4	48	280	680	570	110	00	38	110
Kamrangir Char	7.2	32	201	480	412	68	00	24	56
Chandnighat	7.3	28	208	490	414	66	00	20	46
Sadarghat	7.5	34	204	470	410	60	00	20	65
Bangladesh- China Friendship Bridge	7.1	36	250	620	520	100	00	28	80

Location	pH	Chloride (mg/l)	T. Alkalinity (mg/l)	TS (mg/l)	TDS (mg/l)	SS (mg/l)	DO (mg/l)	BOD ₅ at 20 ⁰ C, 5 days	COD (mg/l)
Dholaikhal	7.26	38	150	460	406	54	00	20	52
Pagla	6.8	36	230	480	430	50	00	24	65

Source: Department of Environment (Dhaka Divisional Office), May 2012.

48. The distance of the proposed STSs and effluent discharge point to the rivers Buriganga, Turag and Balu is variable because 12 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 DCC.

5. Groundwater

30. 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.

31. In Dhaka 80% of the domestic water supply is obtained from the middle aquifer, extracted by tube-wells throughout the city. Recent studies have shown that water levels have fallen dramatically (20 m over the past six years) and suggest that the aquifer may be changing from a confined to an unconfined condition, which could make it vulnerable to contamination. There is already evidence of pollution by leaking underground tanks at petrol stations and chemical plants, and seepage from sewers, septic tanks and pit latrines. DWASA is implementing a major project to improve the water supply service, which amongst other things will increase the usage of surface water and extend groundwater abstraction to the deeper aquifer, at a sustainable rate.

32. 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.

49. Discussions with DCC officials during site visits indicated that the water table at the locations of the proposed STS sites is approximately 5 meters below the surface, so there is no problem of water-logging. There were some visible inhabitants in the surrounding area but no sources for the abstraction of drinking water.

50. 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 be sourced

from city corporation supply as the water required in the STSs is not very large quantity and it is expected that the DCC will be able to supply this quantity easily.

6. Geology and Seismology

51. 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.

52. Dhaka is situated at the southern tip of a Pleistocene terrace, the Madhupur tract. Two characteristic geological units cover the city and surroundings, viz Madhupur Clay of the Pleistocene age and alluvial deposits of recent age. The Madhupur Clay is the oldest sediment exposed in and around the city area having characteristic topography and drainage. The major geomorphic units of the city are: the high land or the Dhaka terrace, the low lands or floodplains and depressions and abandoned channels. Low lying swamps and marshes located in and around the city are other major topographic features.

53. The National Seismic Zoning Map (Fig 32) 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 Khulna 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. This map clarifies the seismological status of the various regions of the country. The city of Dhaka falls within the medium-risk zone. The earthquake risk factor for this zone – 2 is 0.15, while the risk factors for zone – 1 and zone – 3 are 0.075 and 0.25 respectively. 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.



Fig 32: National Seismic Zoning Map of Bangladesh

Source: Internet.

B. Ecological Resources

1. Habitats

54. 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.

55. 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.

2. Rivers

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

57. Dhaka is enclosed between the Turag-Buriganga River in the west and the Balu-Sitalakhya River in the east (Fig 15), both of which drain into the Meghna in the south, along with the Dhaleswari, old Brahmaputra and other rivers outside the city limits. Like other inland waterways these rivers support a fish fauna that includes carp, catfish, loach, *hilsa* and shrimp, plus a variety of invertebrates and insects that have been little studied. The Ministry of Environment and Forests estimates that 80% of the sewage produced by the 15 million people in Dhaka and surrounding areas enters the rivers untreated, and most of the 7,000 industries dispose of their waste to drainage ditches and rivers without treatment (Dhaka Environment Program 2005). It is not surprising that the ecology of the rivers has deteriorated under such pressure, and declining fish catches (from pollution, habitat degradation and over-exploitation) are just one indicator of the malaise. Catches in the North Central region for example were 26,476 t in 1983-4 to 6,095 t in 1996-7.

3. Floodplains and Fisheries

58. 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.

59. Most of Dhaka is in the natural floodplain of the various rivers in the area, and would have functioned as an important breeding and nursery ground for many aquatic species in the past. This function is still evident in the seasonal flooding that affects large parts of the city, although now the floodwaters invariably become polluted by sewage and chemicals washed out from the inundated areas. The floodplain function has been further degraded by the construction of embankments to protect the city from flooding, and particularly from infilling to reclaim land, which dramatically reduces the water retention capacity of these areas and increasing flooding both upstream and downstream. These factors have greatly reduced the importance and capacity of this area as a breeding ground, which has contributed to the declining ecology in the rivers.

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.

4. Other Aquatic Habitats

61. Like elsewhere throughout the country, there are a variety of other aquatic habitats in Dhaka which include man-made lakes in residential neighborhoods, permanent and ephemeral pools in natural lowlands (known as *beels*), and flooded borrow pits excavated for building material (Fig 33). 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 and lotus can be seen in places.

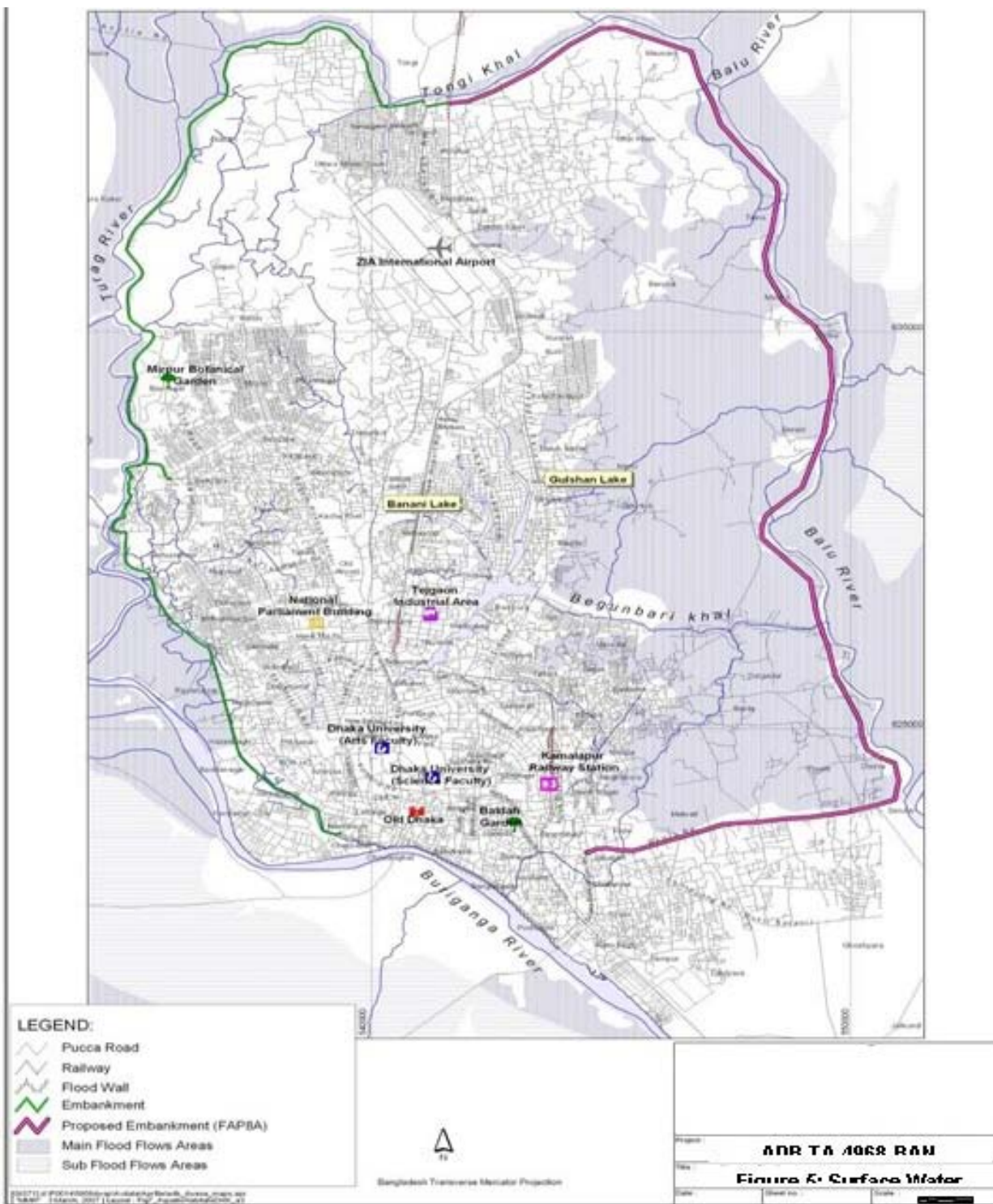


Figure 33: Surface water and aquatic habitats of Dhaka

5. Terrestrial Ecology

62. The city of Dhaka is almost denuded of the trees and vegetation that once had beautified and made its environment congenial to terrestrial ecology specific of this area. 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.

63. 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.

6. Protected Areas and Endangered Species

64. Bangladesh has a number of nature conservation designations, but few areas have been mentioned in gazette, and most of these are not given the protection they are afforded by law. Pressure on land to provide food and income for the burgeoning population is the main problem, and this leads to encroachment into protected areas, which has caused severe habitat degradation in many places.

65. 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. There are however exceptions, such as the Baldah Garden in the centre of old Dhaka, which was established at the beginning of the last century by Narendra Narayan Roy Chowdhury, and contains around 15,000 plants of 600 species from more than 50 countries, including a notable Baobab tree from Africa (*Adansonia digitala*). Mirpur Botanical Garden in the north-west of Dhaka also contains exotic plants, and both gardens are open to the public and managed by the Forestry Department.

C. Economic Development

1. Industry

65. Almost half of all Bangladesh's industry is based in Dhaka, where manufacturing is the most important activity, with many factories supplying low cost garments to major companies in Europe. The main industries are leather tanneries and textile production, but there are factories manufacturing a wide range of other products including fertilizers, pesticides, chemicals, pharmaceuticals, rubber, plastics, cement, and foodstuffs including salt, sugar and rice. There are also heavier industries including iron and steel mills, ship repair yards, power plants, oil refineries and pulp and paper mills.

66. There are several industrial areas in Dhaka, including Sayampur, Demra and Fatullah in the south-east, Hazaribag in the west and Tejgaon (one of the oldest industrial areas in Bangladesh) in the centre. Although workers are still primarily male, there has been an increase

in the employment of women during the past 30-40 years, particularly in the manufacture of ready-made garments.

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 underfunding 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. Solid waste in urban areas is the responsibility of the city corporations (DCC), and in most locations NGOs or CBOs operate the primary collection service, removing waste from houses and businesses each day, mainly on cycle-rickshaws. These carry waste to STS at various locations around the town, from where it is carried for final disposal by vehicles operated by the respective city corporation. There are two semi-engineered landfills (one in Matuail and the other in Aminbazar), in Dhaka, where poor practices (including leaving waste uncovered until a cell is filled and allowing people to sort through the waste for recyclables in a disorganized and unsafe manner) create an unsightly and insanitary facility. Elsewhere 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.

69. In Dhaka, there is an effective medical waste treatment facility operated by the NGO PRISM (Projects in Agriculture, Rural Industry, Science and Medicine), located alongside the municipal landfill at Matuail. Here infected waste is treated by autoclaving, plastics are recovered for recycling after disinfection, body parts are buried and any remaining waste is incinerated. At present, there are some simple types of transfer stations in DCC area but the collection and transportation of solid waste will be improved substantially after implementation of the 12 STSs proposed under this subproject.

3. Transportation

70. Dhaka poses a particular problem in respect of transportation facilities because of the very large population housed in a relatively small area, in which there is no available space for new roadways. The morning and evening rush-hour periods have gradually expanded so that the main roads are now congested throughout most of the day, making travel in the city extremely difficult and time-consuming. The atmospheric pollution generated by vehicles idling in traffic jams contributes greatly to the environmental degradation of the city.

71. As the capital city of Bangladesh, Dhaka is well connected with the entire country in different modes of transport. Air flights are available to cities like Chittagong, Cox's Bazaar, Sylhet, Jessore, etc. Other flights previously available from Dhaka to Rajshahi, Syedpur, Barisal are not feasible nowadays because of shortage of passengers. Road transport system has improved and people find it more convenient to travel by long distance buses rather than using the comparatively expensive air flights. The southern part of the country is connected with Dhaka by cheaper mode of river transport.

4. Land Use

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 Dhaka 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 12 STSs are on the land owned by the DCC and Government of Bangladesh, and at present in 6 cases being used as temporary dumping places for municipal solid wastes collected from the locality. These are STSs at Uttara Jashimuddin Road, Uttara Rajuk College, Golar Tek Mirpur, Berry Bandh Mohammadpur Jurain Kabarosthan and DMC Dhaka University Playground. The remaining 6 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 Bangladesh Power Development Board (BPDB) is responsible for the generation of power in the country, and distributes electricity to retail customers, as well as to two other distribution utilities: the Rural Electrification Board (REB); and the Dhaka Electric Supply Authority (DESA) in the capital. Power transmission is handled by the Power Grid Company of Bangladesh (PGCB). There are currently 18 power stations with a generating capacity of 4230 MW, of which 94% is thermal (mainly fired by imported gas, oil and coal) and the remainder hydroelectric. This industry however suffers the same problems as the other public utilities, of high system losses, low plant efficiency, theft of the resource through illegal connections, inadequate investment in maintenance and new infrastructure, and corruption compounding inefficient cost recovery from the consumer. 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.

6. Other Economic Development

77. Like most of the towns and cities of Bangladesh, agriculture is important in parts of the urban fringe of the Dhaka city. Rice is the most important crop and farmers plant varieties with different flood tolerances (developed by the Bangladesh Rice Research Institute) in different seasons to obtain two or even three harvests. *Aus* rice is grown in March to June, followed by the flood-tolerant *Aman* in July to October, and in the dry season farmers plant a combination of *Boro* rice and vegetables. Wheat and potatoes are also important, along with fruit, in particular mango, banana and pineapple. Most of the produce is sold in markets in the city, although rice is also exported, after processing in one of the local mills.

78. Dhaka is the commercial heart of Bangladesh. The city has a growing middle class population, driving the market for modern consumer and luxury goods. The city has historically attracted a large number of migrant workers. Hawkers, peddlers, small shops, rickshaw transport, roadside vendors and stalls employ a large segment of the population — rickshaw-drivers alone number as many as 400,000. Half the workforce is employed in household and unorganized labor, while about 800,000 work in the textile industry. Even so, unemployment remains high at 19%. As of 2009, Dhaka's Gross Municipal Product (GMP) is registered at \$85 billion. With an annual growth rate of 6.2%, the GMP is projected to rise to \$215 billion by 2025. The annual per capita income of Dhaka is estimated at \$1,350(USD), with 34% of households living below the poverty line, including a large segment of the population coming from rural areas in search of employment, with most surviving on less than \$5 a day.

79. The main commercial areas of the city include Motijheel, Dilkusha, Paltan, New Market, Shahbag, Gulshan, Mohakhali, Karwan Bazar and Farmgate, while Tejgaon and Hazaribagh are the major industrial areas. Bashundhara-Baridhara is a developing economic area that will include high-tech industries, corporations and a large shopping precinct in about 5 years. The Export Processing Zone in Dhaka was set up to encourage the export of garments, textiles and other goods. Dhaka has two EPZs. They are home to 413 industries, which employ mostly women. The Dhaka Stock Exchange is based in the city, including many large multinationals and BRAC are based in Dhaka. Country's central bank Bangladesh Bank and Nobel Peace Prize winning organization Grameen Bank have their head-quarters in Dhaka. Urban developments have sparked a widespread construction boom; new high-rise buildings and skyscrapers have changed the city landscape. Growth has been especially strong in the finance, banking, manufacturing, telecommunications and services sectors, while tourism, hotels and restaurants continue as important elements in the economy of Dhaka.

D. Social and Cultural Resources

1. Population and Communities

80. Bangladesh has a population of 140 million, of whom 30% (over 40 million people) live in urban areas, and this is predicted to rise to 50% in the next 25 years. Dhaka, with 10 million people in an area of around 800 km² is one of the most densely populated areas in the world.

81. Dhaka has grown to 10 million people from 3.4 million in 1981, which is one of the fastest rates of population increase seen anywhere in the world; and if growth continues at the same rate, by 2025 the city will accommodate over 22 million people.

82. One of the main reasons for the population growth has been the influx of rural migrants, attracted by the prospect of easier lives and increased incomes in urban areas. When these fail to materialize the inevitable result is an increase in the urban poor and an expansion of slums. Thirty five percent the urban population now lives in slums, which is almost 15 million people, and in the six cities under UPEHSDP there are almost 10,000 slums, 55% in Dhaka and 20% in Chittagong.

83. Bangladesh is inhabited predominantly by a single ethnic group, Bengali, who constitute more than 98% of the population of the country. According to the 2001 census over 90% of the country is Muslim, and although this includes both Sunni and Shia, Sunnis are in the majority. Other religions are Hindu (9.2%), Buddhist (0.7%) and Christian (0.3%). The average male: female ratio is around 54% to 46% in Bangladesh, instead of the natural 1:1. The average household size is between 4.5 and 5 persons, down from 6 per household in 1981.

2. Health Facilities

84. Health facilities are generally more widely available in towns and cities than in the rural areas, but the cost of the service means that it is not widely used by poorer people and slum dwellers in particular. This along with various other factors, including poor sanitation and nutrition (which decrease immunity and resistance), overcrowding (which facilitates disease transmission) and poor public and environmental health mean that the urban poor suffer disproportionately from ill health. As a result, child morbidity and mortality, malnutrition and growth retardation are all higher in slum areas. There are also gender inequalities, with mortality in years 1- 4 being 28 per 1,000 births in boys, compared to 38 in girls.

85. People in urban areas suffer many of the diseases associated with overcrowding and poor sanitation, including dysentery, diarrhea, whooping cough, gastro-enteritis, TB, etc. In the larger cities like Dhaka, Chittagong and Khulna they also suffer respiratory problems and other illnesses caused by excessive exposure to traffic pollutants.

86. There are public and private hospitals and clinics in Dhaka including Dhaka Medical College Hospital, founded in 1949 (the oldest facility in the country), Bangabandhu Sheikh Mujib Medical University Hospital (600 beds), Sir Salimullah Medical College Hospital (600 beds), and the Hospital for the Disabled (500 beds).

87. Some public facilities provide a good service, but many are under staffed and under resourced, and ratios of beds per numbers of population are inadequate (e.g. 5,000 beds for 10 million people in Dhaka). 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

88. Bangladesh has a well established educational tradition, which dates back to the founding of Dhaka Collegiate School in 1835 and Dhaka College in 1841, when English was established as the main teaching medium. The first university, the University of Dhaka was created in 1921, and stands today on the original campus in the centre of the city.

89. There are institutions offering primary, secondary and tertiary education in all of the main urban areas in the country. As in most countries the largest numbers of facilities are available in the capital, the city of Dhaka has, currently, over 12,000 primary and secondary schools, several hundred colleges and technical institutes, and 52 universities (nine state-funded and 45 in the private sector). Generally boys and girls are educated together, and there are no major differences in enrolment between the genders in schools, although boys outnumber girls in higher education. Adult literacy (over 15 years' of age) is 31% in females and 50% in males.

4. Socio-economic conditions

85. The mega-city of Dhaka accommodates almost 9% of the total population and is the most urbanized area in the country. In this area people are engaged in various activities, mainly laboring (50%), business (23%), industry (10%), and transport and communication (7%). There are around 1,500 garment factories, in which more than a million people work, mainly women. Other types of manufacturing are also major employers, as is the construction industry. According to BBS statistics, in 1999-2000, per capita GDP for Dhaka was US \$872, so with an annual average growth of 4% the present figure would be around \$1,300 (\$108 per month).

86. 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.

87. 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

88. Bangladesh has many sites, buildings and artifacts that are of historical and cultural significance. Many date back to the British colonial period from the mid-19th to the mid-20th centuries, and some are from earlier periods, including the Muslim era of the 13th to 17th centuries, the Sena dynasty of the 12th and 13th centuries, and even the Gupta Buddhist era of the 4th to 7th centuries A.D. However, construction practices that pay scant regard to the possible discovery of ancient remains have meant that most of the older sites that remain are located well away from urban areas.

89. Some older buildings that are of religious importance have been retained relatively intact in urban areas, where many are still used for worship today. These include:

- (i) The 12th century Dhakeshwari temple, which is the oldest Hindu temple in Dhaka and is believed to be the origin of the name of the city; and
- (ii) The 18th century Star Mosque, also in Dhaka, which has many architectural features including a three domed (Mughal style) structure, mosaic floors and decorated walls.

90. There are more buildings and sites from the more recent colonial era including:

- (i) Ahsan Manjil on the bank of the Buriganga River was built by the Nawabs (rulers) of Dhaka in 1872, and is now a museum displaying many artifacts from this time; and
- (II) The Old High Court in Dhaka, which was originally built as the residence of the British Governor and includes both European and Mughal architecture.

91. Other notable buildings and locations in urban areas include:

National Museum; Science Museum; National Art Gallery; National Botanical Garden; Zoological Garden; and the National Parliament.

92. It may be mentioned here that none of the proposed 12 STS sites are adjacent to any of the enumerated archaeological heritage and relics of Dhaka.

6. Indigenous Peoples

93. 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 Dhaka City Corporation where indigenous people can be found; rather they have mixed with other people of the community. Within the Dhaka 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.

94. 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

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

96. **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

97. 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 DCC authority is already using part 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.

98. 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 DCC 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.

99. 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.

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

B. Construction Impacts

101. **Construction method.** The work comprises the construction of 12 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.

102. 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.

103. 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.

104. 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.

105. 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.

106. 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.

107. 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.

108. **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 8 small sites within the DCC. 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	Dhaka 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.

109. **Impacts due to excavations.** Excavating the foundations for the buildings, roads, walkways and other structures on sites will produce around 1,200 m³ 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.

110. 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.

111. 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.

112. 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 Dhaka 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 Dhaka City Corporation as well the income of people who are engaged in picking recyclable materials due to construction of this subproject.

113. 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.

114. 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.

115. 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 m³ so the disposal of 1,200 m³ of soil and stone will require a relatively small number of truck movements: around 45.

116. 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.

117. 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.

118. **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

119. For the first 2 years of operations of the STSs, the Contractor will manage the operations and maintain² 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 Dhaka City Corporation, will also develop a manual for the regular and preventive maintenance of the STSs.

120. 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.

121. 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.

122. **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.

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

124. **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.

125. **Generation of Wastewater.** The liquid wastes of STS are high in biological oxygen demand. But the quantity will be small and it will be allowed to drain through the existing municipal covered surface drains.

126. **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

² 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.

premises always give a particular stink. Excessive odor is a nuisance to locals and attracts vermin and scavengers.

127. **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.

128. **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.

129. 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	Dhaka 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

130. 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 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) Dhaka 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.

Parameter	Mitigation Measures
Barricades and warning signs	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - Establish extensive coordination with Dhaka 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 Dhaka 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	<ul style="list-style-type: none"> - In all instances, Dhaka 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 Dhaka 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	<ul style="list-style-type: none"> - 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 ³	<ul style="list-style-type: none"> - 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 ⁴	<ul style="list-style-type: none"> - 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 ⁵	<ul style="list-style-type: none"> - 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 ⁶	<ul style="list-style-type: none"> - 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.
Construction phase	
Excavated materials	<ul style="list-style-type: none"> - 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 Dhaka City Corporation.

³ Careful planning of the construction camp can ensure that time and costs associated with environmental management and rehabilitation is reduced

⁴ Storage areas can be hazardous and unsightly and can cause environmental pollution if not designed and managed carefully.

⁵ Materials must be sourced in a legal and sustainable way to prevent offsite environmental degradation.

⁶ These points need to be made clear to all staff on site before the project begins.

Parameter	Mitigation Measures
	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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. - 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

Parameter	Mitigation Measures
	<p>establishments during the construction, so that there is no closure of these shops or any loss of clientage.</p> <ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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 all temporary services.
Dust and air pollution	<ul style="list-style-type: none"> - 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

Parameter	Mitigation Measures
	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, 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

Parameter	Mitigation Measures
	over to the Contractor for construction activities.
Operation and maintenance phase	
General	<ul style="list-style-type: none"> - 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 x 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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.

131. Dhaka 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.

132. 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 Dhaka City Corporation because it would reduce the expenditure of DCC up to about 50% in collection and transportation of solid waste. And the DCC should re-invest this amount in staff training and equipment for the STSs, and ultimately in establishing similar facilities elsewhere in the city.

133. 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

134. 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 Dhaka; and
- (v) Companies and private individuals who are benefitted from the existing STSs.

135. 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

136. 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:

137. 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.

138. 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.

139. 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

140. 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

141. Figure 34 is an organization chart showing how the project will be managed and implemented.

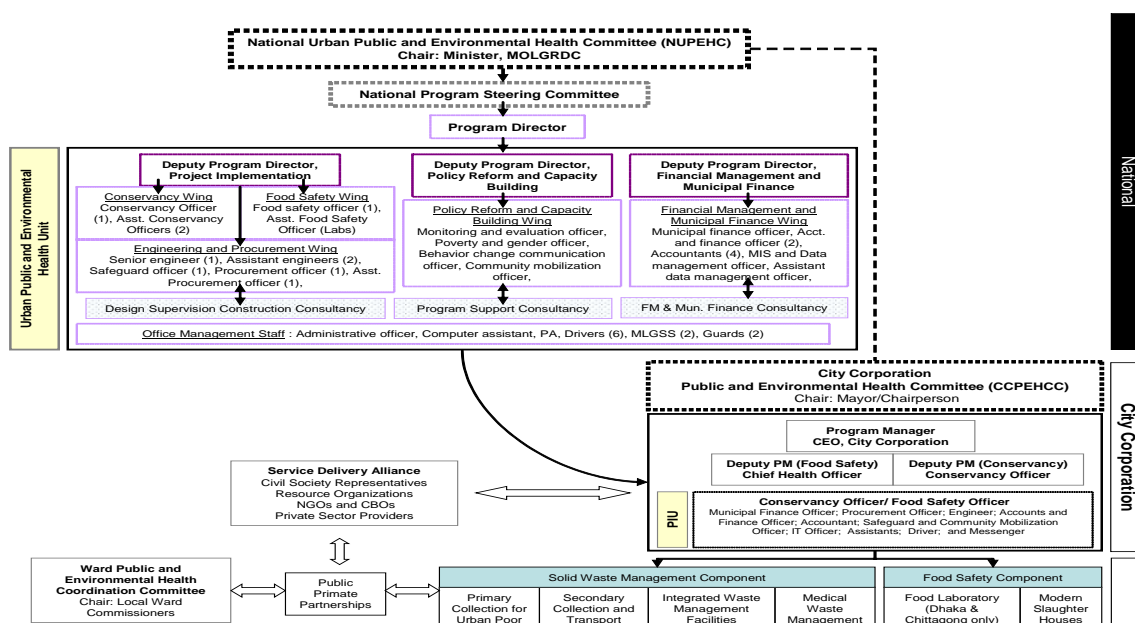


Fig 34: Organization Chart for UPEHSDP

142. **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.

143. 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).

144. 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.

145. 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 Dhaka 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

146. 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.

147. 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
	Module 2 – Environmental Assessment Process ADB environmental process, identification of impacts and mitigation measures, formulation of		CCPIUs

Description	Contents	Schedule	Participants
	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		
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 ⁷ 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

148. 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.

149. **Environmental monitoring program.** Prior to commencement of any civil work, the contractors will submit a compliance report⁸ to the DSC ensuring that all identified pre-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.

⁷ **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.

⁸ 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.

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) Dhaka 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, training, and know-how. It is	Contractors	DSC CCPIU	Workers list (for internal monitoring)	Prior to approval of detailed design	Detailed Design documents

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	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.				documents	
Community and public awareness	<ul style="list-style-type: none"> - Establish extensive coordination with Dhaka 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 Dhaka 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	<ul style="list-style-type: none"> - In all instances, Dhaka 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 Dhaka City Corporation, LGD, Ministry of Local Government, Rural 	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
	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. - The contractor should	Contractor	DSC CCPIU	Location plan	Prior to approval of detailed design documents	Approved location plan Construction method No complaints received

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	submit a method statement and plans for the storage of hazardous materials (fuels, oils, and chemicals) and emergency procedures.					
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 ⁹	- 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. - The contractor can process	Contractor	DSC	Construction method statement	As work progresses	Construction method Detailed design documents

⁹ 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
	<p>the excavated materials and use these as selected backfill materials.</p> <ul style="list-style-type: none"> - If excavated materials are not suitable for reuse, the contractor should deposit these in an area designated by Dhaka 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. 					Identify and obtain clearance from DoE for disposal sites of excavated soils and contaminated materials
Hauling of Construction Materials	<ul style="list-style-type: none"> - The contractor must maintain all the materials necessary in his inventory so that these can be easily hauled to the construction 	Contractor	DSC	Construction method statement	As work progresses	<p>Construction method</p> <p>Detailed design documents</p>

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	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.	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; (ii) prevent excessive noise; (iii) construction staff are to	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
	<p>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.</p> <ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - Contractor's activities and movement of staff will be restricted to designated construction areas. - Should the construction 	Contractor	DSC	<p>Complaints from community</p> <p>Activities based on the</p>	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
	<p>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.</p> <ul style="list-style-type: none"> - 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 can take place by way of leaflets placed in the 			communication and participation strategy		

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	<p>postboxes giving the environment management specialist's and contractor's details or other method approved by the environment management specialist.</p> <ul style="list-style-type: none"> - 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 					

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	<p>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.</p> <ul style="list-style-type: none"> - 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 					

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	<p>in complaints register; (iii) bringing issues to the environment management specialist's attention immediately; and (iv) taking remedial action as per environment management specialist's instruction.</p> <p>- 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.</p>					
Community and public awareness	<p>- Storage facilities and other temporary structures on-site should be located such that they have as little visual impact on local residents as possible.</p> <p>- Special attention should be given to the screening of highly reflective materials on site.</p> <p>- 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.</p>	Contractor	DSC	<p>Complaints from community</p> <p>Activities based on the communication and participation strategy</p>	As work progresses	Zero complaints from community and workers
Construction camps and storage	- The contractor is to ensure that open areas or the	Contractor	DSC	Approved location plan	As work progresses	Approved location plan

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
areas	<p>surrounding bushes are not being used as toilet facility.</p> <ul style="list-style-type: none"> - 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 all temporary services. 			Complaints from community		Zero complaints from community and workers
Dust and air	- Vehicles travelling to and	Contractor	DSC	Vehicle	As work	No visible increase in

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
pollution	<p>from the construction site must adhere to speed limits so as to avoid producing excessive dust.</p> <ul style="list-style-type: none"> - 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, 			<p>emission testing records</p> <p>Complaints from community</p>	progresses	<p>dust and particulate matters</p> <p>Zero complaints from community</p>
Noise levels	<ul style="list-style-type: none"> - 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. 	Contractor	MASC environment management specialist	<p>Complaints from community</p> <p>Noise level monitoring record</p>	As work progresses	ECR 1997
Utilities	- Prepare a list of affected	Contractor	DSC	Number of	As work	No disrupted service

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	utilities and operators - Prepare a contingency plan to include actions to be done in case of unintentional interruption of services.			affected utilities Length of time to restore disrupted services	progresses	
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,	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
	<p>placing, or compacting asphalt or any other bituminous product may be washed on-site.</p> <ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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. <p>Waybills proving disposal at each site should be provided for the environment management specialist's</p>	Contractor	DSC	<p>Complaints from community</p> <p>Waste disposal manifest/record</p>	As work progresses	<p>No dumped wastes and litter at work sites at all times</p> <p>Zero complaints from community</p>

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	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 archaeological value, which include old stone	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
	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	<ul style="list-style-type: none"> - 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 adjacent areas should be sprinkled or sprayed 	Contractor (up to service delivery period) Dhaka City Corporation	Dhaka 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
	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) Dhaka City Corporation	Dhaka 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) Dhaka City Corporation	Dhaka 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) Dhaka City Corporation	Dhaka 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) Dhaka City Corporation	Dhaka 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 avoided after hours. - Vehicles should be fitted	Contractor (up to service delivery period)	Dhaka City Corporation (up to service delivery period)	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

Parameter	Mitigation Measures	Responsible for Implementation	Responsible for Monitoring	Parameters to be Monitored	Frequency of Monitoring	Guidelines/Standards
	with silencers. - Vehicles and machinery are to be kept in good working order.	Dhaka City Corporation	Independent Monitoring Agency			
Water use	- Minimize water use through dedicated metering of water consumption	Contractor (up to service delivery period) Dhaka City Corporation	Dhaka 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) Dhaka City Corporation	Dhaka 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

150. 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

151. 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.

152. 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 (Dhaka City Corporation). All monitoring during the operation and maintenance phase will be conducted by Dhaka City Corporation; therefore, there are no additional costs.

153. 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.

154. 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 Dhaka 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 Dhaka 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	300,000 ¹⁰	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)				

¹⁰ 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

155. The process described in this document has assessed the environmental impacts of all elements of the infrastructure proposed under the Dhaka 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 DCC before the construction activities begins.

156. 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.

157. 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.

158. 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.

159. 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 Dhaka 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.

160. 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 Dhaka City Corporation to achieve expected standards.

161. 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

162. 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.

163. 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

164. 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

165. The environmental impacts of the proposed STSs subprojects in the Dhaka 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.

166. In relation to Bangladeshi ECR 1997, the Dhaka 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 50% of them 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 available water supply, deterioration for surface and ground		X	

Screening Questions	Yes	No	Remarks
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 Uttara Jasimuddin Road



STS – 2 Uttara Rajuk College



STS – 3 Golar Tek Mirpur



STS – 4 Kawran Bazar



STS – 5 Berry Bandh Mohammadpur



STS – 6 Berry Bandh Rayer Bazar



STS – 7 Berry Bandh Hazaribag Progoti



STS – 8 Berry Bandh Hazaribag Matador



STS – 9 Jurain Kabarosthan



STS – 10 Jatrabari Crossing



STS – 11 Golapshah Mazar Gulistan



STS – 12 DMC Dhaka University Playground

ANNEX 3: Records of Public Consultations Conducted

The stakeholders' consultation meeting was held at STS site of New Market, Dhaka at 12-00 Noon on 27 December 2012 with local people and Urban Public and Environmental Health Sector Development Project (UPEHSDP) officials.

The meeting was held with local people and Assistant Project Director (Dr. Samir Kanti Sarkar) of UPEHSDP. Among the local people, most of them were laborers, small shop keepers and local rickshaw pullers who participated actively in the consultation.



Meeting at New Market STS site in Dhaka

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 DCC has undertaken a project to construct one modern slaughterhouse, one food laboratory with training facilities and 12 secondary transfer stations in DCC 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 DCC. 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 KCC 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 DCC 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: 27/12/2012

Place of meeting: STS site west of New Market, Dhaka

Union: W-18 Thana: New Market

Serial Number	Name of Participant	Father's/ Husband's Name	Address	Mobile Number	Signature
1	Md. Enamul Hoque	Md. Ear Fen Shake	Pallabi, Dhaka	01721-021873	
2	Dr. Samir Kanti Sarkar	Atindro Ch. Sarkar	UPEHSDP	01711-795285	
3	AK Fazlur Rahman	Akram Ali	DSCC	01552-389670	
4	Md. Mustafizur Rahman	Late AKM Nurul Hoque	DDCL	01817-026339	
5	Monir Hossain	Fazlul Karim	New Market	01766-800726	
6	Md. Sala Uddin	Delwar Hossain	New Market	01926-624777	
7	Md. Mamun	Yunus	New Market	01918-272096	
8	Sohel	Md. Hossain	New Market	01756-005686	
9	Sohel	Abdul Khaleque	Kamrangirchar	-	
10	Md. Alamin	Abdul Khaleque	Lalbag	-	
11	Md. Jahangir	Md. Habibur	Naogaon	01738-900434	

[illegible]