

## Urban Solid Waste Management: A Study on Comilla City Corporation

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### Abstract

Improper management of solid waste is one of the main causes of environmental pollution and degradation in many cities. Low collection coverage, unavailable transport services, and lack of suitable treatment, recycling and disposal facilities are responsible for unsatisfactory waste management, leading to water, land and air pollution, and for putting people and the environment at risk. The process of establishing door-to-door waste collection system is not always transparent to the public. People usually receive services of primary collection service providers (Community Based Organization) and Comilla City Corporation (CCC) are not fully involved in the activities/decision making process. Comilla City Corporation does not have adequate capacity to handle the increasing solid waste mainly due to limited budgets. This paper aims to identify the status of waste management process, explore the problems of service delivery, and to justify the public satisfaction. It also provides some recommendations for better solid waste management in Comilla City Corporation.

**Keywords:** Solid Waste Management, Comilla city Corporation, Satisfaction, Public Awareness.

### 1. Introduction

Waste Management has emerged as one of the greatest challenges facing urban local authorities throughout Bangladesh though it is an obligatory function of it. Bangladesh is a densely populated country. Her population will be about 17 core by 2020 (BBS, 2001; Population Council, 2010). In a country like Bangladesh, urban solid waste creates an incredible environmental hazard and social problem in city lives (Hasan & Chowdhury, 2006). A massive volume of solid waste is generated every day in the city areas and unfortunately, solid waste management is being deteriorated day by day due to the limited resources in handling the increasing rate of generated waste (Enayetullah & Hashmi, 2006). With over 3.3% annual growth of urban population in Bangladesh during 1991-2001 census years, solid waste generation has also increased proportionately with the growth of urban population (SAARC workshop). Zurbrugg (2003) describes that one to two thirds of the solid waste generation in developing countries is not collected. Human activities create waste, and it is the way these wastes are handled, stored, collected and disposed of, which can pose risks to the environment and to public health. According to Pierce and Turner (1994) current systems of solid waste management in most of developing countries are inefficient and ineffective. This inefficient solid waste management is generating the problems of air pollution in form of green house effect, ozone depletion, acidic rains as well as water and soil pollution (Visvanathan, 2006). In urban areas, especially in the rapid urbanizing cities of the developing world, problems and issues of Urban Solid Waste Management (USWM) are of immediate importance. The uncollected waste, which is often mixed up with human and animal excreta, is dumped indiscriminately in the streets and in drains, resulting in flood, breeding of insect and rodent vectors and the spread of diseases. Furthermore, collected waste is often disposed of uncontrolled.

#### 1.1 Definition of Waste

Solid waste can be defined as “any residue that is of no use in its current status to the people who caused it” (Khattak et.al.; 2009). Synonyms to solid waste are terms such as “garbage”, “trash”, “refuse” and “rubbish”. Urban solid waste (USW) is defined to include refuse from households (kitchen and yards), non-hazardous solid waste from industrial (raw material and packaging), commercial (shops, markets, hotels, and restaurants) and institutional (schools, hospitals, and offices) establishments, construction and demolition sites, wild and domesticated animals (carcasses of dead animals, manure), parks (fallen branches, leaves from trees) and street sweepings (sand, silt, clay, concrete, bricks, asphalt, residues from air deposition and dust). Urban solid waste management (USWM) refers to the collection, transfer, treatment, recycling, resources recovery and disposal of solid waste in urban areas (T. Ch. Ogwueleka, 2009). Solid waste from industrial processes are generally not

considered "municipal", however, they need to be taken into account when dealing with solid waste as they often end up in the municipal solid waste stream ((Zurbrugg, C.,2003).

### 1.2 Waste Generation Rates

Waste generation rates are affected by socioeconomic development, degree of industrialization, and climate. Generally, the greater the economic prosperity and the higher percentage of urban population, the greater the amount of solid waste produced.

Figure 1: Sources and Types of Solid Wastes

Source	Typical waste generators	Types of solid wastes
Residential	Single and multifamily dwellings	Food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood,  glass, metals, ashes, special wastes (e.g., bulky items, consumer electronics,  white goods, batteries, oil, tires), and household hazardous wastes
Industrial	Light and heavy manufacturing, fabrication, construction sites, power and chemical plants	Housekeeping wastes, packaging, food wastes, construction and demolition materials, hazardous wastes, ashes, special wastes
Commercial	Stores, hotels, restaurants, markets, , office buildings, etc.	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes
Institutional	Schools, hospitals, prisons, government centers	Same as commercial
Construction and demolition	New construction sites, road repair, renovation sites, demolition of buildings	Wood, steel, concrete, dirt, etc.
Municipal services	Street cleaning, landscaping, parks, beaches, other recreational areas, water and wastewater treatment plants	Street sweepings; landscape and tree trimmings; general wastes from parks,  beaches, other recreational areas, beaches, and other recreational areas; sludge
Process	Heavy and light manufacturing, refineries,  chemical plants, power plants, mineral extraction and processing	Industrial process wastes, scrap materials, off-specification products, slag, tailings
Agriculture	Crops, orchards, vineyards, dairies feedlots, farms	Spoiled food wastes, agricultural wastes, hazardous wastes (e.g., pesticides)

Source: THE WORLD BANK, Urban Development Sector Unit, East Asia and Pacific Region, May 1999

### 1.3 Study Area

Comilla District (Chittagong division) with an area of 3085.17 sq km, is bounded by Brahmanbaria and Narayanganj districts on the north, Noakhali and Feni districts on the south, Tripura (state of India) on the east, Munshiganj and Chandpur districts on the west. Annual average temperature of this city is maximum 34.3°C and minimum 12.7°C; and rainfall 2551 mm. Main rivers are Meghna, Gumti and Dakatia. Comilla City Corporation stands on the bank of the Gumti River, which was formed in 2011. It consists of 27 wards. It has an area of 53.04 sq km and a population of 8 lakh; male 52.56%, female 47.44%. Literacy rate among the town people is 60.3% (Banglapedia, 2008).

### 1.4 Objectives

The specific objectives of the study are:

- To identify the current status of solid waste management process of Comilla City Corporation.
- To investigate the problems of service delivery in terms of waste management.
- To find out the public satisfaction on waste management.
- To evaluate the environmental aspects around the ultimate disposal sites of solid waste of the city and to suggest for taking necessary measures to safeguard the environment.

### 1.5 Methods of the Study

The study used both primary and secondary data. Primary data collected from officials and general people of Comilla City Corporation. The methods used for this study are a combination of observation by case studies and questionnaire survey. Relevant data for this study were collected directly from the field by using a questionnaire and depth-interview. The sample size was 250 respondents (Residential respondents 150, Commercial 50, Service Sector 50) for the questionnaire survey. The study conducted from January 2012 to February 2012. The key part of the questionnaire inquires the perception on the general people who received the service. The methods adopted for the present study also make extensive use of secondary material analysis to build up and support the objectives of the study. These were mainly collected from different

## 2 Findings and Discussions

### 2.1 Problems of Urban Solid Waste Management in CCC

While people are willing to pay for water and other services that are essential to their survival, solid waste removal does not always fall into this category. In Solid Waste Management of Comilla City Corporation, typical problematized areas can be identified. These can be described as the following Table.

- Within 27 wards, City Corporation provides solid waste services only to 18 wards even though those wards are not covered by the service vastly. CCC is unable to provide standard service.
- The workers who are in contract basis, they have no commitment to their jobs. As a result, conservancy department faces difficulty to control them.
- The city corporation has not enough equipment such as van, trucktor, storage container, waste wagon etc.
- In most of the developing countries, the basic issues related to the solid waste management is the lack of financial and institutional capability of the local governments and CCC is not different from it. Poor funding is one of the main reasons for poor collection and disposal of refuse. The waste management fee is insufficient for waste management system. CCC does not have adequate capacity to handle the increasing solid waste mainly due to limited budgets.
- CCC has no recycling system; it stores wastage in the open place of Jakuni para. It collects the waste in traditional ways. It has no proper plan how to improve its service.
- In particular, the legislative and regulatory context for solid waste management is dispersed, fragmented, and incomplete, and so does not tend to facilitate the formation of cross-sectoral partnerships.
- Operational inefficiencies of solid waste services operated by municipalities are due to inefficient institutional structures, inefficient organizational procedures, or deficient management capacity of the institutions involved as well as the use of inappropriate technologies.
- Conservancy department is understaffed and inadequately staffed with poorly trained-up workers. The department is faced with financial difficulties in meeting the large recruitment of the labours. Lack of expertise and manpower also hinders to run solid waste management program in Comilla City Corporation.

- There is no reliable measurement of generated waste. Non-appreciation of the magnitude of the waste management is a problem.
- Most of the used vehicles are not sophisticated, they are known, as truck. Their carrying capacity is very low. After a short time of operation usually only a small part of the vehicles fleet remains in operation. Solid waste collection vehicles are assigned to urban areas without any serious waste analysis. Route selection is left to the drivers. Solid waste collection is done in a contractual basis, which contributes to high solid waste collection cost and the crippling fuel crisis. The vehicles are not full on some trips to the disposal site. The vehicles are obsolete and too expensive to operate and maintain. The containers are old and few. Transportation of waste using heavy vehicles is very difficult because the roads are very congested.

Table1: Problems of solid waste management in CCC

Problem	Very serious	serious	Not so serious	No problem
Inadequate service coverage (some people not given service)	√			
Lack service quality (not frequent enough, spill, etc.)		√		
Lack of qualified contractual Labours				√
Difficult to control contractual service		√		
Lack of control on hazardous waste			√	
Lack of financial resources	√			
Lack of vehicles	√			
Lack of equipment	√			
Old vehicle/equipment frequent breakdown	√			
Lack of capability to maintain/repair vehicle/equipment			√	
No proper institutional set-up for solid waste management service	√			
Poor response to waste minimization (reuse/recycling)	√			
Lack of legislation		√		
Lack of planning (short, medium and long term plan)	√			
Poor public cooperation		√		
Rapid urbanization outstripping service capacity		√		
Poor cooperation by Government agencies			√	
Uncontrolled proliferation of squatter settlements		√		
Difficult to obtain cover material	√			
Public Awareness	√			

Source: Health & Conservancy Department of CCC

- At present, the solid waste management system in CCC is not well organized. For instance, it has recently proposed a Solid Waste Management Cell to improve the waste management services in the

city. Solid waste management is organized and run by conservancy section of the CCC, the prime responsibility of that is to collect waste.

- The service of the CCC is unable to cope up with rapid urbanization. It has no capacity to provide services with growing people.
- Although production and consumption are rising, awareness of citizens, and co-operations of governments agencies are still low towards waste issues. A large number of people of Comilla may still be unaware of the waste, how it pollutes environment, and why it should be protected. Slum dwellers are living in an unhygienic condition and polluting environment through regular activities i.e. burning of biomass, unsanitary practices etc. Lack of awareness and insufficient services are identified as major causes behind it.

## 2.2 Human Resources of Conservancy Department in CCC

The city authority has limited fund for utility service management and development activities. Comilla City Corporation has not yet separated department of conservancy. It is working under the Health and Conservancy Department. There are only four permanent employees in conservancy department whereas 319 labours are working on contractual basis. There are ten drivers, seventy-four sweepers, 124 labours (52 vichale labours, 57 ward labours, 15 garden and park labours) and 29 labours' supervisors in CCC. All of the cleaners and sweepers are hired on temporary basis. The chief conservancy officer or assistant conservancy officer in the CCC has to coordinate with the transport department to get the waste transferred from collection points to designated waste disposal sites. In addition to the shortage of personnel, the staffs are handicapped with relatively small amount of resources available to them for management of solid waste in their particular area of operation.

## 2.3 Waste collection and transportation in Comilla City Corporation

The collection of solid waste is the function of Urban local government. Community Based Organization (CBO) exists in parallel with official agencies in 18 wards for solid waste collection operations. Otherwise the informal (guard of residential areas) collectors provide the service for a fee. In most urban areas, stationary containers system is adopted for waste collection; the waste containers remain at the points of waste generation. This method requires the delivery of waste by the residents to a storage container. These containers are generally kept at open spaces along the street ends or junctions. Some bins are fixed on the ground and some are movable. House-to-house service is very rare in Comilla City Corporation, which is done by CBO within a limited scope. Different types of vehicles are used for solid waste collection in Comilla City Corporation. The four-hydraulic trucks, seven mini trucks, one-bimlift trucks and four trucktors are the commonly used vehicles. It was observed that 60 percent of trucks always remain out of service. There is little service coverage in most urban areas and it is totally absent in peri-urban areas. Comilla Sador South has no access to waste collection service though it is a part of newly formed CCC. They dump waste at any vacant plot, public space, and canal or burn it in their backyard, thereby polluting the air. Solid waste generation exceeds collection capacity. As per traditional method of waste collections, Rickshaw vans are modified to collect waste from each house under the project of UGIIP-2, and City Corporation has its own vehicles for collecting waste. There is no regular routine collection. Urban solid waste is collected and taken by collection vehicles directly to the disposal sites. The waste accumulates in open dumps at roadsides. The open dumps provide harborage for diseases causing organisms, bacteria, insects, and rodents.

## 3. Service Covered by Comilla City Corporation

CCC does not provide the waste management service to all the wards belonging to it. Community Based Organization that provides five units for each ward covers eighteen wards. In the following service, covered scenario has been illustrated.

Table2: Service covered scenario

Service Covered by CCC	Residential	Commercial	Service Sector
Yes	(n=108) 72%	(n=40) 80%	(n=22) 44%
No	(n=37) 25%	(n=9) 18%	(n=28) 56%
Unknown	(n=5) 3%	(n=1) 2%	
Total	(n=150) 100%	(n=50) 100%	(n=50) 100%

Source: Field Survey, 2012

In residential areas, 72% respondents said that they received the service covered by CCC. In commercial area, the percentage is 80 and in service sector, it is 44. So service sectors are the lowest service covered area by CCC. The reason lies behind the fact that most of the service sectors specially the hospitals and clinics have their own

wastage carriage system. On the contrary, it is the commercial area that got the service most. As nine of the twenty-seven wards of the CCC are out of the services of Community Based Organization (CBO) and CCC, 25% people get no waste management service.

### 3.1 Community Based Organization for solid waste management

Community Initiatives' (based on primary solid waste collection by CBOs and NGOs) house-to-house waste collection in neighborhood started due to the lack of satisfaction with solid waste management service. It is clear that due to limited resources and organizational capacity, it is hard for CCC to ensure efficient and appropriate delivery of solid waste collection and disposal services to the entire city population. Therefore, CCC is encouraging community based organizations and local NGOs to organize and carryout community waste management program (mainly house-to-house collection and disposal). For example at present CBO is working in eighteen wards of CCC which is partially financed by the projects (UGIIP-2) of Bangladesh Government, Asian Development Bank, and BMZ. In addition, beneficiary users of the wards finance the rest. The activities provided by CBO are to construct transfer station, to make treaty for waste management, to revive dustbins, to revive Clean Development Mechanism (CDM), and to manage hospital wastage.

Table3: The Satisfactory level

Satisfaction	Residential	Commercial	Service
Yes	(n=36) 24%	(n=15) 30%	(n=22) 44%
No	(n=98) 65%	(n=24) 48%	(n=23) 46%
Moderate	(n=16) 11%	(n=11) 22%	(n=5) 10%
Total	(n=150) 100%	(n=50) 100%	(n=50) 100%

Source: Field Survey, 2012

It is obvious from the table 3 that most of the residential (65%) are unsatisfied to CCC waste service delivery systems. Only 24% respondents are satisfied and 16% people are satisfied moderately. On the other hand, in commercial area only 30%, people are satisfied and half of the respondents (48%) are unsatisfied to this service. In service sector, 44% people are satisfied whereas 46% are not convinced. Those respondents are not satisfied to CCC waste management services. They identified some problems, which are shown in the following figure:

#### 3.1.1 Why people are not satisfied

Figure2: Respondent comments of waste management system.

Residential	Commercial	Service
<ul style="list-style-type: none"> <li>• Not available dustbin</li> <li>• Service is not covered by CCC.</li> <li>• Waste does not collected daily.</li> <li>• Employees/Labours are not punctual.</li> <li>• Poor response from CCC</li> <li>• Lack of proper system</li> <li>• Charge is applicable</li> <li>• Lack of trained labour</li> <li>• No recycling system</li> </ul>	<ul style="list-style-type: none"> <li>• Waste is not collected in time</li> <li>• Lack of sufficient storage bin</li> <li>• Waste labour are not cordial in service</li> <li>• Poor service standard</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of efficiency</li> <li>• Waste collected in office hour</li> <li>• Service provide only high income areas</li> <li>• Lack of conscious/awareness</li> <li>• No effective service</li> </ul>

Source: Field Survey, 2012

### 3.2 Types of storage bin used

The types of the storage bins used by the respondents are shown in the Table 4.

Table4: Types of storage bin used

Type of Storage	Residential Premise				Commercial Premise				Service Sector Premise			
	A	F	S	N	A	F	S	N	A	F	S	N
Metal bin				(n=150) 100%				(n=50) 100%	(n=11) 22%		(n=5) 10%	(n=34) 68%
Plastic bin	(n=111) 74%			(n=39) 26%	(n=13) 26%			(n=37) 74%	(n=28) 56%		(n=6) 12%	(n=16) 32%
Plastic bag	(n=12) 8%	(n=14) 10%	(n=27) 18%	(n=97) 64%	(n=5) 10%		(n=10) 20%	(n=35) 70%	(n=25) 50%		(n=25) 50%	
Oil Drum				(n=150) 100%	(n=7) 14%		(n=3) 6%	(n=40) 80%	(n=1) 2%		(n=6) 12%	(n=43) 86%
Open Space	(n=45) 30%		(n=14) 10%	(n=91) 60%	(n=28) 56%			(n=22) 44%	(n=6) 12%		(n=6) 12%	(n=38) 76%
Concrete Bin	(n=21) 14%			(n=129) 86%	(n=9) 18%		(n=3) 6%	(n=38) 76%	(n=6) 12%		(n=16) 32%	(n=28) 56%

Source: Field Survey, 2012. Notes: N= Total number of Respondent Surveyed, n= Number of respondent by specific storage bin used.

A= Almost exclusively used

F= Frequently used

S= Sometimes used

N= Never used

It is shown the Table 4, that the metal bin is entirely unused by the respondents. 74% of them almost exclusively used plastic bin, 8% almost exclusively used plastic bag, 18% used it sometimes but 64% never used it. No respondents used oil drum. Almost 30% people threw the waste in open space though 60% never did it. However, 10% people used it sometimes. As the concrete bin is not available in the area far from the main road, only 14% people almost exclusively used it. Moreover, the rest 86% people do not used it.

It is obvious that in service sectors 22% respondents almost exclusively used metal bin but 68% never used it. In addition, 10% respondents sometimes used it. Plastic bin is much more used than the metal bin. Almost 56% respondents responded to it positively and only 32% of them used it never. Then half of the respondents almost exclusively used plastic bag and the rest half never used it. 86% people never used oil drum. Only 12% respondents almost exclusively used the open space but 76% never used it. And 12% of them sometimes used it. As the concrete bin is not accessible, 56% respondents did not use it. 32% of them used it sometime and only 12% people used it almost exclusively.

In commercial sector, metal bin is never used. 26% people almost exclusively used plastic bin but 74% did not used it. To plastic bag, 70% respondents responded negatively but 10% respondents to it positively. Only 14% people use oil drum. More than half of the people (56%) threw the waste in the open space whereas only 44% never threw the waste elsewhere. As the concrete bin is not enough, 76% respondents did not use it. Only 18% people use it. Therefore, it is clear that most of the respondents in commercial area throw their wastage in open space that polluted the environment.

#### 4 Environmental and health impacts of improper solid waste management

Effective solid management systems are needed to ensure better human health and safety.

The problem of solid waste management and the subsequent impact on neighborhood environments is critical in CCC. The environment in part of the city bears signs of polluted environmental conditions because of the accumulated uncontrolled garbage on the roads and drains filled with solid wastes. Solid waste disposal possesses a greater problem because it leads to land pollution when openly dumped, water pollution when dumped in low land and air pollution when burnt (Akter et al., 1997). CCC is facing serious environmental degradation and public-health risk due to uncollected disposal of waste on streets and other public areas, drainage congestion by indiscriminately dumped wastes and contamination of water resources near uncontrolled dumping sites. Generation of leachate, gas, odor, noise, dust, potential fire hazards etc. are the common

environmental problems in the existing sites that cause threats to human health and nature. Noise pollution is occurring due to waste spreading operations using equipment, collection vehicles and compactors (Islam and Shafi, 2004). The noise pollution status is moderate in the existing disposal site, since the use of operation vehicles is very limited. The unauthorized and uncontrolled burning of waste at the existing disposal site causes air pollution. Burning of waste, including partly hazardous and clinical waste, creates smoke, which releases toxic compounds and ashes into the air that are threats to the environment. Burning is done at limited scale, in all the sites. As no daily covers are used. Dusts as well as unwanted green house gases mixes with the atmosphere and pollutes the air. Odors are a complex mixture of gases, vapors and dust. Study reveals that odor is a significant pollutant at solid waste disposal areas of CCC. Hazardous wastes are also dumped at the site that can pose a threat to human health and the environment. CCC authority is falling short in providing a satisfactory service to the city dwellers with its limited resources and a poor management plan. A derisory information base on the quantity, type and characteristics of wastes; poor operation and maintenance of service facilities and above all, a lack of civic awareness on the part of a section of the population are together leading to the worsening environmental condition. Health and safety issues also arise from improper solid waste management. Human fecal matter is commonly found in municipal waste. Insect and rodent vectors are attracted to the waste and can spread diseases such as cholera and dengue fever. Using water polluted by solid waste for bathing, food irrigation, and drinking water can also expose individuals to disease organisms and other contaminants. The U.S. Public Health Service identified 22 human diseases that are linked to improper solid waste management (Tchobanoglous et al., 1993). Waste workers and pickers in developing countries are seldom protected from direct contact and injury; and the co-disposal of hazardous and medical wastes with municipal wastes poses serious health threat. Exhaust fumes from waste collection vehicles, dust stemming from disposal practices, and open burning of waste also contribute to overall health problems. People know that poor sanitation affects their health, and nowhere is this link more apparent than in low-income countries.

## 5 Conclusion and Recommendations

Urban solid waste issues represent major problems of the governments of developing nations. For the development of the poorer nations, infrastructure and technology should be improved to overcome barriers to the safe disposal of urban waste. Effective solid management systems are needed to ensure better human health and safety. They must be safe for workers and safeguard public health by preventing the spread of disease. In addition to these prerequisites, an effective system of solid waste management must be both environmentally and economically sustainable.

It must operate at a cost acceptable to community. Clearly it is difficult to minimise the two variables, cost and environmental impact, simultaneously. There will always be a trade off. The balance that needs to be struck is to reduce the overall environmental impacts of the waste management system as far as possible, within an acceptable level of cost.

Summarizing the discussion, it can be concluded that Solid Waste Management services in CCC are not satisfactory. At present, the solid waste management system in CCC is not well organized.

The following recommendations are made based on the study findings to improve the SWM services in CCC.

- Higher awareness should be followed to motivate public towards better solution. Awareness rising should continue in a bid to change negative attitudes. CCC should raise public awareness/education campaigns focusing on legislation, waste hazards, waste minimization, material recovery, composting, recycling and engaging the media for increasing coverage on waste management.
- It should set up collection and recycling centers in the residential, commercial and industrial areas, which will generate employment-generating opportunities as well as help in environment friendly disposal of solid waste. Recycling projects should be encouraged for income generation.
- People's participation must be encouraged to keep cities clean. Efforts to improve urban waste management essentially involve activities promoting participatory processes; developing effective partnerships among all citizens of civil society, particularly the private and community sectors.
- Reduction of the amount of waste generated at the source will be very much effective for waste management. In case of increase in waste quantities, the levying (by communities) of cess/fees for waste management services should be increased.
- Mobilizations of the resources are needed for financing entrepreneurship based on waste recovery, reuse, recycling and composting. Waste should be considered as wealth.
- Transportation should be well maintained and needs to be modernized to improve collection and transportation efficiency.
- Three 'R's of solid waste management i.e. reduce; reuse and recycle must be adopted by CCC. This will help in reducing the quantum of solid waste that the local governments have to deal with.



- Efficiency of waste collection must be improved in cities by bringing about the necessary changes in the design of equipment used by sanitary staff, manpower management and planning.
- Crude/ open dumping of waste must be completely discouraged by encouraging controlled tipping.
- Separate collection of public and private hospital waste must be ensured in all over the city.

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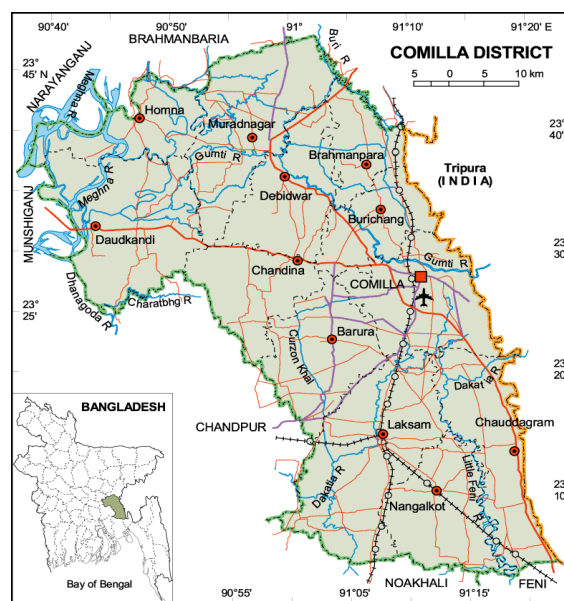


Figure3: Map of the Study Area.

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