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Full Length Research Paper

Solid waste management system of Narayanganj city: An environmental study

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Improper management of solid waste is one of the main causes of environmental pollution and degradation in many cities. Many cities lack solid waste regulations and proper disposal facilities. The present paper attempts to understand the poor disposal and handling of waste that leads to environmental degradation, destruction of the ecosystem and poses great risks to public health in Narayanganj City of Bangladesh. The study shows that there is a significant link between the improper management of urban solid wastes and environmental pollution. In order to achieve the goals and to evaluate the environmental aspects around the ultimate disposal sites of solid wastes the current amount of waste generation and the nature of the solid waste management system of the city has been analyzed. Finally, the paper suggests some measures for taking necessary steps to keep the city nice and healthy.

Key words: Contamination, environment, leachate, recycling, disposal.

INTRODUCTION

Until recently, the environment was not an issue in a developing country like Bangladesh, and solid waste management was definitely not the prime concern of environmentalists and the government. It has only been in 1990s, when certain non governmental organizations (NGOs) started working and highlighting the pathetic state of municipal waste services provided in the country that the decision-makers realized the importance of this particular aspect of environmental management (Rahman and Ali, 2000). This study made an attempt to evaluate the existing solid waste management system of Narayanganj City and to assess the impacts associated with the current practice of the final disposal of solid wastes.

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Abbreviations: NGO, Non governmental organization; **DMDP,** Dhaka metropolitan development program; **CBO,** community based organization; **UDS,** ultimate disposal sites; **TDS,** total dissolved solids; **EC,** electric conductivity; **DO,** dissolved oxygen; **BOD,** biochemical oxygen demand; **DoE,** department of environment of Bangladesh.

Study area

Narayanganj, a former sub-divisional town of Dhaka district, is characterized as an important trade and manufacturing center of Bangladesh. The district lies under the zone of influence of the capital city Dhaka which is one of the fast developing mega cities in the world. The district is dotted with many industrial units for its easy transportation linkages with other parts of the country. It also plays a vital role on food security for both Dhaka and Narayanganj. Therefore as part of Dhaka Metropolitan Development Program (DMDP), a study of the secondary city adjacent to the mega city, bears a great importance. As such, Narayanganj City (presently Narayanganj Pourashava) is selected as the study area for this research (Figure 1).

Objectives of the study

The aims of the present study are:

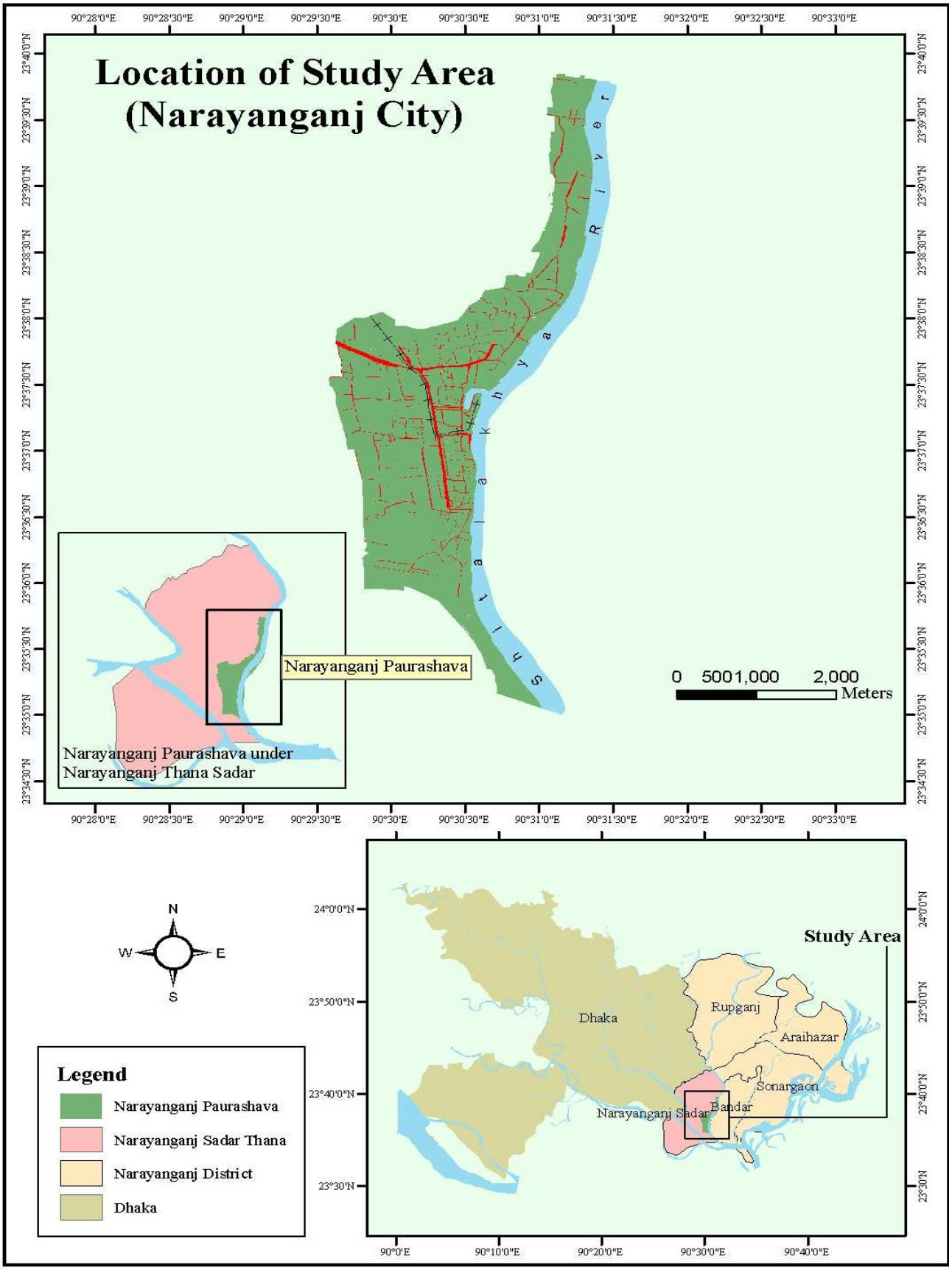

Figure 1. Location of the study area.

1. To view the types and current amount of wastes generated in the city.
2. To portray the nature of the solid waste management system of the study area.
3. To evaluate the environmental aspects around the ultimate disposal sites of solid wastes of the city and suggests for taking necessary measures to safeguard the environment.

METHODOLOGY

The methods used for this study are a combination of observation by transect walk in the study area, case studies and questionnaire survey. The study conducted from May 2009 to December 2009. Data were collected in and around different dumping sites of the study area along with other sources of waste generation. Observation was done by transect walk in the study area to observe the sources of wastes, types of wastes and dumping sites of wastes and necessary notes were taken in the note book. Photographs were taken during the observation. 10 waste collectors from different organizations including municipality, community based organizations (CBOs) and non-governmental organizations (NGOs), 10 inhabitants living adjacent to the dumping sites were selected for case studies. Other relevant data for this research were collected directly from the field by using a questionnaire which contained structured and open to end questions. The sample size was 120 households for the questionnaire survey. The key part of the questionnaire inquires the perception on the environmental aspects of the dumping sites and their adjustment process with that environment. They included all types of households regardless of profession, nature of work, academic attainment, social status, political attitude, land ownership, gender perspective and other components to get a respective opinion.

The methodology adopted for the present study also makes extensive use of secondary material and laboratory analysis to build up and support the objectives of the study and to corroborate the findings that give an account of current amount of wastes generated by the inhabitants of the city and collection and efficiencies of Pourashava authority. Through reviewing available literature, observations and conducting case studies the locations for data collections through questionnaires were selected purposively.

Some solid wastes in the study area

In Narayanganj City of Bangladesh, like in other developing countries, the materials discarded are usually regarded as a municipal liability. This includes household garbage and rubbish, commercial refuse, cleaning and maintenance, refuse of dead animals, basin and drain cleaning wastes, bulky wastes and sanitation residues. Household garbage and rubbish, also known as residential refuse or domestic wastes, includes food preparation, sweeping, cleaning, fuel burning and gardening wastes. Commercial refuse are the wastes that come from stores, offices, fuel service stations, restaurants, warehouse and hotels. These wastes usually comprise packing and container materials, used office supplies and food wastes. Institutional refuse is wastes from schools, offices, hospitals, police barracks and religious buildings (Byron, 1956). This category usually produces a large portion of paper waste. Street sweeping is the source of wastes that comprises dirt and litter, household refuse, drain clearings, and human fecal waste. In Narayanganj City, sewage is not the major means of containing human excretion and sludge as sanitation residues may occur from privies and latrines. The human waste generated in these sanitation systems that waits regular cleaning may get service either from the municipality or the private sector. Processing and non-processing industries, as well as utilities, produce industrial wastes in the city. These include packaging material, food wastes, spoiled metal, plastic and textiles, fuel burning residuals and spent processing chemicals.

Current amount of wastes generation

Narayanganj City is predominantly an industrial area. A huge quantity of industrial waste is generated here daily, estimated to be around 120 to 125 tons everyday. Out of which about 50% is disposed in the landfills and the rest left unattended and locally dumped. Narayanganj Pourashava authority is the only formal organization responsible for waste management. It is broadly estimated that between 8 to10% of the total municipal budget is used for solid waste management which is approximately 0.75 million taka per year (Narayanganj Pourashava Authority 2009). Around 367 people are working in street sweeping and collecting waste. In the Pourashava area the per capita rate of waste generation is 0.5 kg/d and the amount of residential waste is half of the total amount. The major components of municipal solid waste include food, vegetables, fruits, polyethylene, paper and cloths. Among these, food and vegetables waste comprise the major component of the city waste, both in the residential and commercial areas. A rough estimate of Pourashava authority suggests that around 58.9 tons of waste is generated from residential sources which cover 52.1% of the total waste of 113.0 tons per day. Sources from commercial and industrial land use generate 24.7 and 20.6 tons, respectively, of waste daily, which is nearly the same amount (Narayanganj Pourashava Authority, 2009).

Solid waste management system of Narayanganj City

Solid waste management of Narayanganj Pourashava consists of the following four phases.

Primary collection and accumulation

Normally the households bring their refuse to the nearby communal bins/containers located on the street side, while in some specific areas the community has arranged house to house collection of garbage with their own initiatives and efforts. The household, commercial, institutional and medical wastes are deposited in the same waste collection bins located on the streets. Street sweeping is done manually and debris is loaded from the curb-side into the handcarts and delivered to the collection bins. Sweepers/cleaners sweep the roads and clean the drains and then place those wastes in the nearby dustbins or containers using a hand cart. Presently some CBOs are doing house-to-house collection of solid wastes at a reasonable charge, which is accepted by the city dwellers. These CBOs are playing a significant role in primary collection of solid wastes. However, most of the domestic, commercial & industrial solid wastes are still being accumulated in the dustbins/containers by the concerned household owners themselves.

Transportation

Wastes are transported by fleet (flat bedded) from the old part of the city where the roads and the lanes are narrow to the dumping sites. Every vehicle has got specified areas and route through which they move to collect wastes. The number of solid waste transporting vehicles available and their capacity is seen in Table 1.

Table 1. The number of transporting vehicles.

Vehicles	Numbers	Capacity
Garbage Truck	7	1.5 - 3 ton
Rickshaw Van	21	100 kg
Trolley	30	25 kg

Source: Narayanganj Pourashava, 2009.

Final disposal

Garbage trucks bring the collected solid wastes to the selected dumping sites. City wastes are only being used for filling low-lying lands. The waste is presently being disposed of mainly on the lowland, Panchabati, about 2.5 km from the Narayanganj Pourashava area and a number of minor sites which are operated in an uncontrolled manner without any proper earth cover and compaction. The uncollected wastes are dumped in open spaces and streets clogging drainage systems and creating serious environmental degradation and health risks.

Recycling

Narayanganj Pourashava does not yet have any solid wastes recycling projects. However, wastes which have market value are being reclaimed or salvaged for recycling. Recycling contributes to resource conservation as well as environmental protection. Papers, broken glass, metals, plastic are purchased on a house to house basis by a class of mobile purchasers. A section of the poor people collects re-useable and recyclable waste materials from the dustbins/containers as well as from the streets and dumping sites.

Ultimate disposal sites of Narayanganj City

Disposal sites can be regarded as an important component of integrated waste management in urban areas (Kazi et al., 1999). The sites need to be safe, long-term and reliable for disposal of solid wastes. Currently there are five sites (Figure 2) to dispose the daily generated solid wastes. Among them four are used by the communities of the municipality and the remaining one is used only by the municipality authority that is located outside the Pourashava boundary.

The only disposal site used by the Pourashava is located at Panchabati, outside of the city. The Narayanganj- Muktarpur road passes alongside the site. The greater part of the site is flat. The site is free from flooding. It is 2.42 km away from the center of Chashara, Narayanganj. The municipality authority deposits 120 to125 tons of wastes daily and another 180 to 200 tons of wastes come from the Panchabati residential area, Fatulla, Enayetnagar and other surrounding areas. Unauthorized but significant amount of wastes are deposited in four areas of the city. These are located at Chashara (near rail station), Khanpur (near ice making factory), near Kalir Bazar and Shahid Nagar. All the sites are located in low land areas. Out of the four, two sites, namely Khanpur and Shahid Nagar, are affected by flooding. Community based household wastes, commercial, and medical wastes are disposed of daily in these sites. About 8 to 10 tons of waste is disposed of per day in each of the sites.

Environmental aspects of solid wastes in Narayanganj City

The problem of solid waste management and the consequent impact on neighborhood environments is critical in Narayanganj City. 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 and human feces in the low and middle income areas of the city. 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). Narayanganj 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. The environmental conditions of all of the five dumping sites were investigated and discussed.

RESULTS AND DISCUSSION

Surface water contamination

Surface water is also contaminated because solid wastes are dumped near the pond, canals and the river Shitalakhya is used for fishing purposes and even sometimes by households. Contaminated water is harmful for fish and aquatic life and has the possibility of different diseases by reducing the amount of oxygen in the water (Bhuiyan et al., 2003). Chemical and oil spills also cause serious water pollution that kills water floral-faunal species and other wildlife. In the entire studied ultimate disposal sites (UDS), there is no control of waste contents. As a result several types of hazardous wastes are also disposed in the main stream of the river Shitalakhya and the canals of the city. The study finds that the release of toxic components such as Total Dissolved Solids (TDS), Electric Conductivity (EC) etc., from dumping sites are mainly responsible for the contamination of pond, canal and river water bodies adjacent to the mentioned dumping sites (Table 2). It is noted here that the values occurred for some phisco-chemical parameters such as Dissolved Oxygen (DO), pH, Biochemical Oxygen Demand (BOD), Chloride by laboratory analysis for the stations of surface water bodies are not fit with the standard values set by the Department of Environment (DoE) of Bangladesh.

Ground water contamination

In Narayanganj City, ground water is a very essential source for drinking and other purposes in households and industry. Tube wells are situated nearly 50 to 320 m away from the disposal sites and people of adjacent houses are drinking the water regularly, which is not recommended due to the high probability of ground water contamination, especially during the monsoon season when ground water leaching occurs. The values of analysis of two ground water stations (tube wells) show different results from the standard values set by DoE (Table 2).

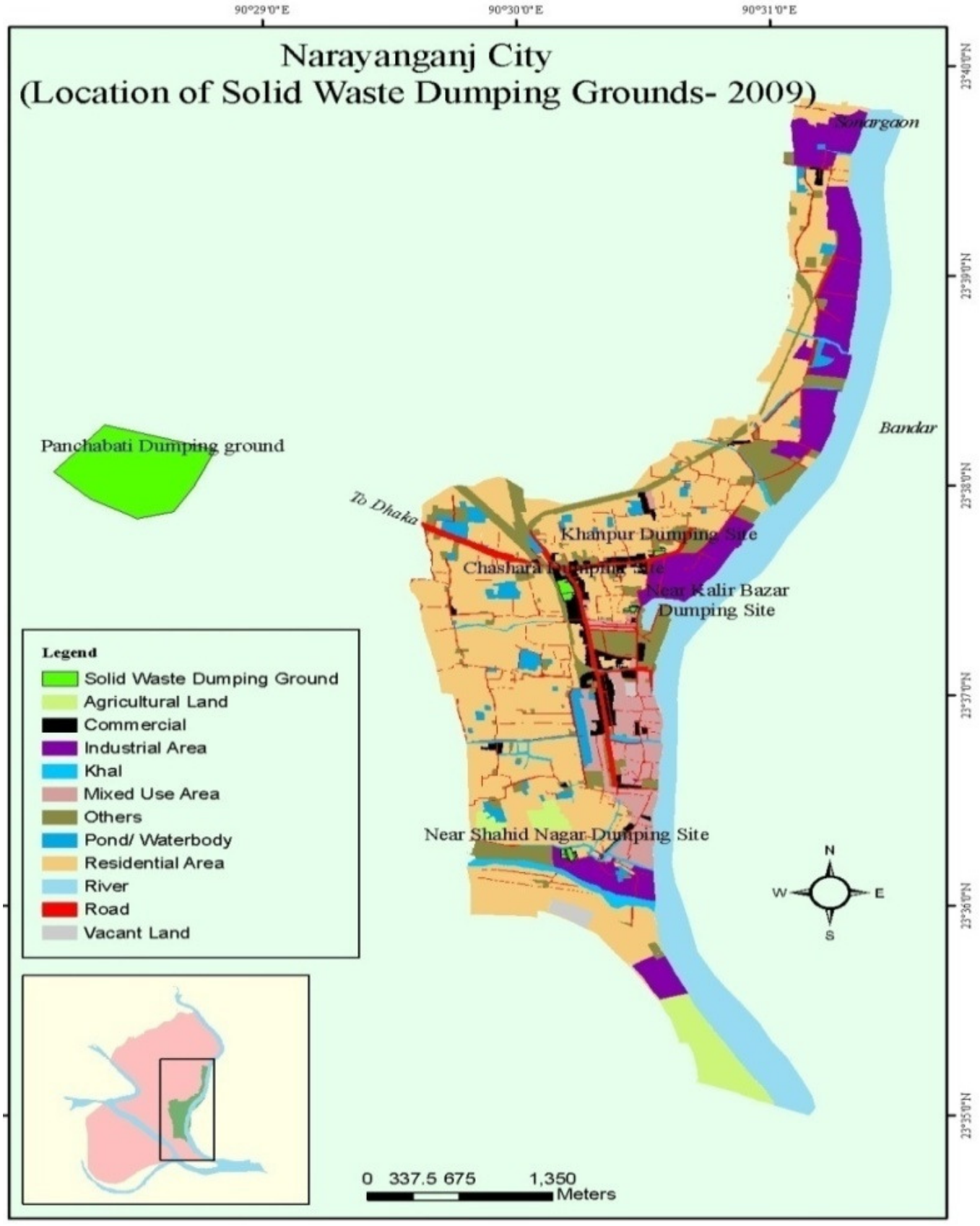

Figure 2. Major solid waste dumping grounds of Narayanganj City.

Table 2. Results of laboratory analysis of different surface and ground water quality parameters (mg/l, except pH) during pre-monsoon.

Sample name	Color	Do Std. = 4.0-6.0	pH Std. = 6.5-8.5	Sal Std. = 120	Ec Std. = 800-1000	BOD Std. = 3.0-10.0	TDS Std. = 800-1000	Chloride Std. = 150-600	Sodium chloride Std. = 200	Iron Std. = 0.30-1.0
S1	Transparent	0.8	7.3	320	495	0.89	571	80	128	*0.5*
S2	Transparent	1.4	7.1	313	504	0.45	510	80	128	*0.3*
S3	Transparent	1.4	7.1	234	512	0.27	490	100	160	*0.5*
C1	Light Gray	0.7	6.8	325	565	0.18	1000	120	192	*0.8*
C2	Slightly Turbid	1.3	7.3	319	589	0.36	793	120	192	*0.6*
C3	Light Gray	0.5	7.2	300	548	0.20	1146	200	320	*0.7*
P1	Green	3.5	7.7	280	526	2.5	906	140	224	*1.2*
P2	Light Green	1.5	7.4	286	534	0.45	991	200	320	*0.4*
G1	Transparent	2.7	6.7	216	439	1.34	638	140	224	*0.2*
G2	Transparent	3.4	6.8	225	456	0.45	497	80	128	*0.4*

Std. = Standard values guided by DoE, S = Stream, C = Canal, P = Pond, G = Ground water.
Source: Laboratory analysis, 2009.

Noise pollution

Noise pollution is occurring due to waste spreading operations using equipment, collection vehicles and compactors (Islam and Shafi, 2004). Noise causes discomfort and hearing loss in human beings and other animals. Another cause of noise pollution is verbalization of different animals like dogs, birds, and mainly crows. The noise pollution status is moderate in the existing disposal site, since the use of operation vehicles is very limited.

Land contamination

Leachate which percolates into the ground and the land might be responsible for the contamination of the vegetables produced on the land near the disposal sites. This can cause threats to the environment and pose a risk to human health and nature. Hazardous wastes are also dumped at the site that can pose a threat to human health and the environment.

Air pollution

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.

Odor

Odors are a complex mixture of gases, vapors and dust.

The potential health impact of odor depends on the concentration of odorous emissions as well as frequency and duration of exposure. Study reveals that odor is a significant pollutant at solid waste disposal areas of Narayanganj City (Table 3).

Narayanganj municipal 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.

Existing limitations

Despite the efforts of the municipal authority there

Table 3. Resident's perception on environmental aspects of five solid wastes dumping grounds of the city.

Impacts on surrounding environment	Variable													
	Surface water contamination		Ground water contamination		Noise pollution		Land contamination		Air pollution		Odor		Nuisance for neighbor	
	f	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%
Less	21	17.5	36	30	18	15	24	20	05	4.2	08	6.7	09	7.5
Moderate	43	35.8	23	19.2	59	49.2	39	32.5	43	35.8	29	24.2	36	30
High	56	46.6	61	50.8	43	35.8	57	47.5	72	60	83	69.2	75	62.5
Total	120	100	120	100	120	100	120	100	120	100	120	100	120	100

Source*:* Field Survey, 2009.

are some problems associated with the current management system of solid wastes of the city. Narayanganj municipal authority has no scientific or engineered planning approach on solid waste management. It has no solid waste management specialist (with an engineering background). The City planning department is yet to allocate any specific space for storage of waste bins or placing of containers. Placing of dustbins on the road, near any house, creates social problems because of improper use, irregular cleaning, and road blockage by collection vehicles, bad smell, rodents, vermins, flies and unhygienic conditions. Open truck collection systems need an average of 2 to 3 h for loading and unloading the waste to and from the trucks. Municipal authority normally spends only about 0.75 million taka for providing the service and that is not sufficient**.** Inefficient management of existing manpower, equipment and other resources, unscientific and inefficient collection practices, inefficient management of landfill make the management system more vulnerable.

Suggestive measures

The findings of the study suggest some measures to efficiently manage the solid wastes and to take necessary steps for environmental degradation such as surface and ground water contamination, air pollution, noise pollution and odor due to inefficient management of solid waste of the city. It needs to maintain a scientific and engineering approach by the city authority for solid wastes management. Scientific and efficient collection practices, efficient management of landfill and sufficient manpower and funds are vital for this. The municipal authority should strictly maintain all the five dumping grounds. To prevent surface and ground water pollution it needs to separate the collected wastes into hazardous and non-hazardous materials. The appropriate solid waste disposal method has to be selected, keeping in view that it should be economically viable, should not create a health hazard, should not cause adverse environmental effects, and should not result in unpleasant sight, odor, and noise. In order to prevent landfill leachate pollution of groundwater, the landfill must be impermeable to take effective measures to end. It needs to strengthen legislation, strengthen management, minimize or control the use of non-degradable plastics for daily use. Overall, the public awareness is vital for solid wastes management of the city.

Conclusion

For managing solid wastes of a city community based projects have a demonstrated effect. NGOs can play an important role in initiating, demonstrating new concepts, providing technical knowledge and providing training to others. In Narayanganj City a large number of residences are not aware of the health hazard and solid waste related problems. Many households are not disposing of garbage in nearby open spaces. Therefore, it is important to launch a long-term awareness building and campaigning program in the area so that people will be motivated about enhancing their own environmental conditions willingly.

REFERENCES

Akter NR, Acott E, Sattar MG, Chowdhury SA (1997). Environmental Investigation of Medical Waste Disposal at BRAC Health Centre's. BRAC, Research and Evaluation Division, 75 Mohakhali, Dhaka 1212, Bangladesh. pp. 16-18.

Bhuiyan AH, Nasser-Ejazul HM, Moinul H (2003). Unplanned waste disposal and its possible impact on subsurface environment of Dhaka City, Bangladesh. Unpublished research paper, Department of Geological Sciences, Jahangirnagar University, Dhaka.

Byron C (1956). Perceptions of Environmental Quality: On Housing Eastates, in J.T. Coppock & C.B. Wilson (eds.), "Environmental Quality: With Emphasis on Urban Problems", New York: John Wiley & Sons. p. 25.

Islam NS, Shafi SA (2004). Solid waste management and urban poor in Dhaka, Paper presented at the forum on urban infrastructure and public service delivery for the urban poor, Regional Focus: Asia, dated 24-25 June. New Delhi, India.

Kazi NM, Akter N, Chowdhury AMR (1999). Medical Waste Disposal in Dhaka City: An Environmental Evaluation. International Centre for Diarrhoeal Disease Research, Bangladesh. Mohakhali, Dhaka 1212 (GPO Box 128, Dhaka 1000), February. Bangladesh. Special Publication p. 87.

Narayanganj P (2009). Rough estimate of Solid Waste Collection Database. pp. 14-15.
Rahman MM, Ali MA (2000). Waste Management and Environmental Pollution in Bangladesh. Paper presented at the International Conference on Bangladesh Environment, ICBEN, at BUET, Dhaka Bangladesh. 14-15 January.