Chapter One

Introduction

Throughout the world the municipal authorities are generally entrusted with the responsibility of solid waste management (SWM) in towns and cities. This issue is the key to determining the overall levels of well-being, satisfaction, happiness and welfare of people dwelling in towns and cities. However it is apparent that the majority of municipal corporations and boards in India are at present in capable of managing urban waste in an environmentally ethical, sustainable and efficient manner. Ideally municipal authorities must ensure environmentally ethical and sustainable ways of dealing with waste collection, transportation, treatment and disposal. The letdown of municipal solid waste management (MSWM) can result in serious health hazards and severe environmental degradation in towns and cities. Because of irregular and unplanned waste collection services of municipal authorities, uncollected waste that is dumped haphazardly by the road side clog the drains during periods of heavy downpour, thereby resulting in frequent flooding or water logging and consequent breeding of insects and rodent vectors. Evidently the failure of municipal authorities in this regard is to a large extent responsible for the spread of diseases in urban and semi-urban areas. In addition even the collected waste is disposed off in uncontrolled and unplanned dumpsites or sometimes burnt openly, thus contributing to relentless environmental threats including pollution of water and air.

The problem of SWM in India, in the midst of rapid urbanization and unplanned developments, is anticipated to be blown out of proportions and reasons are serious enough to call for immediate remedial actions so that citizens may be freed from this awful situation so that they may enhance their overall quality of life.
This chapter elaborates the existing SWM situation in Silchar town (which is a municipal area), highlights the existing legal frameworks, explores the major challenges that municipality faces, and outlines the causes of deficient SWM and noncompliance with the mandatory rules for the management of and handling of solid waste. The objectives and the hypotheses of the present study are also presented.

1.1 Sustainable Urban Waste Management

Municipal Solid Waste (MSW) or what is commonly known as urban waste refers to wastes arising from domestic, commercial, industrial, and institutional activities in an urban area. Quite obviously, municipal solid waste does not encompass wastewater (or sewage discharges) or atmospheric emissions. A solid waste may be semi-solid, solid, or even a liquid, and is generally perceived by the society as lying within the responsibility of the municipal authorities to collect, dispose, recycle. Categories of municipal solid waste include: household garbage and rubbish, yard waste, commercial refuse, institutional refuse, construction and demolition debris, street cleaning and maintenance refuse, dead animals, bulky wastes, abandoned vehicles, and sanitation residues.

Successful urban waste management covers various segments and strata of our society and call for participation from all sections. It must be understood that basic education along with awareness and consciousness at the societal level is the key to successful implementation and smooth functioning of an environmentally ethical and sustainable system of urban solid waste collection, disposal and recycling. However basic education at the individual level may or may not lead to an augmentation of awareness and consciousness levels regarding the need to adopt environmentally and scientifically approved urban waste disposal systems. Awareness building measures at the community level may be expected to generate mass cooperation, participation and active support for environmentally ethical and sustainable urban waste disposal systems. Education and
awareness building at the community level may possibly bring a gradual change in societal attitude towards waste disposal practices.

Even recycling of the urban waste has administrative and technological dimensions on the one hand and support of the community on the other. Rise in awareness levels can bring about a desirable change in peoples’ actual behavior towards waste disposal practices and can therefore reduce manhandling and mismanagement of urban disposal and collection to a significant extent. The overall target of urban solid waste management is to collect, treat and dispose of solid wastes generated by all urban population groups in an environmentally ethical and socially acceptable method using the most economical means accessible. Local governments are normally authorized to have responsibility for providing solid waste management services, and most local government laws provide them exclusive ownership over waste once it has been placed outside a houses or establishments for collection. As cities grow economically, business activities and diverse consumption patterns and human requirements drive up solid waste quantities. At the same time, increased traffic congestion in metros and other big cities unfavorably affects the smooth transportation of the solid waste fleet. The entire operation of collection and disposal is exacerbated by longer hauls required of the fleet, as open lands for disposal or dumping grounds these days are located further and further away from urban centers in order to minimize health hazards. The challenge is to rationalize worker and vehicle performance, while extending services to a growing urban population.

In developing countries, it is common for municipalities to spend 20-50 per cent of their available recurrent budget on solid waste management. Yet, it is also commonly observed that 30-60 per cent of the entire urban solid waste in developing countries is uncollected and less than 50 per cent of the population is served. In some cases, as much as 80 per cent of the collection and transport equipment is out of service, in need of restore or

Sustainable waste management means less reliance on dumping and landfill and greater amounts of recycling and composting. Sustainability of waste management is a key to providing an effective service that satisfies the needs of the end users. One pillar of sustainable solid waste management is strategic planning and another pillar is cost analysis of solid waste options. For financing, private sector involvement is a growing trend in solid waste management throughout the world. For successful development of any environmentally sustainable solid waste project, community participation in collection, community consultation on cost recovery, and public participation in siting and design of facilities is inherently essential. Some of the central sustainability issues surrounding waste management include:

- Inefficient resource use – the land filling of materials that still have value, perhaps in a different form.
- The increasing shortage of land where waste can be buried.
- The large distances over which waste has to be transported.
- Health implications of hazardous waste and its consequences around landfill sites.
- Polluting effects of landfill sites – gas (including methane) emissions and liquid runoff.
- The economic folly of unnecessary and excess packaging.
- Excess consumption driven by the forces of lifestyle, marketing and designed obsolescence.
Sustainable urban waste management recognizes that willingness to pay is affected by perceptions of the service excellence received and by the involvement of the stakeholders in decision making. It therefore places a high priority on keeping stakeholders up to date and involved in issues and proposals. Furthermore, it looks for ways to help out communities to be responsible and for individuals to take action in ways that put up public cooperation with the service. Sustainable urban SWM is open to all viable parties, counting women and microenterprises, who can contribute to the economic provision of services. It also allows for the flexible service levels and situation desired by the residents and establishments receiving service. It provides workers with safe working conditions and defines clear collection routes and verifiable performance tasks and outputs. To do so, it establishes management information systems that enable cost-effective accounting and in general cost-related performance monitoring.

1.2 Purpose and Importance of Waste Management

Solid waste management is defined as all activities that aim to minimize undesirable impacts of solid wastes and to derive some benefit from these wastes. Urban Solid Waste, also called Municipal solid waste (MSW), is a waste type that includes predominantly household waste (domestic waste) with sometimes the addition of commercial wastes, construction and demolition debris, sanitation residue, and waste from streets collected by a municipality within a given area. Solid Waste Management refers to the collection, transfer, treatment, recycling, resource recovery, and disposal of solid waste generated in urban areas. It is a major responsibility of local governments and a complex service involving appropriate organizational, technical, and managerial capacity and cooperation between numerous stakeholders in both the private and public sectors. Urban waste management encompasses: refuse storage and collection, street and drain cleaning, solid waste transfer and transport, solid waste disposal, and resource recovery. It also involves
vehicle maintenance repair; financial management; administrative activities such as routing, scheduling, and record keeping; staff management and development, and strategic planning. Generally, these facilities fall within the jurisdiction of the municipality, but the private sector often manages some domestic refuse and the wastes from large-scale industries, hospitals, and large office complexes.

Any satisfactory method of waste disposal must prevent or dramatically reduce the probability of all the threats relating to unsafe waste management. However, safeguarding public health through safe disposal also entails a safe and comprehensive waste collection and transportation system which could be designed in a manner to incorporate some of the other important areas.

(i) Protection of Environment

Impacts on the environment can be divided into two groups—those related to preventing pollution and those related to conservation. In the context of solid waste management, many of the reasons for striving to prevent pollution are related directly to health impacts, but there are also global considerations — primarily the reduction in the production of greenhouse gases that cause climate change. In addition, there is also the concern to reduce the consumption of raw materials and energy, and also the areas of land used for waste disposal. The focus then is on reuse, treatment, and recycling of waste, often neglecting, or in the absence of, systems for safe disposal. Proper environmental protection therefore includes a safe disposal system and does not preclude the importance of an efficient waste collection and transportation system.
(ii) **Aesthetics, Politics and Clean Cities**

It is desirable to clean cities beyond the standard required for health protection according to considerations of economics and politics. However, this perspective limits the focus to street sweeping and waste collection, rather than treatment or disposal.

(iii) **Generation of Employment**

This is another consideration that sometimes influences decisions in solid waste management, but again this generally affects waste collection, not treatment or disposal. Informal sector recycling provides a livelihood for many people, and this fact should be included in decisions regarding waste treatment and disposal.

(iv) **Meeting Legal Requirements**

Many local administrations show little concern for waste disposal for a variety of reasons. In such cases attempts may be made to use legislation as the motivating factor to achieve improvements. Legislation is also used in some industrialized nations to encourage resource recovery. Resource recovery embraces all means of gaining some economic benefit from waste. This may involve reusing items in the waste in their original form, processing them to make new materials or products, or burning the waste or a product from the waste to gain energy, which may be converted into electrical power. In solid waste management it is vital to first go back to principles, that is, to identify the objectives that need to be met. The choice of objectives has a direct bearing on the outcomes achieved.

(v) **Being Modern and Sophisticated**

This point may sometimes be stated explicitly, but more often it appears to be implicitly influencing decisions. The desire to be seen as technologically very advanced may be evidenced by the interest in waste treatment technologies that are still in the experimental stage, or have not been exploited at more than the pilot scale in even the most
industrialized of countries. An alternative reason for advocating sophisticated and unproven technologies may be that simpler technologies have been tried without success, so that, in desperation, decision-makers grasp at any other option. Persuasive salesmen and seemingly attractive contract conditions may influence some administrations to opt for highly sophisticated technologies. In some circles, the word ‘integrated’ has great significance. Various modern connotations are associated with this word. Some people use it to insist on intensive resource recovery. However, the concept of an integrated solid waste management system, in which the requirements and impacts of each link in the chain from generation to disposal should be considered in the design of all the other stages, is of great significance. An important consequence of the integrated approach is that the disposal stage should always be considered a vital part of every waste management system.

(vi) **Pleasing Voters**

In one sense, it is the essence of democracy to provide the voters with what they want. However, the democratic process generally results in short-term horizons, and politicians are generally reluctant to impose fees or taxes that will lead to sustainable systems; they see little benefit in acquiring land that will provide a good means of waste disposal for decades rather than years. Unless it is carefully done, acquiring land for waste disposal generates opposition rather than votes, and so politicians may be unwilling to take action that will ensure good solutions for the disposal of waste. The best waste disposal solutions may involve accepting waste from other local administrations, and this can lead to additional voter displeasure. Votes can often be won by a good waste collection service, but very rarely by a sound waste disposal system. Good solid waste management requires leadership, vision, a consideration of the longer term, and of ensuing benefits that voters might not understand or interpret.
(vii) Earning from Waste

Over the last two decades there has been considerable interest in the idea of generating profit from waste. And while it is true that it is possible to sell compost and electric power, the costs of producing these commodities from waste are usually significantly more than the prevailing market prices. Usable energy can be obtained from waste, but these processes require subsidies even in countries where the waste has high energy content. In many industrialized countries, legislation and taxes imposed on disposal are needed to motivate local administrations to bear the additional costs of treatment processes that seek to gain some value from waste. Experience across the world suggests that the bulk of the revenues generated in the sector arise from fees paid by waste generators, not the financial value of the waste itself. In some situations, small-scale composting generates sufficient income to support a family, especially where there is a dependable income from sales to plantations, commercial complexes or households owning exotic plants. Any satisfactory waste management system must be paid for.

These areas have provided a window of opportunity for cities to find solutions - involving the civil society and the private sector; involving innovative technologies and disposal methods; and involving behavior changes and awareness raising drives. These issues have been amply demonstrated by good practices from many cities around the world. There is a need, therefore, for a complete rethinking of "waste" - to analyze if waste is indeed a 'waste'.

1.2.1 Necessity of the Study

A research on the environmentally safe and ethical solid waste management system in Silchar municipal area must be justified. Silchar is the second largest city of Assam after the twin cities of Guwahati and Dispur (the state capital) both in terms of population as
well as in terms of area covered under the jurisdiction of the municipal board. It is the largest city in southern Assam and is the district headquarters of Cachar. Located on the banks of the river Barak, it covers an area of about 15 square kilometers only but accommodates a population of almost 1,80,000 thousand people. This makes Silchar the most congested city of southern Assam. Moreover being the business capital of the region it acts as a transit point for transportation of enormous volume of goods to Manipur, Mizoram and Tripura. Unplanned growth and development of the town in recent years in the form of new housing constructions, has led to over-crowding and has created difficulties in construction of a planned drainage system. Being an old and ingenuous town that did not have any planned drainage system since the pre-independence era, Silchar still suffers immensely today due to the lack of a smooth sewage outflow system. The problem is clearly most acute during the monsoons. Coupled with the faulty drainage system, environmentally unlawful and unsafe disposal of urban solid wastes by residents over the last two decades have been a major cause of the life threaten health hazards in the town. In this context the public health implications of poor solid waste management, according to World Health Organization are worth noting. They include the following:

- Inhalation of contaminated dust, toxins, and smoke from burning waste.
- Breeding of vectors that spread diseases.
- Pollution of surface and groundwater.
- Injuries from sharp objects.
- Infection from contaminated wastes, especially if they are reused.
- Poisoning and injury by hazardous chemicals.

The present scenario of waste management in Silchar is characterized by following state of affairs:
(1) Streets are generally treated as the receptacles of waste. Consequently, unsanitary conditions affect overall health and environment.

(2) There is hardly any segregation of recyclable waste. Waste paper, plastic, metal, glass, rubber, rags and so on are thrown on the streets along with domestic, trade and institutional wastes.

(3) Transportation is not well coordinated with primary collection, resulting in multiple and manual handling of waste. This is injurious to the health of waste disposal workers.

(4) Waste collection from waste disposal sites (by collection vehicles) is irregular and hence leads to over accumulation. This is injurious to the health of all passersby.

(5) The method of crude dumping is adopted for waste disposal.

In order to achieve the ideal situation, there should be a marked improvement in the entire waste disposal chain. At present, the situation is not at par with compliance criteria laid down in Municipal Solid Wastes (Management and Handling) Rules 2000, Government of India.

It has been clearly mentioned in the Management of Municipal Solid wastes Schedule-II that littering of municipal solid waste shall be prohibited in cities, towns and in urban areas notified by the State Governments. As according to Schedule II, to prohibit littering and facilitate compliance the following steps shall be taken by the municipal authority in the case of waste collection from households.

(i) Organizing house-to house collection of municipal solid wastes through any of the methods, like community bin collection (central bin), house-to-house collection, collection on regular pre-informed timings and scheduling by using bell ringing of musical vehicle (without exceeding permissible noise levels).
(ii) Collected waste from residential and other areas shall be transferred to community bin by hand-driven containerized carts or other small vehicles.

(iii) The municipal authority shall notify waste collection schedule and the likely method to be adopted for public benefit in a city or town.

(iv) It shall be the responsibility of generator of wastes to avoid littering and ensure delivery of wastes in accordance with the collection and segregation system to be directed and notified by the municipal authority.

The local municipal authority has only succeeded to notify the likely method to be adopted for public benefit in the town. Due to lack of house-to-house waste collection and appropriate community bins in the residential areas, littering continues to be a problem. Private collection and disposal of waste through ‘thelawala’ does not encourage segregation system as people handover both biodegradable and non-biodegradable wastes to these informal and private waste collectors. Final disposal of these wastes is also not environmentally hygienic as most ‘thelawalas’ throw the daily collected garbage in the vacant plots and spaces by the road sides inside the town. There is complete absence on the part of the municipal authority to organize awareness program for segregation of wastes and promoting recycling or reuse of segregated materials. Moreover regular meetings at quarterly intervals with representatives of local resident welfare associations and non-governmental organizations are unheard of. In this situation, ‘Para’ or lane development committee initiates and ensures private handling of waste collection and disposal system in most of the wards in the town. At present the municipal waste collection staff collect garbage from some selected spots in the town by medium size trucks and dump it into the ‘Meherpur’ trenching ground (basically a solid waste dumping ground under the ownership and control of Silchar Municipal Board), located around 2.5 km south of the southern end of the city.
According to municipal sources presently more than 90 tons of municipal solid waste is generated daily in Silchar town. As a group, households are the single largest generators of municipal solid waste. A substantial part of household waste in Silchar is disposed of through the municipal service. Under the existing system, the Silchar Municipal Board (SMB) disposes the collected waste by means of open dumping in a crude landfill near ‘Meherpur’. As there is no provision for collection of pre-sorted waste, the disposed off waste mostly consists of kitchen waste along with household toxic waste. However it is natural for households to separate items like plastic, paper, metal glass etc. from their regular garbage because these can be re-used or sold in an informal market. The buyers of these waste and rejected materials like plastics, plastic carry bags, paper, glass materials like bottles and ceramics, metallic cans, foils and wraps, among others are itinerant vendors who pay households for these items. Furthermore it is of common knowledge that households bargain with these collectors for an acceptable price. Thus there exists some sort of an economic incentive (no matter how small) for the households to hand over or dispose a part of their daily solid waste to collectors.

Given the fact that per capita waste generation per day in the city is over 0.5 kg and also that there is a shortage of adequate dumping space, management of this huge quantum of waste is a serious problem for the municipal authorities. Moreover, the possibilities of ground water contamination and adverse health consequences have made open dumping a non-viable mode of disposal. However the possibility of adoption of an alternative disposal method such as composting may be seriously questioned as because the household waste is not properly segregated at source. In fact the households’ source separation activity is limited to items that can either be re-used or have an exchange value in the market (to second hand buyers).
In designing efficient strategies of waste management for Silchar, one important feature of the city should be kept in mind. Due to unplanned growth in most wards of SMB, both commercial and residential units co-exist. The complexity of composition of waste increases the difficulty involved in its management. The commercial waste is mostly non-biodegradable. To handle such waste, installation of effluent treatment plants, incineration etc. may be useful. On the other hand, domestic waste is mostly biodegradable and composting remains an alternative mode of waste disposal. The major difficulty faced in its widespread use, as indicated already, is the absence of source-separation at the point of garbage production. A substantial amount of recyclable items such as plastic, glass and metal along with household appliances (which may include toxic waste) are also disposed off along with the regular garbage. The collection system of residential waste is not designed to collect pre-sorted waste. In some parts of the town, households simply dispose of their garbage in concrete vats or into metal bins and containers. These are then loaded into tipper trucks and carried to the dumping ground. House to house collection of residential waste has not been started although it is clearly mentioned in the Municipal Solid Wastes (Management and Handling) Rules 2000. Informal waste disposal arrangement is carried on in some wards where lane development committee hires the ‘thelawalas’ – people who collect the household generated solid waste of a lane or locality by means of a hand-driven uncovered containerized cart or a small vehicle in lieu of a monthly payment and dump it to the municipal waste collection truck/tipper.

While there remains no provision for collection of source-separated waste, households also do not face economic incentives for practicing source-separation. Finally, it is common for households in Silchar to litter or indiscriminately dump solid waste items by the roadside. This is the precise cause of clogging of sewage drains and water logging in the town area during the monsoons. Any satisfactory, safe and ethical method of waste disposal must
prevent or dramatically reduce the probability of all these threats. This dismal picture of household solid waste management in the city calls for immediate improvement of the current state of affairs.

In this backdrop the focus of the present study is to provide answer to the following fundamental questions:

- To what extent are current solid waste management practices in Silchar Municipal Area threatening our environment?
- Is the households’ lack of awareness and consciousness the true reasons for the current state of affairs?
- Are the households willing to co-operate, contribute and adopt a sustainable urban waste management strategy?

1.2.2 Statement of the Problem

In view of the enormity of the problem, a feasible and credible solution is impossible without participation and co-operation of the stakeholders. The principal polluters of the city are households and firms. Households and firms dispose-off solid waste in a manner that is environmentally unsustainable, hazardous to people and other life forms, and is thus a major cause and source of disutility or dissatisfaction to citizens. In this study the waste disposal habits of households is under the scanner along with the level of environmental awareness regarding the households’ immediate surroundings and the environment at large. Unhealthy and unethical waste disposal practices create a negative externality for citizens, and hence generate a social loss. The willingness to pay (WTP) for a sustainable urban waste management system well reflects the household’s eagerness or urgency to overcome the disutility or the dissatisfaction on account of environmentally unethical and unsafe urban solid waste dumping practices in the city. This WTP may be taken as a
money-metric equivalent of the households’ utility loss due to compulsive living in a polluted environment. In sum, this study attempts to capture the possible socio-economic roles of the stakeholders in controlling environmentally unethical, unsafe and unsustainable management of solid waste in Silchar Municipal area.

1.3 Objectives of the Study

The present study has been carried out with a few specific objectives and these are listed in an order of priority.

(1) To estimate and analyze the demand for a safe and sustainable urban solid waste management in Silchar municipal area.

(2) To identify and assess the impact of selected socio-economic factors and environmental awareness levels on the demand for improved urban solid waste management services in Silchar municipal area.

(3) To recommend a tariff system (policy) to be imposed on households such that the proposed sustainable urban solid waste management system is economically viable.

(4) To suggest an environmentally desirable scheme of urban solid waste management in Silchar Municipal Area.

The objectives of this research need clarification and discussion. The first objective is most basic. The household’s demand for safe and sustainable urban solid waste management in Silchar municipal area may be appropriately captured using Contingent Valuation Method (CVM). In a contingent valuation method, respondents’ preferences are often solicited through a survey technique to state their willingness to pay (WTP) for the benefit gained from an improvement in environmental quality (in this study an improvement in quality of waste management). Compared with other valuation techniques, it is considered very flexible and adaptable to some valuation tasks that alternative valuation techniques cannot handle. It is one of the most widely used and generally
acceptable techniques for estimating the total economic value of many classes of public
goods and services that other economic techniques cannot accommodate. In addition, its
results are also relatively easy to understand, interpret, and to use for policy purposes. A
selected sample of households in the Silchar municipal area is chosen for the CVM
exercise. **Secondly,** the other objectives in WTP survey are to calculate mean WTP and to
estimate a parametric model to allow inclusion of respondents’ socio-economic factors in
the WTP function. Incorporation of individuals’ socio-economic variables into the CVM
helps the researcher to gain information on validity and reliability of the CVM results and
increase confidence in practical application of results obtained from the CVM analysis. In
this study CVM is employed, with a single bounded dichotomous choice elicitation format
followed by open-ended questions in the WTP section. **Thirdly,** a tariff system is
recommended which is to be imposed on households such that the proposed sustainable
urban solid waste disposal system is economically viable. This is important from the view
point of policy analysis. **Fourthly,** solid waste management service is mainly provided by
the municipality and it has been measured and evaluated always based on the role and
performance of the service provider (supplier of the service) and demand side i.e. WTP of
the residents is ignored. The service receivers or clients (households in this case) who are
the primary producers and generators of significant proportions of uncollected solid waste
and are perhaps the main victims of untreated solid waste, should be made to participate in
a sound system of urban solid waste management.

Only this would enable the making of sound policy decisions in this regard including
designing of effective joint solutions of solid waste management. Most importantly, the
service providers, the municipal board in this case, has to understand and economically
evaluate the households’ willingness to participate and pay in this joint endeavor of urban
solid waste management. Therefore, the study suggests and at the same time justifies the
application of the CVM in order to evaluate and examine the households’ willingness to participate in an environmentally desirable scheme of urban solid waste management in Silchar Municipal Area.

1.4 Hypotheses

As a direct upshot of the objectives already mentioned, the study considers three hypotheses. These are:

(1) Households are unwilling to pay for an improved quality of urban solid waste management.

(2) Environmental awareness does not influence the willingness to pay for an improved quality of urban solid waste management.

(3) Selected socio-economic variables do not influence the WTP for a sustainable urban solid waste management.

Admittedly, all these hypotheses are framed in the form of null hypotheses that are to be statistically tested for possible rejection. The first hypothesis is related to demand for an improved quality of urban solid waste management. All it says is that households are not willing to pay for an improved quality of urban solid waste management. The second hypothesis says that environmental awareness does not influence the WTP to pay for an improved quality of urban solid waste management. Finally in line with the second hypothesis, the third hypothesis says that selected socio-economic variables do not influence the WTP for sustainable urban solid waste management. Appropriate statistical and econometric tools are used to test the hypotheses. These are discussed in detail in the methodology chapter.

Logically these objectives and hypotheses are an offshoot of the review of literature that is presented in the chapter two following this introductory chapter. A research gap as per
existing literature is also discussed there. In brief it may be argued that very few studies have been conducted in India on the willingness to pay for a safe and sustainable waste management system although a large number of CVM studies on urban waste management have been conducted in foreign countries. Moreover just three studies in this area are reported in literature for selected towns of the northeastern region. But similar studies in Silchar Municipal Area are not reported in literature at all. Clearly this is a serious enough reason behind the present research undertaking.

1.5 A Brief Account of Silchar Municipal Area

Silchar is the district headquarters of Cachar – the largest district in the southern part of the state of Assam in north eastern India. It is both the physical as well as the economic gateway to the states of Mizoram, Manipur and Tripura. It is 343 kilometers (213 miles) south east of Guwahati and on the left bank of river Barak. The exact geographical location of Silchar city is 24.82°N and 92.8°E. The city of Silchar is the second largest city of Assam after Guwahati in terms of population and municipal area. Being the physical gateway to several other states of the north eastern part of India, the town of Silchar has tremendous commercial importance. It consequently witnesses the settlement of a sizeable population of traders from distant parts of India. The city has an airport and is connected both by railways and roadways with Guwahati and Agartala (the state capitals of Assam and Tripura respectively). Besides it is connected by road with Imphal and Aizawl, the state capitals of Manipur and Mizoram respectively. The present roadway connecting Silchar with Guwahati passes through Shillong the state capital of Meghalaya.

Silchar is the most densely populated city of South Assam, or what is otherwise known as Barak valley. The total population of this town was merely 34 thousands in the year 1951 which increased to around 1.15 lakhs in 1991 thereby showing an annual average growth
rate of 6 per cent over a period of 40 years. The population of the town increased to 1.42 lakhs in 2001-02 and 1.72 lakhs in 2011-12, thereby exhibiting an average annual growth rate of 2.3 per cent and 2.1 per cent respectively. An unprecedented average annual population growth rate of 10.5 per cent was experienced during the fifty year period 1941-1951. This was mainly due to the influx into Assam from the Sylhet, Mymansingh and Noakhali districts of Bangladesh (the then East Pakistan) resulting from the partition of the country in 1947. Even after 1951, immigration continued at varying rates. Added to the problem of refugee influx from the erstwhile East Pakistan (now Bangladesh) was the problem of migration from other parts of the north eastern region owing to social unrest. These factors together contributed rapid demographic change of Silchar town and Barak valley at large.

Approximately 90 per cent of residents of Silchar are Bengali who speaks the Sylheti dialect, the rest being Dimasa or Kachari (mainly Barmans), Manipuri (Meitei and Bishnupriya), Rajastanis (Marwari), Assamese and some tribal groups as the Nagas.
The area under Silchar Municipal Board (SMB) was only 10 sq. km. in 1971. Population density in 1971 was 5260 persons per sq. km. In 1991 the area under municipal control increased to 15.75 sq. km with the density of population increasing to 7301 persons per sq. km (Dey and Nayak, 1998). The number of holdings assessed for municipal taxation rose from 5137 in 1971-72 to 13,358 in 1994-95 and further to 19652 till the year 2010 (Silchar Municipal Board, 2010). A detailed ward map of Silchar municipal area is shown in Figure 1.2.
Figure 1.2 Map of Silchar Municipal Area

Source: www.silcharmunicipality.com
1.6 Present Solid Waste Management Scenario in Silchar

The management of urban solid waste in Silchar municipal area involves steps such as storage at the source, collection, transportation and final disposal of the refuse. Evidently, rising urbanization, improvements in standards of living and rapid consumption growth associated with growth of population and urban settlements, solid and liquid waste generations due to domestic and commercial activities have increased by leaps and bounds in Silchar municipal area. Researchers, town planners, engineers, local politicians and policy makers are rather being forced to express their interests in waste management related plans and actions in Silchar at present.

Silchar city has a Municipal Board consisting of 28 wards for civic activity. Due to the many fold increase in the city population over the past few decades along with changing life styles, the daily rate of waste generation has reached gigantic levels. The current solid waste generated in the city is about 90 metric tons per day. Table 1.1 shows the type and amount of waste generated in Silchar Municipality. This figure is likely to increase in near future due to rapid increase of population and rapid rise in the number of new housing and construction projects. It is thus apprehended that rising volumes of waste generation will raise the level of difficulty of waste management especially if the waste is to be disposed off in a scientific and environmentally acceptable manner.

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<th>Table-1.1: Type and Amount of Waste Generated in Silchar Municipality</th>
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1.6.1 Waste Collection and Disposal Facilities

At present, though the Silchar Municipal Board (SMB) is continuing activities as sweeping, collection, transportation and disposal of solid waste as a part of its solid waste management strategy, its actions (both in size and method) are far from desirable. Casual municipal cleaning staffs are occasionally seen sweeping the broad or main roads and pavements but not the lanes. The municipal authorities have placed waste collection bins on the roadside though their numbers are too miniscule especially with respect to the rate of solid waste disposal by the commercial establishments, other institutions and the public in general. Worst of all, in the immediate neighborhood of some of the main market areas of the town such bins are absent. Consequently commercial establishments and other institutions (both public and private) are forced to use a portion of street as a waste disposal area which invariably creates an unhygienic and abominable condition around it.

The municipality authorities are clearly underequipped and are thus unable to provide credible waste collection services to all nooks and corners of the city. A typical and complicated problem in this context is that of waste collection and disposal related activities in urban slums and illegal low income class dwellings within the municipal area. Generally, these overcrowded low-income (or BPL) settlements do not have MSW collection and disposal services facility. The key reason being that these settlements are mostly illegal and the inhabitants are both unwilling and unable to pay for the services. They dispose of the waste near or around their houses at different times which make the collection and transportation of waste very difficult in these slum areas.

During the field survey around various strategically important locations in the city it was observed that people just fling the trash around the waste bins as the bins are mostly in a rundown state. The problem is compounded by residents’ indifference regarding their roles in waste management and also regarding the environmental hazards emanating from
improper waste handling. Throwing of solid waste on the road sides and outside homes, shops etc. are a common practice. Mid-night dumping is rampant. The immediate surroundings of bins and containers are usually very dirty as heaps of garbage is found lying all around them. The walls and floors of the waste bins are mostly damaged or broken which make the lifting of waste by loader difficult and messy. Besides, the bins become almost inaccessible during monsoons. The open waste disposal bins are physically vile, repulsive and nauseating. It gives a very dirty look even immediately after the lifting and evacuation of wastes by the collection staff. Municipal employees with the excavator, dumper, mini truck, wheel barrow; carry the collection from such places and bins. After collection, the waste is disposed off with the help of mini trucks. All wastes are dumped in the waste landfill at Meherpur trenching ground. Table 1.2 shows the physical equipments of Silchar Municipality. Besides equipment the casual staff strength is 116.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Equipment</th>
<th>Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Excavator</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Robot</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Lifter</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Tripper</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Truck</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Tractor</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: Silchar Municipal Board, 2011.

1.6.2 Waste Storage

Source-separated waste collection is considered to be one of the crucial steps required for a successful implementation of an integrated solid waste management programme. It means that the generated waste is classified and stored separately as biodegradables and recyclables of different types and collected separately for further treatment, reuse and disposal. However, segregation of MSW at source is totally lacking in the Silchar
municipal area as because such an instruction on ‘segregation at source’ has never been issued to households and business establishments. The bins are common for both decomposable and non-decomposable waste. Currently the entire solid waste of the city is collected in an unsegregated manner and as such when the waste reaches the trenching ground at Meherpur there is no scope of distinction between decomposable and non-decomposable, or else between recyclables and non-recyclables.

1.6.3 Sources and Types of Waste in Silchar Municipal Area

A clear understanding of the source of waste is the first element of waste management. It is prerequisite to any waste management plan to have adequate knowledge of the sources of waste and its physical and compound characteristics. The major sources and types of waste generated in Silchar are elaborated in Table 1.3. A few important features of waste sources and disposal habits in Silchar are noted below.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Sources</th>
<th>Types of waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Households and institutions</td>
<td>Mostly organic with some plastics, glass, metals, inert materials and hazardous</td>
</tr>
<tr>
<td></td>
<td></td>
<td>waste like batteries, paint etc.</td>
</tr>
<tr>
<td>2</td>
<td>Schools</td>
<td>Mostly papers, plastics and glass.</td>
</tr>
<tr>
<td>3</td>
<td>Veg./fruit markets, restaurants</td>
<td>Mostly organic.</td>
</tr>
<tr>
<td></td>
<td>etc.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Commercial centers</td>
<td>Mostly papers and plastics.</td>
</tr>
<tr>
<td>5</td>
<td>Health care facilities</td>
<td>Infectious and non-infectious waste.</td>
</tr>
</tbody>
</table>

Source: Author’s own findings, 2011.

**Residential waste:** Households throw the daily waste generated on the roads or in nearby waste bins from where it is collected and taken in tractors or mini trucks by municipal waste collectors directly to the municipal waste dumping ground. Door to door collection from households and business establishments is not practiced.
**Commercial and market waste:** Commercial waste is dumped at various vacant spaces or simply thrown along roadside. No arrangements of primary collection from hotels and restaurants exist. Hotels and restaurants therefore, dispose off their waste on the road sides or municipal bins. Waste generated by the street-food vendors, which is almost totally organic in nature, is burgeoning problem. The collection and clearance of such waste is the responsibility of the Municipal Board. The problem is acute as the number of fast food providers are raising at a brisk pace.

**Bio-medical waste:** The process of daily incineration within the hospital campus is the general practice of all medical institutions, both government and private.

**Industrial waste:** Hazardous industrial waste falls under a separate category altogether and is not covered in the study. Incidentally no medium or large scale industrial unit is located within the municipal area of Silchar. The small scale units that are located within the municipal area are mainly light engineering works, metal works including iron grill making for housing and construction, marble and granite cutting/polishing, wood works, automobile service centers including workshops, etc.

**Institutional waste:** Both private and public organizations dispose-off their daily waste in nearby collection points from where street sweepers and collection crew of municipality collect and carry for final disposal.

Municipal sweepers collect the roadside waste and waste from public places and carry it to the nearest secondary collection point for further transportation to the final disposal site. There is no system of primary collection of construction waste. Generally the people dispose off their construction waste on the streets near the construction site. Vegetable, fruit, meat and fish markets do not have adequate storage facilities with the result that a
part of the unsold stocks along with the market waste is thrown in open spaces causing unhygienic conditions in surrounding areas.

1.6.4 Resource Recovery and Recycling

Recycling at household level is observed to be a frugal practice in the city. Materials like magazines, newspaper, bottles, cans, glass, metals etc. are stored and sold to the itinerant waste buyers who pay for the materials according to weight, or volume or sometimes, numbers. Waste pickers and rag pickers are observed collecting the recyclables from the various collection points and dump sites. There are no estimates as to the number of people involved in waste recycling sector in the city. Bhattacharjee and Gupta (2011) made a study on the waste pickers and waste traders of Silchar and found that children constitute 63 per cent of the waste picker population, women 21 per cent and men comprise the remaining 16 per cent. The waste collected by waste pickers and itinerant buyers was around 15.7 per cent of the total waste thus saving approximately 15.7 per cent of the expenses of municipal authorities. This remarkable study brings out the economic potentials of recycled waste in the city and also that value creation from urban waste, or rather, value recovery, is a serious economic possibility in Silchar provided the toxicity of the recycled materials are found to be within human tolerance limits.

1.6.5 Waste Disposal and Treatment

Admittedly, there are no facilities for the treatment of MSW in Silchar. The municipal authorities have placed a number of waste collection bins, or what are otherwise known as garbage collection bins, in some strategic locations within the municipal area where citizens are to dump their daily solid waste or garbage. The solid waste is simply dumped at the designated sites where no provisions for covering the waste are in place. In fact the waste bins are not in the form of air tight chambers that can prevent spill-over or spread of
bad odor in its immediate surroundings. Furthermore no visible physical barriers or fences are in place to demarcate the main waste dumping site (located just outside the town) and no provision for security is in place that may stop people from entering this awfully polluted and vile location.

In recent years a number of unofficial dumpsites have come into being that is not recognized by the authorities as waste bins. Of late the municipal authorities have banned some informal and municipality unapproved dumping sites by means of public announcements, notices and visual advertisements. Unfortunately waste dumping by citizens’ still continues in such sites and remains uncontrolled even today. Open burning of solid waste on roadsides and small dumps are often found to be practiced by local residents and at times even by the municipal sweepers or waste disposal staff. Toxic and poisonous fumes or smoke emanating from such unethical practices pollute the surrounding air and make breathing difficult. Passersby invariably end up inhaling such smoke and fumes as they are directly exposed to such hazardous sources of air pollution. Such inhalation may often be fatal especially for the old and the young and can trigger allergy, asthma, breathing trouble and nausea among many other ailments.

The rampant use of plastic carry bags and its environmental risks in Silchar municipal area need special mention. As per declared municipal regulation the use of polybags or plastic bags is not completely banned in the city. Long back during 2005-06, a comprehensive drive was undertaken by the Silchar Municipal Board under the active support and cooperation of the then Deputy Commissioner (DC) of the district of Cachar, to ban the use of all plastic carry bags in day to day market transactions that violated the thickness and other technical (actually chemical) specifications as laid down by the Central Pollution Control Board. This drive excluded the thicker variety (permissible as per government norms) of plastic carry bags used commonly in shopping malls and departmental stores.
meant for carrying larger volumes of goods. Unfortunately this drive did not last even a quarter of a year. At present the use of plastic carry bags have reached alarming proportions as it is absolutely uncontrolled and rampant and are responsible to a large extent for soil pollution, drain clogging along with rising non-biodegradable content in the city’s daily waste.

During the board meeting of Silchar Municipality held on 6th January, 2011 a detailed proposal was drafted regarding implementation of a safe and sustainable solid waste management system in the city. According to this detailed project report, the estimated cost of the environmentally safe and sustainable municipal solid waste management system stood at Rs.7.8 crore. The proposed plan included the use of modern waste disposal machinery (tippers, robots, trucks, tractors, bull dozers, etc.) that are normally used in all major urban areas in the country. The proposed plan mentioned more efficient and safe utilization of the trenching ground in Meherpur for solid waste management.

**1.6.6 Current Expenditures of the Municipality on Solid Waste Management**

Annually, Silchar Municipal Board (SMB) allocates its budget for the development of infrastructure necessary for solid waste management and also for the running costs of waste collection and disposal. SMB incurs its annual expenditures under different heads as shown in Table-1.4.

<table>
<thead>
<tr>
<th>Heads of Expenditure (2010-2011)</th>
<th>Amount (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of labor</td>
<td>15,600,000</td>
</tr>
<tr>
<td>Running cost of all vehicles</td>
<td>26,00,000</td>
</tr>
<tr>
<td>Purchase of machines/equipment</td>
<td>50,00,000</td>
</tr>
</tbody>
</table>

Source: Silchar Municipal Board, 2011.
The figures in table-1.4 reveal that in the financial year 2010-11, SMB allocated a sum of Rs. 1.56 crore on labor for waste collection and disposal. For the running all vehicles engaged in collection and disposal of waste SMB allocated amount of Rs. 26 lakhs. An amount of Rs. 50 lakhs had been allocated for purchasing of machinery and equipments for facilitating efficient collection and disposal of waste in the town. Although SMB is allocating funds for betterment of the SWM system the overall situation still remains grim primarily because the existing infrastructure is far short of what is actually necessary.

1.7 Environmental Quality in Silchar Municipal Area

Environmental quality of a city, town or municipal area may be judged by various indicators. Some of these indicators are physical in nature like the level of pollutants in the air and water. Beyond these, noise pollution which is normally associated with a densely populated vibrant township is a third dimension. Factory smoke and vehicular emissions are perhaps the two biggest sources of air pollution in the city. Since Silchar does not have an established industrial base, factory related air pollution would be rather low. Hence automobile emissions may be expected to be the single largest source of air pollution within the municipal area. Expectedly, the larger is the size of vehicular traffic, slower would be the pace of traffic movement (given insufficient road area in town) and consequently higher would be the rate of automobile emissions.

As per the secondary data provided by the State Pollution Control Board of Assam in 2009, the average levels of sulphur dioxide in the air was around 6.05 μgm/m³, nitrogen dioxide was around 13.75 μgm/m³,respirable suspended particulate matter was about 67.33 μgm/m³ and finally the suspended particulate matter was around 116.8 μgm/m³. Clearly it can be verified that all the four indicators of air pollution were far lower in Silchar town compared to that in the metros and other million cities.
Apart from air pollution the level of pollutants in water, especially that in ground and surface water are of vital importance. A few points are worth mentioning in this context. The sewage generated by Silchar town flows into the river Barak. The drainage system in the town is ill developed as a result of which the rate of effluent flow into the river is very slow. The Barak is itself a shallow (due to heavy siltation) and highly meandering river that requires immediate dredging in order to raise the rate of water flow as well as the water volume by increasing its average depth. Thus during the dry season when water volume in the river is low, presence of pollutants per unit volume (cubic meter or gallon for example) of water would naturally be high. The converse would happen during the monsoons when the water levels in the Barak are near about the danger levels. In other words, presence of water pollutants in the river would be diluted to a large extent during the rainy seasons. Thus if the municipal authorities pump up the river water and purify it in order to supply it to residents (which they really do), there is a higher chance of consuming hazardous chemicals (from municipal supply water) during the drier seasons.

Beyond these physical indicators for judging environmental quality, peoples’ perception and opinion regarding environmental quality based on their actual day-to-day exposure to the visible or perceptible sources of pollution is equally vital. Peoples’ opinions and perceptions regarding actual environmental quality are formed on the basis of their actual observations on solid waste disposal and collection system on the one hand and the efficacy of the sewerage system on the other. People cannot directly perceive the pollutants in the air and water (along with their levels) but what they perceive through their daily experiences and personal observations are noted in the following sub-sections. Primarily they include peoples’ observations and experiences with the drainage systems, the solid waste disposal systems within the municipal area and problems associated with their faulty functioning.
1.7.1 Faulty Sewerage system and Consequent Problems

The sewerage system in the municipal area is in an awful state. Most of the drains are clogged and are not cleared regularly which intensifies the water logging problem even due to small spurts of rainfall. From the sanitary point of view covered drains are safer and hygienic for residents. These covers are usually made up of concrete slabs. Unfortunately in town it is found that just 12 per cent of the sewerage is under covered drainage system.

The drains by the side of the main roads in town are basically covered drains. But most of these drains are in a damaged state, and are in a very deplorable condition on account of faulty construction.

The sewage does not have any flow in either direction mainly due to lack of any slope. Ideally the drains should be so constructed that the sewage flows towards the river Barak. Apparently town planners and civil engineers did not construct these drains in line with ideal technical norms. Many of these covered drains in the busy commercial areas are presently damaged and uncovered. During the rainy season these drains overflow causing a very unhygienic and unhealthy condition for citizens. Table-1.5 shows the drainage facilities available in the municipal area.

<table>
<thead>
<tr>
<th>Type of Sewerage system</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open pucca drain</td>
<td>37.04</td>
</tr>
<tr>
<td>Open kachcha drain</td>
<td>34.39</td>
</tr>
<tr>
<td>Covered pucca drain</td>
<td>12.7</td>
</tr>
<tr>
<td>Other types</td>
<td>15.87</td>
</tr>
</tbody>
</table>

Source: Author’s findings based on primary data.

Table-1.5 illustrates the percentages distribution of the entire sewerage system in Silchar town according to types. This reflects that most of the sewerage system is covered by open pucca drain and open kachcha drain. Since the drains do not have much of a flow in either
direction they require regular cleaning. But this is done very irregularly. Water logging is the inevitable result during the monsoons. Sewage flowing through the drains contains high amount of pollutants and require suitable methods of disposal and treatment prior to its discharge in the water bodies or on the soil to protect the ecology and the environment.

While conducting household level survey for the collection of primary data for the present study it has been observed that absence of proper sewerage system is a persistent problem in most of the wards in town. The detailed sampling chart and sampling methodology along with the particulars of sample size and selection methods are given in the chapter on methodology. In fact during the course of the survey, 69 per cent of the respondents reported that there is usually no monthly clearance of the drains by municipal authorities. Worst of all, about 72 per cent of the respondents complained that after lifting the sewage from the drains, the waste is placed by the side of the roads and is not removed until and unless it dries and hardens. This creates a menace to passerby and the locality as the waste is extremely harmful and unsafe from the health perspective.

Around 62 per cent of the respondents confirmed that they are facing water logging problems in their respective localities and in their opinion the main cause of such problems are obstructions in the drains due to solid waste dumping, irregular cleaning, lack of suitable drainage system (in line with requirements) and its faulty construction. The refuse evacuated from the drains are dumped besides the drains which is highly objectionable and an environmentally unethical practice. In the absence of proper outflow the sewage water flows back into the premises of the households that are located in low lying areas and sometimes such water logging may be observed on the street sides in an entire neighborhood.
1.7.2 Peoples’ Perception on Solid Waste Management System

The details of the present solid waste management mechanism in Silchar have been discussed in detail in section 1.7. How the daily waste is collected and disposed without segregation and treatment is clearly a matter of concern. Worst of all as already mentioned the collected waste is carried in open trucks and tippers that do not have any air tight cover. These carriers travel through busy streets of the town during busy hours or what are otherwise called normal office hours. Students and people attending schools, colleges and other educational institutions are also exposed to the vile solid waste carried by these municipal waste disposal trucks through busy streets during rush hours.

The respondents from the selected households revealed their perceptions on the present state of urban solid waste management system in Silchar town. Although details of such perceptions and opinions are provided in the chapter on empirical findings (Chapter 5) a glimpse of their response is presented here. Almost 90 per cent of the respondents believe that the solid waste disposal system in Silchar at present is faulty, unhygienic and environmentally immoral and unethical. Around 75 per cent of the respondents believe that open vats and waste bins on the road sides is the principal factor behind poor health conditions of residents. In fact in their opinion, frequent fevers, alimentary diseases etc. due to bacterial and viral attacks are actually triggered by improper solid waste disposal and faulty sewerage systems in town. According to almost 90 per cent of the respondents the abominable conditions created by open waste dumping by the roadsides is completely intolerable. However just 10 per cent believe that it is within tolerable limits. Around 73 per cent of the respondents feel that the residents’ actual attitude with respect to waste disposal habits and practices is the real cause behind the poor solid waste management in town. Others however feel that it is the failure of the municipal authorities that has led to the unacceptable and unsatisfactory waste disposal system. Only 32 per cent of the
respondents believe that the waste disposal and drainage systems in Silchar can actually be improved within a time frame of five years. Others are against this opinion. Among the 73 per cent who questioned peoples’ attitude, almost 88 per cent were of the opinion that peoples’ attitudes cannot be changed overnight due to a host of socio-economic factors. They were also of the opinion that there is no possibility of any significant improvement in the waste management system and the drainage system in town within a time span of 10 years.

Actual actions of respondents with respect to irregular evacuation of vats and waste bins were recorded and its distribution is presented in a tabular format below in table-1.6.

<table>
<thead>
<tr>
<th>Steps</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inform the municipal office</td>
<td>6.5</td>
</tr>
<tr>
<td>Meet the ward commissioner</td>
<td>25.3</td>
</tr>
<tr>
<td>Organized representation to chairperson</td>
<td>2.6</td>
</tr>
<tr>
<td>Make Private arrangement</td>
<td>27.5</td>
</tr>
<tr>
<td>No steps taken</td>
<td>33.8</td>
</tr>
<tr>
<td>Steps Not required</td>
<td>4.3</td>
</tr>
</tbody>
</table>

Source: Author’s estimates based on primary data.

1.7.2 Intolerable Mosquito Problem in the Town

Mosquito problem is bound to prevail under the situations of unclear and waterlogged drains and heaps of refuse. It is also evident from peoples’ perceptions and opinions as around 49.60 per cent respondent said that mosquito, common flies and other insects have created an extremely vicious situation in their locality and is detrimental from the point of view of health status of residents. Only 11 per cent of the respondents were of the opinion that the problem is within tolerable limits.
1.7.3 Steps against Irregular Evacuation of Drains

Residents are forced under compulsion to take certain steps taken when the drains are not cleared regularly and frequently. Majority of residents try to manage it themselves by making private arrangements. Some of them infrequently meet the ward commissioner. Organized representations to chairperson of the Municipal Board are also given but the pressures created due to such infrequent and unorganized representations are insignificant. There are also some groups of people who are indifferent and unreactive to the situation and hence do not take any steps in this regard. Another group of respondents assured that in their area regular clearing of drains are practiced by the municipal staff as a result of which the waste flow is regular and satisfactory. The following table-1.6 gives the percentage distribution of the steps taken by the sample respondents in this respect.

<table>
<thead>
<tr>
<th>Steps</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inform the municipal office</td>
<td>7.94</td>
</tr>
<tr>
<td>Meet the ward commissioner</td>
<td>21.16</td>
</tr>
<tr>
<td>Organized representation to chairperson</td>
<td>3.18</td>
</tr>
<tr>
<td>Make Private arrangements</td>
<td>24.07</td>
</tr>
<tr>
<td>No steps taken</td>
<td>19.05</td>
</tr>
<tr>
<td>Steps not required</td>
<td>2.65</td>
</tr>
</tbody>
</table>

Source: Author’s calculation based on primary data.

The rules that have been established to govern solid waste management in Silchar are intended to improve public health and the overall environment in town. Unfortunately the municipal authorities themselves are questioned due to their lack of efficacy, commitment, professional urgency and absence of concern (and insensitivity) regarding environmental hazards to which residents are being constantly exposed. In fact the municipal authorities are actually observed to have broken or violated a rule they have themselves framed. An example is that of illegal waste dumping adjacent to the railway level crossing in between
Tarapur and Ramnagar. Furthermore untreated waste is dumped in the landfill which is objectionable. Persistence of open dumping on this basis is against the spirit and objectives of the MSW rules.

In sum the focus of this study has been primarily on finding ways to provide safe and sanitary collection and disposal for solid waste so that the environment is no longer damaged or deteriorated by the unsafe and unhygienic solid waste management practices. In the backdrop of the present situation, the available alternatives, obstacles and challenges, that includes the institutional, financial and practical aspects, this study proposes a set of recommendations for a sustainable approach that can meet the basic and essential objective of minimizing risks to public health and the environment of Silchar town.

This study proposes an improved urban solid waste management system in Silchar municipal area that would be environmentally safe and sustainable, and that which can be implemented at an affordable cost by the municipal authorities under active co-operation and financial support of residents.
Figure 1.3 Broken Vats

Figure 1.4 Vegetables being sold near a broken vat
Figure 1.5 A View of Meherpur Trenching Ground

Figure 1.6 Heaps of waste on the Roadside at Rangirkhari Bazar
Figure 1.7 Over-flowing Waste bin in Hospital Road

Figure 1.8 A Private Waste Collector in Action
Figure 1.9 Municipal Robot Collecting Waste near Gandhi Bhavan

Figure 1.10 Transferring Wastes to the Garbage Compactor Vehicle