Urban Solid Waste Management in Hinthada

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Abstract

In the past decades, economic growth and urbanization have greatly magnified to deal with Hinthada's solid waste management system, pushing waste management to the forefront of environmental challenges with which it must contend. Not only has there been an increase in the amounts of waste generated, the composition of the waste has changed as well. This paper presents an analysis of current solid waste management practices in Hinthada and future challenges. This research also demonstrated the potentiality and efficiency of using GIS in selecting optimum sites for solid waste.

Key words: Urban, solid waste management, optimum site, Hinthada

Introduction

Due to the rapid rate of urbanization around the world, the importance of an efficient and effective solid waste management system is more critical than ever before. Nowhere is this truer than in the developing world, where unprecedented urban growth has resulted in greater amounts of municipal solid waste (MSW) being generated. By 2015, in just another five years, the number of urban residents will have doubled since 1987; a disproportionately large amount – nearly 90% – of this increase will take place in the developing world (Medina, 2000). Not only will these city dwellers produce more waste, the composition of their waste will change as well.

Within the developing world, Asia accounts for much of the urban growth. In 2000, almost one-third of the Asian populace lived in urban areas; moreover, this region has more urban areas than any other part of the world (World Bank, 2003). This urbanization, not to mention increasing population growth rates, has been accompanied by dynamic economic growth, the impacts of which have put even greater strain on municipal solid waste management systems (MSWM). In 1998, cities in Asia generated approximately 0.76 million tons (2.7 million m^3) per day of MSW, a number that will jump to 1.8 million tons (5.2 $meter^3$) per day by 2025 (World Bank, 1999).

Hinthada is no exception to these figures. If anything, the solid waste problem is even more acute for this Southeast Asian country that is limited by weak institutional capacity and insufficient human and capital resources in addressing the crisis.

Research Questions

Being a developing country, a typical solid waste management system in Hinthada displays an array of problems, including low collection coverage and irregular collection services, crude open dumping and burning without air and water pollution control, the breeding of flies and vermin, and the handling and control of informal waste picking or scavenging activities. These public health, environmental, and management problems are caused by various factors which constrain the development of effective solid waste management systems. They can be categorized into technical, financial, institutional,

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economic, and social constraints. In this research, researchers would like to answer the following questions.

What is the condition of solid waste management system in Hinthada?

How can appropriate site in Hinthada be selected?

Aim and Objectives

The amount of solid waste generated in Hinthada has been steadily increasing over the last decades. Therefore, this research paper aims to present an analysis of current solid waste management practices in Hinthada and future challenges.

To understand the current condition of Hinthada, the current solid waste management system in Hinthada was identified. Then to consider on the current land use, current land use of Hinthada was mapped and then, the GIS techniques were used to suggest potential solid waste disposal site in Hinthada.

Study Area

Geography

Hinthada is located on the western bank of the Ayeyawady River. It extends 5.36 km from north to south and 4.26 km from east to west. It is located at latitudes 17º 15' - 17º 39' north; its longitudes cover 95º 13' - 95º 30' east. Its total land area is approximately 14,586.81 sq km. Its climate generally falls within the tropics and experiences the Tropical Monsoon Climate (Am) which receives heavy rain in June, July and August, according to the Koppen's system of climate classification. But in some years it has the climatic conditions likely to be tropical savanna (Aw) (Khin Mar Aye *et al.*, 2007).

Demography

Hinthada is the most populous town in Hinthada District. Population of Hinthada Town is 77,696 in 2008 and 77,921 in 2009 (source: Township Peace and Development Council).

Economy

In 1989, the government launched the market-oriented economic policy, implementing economic liberalization measures which moved the centrally planned economy towards a market-based one. Since then, the country has seen robust economic growth and Hinthada is no exception.

Source of Data

For the compilation of this research, necessary data, figures and information are provided by the following:

(1) District Gazetteer (2009) of District Administration Department, Peace and Development Council, Hinthada District

(2) Hinthada Township Development Committee

(3) Immigration and Man Power Department

(4) Settlement and Land Record Department

(5) Pollution Control and Cleansing Department (PCCD) and many other departments.

Background of Research

As it is happening in most major urban areas, the waste management problem has already become a considerable factor in Hinthada Town. The problem is compounded by the increasing amounts of waste of complex nature and composition, which results from the growth in the Town's population and the changes in the consumption patterns. The problem is further compounded by the uncontrolled growth of industries and business community, without proper legal enforcement to ensure pollution control.

To add to the problem, residents commonly dispose of their solid waste into the alleys, streets, BDS (*back drainage space*), rivers, channels, and drains/ ditches indiscriminately. These are not only causing a number of health hazards from pathogenic organisms, insects and rodents, etc. and environmental impacts but also affecting negative landscape images. They also represent specific health risks to municipal workers, waste pickers and residents living close to the dumps. The disposal of garbage in street drains and ditches causes blockages and contribute to increase of flooding in rainy seasons.

At present, recycling of municipal waste has not fully and systematically developed in Hinthada yet. Some recyclable materials such as paper, plastics, etc. are collected separately from municipal waste and used for recycling practices. Normally domestic industries process the collected recyclable materials further into raw materials for final products. However, there are no reliable data on the amount of recyclable materials collected or the number of recycle factories.

Composting was introduced in Hinthada in 2005 with the following purposes:

1. to solve the problem of insufficient amount and/ or high cost of chemical fertilizer,

2. to produce the compost from the municipal waste and

3. to provide natural fertilizer for farmers with low cost.

Compost site located in Kyaukyelay Village of Nyaung Bin Ward is operated under control of Hinthada Township Development Committee (HTDC). Composting is only at the initial stage at the moment and it should be necessary to take measures for significant progress from pilot scale to composting industry.

Solid waste management problems

Solid waste collection and disposal is indeed a major problem faced by the Pollution Control and Cleansing Department (PCCD) like other municipal authorities of developing countries.

Major issues and constraints of solid waste management in Hinthada are summarized as follows:

1. No comprehensive plan on SWM
2. Lack of data on waste amount and composition generated
3. Indiscriminate dumping at unauthorized places like sidewalks, storm drains/ ditches, water bodies, wetlands etc. causing serious public health risks, environmental impacts and negatively affecting landscape as well.
4. Present landfill practice is uncontrolled and unhygienic. New landfill site in the east has to be looked for and controlled landfill shall be introduced.
5. Inefficient collection routine and coverage area

6. Other alternate waste volume reduction systems like separate collection, recycling, composting, etc. are not fully and systematically developed.
7. Limited human resources in agencies concerned (including Institutional structure).
8. Lack of people's awareness on sanitation/ environment.
9. No enforcement of solid waste regulations. There is very limited control over hospital and industrial waste.

There is a technique called geographic information system or GIS, in which the planner initially specifies all conceivable requirements (e.g. site should be at least 500 meters from the nearest dwelling unit) and based on these, identifies suitable sites for dumping. GIS is a digital database management system from various sources. The GIS effectively stores, retrieves, analyzes, and displays the collected information according to the specifications of the user of analyst.

This research has another idea which aims to demonstrate the potential and efficiency of using GIS in selecting optimum sites for the storage of solid waste. The study area selected is Hinthada because the required data in this area are readily available. First the requirements in selecting a landfill site are identified. These criteria are according to government's regulations for sound environmental management. The relevant environmental and cultural data are then collected from analogue maps, satellite images, aerial photographs and field surveys. As soon as these data are converted to digital form, they are analyzed using GIS functions to produce a final map showing the areas meeting all the criteria of the optimum sites for solid waste disposal.

Solid Waste Management in Hinthada Township

Generation and components

In Hinthada's municipal areas, the daily generation rate of solid waste is approximately 3 tons. The average waste generation of public sector is about 0.27 kilogram per capita per day. In industrial and agricultural sectors, all activities are currently low level and solid wastes generated from industrial and agricultural activities are not severe. Due to increase in urbanization, area of Hinthada becomes wider and the Pollution Control and Cleansing Department (PCCD) have to collect the solid waste in larger extent across the area of town. However, gradual increase in population causes the generation rate in regular order.

Municipal Solid waste in Hinthada can be grouped broadly into three categories: residential, commercial and market wastes.

Percentage contribution of the garbage generated is shown in the following:

Table 1. Percentage contribution of the garbage generated in Hinthada

Source of Solid Waste	% Contribution
1. Kitchen	62
2. Market	15
3. Garden	5
4. Commercial	10
5. Other	8

Source: Based on interview, 2010.

Waste handling and separation, storage, and processing at the sources

Most families use plastic bags, baskets, and other containers for site storage. Some families used to separate garbage to sell it to the plastic collectors for a small income. There are a few activities in processing of garbage. Some families make natural fertilizers from garbage by using the fermentation process. Most families have a little willingness to store their refuses in their homes or site for a period, not more than one day due to putrescence of refuses.

Collection system

With development and urbanization, various forms of waste discharge arising from human activities have increased, ranging from sewage, garbage, night soil, industrial effects and hazardous waste.

The PCCD, under the Hinthada Township Development Committee (HTDC), is the responsible government department for solid waste management in Hinthada and the responsibilities comprise of collection, storage, transportation, disposal of solid waste and collection of service fees.

The daily collection efficiency is 57%. Solid waste that is not collected by PCCD is disposed of by people by their own means, usually by burning and filling up low-lying areas. At present, collected solid wastes are transported to uncontrolled dumping sites, which are not far from the collection points. Residential wastes are collected every day with two trucks, commercial wastes are collected in weekdays with bell ring collection and market wastes are collected everyday.

PCCD possesses 4 collection vehicles and uses them daily. It is reported that the waste collection in Hinthada is only 50-60%. In other words, the features of SWM in Hinthada are basically labour-intensive and uncontrolled. Collection as practised by HTDC can be categorized into three types:

1. Bell ringing system (in this system, collection vehicles pass through streets with bell ringing sound so that people can come out to dispose garbage, Figure 1)
2. Collection at street dumps, and
3. Limited collection of market wastes and other wastes.

The collected solid wastes are hauled into waste dumping site.

Waste generated from hospitals are basically collected separately and disposed by PCCD. PCCD also collects the part of industrial wastes at the request of respective factories concerned and disposes of them along with domestic wastes.

Generally, main issues on waste collection are:

1. Inadequate waste collection
2. Insufficient facilities
3. Lack of public participation
4. Lack of law enforcement.

Solid waste disposal

Collected wastes are hauled into waste dumping site which is located in Kyaukyelay Village of Nyaung Bin Ward (Figure 1). The extent of site is 3.09 hectare and disposal place is 0.81 hectare. The site is known to be uncontrolled dumping and incineration. Hospital

wastes are deeply buried. The daily disposed solid municipal waste in Hinthada is 3 tons and promotion of 3Rs (Reduce, Reuse and Recycle) is only a pilot scale stage.

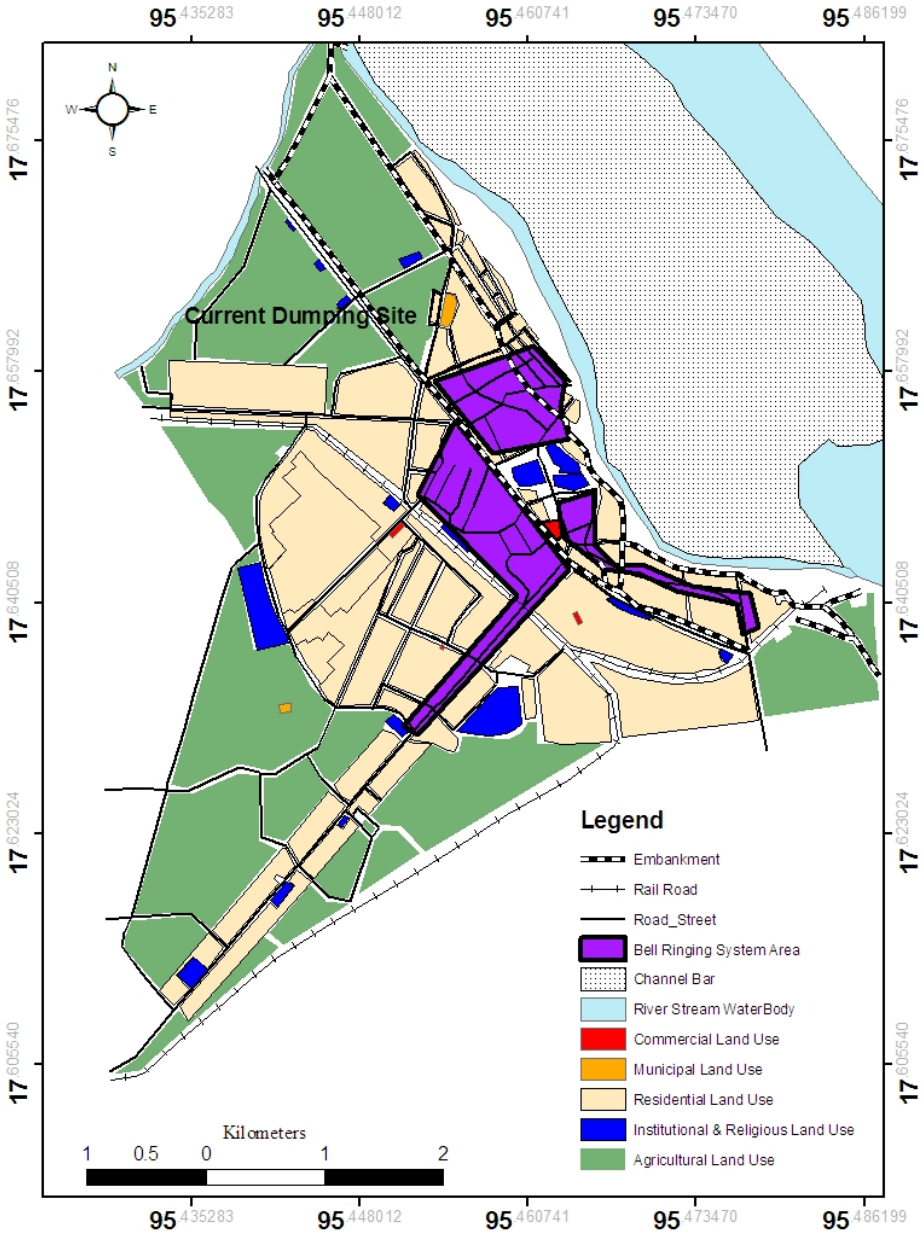

Figure 1. Waste collection by bell ringing system area in Hinthada.
Source: Myanmar Land Survey Department (Yangon)

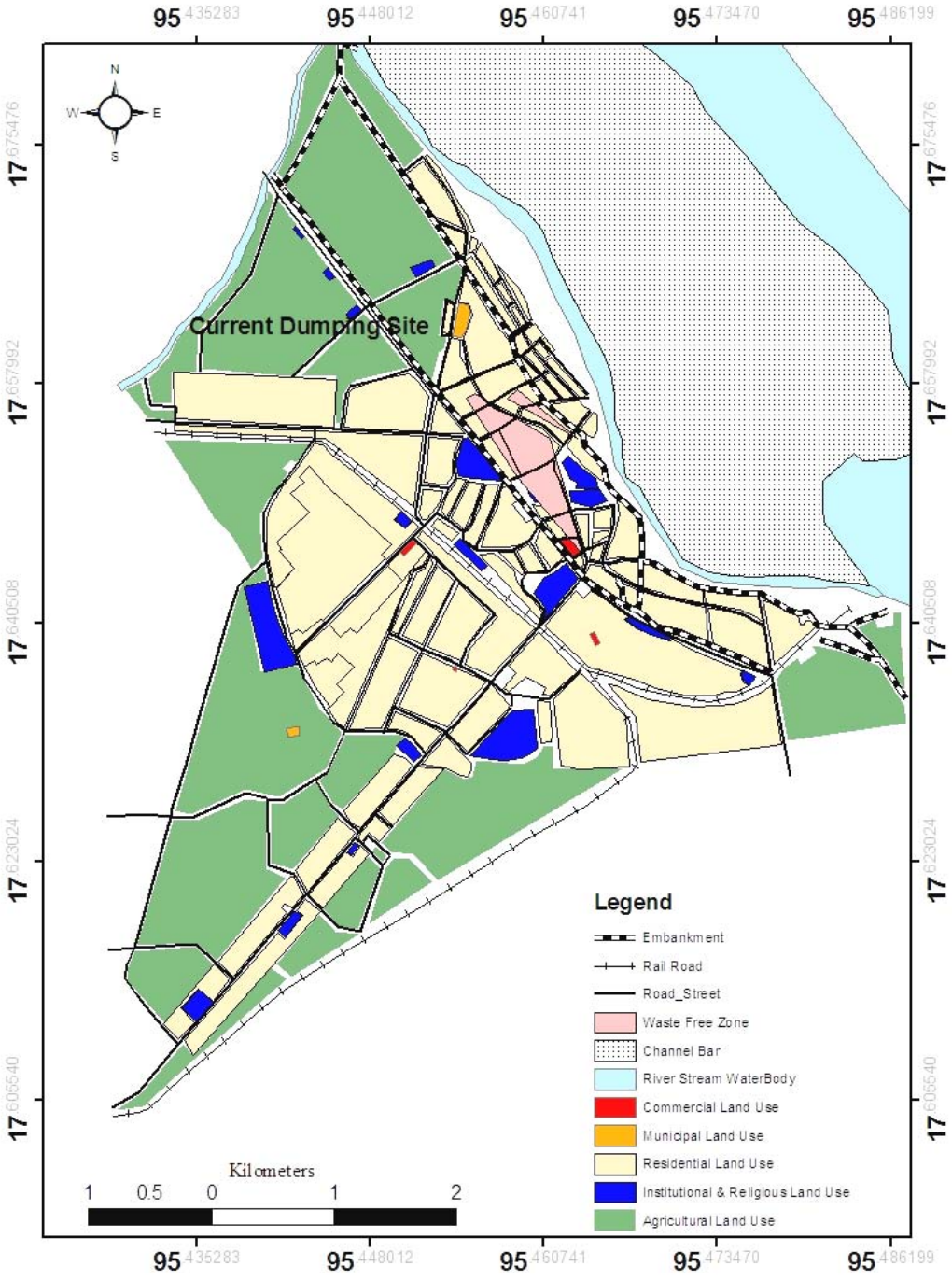

Figure 2. Waste free zone in Hinthada.
Source: Myanmar Land Survey Department (Yangon)

Recycling and composting

At present, recycling of municipal waste is not fully and systematically developed in Hinthada Town yet. Composting has introduced in Myanmar in 1999 operated under the control of the Ministry of Agriculture and Irrigation (MAI). HTDC is interested in composting to produce organic fertilizers and is operating the compost in order to reduce the waste and the burden of the waste disposal.

Potential Disposal Site Selection for Solid Waste

General evaluation

The selection of an ideal site is a difficult task. The wastes would remain in the site for a long duration. The physical features of the site are useful in understanding the impact of the wastes on the local environment. The ecological features are necessary to understand their potential changes. However, a few guidelines are reported (Lakshmi, 1999) (Table 2) for selecting a best site out of the available options. The researchers would like to propose that the selection of a best site can be achieved by general evaluation considering various features of the region/ site such as climate, ecology, land use, logistics, topography, soil properties, aesthetics, etc.

Table 2. Aspects covered under general evaluation of site selection

Physical features · Topography · Land stability · Seismic stability · Surface soils · Surface water and streams · Subsurface geology & aquifers	***Human values*** · Landscape · Recreation · Historical and archaeological monuments · Population density · Employment opportunities · Health status of population
Climate · Wind direction · Temperature · Moisture	***Land use features*** · Development potential · Landuse designation · Agricultural use · Transportation corridor · Extraction industries/mining
Logistics · Proximity to users · Transport access · Availability of utilities (Hospitals, fire services etc.) · Adjacent land use	***Ecological features*** · Flora and fauna · Conservation value · Habitat

Source: Lakshmi Raghupathy (1999)

Constraint mapping

Constraint Mapping is used for eliminating unsuitable areas for narrowing down the site selection. Selected exclusion factors can be used for this purpose (Lakshmi, 1999). The details of the site with respect to these features are mapped and superimposed over the base map of the region. There is a technique called geographic information systems or GIS, in

which the planner initially specifies all conceivable requirements (e.g. site should be at least 500 metres from the nearest residential area) and based on these, identifies suitable sites for solid waste. If the wastes are dumped in site which is located within 500 metres of residential area, an enormous health threat is posed to local population due to ground and surface water contamination from untreated leachate.

In the case of Hinthada, the land use map was based on to give only constraints as 500 m buffer zone for the river/ stream and water body so that institutional and religious space and residential area can be eliminated as unsuitable areas, and this can narrow down the site selection. According to this mapping, the site can be selected from the region excluding constraints (Figure 3).

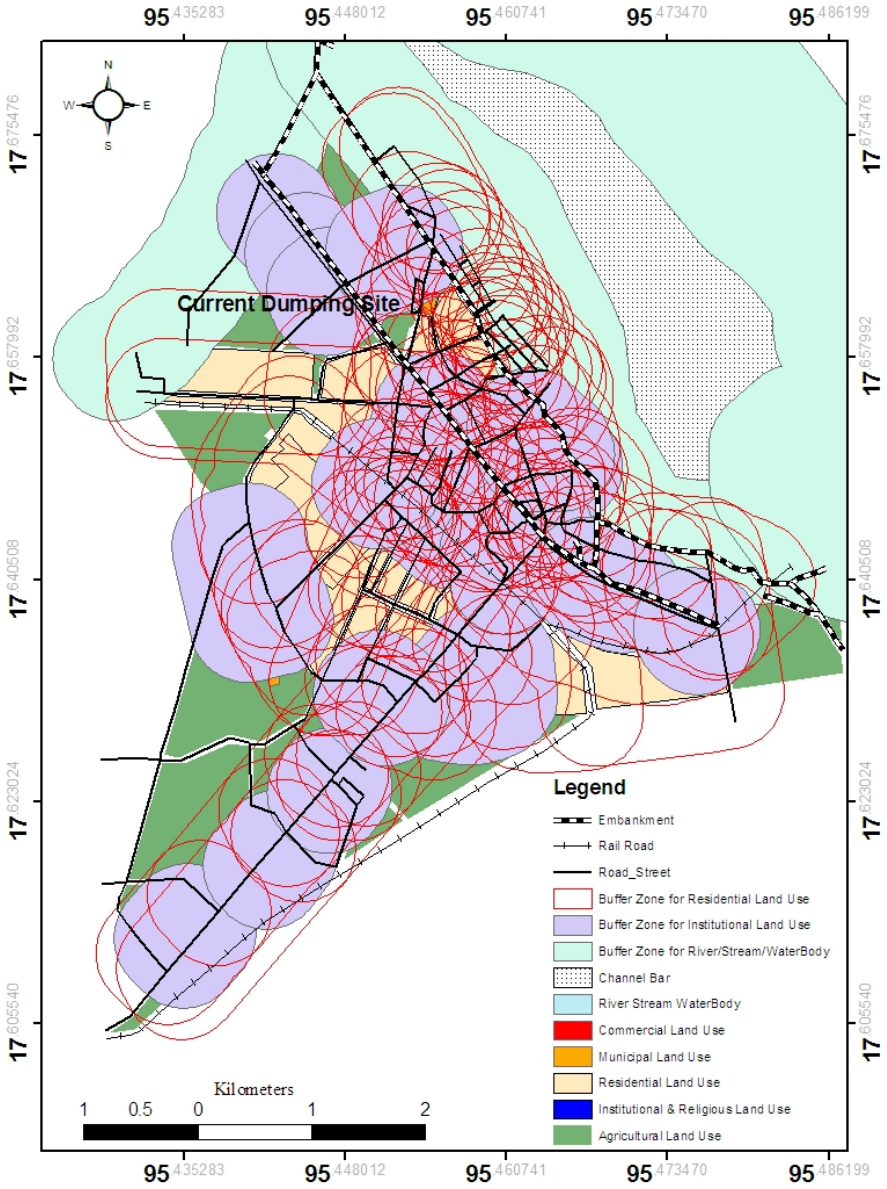

Figure 3. Potential sites should be at least 500 m far from nearest water body, institutional and religious space, and residential area in Hinthada.
Source: Myanmar Land Survey Department (Yangon)

Conclusion

The economic growth and urbanization have pushed the issue of solid waste management to the forefront of environmental challenges. This paper presented an analysis of current solid waste management practices in Hinthada Town and future challenges. The present solid waste disposal system in Hinthada, the dump method, creates a number of environmental problems like air and water pollution and transmission of communicable diseases. Effective waste management planning is necessary for it will enable the government to design a system that is tailored to the community. Comprehensive and regular waste collection services have to be offered to the population regardless of where they live. The 3 Rs – reduce, reuse and recycle – method of waste minimization can also be used to address the growing waste problem. Another method that is currently not practised on a wide-scale is the sorting of trash at the source before it reaches the landfills or dump sites. Waste minimization may be the most feasible scheme because it requires the least capital investment and relies mainly on either the waste operators and/ or the waste generators. In short, any strategy implemented must be inclusive of the communities that are producing the waste and who are affected by the waste in addition to the people who have the policy-making authority. This research also demonstrated the potential and efficiency of using GIS in selecting optimum sites for solid waste.

The conditions, issues and problems of urban waste management in the developing worlds are different. Though the developed countries generate larger amounts of wastes, they have developed adequate facilities, competent government institutions and bureaucracies to manage their wastes. Developing countries are still in the transition towards better waste management but they currently have insufficient collection and improper disposal of wastes. Clear government policies and competent bureaucracies for management of solid wastes are needed urgently especially in countries where there is population growth through urbanization into peri-urban areas. Services and programmes that include proper waste disposal for management of hazardous biological and chemical wastes, minimisation and recycling will be needed. Disposal of wastes is commonly done by dumping (on land or into water bodies), incineration or long term storage in a secured facility. All these methods have varying degrees of negative environmental impacts with adverse environmental and health risks if wastes are improperly disposed or stored.

Good waste management needs the cooperation of the people. A lot of improvements can be made if authorities and the populace sit together to find ways and means of solving urban problems. People should also be encouraged to establish local community organizations to enhance urban waste management. If systems for solid waste removal are to be efficient, people need to know their daily responsibilities, the routines, the collection timetables, the standard procedures, and the locational factors. An elaborate system of public education should therefore be called for, with a focus on critical issues, such as methods for waste collection, storage, and delivery to the refuse dumps and the inherent dangers of giving inadequate or no attention at all to waste.

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