Chapter-5

5. ANALYSIS OF SOLID WASTE MANAGEMENT

This chapter deals with the analysis of SWM and formulates proposals leading to improvements suitably. SWM involves activities associated with generation, storage, collection, transport and disposal of solid wastes impinging on the principles of administration, economics, law enforcement, aesthetics, energy recovery, environmental suitability, and conservation. These aspects of SWM have not received the consideration they deserve in the city administration of Hassan. There is a daily backlog of about 28 tones of wastes getting accumulated in different parts of the city. Particularly in low-income areas such as urban village pockets, slums and squatter settlements areas and revenue/unauthorized layouts in the outskirts of the city, the solid waste is not collected at all. A well-prepared plan can have a positive impact on economic and social development while it takes sufficient care of the environmental protection in slums and squatter areas. Preparation and implementation of SWM plans for the slums and squatter settlement areas can go a long way in solving the accumulated problems and to prevent their future escalation. For preparing such plans, the source of the problems has to be identified and solutions provided for short-term mitigation and long-term prevention. This has to be done through environmental management plans. A pocket of unattended and polluted areas destroy the image of clean and planned city and creates urban form deterioration and health hazards. Encroachment on prime land creates obstacles to the intended development and use of that land. Slums and squatter settlements with poor sanitation, drainage and garbage disposal systems degrade the environment. It creates low rise and high-density residential pockets. The basic fact is that ultimately the municipal council is responsible and accountable for maintaining an efficient waste disposal system, improvements of slums and rehabilitation of low income people living in slums.
5.1 PLANNING OF ROUTES FOR WASTE DISPOSAL VEHICLES

Presently in most of the cases the routes of refuse vehicles are not properly designed but left to the vehicle operator or supervisor to use his discretion. If these routes are properly planned the expenditure can be reduced and better service provided. The Wards and Routes have to be balanced so that every day the crews have a fair share of work and all the areas are covered evenly and more frequently.

Based on the existing experiences, micro routing involves careful analysis of routes in each service area and minimizing the transportation distance after carefully considering all the relevant factors. The advantages such as the overall reduction of transportation costs; the suitable vehicle will be used to dispose more quantity/day; the labor cost is also significantly reduced; the service area will be cleaned more frequently; the life span of vehicles is enhanced; and economical use of transfer station is also worked out in such a way that the cost of transport of waste to disposal points from various collection points is minimized.

5.2 HEALTH ASPECTS OF DUMPING GROUND

SWM is an important element of public health and environmental administration. Its purpose is to provide hygienic, efficient and economic collection, transportation, and treatment and disposal of solid wastes without pollution of the atmosphere, land and water system. There are potential risks to health and to the environment from improper handling of solid wastes.

Various flies, particularly the housefly and blowfly breed near the houses where there are waste products in the vicinity. They are also found at disposal sites and control becomes more difficult in cities like Hassan where the rate of decomposition of wastes is faster and propagation of flies and bacteria is much faster due to organic waste content in the garbage. Dumping ground fly menace is another nuisance.
In public mind, rats are often associated with refuse dumps; they can undoubtedly infest dumps where no measures are taken to prevent it. Rodents proliferate very rapidly in uncontrolled deposits (dumps) of refuse, which provide them plenty of food. The presence of food in wastes permits rats to persist and often to migrate from dumps to human dwellings in the vicinity in search of more food. It has been observed that a number of burrows made by these rodents were noticed in and around the dumping sites. The rodents create serious health problems and disease. The residents living near these dumping grounds have stated from their personal experience that rats not only create health problems but they also cause considerable economic loss and damage by destroying and contaminating foodstuffs and other materials. Proliferation of rats is an invitation to snakes; problem of rats leads to the problem of snakes.

In Hassan, one of the most serious effects on public health is issuing from deficient waste disposal mechanism and the consequent breeding of mosquitoes. It has been found that mosquito breeding occurs often in the water polluted by the indiscriminate disposal of solid wastes, especially in tank areas within the urban limits and also along the road side concrete drains.

**5.3 STRENGTHENING OF INSTITUTIONS**

It is necessary to provide adequate training to staff at all levels engaged in SWM services. The lower level staff such as sweepers, sanitation supervisors, and sanitary sub-inspectors should be given training locally in various aspects of storage, segregation of waste, primary collection of waste etc. Whereas the sanitary inspectors and their official superiors may be given training in modern technologies of waste management within and outside the city or state, the senior younger officers of SWM department should be given adequate training through workshops and visits to various parts of the country and abroad.

The ward level administration should be fully responsible for ensuring storage of waste at source, primary collection of waste, street sweeping and taking the waste to the
community storage site etc. The cleaning of each street, lane, by lane, markets, etc, should be regularly supervised by the ward level supervisors. The prevailing laxity in attending to clogged up storm water drains and overflowing manholes should stop and being the nearest authority, ward level administration has to be proactively concerned with this problem.

There should be a regular coordination to sort out the problems faced by the SWM section in the Municipal Council such as expeditious repairs of roads, drains, water supply pipelines etc. which cause hindrance to street cleaning. The expeditious reconditioning of roads dug up by property owners and utility services should be given priority.

Laying of the services in slums; provision of public health engineering services and road construction in slums to improve overall health and sanitation in the city may also be reviewed at the co-ordination committee level. This requires possibly a relocation of slums and squatter settlements, involving phased rehabilitation of low income people living in such areas.

5.3.1 People’s Participation in SWM

a. Defining Participation

As with any community based waste service, there are three main elements to defining participation: awareness, education and management. Each element is equally important and the level of participation required depends upon who is rendering the service and what the community wants.

Community initiatives in Hassan have sought to tackle the waste problem through on-the-ground involvement of stakeholders. As the municipality has failed to provide adequate services, there has been greater involvement of individuals, communities and NGOs who have taken local initiatives to not just manage the waste, but to turn it into a resource.
There is an urgent need to publicize community participation and find ways to provide incentives to them. The policy framework needs to recognize these sustainable waste management systems which are associated with reducing the waste and generating livelihoods by recycling and composting waste.

Any community work needs the support of its stakeholders – waste pickers, residents, local municipal body, CBOs, volunteers, etc – to operate and sustain itself.

Recycling of waste is the most economical and socially viable option; as it generates employment for the urban poor who neither have skills nor capital for investment. The initiative and incentive for community waste management systems should ideally come from the government. Land for composting and other basic infrastructure should be provided by the local government. Currently, urban planning in Hassan seems to be slow in meeting such needs in its spatial city plans.

Markets need to be developed for compost products made from urban waste. Private sector investment in this area has been floundering owing to its inability to sell the compost due to the competition from the heavily subsidized chemical fertilizer industry. For this the greener compost products need urgent attention. Education about their superiority needs to be promoted.

Organized waste collection through community waste management systems should include waste pickers. This will lead to more, and cleaner, recovery of recyclables and enhanced income for the waste pickers.

b) Community-based SWM initiatives

Basically, there are five types of waste management relationships in the Decentralized Solid Waste Management Systems:

- Partnership between municipality and NGOs;
- NGOs/CBOs on their own;
- Municipalities on their own;
- Private operators; and
- Institutions/industrial complexes on their own.

Most of these organizations mainly adopt door-to-door collection, segregation and composting of bio-degradable waste. One of the most important benefits accruing from these community interventions is their ability to divert waste from landfills. Urban wastes in India usually comprise 60 percent bio-degradable waste, about 30 percent recyclables and only 10 percent is absolute waste. Since this debris can be used as land refills or reclamation material, these can be treated as recyclable material (www.tocicslink.org, Toxics Link for a toxics-free world, 2007, p.11). Since about 60 percent of the municipal waste is organic in composition it can easily be composted. Assuming that there is primary segregation taking place in order to ensure the quality of compost, there is an automatic diversion of 60 percent of the waste. Moreover, since source segregation ensures separate collection of recyclables and other waste, the rate of landfill diversion goes up further.

Community participation can increase civil awareness among residents about environmental issues involved in SWM, and improve efficiency of collection, as well as cooperation at the neighborhood level in keeping the urban environment free of waste pollution which can also contribute to reduction of costs to the municipality.

i) **Ecological Sustainability**: Ideally, in order to be ecologically sustainable, any community intervention should strive for the following:

- minimum production of waste;
- reuse and recycling of waste to the maximum;
- bio-degradable waste to be treated separately; and
- only inert to be dumped in landfills.

To fulfill the last two conditions optimally, waste should be segregated at source. Regarding dumping in landfills care has to exercised about preserving and improving water bodies.
ii) **Financial Sustainability**: This is, perhaps, the most important aspect of sustainability. A detailed account of this sustainability is necessary. Selling of compost and recycled products may yield resources to sustain at least partially the SWM.

iii) **The Municipal linkages**: The support of the municipality is crucial to the success of an intervention. The municipality can assist an intervention in many ways:

- it can issue identity cards to waste collectors which save them from harassment by the police;
- it can provide land for composting;
- it can help by performing other services like regular road sweeping, cleaning drains and local containers.

A municipality’s decisions can affect the sustainability of these interventions in rather direct ways. For example, at Bangalore, the Bangalore City Corporation has started door-to-door collection of waste free of cost. They plan to levy a solid waste tax in the coming months (Ibid, p.17). In the city of Hassan, sustainability of a community intervention requires that there be some sort of forward-backward linkages among the CBOs/NGOs, municipality and local political leadership. Ideally, all the important stakeholders – CBOs/NGOs, waste collectors, municipality and local political leadership – should be brought together and there should be continuous interaction and coordination among them.

The best example is that the **Municipal Corporation of Brihanmumbai** (2006) with regard to prohibition of littering and other nuisances; these measures are very much essential in the city of Hassan. They are:

i. **Littering in any public place**: No owner / occupier shall throw, deposit or cause to be thrown or deposited any waste whether liquid, semi-solid or solid including sewage and waste water upon or in any public place, including in any type of water body (natural or man-make) except in a manner provided for in these Rules,
the Environment (Protection) act, 1986, or any other Act or Rules framed under any such Act.

ii. **Creating public Nuisance:** No person shall bathe, spit, urinate, defecate, feed groups of animals or birds, wash vehicles, utensils or any other object, in any public place except in such public facilities or conveniences specifically provided for any of these purposes.

iii. **Segregating of MSW:** Every generator of MSW shall store unmixed in or separate the waste at the source of waste generation into the following six categories: Bio-degradable (wet) waste; Specified household hazardous waste; Bio-medical waste; Construction and demolition waste; Bulk garden and horticultural waste including tree trimmings; All other non-bio-degradable (dry) waste including recyclable and non-recyclable waste.

iv. **Burning of waste:** Disposal by burning of any type of solid waste at roadsides, dump sites, or any private or public property is prohibited. (This does not refer to the facilities set up for close and controlled incineration of specific types of waste which are authorized by the Authority).

v. **Stakeholder awareness, education and training:** The authorities concerned along with NGOs will identify the educational and training needs with regard to cleanliness of different stakeholders such as Municipal staff, Agents of Municipality, schools, housing societies, slums, shops, hawkers, office complexes, industrial units, commercial unions, local area citizens groups, etc. Thereafter a coordinated plan and communication strategy will be drawn up and executed to tackle education, awareness-raising and training of all such stakeholders and municipal staff will invite proposal from professional agencies to undertake a city-wide Awareness and Outreach Program.

vi. **Documentation of successful initiatives:** The Chief of the solid waste authority along with the NGOs will invite documentation of successful citizen and/or local
Citizen-Municipal partnership initiatives in cleanliness and related areas so as to include in the Citizen resource Base that other citizens and the staff of Municipality can utilize. Recognition, awards and publicity will be given by Municipality for such best practices.

vii. **Surprise checks**: The Municipal Commissioner will organize surprise checks in various parts of their respective wards in Municipal limits at any time with a view to encourage compliance. Any contravention will attract a Fine and any litter found during these checks will be cleared by Municipal staff.

viii. **Enforcement Squads**: The Municipal Commissioner will strengthen the existing system of Nuisance Detectors (both with regard to numbers and capabilities) and Enforcement Squads by providing suitable uniforms and vehicles to Nuisance Detectors and creating a system of incentives for nuisance detection and non-revenue targets. “Local Area Citizen Groups”, Citizens Cleanliness Teams or other volunteers may come forward to assist Municipal squad of Nuisance Detectors in nuisance detection in their area. The Municipal Commissioner will provide prompt and adequate Nuisance Detectors when required by “Local Area Citizen Groups”, Citizens Cleanliness Teams.

ix. **Poultry, Fish and Slaughter Waste**: Every owner/occupier of any premises other than designated slaughter houses and markets, who generates poultry, fish and slaughter waste as a result of any commercial activity, shall store the same separately in closed, hygienic conditions and deliver it at a specified time, on a daily basis to municipal collection vehicle provided for this purpose. Deposition of such waste in any community waste bin is prohibited and will attract fines as indicated in the **Schedule of Fines**.

x. **Vendors/Hawkers**: All vendors/hawkers shall keep their bio-degradable and other waste unmixed in containers / bins at the site of vending for the collection of any waste generated by that vending activity. It will be the responsibility of the
generator/vendor to deliver this waste duly segregated or to the nearest designated community waste storage bin. Failure to do so will attract fines as per the Schedule of Fines.

xi. **Litter by owned/pet animals:** It shall be the responsibility of the owner of any pet animal to promptly scoop/clean up any litter created by pet animals on the street or any public place, and take adequate steps for the proper disposal of such waste. Failure to do so will attract fines as per the Schedule of Fines.

xii. **Public gathering and events:** For Public Gathering and Events, organized in the public places for any reason (including for processions, exhibitions, circuses, fairs, political rallies, commercial, religious, socio-cultural events, protests and demonstrations, etc.) where Police and/or Municipal authority permission is required, it will be the responsibility of the Organizer of the event or gathering to ensure the cleanliness of that area as well as all appurtenant areas.

xiii. A Refundable Cleanliness Deposit, as may be notified by Municipality, will be taken from the Organizer, by the concerned ward office for the duration of the event. This Deposit will be refunded on the completion of the event after it is noted that the said public place has been restored back to a clean state, and any waste generated as a result of the event has been collected and transported to designated sites. (This deposit will be only for the cleanliness of the public place and does not cover any damage to property). In case the Organizers of the event wish to avail of the services of Municipality for the cleaning, collection and transport of waste generated as a result of that event, they must apply to the concerned Ward Office of Municipality and pay the necessary charges as may be fixed for this purpose by Municipality.

xiv. **Penalties for contravention of these Rules:** On and after the date of commencement of these Rules (Municipal corporation of Brihanmumbai - Municipal Solid Waste (Prohibition of Littering and Regulation of Segregation,
Storage, Delivery & Collection) Rules 2006), there will be a familiarization/warning period as stated below, after which, any contravention of these Rules shall be punishable with fines as per the Schedule of Fines (Schedule-I) below for every instance of breach of these Rules and thereafter, on a daily basis, for repeat offences. The bio-degradable and recyclable waste and specified household hazardous waste are in the schedule II and III.

**Schedule – I**

Schedule of Fines

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Rule No.</th>
<th>Sub-division / Description of Rule</th>
<th>Amount of Fine applicable for breach of Rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rule No. i</td>
<td>Littering</td>
<td>Rs. 100</td>
</tr>
<tr>
<td>2</td>
<td>Rule No. ii Creating Nuisance</td>
<td>Spitting</td>
<td>Rs. 50</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Bathing</td>
<td>Rs. 50</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Urinating</td>
<td>Rs. 50</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Defecating</td>
<td>Rs. 50</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Feeding groups of animals/birds in non-designated areas</td>
<td>Rs. 50</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Washing vehicles</td>
<td>Rs. 100</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Washing utensils/clothes/any other object</td>
<td>Rs. 50</td>
</tr>
</tbody>
</table>

**Segregation, Storage, Delivery and Collection**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Rule No.</th>
<th>Sub-division / Description of Rule</th>
<th>Amount of Fine applicable for breach of Rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Rule No. 5.1 and 5.2</td>
<td>For delivering waste that is not segregated and stored as specified in separate bins: a) Individual b) Bulk generator</td>
<td>Rs. 100</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Rs. 500</td>
</tr>
<tr>
<td>10</td>
<td>Rule No. 5.12</td>
<td>For disposal of waste by burning</td>
<td>Rs. 500</td>
</tr>
</tbody>
</table>

**Specific Categories / Situations**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Rule No.</th>
<th>Sub-division / Description of Rule</th>
<th>Amount of Fine applicable for breach of Rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Rule No. 7.2</td>
<td>For not delivering (non-household) fish, poultry and meat waste in a segregated manner as specified</td>
<td>Rs. 500</td>
</tr>
<tr>
<td>12</td>
<td>Rule No. 7.3</td>
<td>a) For a vender/hawker without a container/waste basket b) For a vender/hawker who does</td>
<td>Rs. 100</td>
</tr>
</tbody>
</table>
not deliver waste in a segregated manner as specified

<table>
<thead>
<tr>
<th></th>
<th>Rule No. 7.5</th>
<th>For littering by pet/owned animals</th>
<th>Rs. 50</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Rule No. 7.6</td>
<td>For not cleaning-up after public gathering/event within 24 hours</td>
<td>Forfeiture of the Cleanliness Deposit</td>
</tr>
</tbody>
</table>

Source: Municipal Corporation of Brihanmumbai - Municipal Solid Waste (Prohibition of Littering and Regulation of Segregation, Storage, Delivery & Collection) Rules 2006, Notification w.e.f. 1st March 2006, pp.16-17

### Schedule – II
Illustrative list of bio-degradable and recyclable waste

<table>
<thead>
<tr>
<th>Bio-Degradable Waste</th>
<th>Recyclable Waste</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bio-Degradable Waste</strong> means “wet” waste of plant and animal origin</td>
<td><strong>Recyclable Waste</strong> means “dry” waste that can be transformed through a process into raw materials for producing new products, which may or may not be similar to the original products</td>
</tr>
<tr>
<td>• Kitchen Waste including: tea leaves, egg shells, fruit and vegetable peels</td>
<td>• Newspapers</td>
</tr>
<tr>
<td>• Meat and bones</td>
<td>• Paper, books and magazines</td>
</tr>
<tr>
<td>• Garden and leaf litter, including flowers</td>
<td>• Glass</td>
</tr>
<tr>
<td>• Animal litter</td>
<td>• Metal objects and wire</td>
</tr>
<tr>
<td>• Soiled paper</td>
<td>• Plastic</td>
</tr>
<tr>
<td>• House dust after cleaning</td>
<td>• Cloth Rags</td>
</tr>
<tr>
<td>• Coconut shells</td>
<td>• Leather</td>
</tr>
<tr>
<td>• Ashes</td>
<td>• Rexine</td>
</tr>
<tr>
<td></td>
<td>• Rubber</td>
</tr>
<tr>
<td></td>
<td>• Wood/furniture</td>
</tr>
<tr>
<td></td>
<td>• Packaging</td>
</tr>
</tbody>
</table>

Source: Municipal Corporation of Brihanmumbai - Municipal Solid Waste (Prohibition of Littering and Regulation of Segregation, Storage, Delivery & Collection) Rules 2006, Notification w.e.f. 1st March 2006, p.17
Schedule – III
Specified Household Hazardous Waste

<table>
<thead>
<tr>
<th>“Hazardous waste” is waste that can catch fire, react, or explode under certain circumstances, or that is corrosive or toxic</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Aerosol cans</td>
</tr>
<tr>
<td>• Batteries from flashlights and button cells</td>
</tr>
<tr>
<td>• Bleaches and household kitchen and drain cleaning Agents</td>
</tr>
<tr>
<td>• Car batteries, oil filters and car care products and consumables</td>
</tr>
<tr>
<td>• Cosmetic items, chemical-based Insecticides and their empty containers</td>
</tr>
<tr>
<td>• Light bulbs, tube-lights and compact fluorescent lamps</td>
</tr>
<tr>
<td>• Medicines, discarded</td>
</tr>
<tr>
<td>• Paints, oils, lubricants, glues, thinners and their empty containers</td>
</tr>
<tr>
<td>• Pesticides and herbicides and their empty containers</td>
</tr>
<tr>
<td>• Photographic chemicals</td>
</tr>
<tr>
<td>• Styrofoam and soft foam packaging from new equipment</td>
</tr>
<tr>
<td>• Thermometers and mercury-containing products</td>
</tr>
</tbody>
</table>

Source: Municipal Corporation of Brihanmumbai - Municipal Solid Waste (Prohibition of Littering and Regulation of Segregation, Storage, Delivery & Collection) Rules 2006, Notification w.e.f. 1st March 2006, p.18

5.3.2 Public Participation

The problems of SWM are of two types: technical and socio-economic. With the existing technology, management of solid waste by trained personnel will solve the first problem. However, to keep the environment clean is often not a solution to the technical problems, but one of development of consciousness of the right kind among the public who generate solid wastes, discard them and expect efficient, effective, economical, uncomplicated, and nuisance – free collection and disposal. Since solid waste disposal is a distasteful activity to many people, usually the general public does not care to comprehend the difficult problems involved in collection and disposal. Keeping the environment clean requires not only efficient solid waste services, but
public acceptance, co-operation and participation. Any plan to improve it must include a program to involve the members of the public in a manner relevant to SWM.

Awareness leading to attitudinal changes needs to be created among the citizens for keeping the city green, clean and free from pollution. It is necessary to involve citizens to keep the city clean under the motto that keeping Hassan clean is not somebody’s problem but everybody’s responsibility. For this, the problem should be tackled comprehensively. How can they help government bodies, municipality, etc towards achieving this goal? In 1989, on “World Environment Day” (June 5), a Standing Committee for the improvement of environment in Karnataka was constituted and has met regularly at the Institution of Engineers at the behest of the Department of Environment, Karnataka. This committee has representatives from different sections of the community and from Government bodies. Since its constitution, the members of the Committee along with other environmentally conscious social activists and service organizations have been in liaison with civic forums and regulatory authorities to readdress many issues of concern.

- These include hygiene and cleanliness, littering, garbage disposal, defacing of walls, stray animals menace, hospital waste disposal, landscaping and town planning, smoking in public places, wastage of water and electricity.

- The main objectives of this committee is to form an umbrella for several organizations and individuals to plan a coordinated approach to tackle various environmental issues like garbage management, community hygiene and civic sense, protection of greenery and vegetation, prevention of air and noise pollution and water conservation including both availability of water and water contamination.

- The next step is to create awareness among the citizens of Hassan regarding various issues undertaken by the committee.
5.3.3 Private Sector Participation

With a view to improve the efficiency of the municipal personnel and economize expenditure it is considered essential to introduce private sector participation in the SWM services. There should be a right mix of private sector and public sector participation so that there is healthy coordination between private sector and public sector. In the newly developed areas the work of sweeping, collection, transportation, disposal of waste etc. could be contracted out. Besides the facilities which are not being provided by the Hassan Municipal Authorities so far, may as far as practicable be created by private sector participation as and when they are proposed to be provided.

- Collection and transportation of hospital waste, construction waste, hotel waste from the doorstep can be privatized on full cost recovery basis.

- Workshop for the repairs and maintenance of vehicles, setting up of incineration plant for hospital waste, compost plant for the treatment of organic waste and work of managing the landfill sites for the disposal of other wastes can also be entrusted to private sector for making it cost effective, efficient, and accountable.

- The healthcare waste is entrusted to private organization.

A major task of Hassan Municipality is to ensure an integrated SWM system which is efficient, cost effective and environmentally sound by the year 2015 with maximum involvement of local communities as well as the private sector. To address the problems, the Local Body has been soliciting private sector participation to achieve following outcomes:

- Efficient collection system
- Efficient transfer and scrap recovery
- Maximum recycling and composting
- Sanitary landfilling
- Special waste management
- Appropriate policy and law
- Public education and participation
- Professional management and monitoring

Involving the private sector in waste management services usually results in an efficient and professional SWM system. The private sector is usually best at providing efficiency and technical expertise, while the public sector, which is directly responsible to the people, is best at doing the jobs of monitoring and enforcement. Therefore, a suitable combination of the best contributions that the private and the public sector have to offer will be necessary to provide an efficient waste management system.

Effective private sector participation in waste management requires:
- Political commitment on the part of city municipal councilors.
- Faith of all stakeholders in the intentions and methods of the administration.
- Option suited to local conditions and participants.
- Enabling environment.
- Municipality capable to plan and monitor the process.
- Fair and transparent process.

**Phase wise implementation to build confidence**: In order to slowly build the confidence of all stakeholders, the Municipality is eliciting private sector participation in phases, instead of giving all the responsibilities to one company all at once. Incremental involvement of the private sector will enable both the private sector and municipality to slowly learn the process and gain confidence. For this:
- Initiate door-to-door collection of waste in order to avoid dumping of waste on the streets.
- Introduce source separated waste collection system to promote recycling.
- Introduce alternate day waste collection system to reduce cost.
- Encourage citizens to participate in waste management system and pay for waste management services.
- Generate revenue to recover part of the cost of waste collection.

### 5.3.4 Educational Program

The solid waste education program should be handled by the professional and technical staff of the environmental health department in the municipality. The assistance and support of people of influence, such as religious leaders, physicians, elected representatives, trade union leaders, and members of chambers of commerce and community centers should also be enlisted.

Posters, publicity leaflets, films and cinema slides and TV ads should be prepared, emphasizing various aspects of keeping the environment clean. Educational leaflets should be distributed to householders, to teachers and children in schools, and to people at their places of work. Talks, lectures and film shows may be given in clubs, youth organizations and schools. At school and college levels, essay and elocution competitions focusing on SWM have to be promoted.

#### a) List of Common Public Communication Activities:

- Use of mass media such as television, radio, and newspaper to disseminate information and send message to residents.
- Campaign in selected areas using specially – equipped motored vehicles.
- Distribution of posters and leaflets throughout the city.
- Meetings and seminars to discuss solid waste management problems with residents.
- Setting up of a special day, week or month to carry out clean-up campaigns and contests.
- Organization of facility site visits for the citizens and school children and
- Assistance in developing a school curriculum on sanitation, waste handling, and public works.

**b) Public Information Division:** The Hassan Municipal Body has to transmit basic information to the public regarding its waste disposal service and expenditure; its schedule of collection pick-up, regarding storage container placement and removal of pickup, arrangement for special collection of bulky wastes and provision for making complaints about the service. Prompt, courteous and efficient handling of public complaints will go a long way in improving public relations.

Functions of the Public Information Division - Collection of information from other divisions of the cleaning department. Translation of such information into easily understandable formulas using various audio – visual media. Dissemination of information to the concerned public through various communication activities. Collection of information regarding people’s attitudes and opinions about solid waste problems and waste handling including complaints – inputs for waste administration. A complaints box service. Evaluation of such information with the personnel in other divisions to improve solid waste management services. Design and conduct of in-house training programs for collection workers and public relations officers on the promotion of public communication activities, and Periodic evaluation of public communication activities to improve the quality of the program.

In the Municipal Authority, there is a statistical Department. This department deals with information collection and dissemination regarding all municipal activities. Since the statistical department cannot usually provide all the resources needed for public communication programs on SWM services, it is advisable to establish a public relations division in the Health Department.
5.4 EFFECTIVE MANAGEMENT INFORMATION SYSTEM AND THE USE OF GEOGRAPHIC INFORMATION SYSTEM

Good management is the key to keep a city clean. This requires collection of critical information which is not just for keeping the records up to-date but used effectively for taking corrective measures as well as proper planning for future. Some information is, therefore, required to be collected to have an overall idea of the prevalent situation, deficiency in the system and likely requirements for the future, information that highlights the day to day deficiency in the system and can be used in taking corrective measures. Computerization of such information helps people at all the levels to work not harder but smarter and increases the level of job satisfaction.

With the advancement of information technology, Geographic Information System (GIS) could be introduced and Management Information System (MIS) may be integrated in this system. Similarly, there is a need for a citizen interface to seek comments, suggestions, and utility services.

Increasing pressures on resources of land, materials and energy by ever increasing population have made SWM a complex problem at the local level. To make a right choice, most suitable for local conditions, to deal effectively and adequately, city planners make efforts to prepare short term and long term solid waste management projects adopting the latest technology within available resources. All such planning needs back-up information.

With changes in the operational environment demanding new systems, new equipment and effective organization, SWM needs to incorporate a development and management cell, with skilled personnel who can develop management information and continuous analysis of the same. This can be achieved by preparing a data collection system in specific formats by classifying and rational sequencing of the activities.
For thorough and hygienic refuse removal and disposal services there are a number of complex activities and disciplines which need consideration such as input of information and continuous analysis of the same. This can be achieved by preparing a data collection system in specific formats by classifying the activities. GIS activities have to be incorporated into the scheme of municipal administration.

SWM activities are spread over many areas. For cohesive and coordinated control, discipline in the functioning of activities of collection, road sweeping, transportation and disposal of waste, could be maintained by a system of daily reports. These items of information can be classified as – (a) refuse generation, (b) refuse collection, and (c) removal and disposal.

(a) Identification of refuse with their quantities and nature is the basis on which the SWM system is founded. The output of refuse is related to the population and quality is related to different activities viz. domestic, commercial and trade. To get a proper representative data of the highly diversified activities and locations, it needs to be sub-divided into zones, administrative wards or divisions and further, street-wise classification covering residential congested, non-congested area, business and market area, low-income slum areas, industrial areas etc. will have to be made.

(b) On the basis of refuse categorization data, proper collection system could be examined by locating storage points, deciding frequency of clearance, routes to be adopted and transportation system to be used.

(c) From the quantitative and qualitative data collected, disposal systems could be devised taking into consideration the land use facilities and financial viability. Data about the comparability of the garbage, total heat value, organic and ash contents, other nutrients and water moisture etc. would enable the SWM to plan and adopt sanitary landfill, composting or heat recovery system of incineration, gas generation etc. as system of treatment for final disposal.
The management information system plays a very important role in monitoring the services. It is essential to monitor whether everyone involved in SWM services is performing his/her duty well, adequate and appropriate vehicles are given to the SWM by the workshop, the vehicles give their optimum output, the repairing and maintenance of vehicles and equipment at the workshop are properly done, the vehicles carrying the waste to the disposal site are optimally utilized, the processing plants are performing well, landfill sites are well managed etc.

5.5 BUDGET FOR SWM

The financial health of the Hassan local body has been studied in detail and it is observed that revenue receipts have not kept pace with the revenue expenditure. The capital expenditure as well as the expenditure on repairs and maintenance has been on the decline whereas the expenditures on service have been fairly constant. It is also observed that there is sharp fall in the revenue surplus. The property tax is the biggest source of local revenue for the Hassan Municipal Council and revenue grants form the largest source of fund comprising mainly from compensation for octroi, share of motor vehicle tax collection, share of entertainment tax and collection of surcharge on stamp duty.

Garbage collection and disposal expenditure often constitutes more than half the municipality’s budget, and the city faces serious environmental degradation and health hazards due to uncollected waste on streets and in public areas, indiscriminately dumped garbage and contamination of air and water resources near unmanaged dumping sites.
5.6 BUILDING ON THE STRENGTHS OF WASTE MANAGEMENT STAKEHOLDERS

5.6.1 Role of Municipal Authorities

Municipal authorities and governmental organizations are at the epicenter of urban waste management as they are ultimately responsible for designing and implementing waste management policy. Important considerations for municipal authorities include (EAWAG/SANDEC, 2003):

- Clear strategies for ensuring appropriate effective organic waste management and recycling (i.e., what combination of systems is appropriate for the city, the budget, the time frame for implementation, etc).

- Strong political will and continuity of waste management policy. The Commissioner/Chief Officer and the Standing Committees should actively promote decentralized composting and be willing to support it at all levels as required.

- Educate and train MSWM personnel and municipal partners as to the advantages of composting and what roles they will play in the operation of an effective and sustainable system.

- Ensure collection of segregated dry waste and keep debris, road dust, drain silt, and commercial waste out of the biodegradable waste stream while stressing recovery and recycling. This can be accomplished through appropriate regulation and enforcement organized with the help of NGOs working with waste pickers and waste buyers.

- Ensure that waste streams consisting predominantly of biodegradable waste (park and garden waste, market waste, eateries, etc) are not mixed with other contaminating waste streams. Enforcement should be easy since these sorts of
establishments all require municipal licenses to operate. Ensure prompt and regular lifting of compost rejects from decentralized composting sites.

- Encourage institutions, companies and citizens to initiate decentralized composting solutions by establishing and staffing a resource centre that can offer sound composting advice.

- Municipalities can offer a buy-back program for locally produced compost to use in its parks, gardens, traffic islands and dividers. This would be an economical way for city gardeners to satisfy their soil amendment requirements and at the same time induce more people to begin composting.

- Assist in researching and promoting the links between waste management, composting and compost use in agriculture.

5.6.2 Role of Citizens and Institutions

Community participation is the key to sustainable and integrated solid waste management. Law enforcement can help to obtain a certain degree of participation, however, enhancing environmental consciousness and promoting awareness of the detrimental effects to public health and the environment is by far more effective in achieving this goal. All members of society should be encouraged to contribute by (Ibid, 2003):

- Stopping littering and indiscriminate dumping of refuse in open spaces, footpaths, lanes, streets, into drainage channels or water bodies.

- Segregating waste at source into a pure biodegradable fraction and non-biodegradable waste.

- Provision of separate individual or communal bins for biodegradable waste in buildings, institutions, companies and residential colonies; these bins have to be emptied regularly and methodically.
• Utilizing compost for gardening and urban farming. Increased awareness and knowledge on compost use and its numerous benefits for soil improvement is a key to increasing market demand and thus encouraging new composting initiatives. Since composting sites can be established at rural-urban boundary regions, villagers can buy and use these compost materials on their farms with comparatively less transport costs.

5.6.3 Role of the Composter

Those charged with operating and maintaining composting facilities (e.g. individuals, households or entrepreneurs) represent the front lines of composting schemes and have much to do with ensuring their success. Specific demands of this important role include (Ibid, 2003):

• Composting organic waste based on sound application of the science of composting, ensuring production of a quality product while minimizing environmental impacts (such as odor, leachate, and dumping of waste rejects).

• Meeting quality standards for compost as set by the relevant national or state authorities concerned, especially that which is being produced for sale to agricultural users.

• Sharing expertise with others in the community, informally or formally through professional associations or federations.

• Assisting in raising awareness of the merits of composting in communities and participating in building stronger markets for locally produced compost product.

5.6.4 Role of NGOs

NGOs can play a significant role in promoting decentralized composting solutions. Their strengths lie in their close contact with residents and community structures, which make
the delivery of educational and training programs more effective. Their role, in cooperation with municipal authorities, can be to:

- Initiate awareness building campaigns with regard to waste segregation, recycling and reuse.

- Initiate and support decentralized composting efforts with technical and methodological advice.

- Assist in creating market demand for compost through promoting the linkages to organic farming and gardening.

5.6.5 Waste Concern Initiative

Due to increasing lack of job opportunities, many urban poor of Hassan city are gradually getting involved in the recovery process of inorganic recyclable materials from waste with economic value for their living. There are quite a few, who are engaged in waste disposal and environmental conservation services. There is a need for local government and community institutions to collaborate to improve urban management and the lot of waste disposal personnel.

5.6.7 Role of the International Community and Development Assistance Providers

With a view to spread the message of development and improved municipal management all over the world; it is advisable for the advanced countries to adopt research and development institutions such as Department of Water and Sanitation in Developing Countries - Switzerland may have a more global perspective and formal expertise than most Indian municipalities. International Institutions can very well play a number of important roles, including (Ibid, 2003):

- Building network among partners and stakeholders.
• Providing sound technical and logistical advice, know-how and capacity building opportunities.

• Providing a range of development assistance mechanisms, in cooperation with other programs and donors.

When economic, social and environmental benefits are all taken into account, decentralized composting solutions are certainly a viable waste management option and a self-sustaining means of transforming waste into a beneficial soil conditioner.

Table 5.1: Decentralized Composting – ‘Troubleshooter’

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Insufficient market demand for compost</td>
<td>1. Create and sustain a market for compost</td>
</tr>
<tr>
<td>• Skepticism and lack of awareness</td>
<td>• Devise a contextually appropriate marketing strategy. Villages immediately surrounding cities and towns can easily access compost manure with comparatively low transport costs and less logistic organization. And every urban centre has quite a number of villages surrounding</td>
</tr>
<tr>
<td>• Competition from chemical fertilizers</td>
<td>• Set-up demonstration projects and offer free samples</td>
</tr>
<tr>
<td>• Far distance to market (farmers)</td>
<td>• Integrate vermiculture into composting</td>
</tr>
<tr>
<td>2. Contaminated feedstock</td>
<td>• Set certifiable quality standards</td>
</tr>
<tr>
<td>• Inorganic contaminants, such as heavy metals plastics and glass shards, entering the production cycle</td>
<td>• Integrate with existing market and distribution networks</td>
</tr>
<tr>
<td>2. Separate waste at source</td>
<td>• Shift subsidies towards organic fertilizers</td>
</tr>
<tr>
<td></td>
<td>• Collect and contain industrial waste streams separately from street sweeping wastes, market waste and household waste</td>
</tr>
<tr>
<td></td>
<td>• Building debris and road debris can be used for land reclamation. This reclamation should keep in view the need to upgrade the state of water bodies and</td>
</tr>
<tr>
<td>3. Insufficient knowledge or technical expertise</td>
<td>3. Form composter networks and associations</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>- Trepidation prevents those yet to acquire the necessary skills from initiating compost schemes</td>
<td>- Creating networks between competent composters (public organizations, private entrepreneurs and NGOs) and those institutions and individuals eager to learn more can vastly improve the quality and quantity of compost production.</td>
</tr>
<tr>
<td>- Those with limited knowledge produce a low-quality compost that is less marketable and could be contaminated</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Community lacks commitment</th>
<th>4. Generate awareness, understanding and enthusiasm</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Lack of awareness, understanding and enthusiasm</td>
<td>- Explain and promote the economic, social and environmental benefits of decentralized composting schemes.</td>
</tr>
<tr>
<td>- NIMBY syndrome (Not in My Backyard)</td>
<td>- Offer support to composters conceptually and financially that is accessible, applicable and consistent</td>
</tr>
<tr>
<td></td>
<td>- Select appropriate sites for community composting schemes</td>
</tr>
<tr>
<td></td>
<td>- Integrate all stakeholders into planning, design and implementation of a municipal waste management program</td>
</tr>
</tbody>
</table>

5.7 REGULATORY LEGAL MEASURES, CONSTITUTIONAL AND STATUTORY PROVISIONS

5.7.1 Government Policies on SWM

With a fast growing population in the city of Hassan, current institutions are unable to provide an adequate level of services. The result is that piles of rubbish are left to rot in streets, presenting a particular health risk to children who often play close by.

a) SWM – still a low priority in Hassan: The MSW Rules, 2000, were to be implemented in letter and spirit. This timelines was expected to create a sense of urgency among municipalities to implement the various provisions of the rules in a timely fashion. But even after a three-year grace period SWM has a low priority. This is evident from the following:

- There has been no departmental restructuring to streamline SWM functions. In Hassan, there had been no internal capacity building to develop requisite skills to implement these rules.

- SWM appears, from general discussion with municipal officials and lower level staff, that there is no clear cut delegation of roles and responsibilities.

- It seems that there is no sufficient provision for budgetary allocations to perform solid waste functions.

- A medium city like Hassan is still not been able to implement the rules within the given time frame.

By the end of the 1990s a committee constituted by the Supreme Court of India was established to look into all aspects of SWM in the Class 1 cities of India and to submit appropriate recommendations for improvement. On the basis of these recommendations, National Legislation was passed by Parliament in the form of the “Municipal Solid Waste (Management & Handling) Rules” in the year 2000. These rules compel municipal authorities to develop a solid waste management system and
to provide appropriate sites for the controlled, sustainable disposal and separate
treatment of organic and inorganic wastes.

b) **Vision**: A sustainable city’s community seeks a better quality of life for current and
future residents by maintaining nature’s endowments to function over time. It
minimizes waste, prevents pollution, promotes efficiency, and develops resources to
revitalize local economies. The waste management system is a component of the
infrastructure of a sustainable community. Therefore, solid waste will be managed by
technologies and methods that support sustainable communities and environments.
The solid waste hierarchy, with its associated goal of protecting the land, air, water,
and other natural resources and the public health, is central to attaining the objectives
of sustainability and solid waste management.

### 5.7.2 Earlier Guidelines for Solid Waste Management

Environmentally sound management of wastes means ‘taking all practicable steps to
ensure that wastes are managed in a manner which will protect human health and the
environment against the adverse effects of such wastes’.

The Ministry of Environment and Forests has notified the Municipal (Waste Management
& Handling) Rules 1999, which for the first time fixes responsibility on municipal
authorities in various cities for disposing garbage within their jurisdiction. These rules
was for the first time set parameters for the collection, segregation, storage,
transportation, processing and disposal of municipal solid waste. A comprehensive set of
rules has been brought out to streamline the disposal of garbage and to place
responsibility on Authorities.

Among the highlights of the rules is (Deccan Herald, 29th Sep. 1999, p.3):

- The provision for prohibition of littering of municipal solid waste in urban
  areas notified by the government. The municipal authorities will notify the
waste collection schedule and likely method to be adopted for public benefit in a city or town.

- Under the rules, the municipal authorities will organize awareness programs to involve the local community for segregated collection of waste and will also encourage recycling/re-use of segregated material.

- Every municipal authority will within its territorial area, be responsible for the implementation of provisions of the rules, and for any infrastructure development for the collection, storage, segregation, transportation, processing and disposal of municipal solid wastes.

- Under the rules, citizens are even empowered to go to court against municipal authorities for not implementing the rules.

- According to the rules, the municipal authorities in all cities and towns will have to set up suitable composting facilities to make use of waste by December 31, 2000 or earlier.

- Cities with a population of more than 1 millions will have to monitor disposal facilities set up to meet prescribed standards, once in every few months or a year. Those with a population of 0.10 to 1 million will have to monitor once in six months or a year.

- The rules set a deadline for December 31, 2001 (or earlier) for all cities for the improvement of existing landfill sites as per existing provisions or rules. The municipal authorities in all cities will also have to identify landfill sites for future use by 2001 or earlier.
• The municipal authorities will furnish an annual report to the District Magistrate or the Deputy Commissioner who will send the report to the State Pollution Control Board.

• The District Magistrate or the Deputy Commissioner of the concerned district will have the powers to enforce the rules.

In India, the regulations for the Prevention and Control of Pollution of Water and Air were enacted in 1974 and 1981, respectively. No such control measures were taken for solid wastes till 1989, when rules were framed for handling and control of solid wastes, including hazardous material. The Environment (Protection) Act, which was passed in May 1986, specifically defines hazardous substances as a regulatory criterion to separate them from ordinary pollutants. Since it is primarily an enabling statute, the Environment Act has to be followed by considerable rule making activity and setting up of implementing machinery.

Basic changes in the existing law may be required to make the local authorities ensure scientific and hygienic treatment and disposal of wastes. The law at present emphasizes only the storage at generation points, collection there from, and transportation to the disposal venues, it is silent on the nature of final disposal. The law is not sufficiently compelling in respect of penalties for throwing rubbish indiscriminately by the households. The law does not cover the whole of domestic, commercial, agricultural and industrial wastes. There would thus appear a need for separate, comprehensive law dealing with solid wastes management, or at least a codification of the required provisions in municipal law. Such a law could cover the entire waste management system at the local level, responsibilities and role of the Local Bodies as well as the State Government, people’s participation, rights and obligations of trade and industry, finance, institutional arrangements for training, research, data collection and dissemination.

The basic requirements of solid wastes disposal could be stipulated in legislation to conserve urban living environment. The “Waste Disposal Authorities” should have the
power to issue bylaws regulating details of the local waste disposal scheme, such as the use, size, and type of containers, fees for the service and its frequency. They should be in a position to decide which waste can be accepted for municipal waste disposal. The duty of the local authorities should be limited to municipal wastes disposal, including the wastes of small shops and enterprises, and market-generated waste.

The waste generated on a large scale by relatively bigger hotels, hostels and such other establishments has to be disposed of at the municipal dumpsites at the city outskirts by the establishments themselves respectively. Hospital wastes have to be disposed of and incinerated separately.

**Legal Aspects** - The existing laws have failed to be enforced fully in Hassan. For ensuring an appropriate SWM system in the city, the following recommendations have to be incorporated in the laws and byelaws.

**Legal Provisions** - (Report of the Committee Constituted by The Hon. Supreme Court of India, 1999, p. 151)

1. **Duty of households for the storage of solid waste at source of generation**: it shall be incumbent on the households to keep receptacles of a size adequate for the storage of all types of solid waste including food wastes, dust, ashes, refuse, rubbish etc. generated at the said premises.

2. **Duty of households to segregate recyclable non-bio-degradable waste at source**: it shall be incumbent on the households of any premises to segregate the recyclable waste generated at the said premises and keep in a separate receptacle.

3. **Duty of Societies/Associations/Management to provide community bins**: it shall be incumbent on all the Co-operative Societies/associations/management of the residential/commercial complexes, institutional buildings, markets etc. to provide community bin/bins of the appropriate size not exceeding 100-litre capacity for the temporary storage of waste generated at the premises including...
households, shops, establishments, offices etc. in their personal domestic, trade, institutional bin etc. for its primary collection by the municipal authorities.

4. **Receptacles to be kept in good repair**: such receptacles shall at all times be kept in good repair and condition and shall be provided in such numbers and places as may be considered adequate and appropriate to contain the waste produced by the households/shops/establishments supposed to be served by the community bin.

5. **Duty of households to deposit solid waste in the community bins**: it shall be incumbent on the occupiers of all the premises for whom community bins have been provided as per 3 above, to cause all domestic waste, trade waste, institutional waste, dust, ashes, refuse, rubbish etc. to be deposited from their respective premises in the community bins.

6. **Duty of Local Body to provide bulk Community Waste Storage Facility in the city**: it shall be binding on all the Municipal Corporations in the State to make adequate provision for bulk community waste storage facilities (temporary waste storage depots) in the city and maintain them hygienically.

7. **Duty of households/shops/establishment to hand over the recyclable material/non bio-degradable waste to the waste pickers/waste purchasers/recyclers etc**: It shall be incumbent on the households/shops/establishments to hand over the recyclable waste/Non-bio-degradable waste to the rag pickers/waste purchasers/recyclers as may be directed by the local body from time to time. Such waste shall not be disposed of along with the organic waste or mixed with other municipal waste.

8. **Duty of Urban Local Body (ULB) to collect waste from community bins and to deposit it at Bulk Community Waste Storage Sites**: It shall be incumbent for ULBs to remove all the solid waste deposited in community bins on a daily
basis and deposit it at the Bank Community Waste Storage sites (temporary waste storage depots) identified in the city.

9. **Duty of all ULBs to clean all the public streets and open public spaces, slums etc:** - It shall be incumbent on all ULBs to arrange for clearing of all the public sector, open public spaces and slums on all the days of the year including Sundays and public holidays, subject however to adherence to the provisions of the Labor Laws governing the employees of the ULBs.

10. **Prohibition against littering the street and deposit of solid waste:** - No person shall litter public streets or public places or deposit or cause or permit to be deposited or thrown upon or along any public street, public place, land belonging to the local body or any unoccupied land or on the bank of a water-course any solid waste except in the receptacles specified above.

11. **Prohibition against deposition of building rubbish:** - No person shall deposit or cause or permit to be deposited any building rubbish in or along any street, public place or land except in conformity with the conditions of prior permission which shall be given, under an advance payment of a fee for the removal by the employees or contractors of the Local Bodies of such rubbish which has been made in accordance with such rates as may be determined by the Municipality from time to time. Provided further that if the officer authorized by the Municipality thinks fit, he may, for reasons to be recorded, refuse to give such permission.

12. **Prohibition against flow of filthy matters on public places etc:** - No owner or occupier of any building or land, shall allow any filthy matter to flow, soak or be thrown there from, or keep or suffer to be kept therein or thereupon, anything so as to be or become a nuisance to any person, or negligently suffer any receptacle or place for the deposit of filthy matter or rubbish on his premises to be in such a state as to be offensive or injurious to health. No person shall deposit the skin or
otherwise dispose of the carcass of any dead animal at a place not provided or appointed for this purpose.

13. **Punishment for littering on streets and depositing or throwing any solid waste in contravention of the provision of this chapter**: - Whosoever litters the street/public places or deposits or throws or causes or permits to be deposited or thrown any solid waste or construction debris at any place in contravention of the provisions of this chapter or permits flow of any filthy matters from his premises shall be punished with fine as may be prescribed under the rules framed by the State Government from time to time by the officer authorized by the Municipal Commissioner not below the rank of sanitary inspector. The amount of fine imposed shall be recoverable as arrears of property taxes.

**5.7.3 Ministry of Environment and Forests, Notification, New Delhi, the 25th September, 2000 S.O. 908(E). -**

Whereas the draft of the Municipal Solid Wastes (Management and Handling) Rules, 1999 were published under the notification of the Government of India in the Ministry of Environment and Forests number S.O. 783(E), dated, the 27th September, 1999 in the Gazette of India, Part II, Section 3, Sub-section (ii) of the same date inviting objections and suggestions from the persons likely to be affected thereby, before the expiry of the period of sixty days from the date on which the copies of the Gazette containing the said notification are made available to the public;

Now, therefore, in exercise of the powers conferred by section 3, 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby makes the following rules to regulate the management and handling of the municipal solid wastes.
1. Short title and commencement:-

1. These rules may be called the Municipal Solid Wastes (Management and Handling) Rules, 2000.
2. Save as otherwise provided in these rules, they shall come into force on the date of their publication in the Official Gazette.

2. Application:- These rules shall apply to every municipal authority responsible for collection, segregation, storage, transportation, processing and disposal of municipal solid wastes.

3. Responsibility of Municipal Authority:-

1. Every municipal authority shall, within the territorial area of the municipality, be responsible for the implementation of the provisions of these rules, and for any infrastructure development for collection, storage, segregation, transportation, processing and disposal of municipal solid wastes.
2. The municipal authority or an operator of a facility shall make an application in Form-I, for grant of authorization for setting up waste processing and disposal facility including landfills from the State Board or the Committee in order to comply with the implementation program laid down in Schedule I.
3. The municipal authority shall comply with these rules as per the implementation schedule laid down in Schedule I.
4. The municipal authority shall furnish its annual report in Form-II,-
   a. to the Secretary-incharge of the Department of Urban Development of the concerned State or as the case may be of the Union territory, in case of a metropolitan city; or
   b. to the District Magistrate or the Deputy Commissioner concerned in case of all other towns and cities, with a copy to the State Board or the Committee on or before the 30th day of June every year.
4. Responsibility of the State Government and the Union territory Administrations:-

(1) The Secretary-in-charge of the Department of Urban Development of the concerned State or the Union territory, as the case may be, shall have the overall responsibility for the enforcement of the provisions of these rules in the metropolitan cities.

(2) The District Magistrate or the Deputy Commissioner of the concerned district shall have the overall responsibility for the enforcement of the provisions of these rules within the territorial limits of their jurisdiction.

5. Responsibility of the Central Pollution Control Board and the State Board or the Committees:-

1. The State Board or the Committee shall monitor the compliance of the standards regarding ground water, ambient air, leachate quality and the compost quality including incineration standards as specified under Schedules II, III and IV.

2. The State Board or the Committee, after the receipt of application from the municipal authority or the operator of a facility in Form I, for grant of authorization for setting up waste processing and disposal facility including landfills, shall examine the proposal taking into consideration the views of other agencies like the State Urban Development Department, the Town and Country Planning Department, Air Port or Air Base Authority, the Ground Water Board or any such other agency prior to issuing the authorization.

3. The State Board or the Committee shall issue the authorization in Form-III to the municipal authority or an operator of a facility within forty-five days stipulating compliance criteria and standards as specified in Schedules II, III and IV including such other conditions, as may be necessary.

4. The authorization shall be valid for a given period and after the validity is over, a fresh authorization shall be required.

5. The Central Pollution Control Board shall co-ordinate with the State Boards and the Committees with particular reference to implementation and review of standards and guidelines and compilation of monitoring data.
6. Management of municipal solid wastes:-

1. Any municipal solid waste generated in a city or a town, shall be managed and handled in accordance with the compliance criteria and the procedure laid down in Schedule-II.

2. The waste processing and disposal facilities to be set up by the municipal authority on their own or through an operator of a facility shall meet the specifications and standards as specified in Schedules III and IV.

7. Annual Reports:-

1. The State Boards and the Committees shall prepare and submit to the Central Pollution Control Board an annual report with regard to the implementation of these rules by the 15th of September every year in Form-IV.

2. The Central Pollution Control Board shall prepare the consolidated annual review report on management of municipal solid wastes and forward it to the Central Government along with its recommendations before the 15th of December every year.

8. Accident Reporting:- When an accident occurs during the course of any municipal solid wastes collection, segregation, storage, processing, treatment and disposal facility or landfill site or during the transportation of such wastes, the municipal authority shall forthwith report the accident in Form-V to the Secretary in-charge of the Urban Development Department in metropolitan cities, and to District Collector or Deputy Commissioner in all other cases.
### Schedule I
[see Rules 4(2) and (3)]

#### Implementation Schedule

<table>
<thead>
<tr>
<th>Serial No.</th>
<th>Compliance Criteria</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Setting up of waste processing and disposal facilities</td>
<td>By 31.12.2003 or earlier</td>
</tr>
<tr>
<td>2.</td>
<td>Monitoring the performance of waste processing and disposal facilities</td>
<td>Once in six months</td>
</tr>
<tr>
<td>3.</td>
<td>Improvement of existing landfill sites as per provisions of these rules</td>
<td>By 31.12.2001 or earlier</td>
</tr>
<tr>
<td>4.</td>
<td>Identification of landfill sites for future use and making site(s) ready for operation</td>
<td>By 31.12.2002 or earlier</td>
</tr>
</tbody>
</table>

### Schedule -II
[see rules 6(1) and (3), 7(1)]

#### Management of Municipal Solid Wastes

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Parameters</th>
<th>Compliance criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Collection of municipal solid wastes</td>
<td>1. Littering of municipal solid waste shall be prohibited in cities, towns and in urban areas notified by the State Governments. To prohibit littering and facilitate compliance, the following steps shall be taken by the municipal authority, namely:-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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);</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii. Devising collection of waste from slums and squatter</td>
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</tbody>
</table>
areas or localities including hotels, restaurants, office complexes and commercial areas;

iii. Wastes from slaughter houses, meat and fish markets, fruits and vegetable markets, which are biodegradable in nature, shall be managed to make use of such wastes;

iv. Bio-medical wastes and industrial wastes shall not be mixed with municipal solid wastes and such wastes shall follow the rules separately specified for the purpose;

v. Collected waste from residential and other areas shall be transferred to community bin by hand-driven containerized carts or other small vehicles;

vi. Horticultural and construction or demolition wastes** or debris shall be separately collected and disposed off following proper norms. Similarly, wastes generated at dairies shall be regulated in accordance with the State laws;

vii. Waste (garbage, dry leaves) shall not be burnt;

viii. Stray animals shall not be allowed to move around waste storage facilities or at any other place in the city or town and shall be managed in accordance with the State laws.

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

3. 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 notified by the municipal authority as per Para 1(2) of this Schedule.

2. **Segregation of municipal solid wastes**

In order to encourage the citizens, municipal authority shall organize awareness programs for segregation of wastes and shall promote recycling or reuse of segregated materials.

The municipal authority shall undertake phased program to ensure community participation in waste segregation. For this purpose, regular meetings at quarterly intervals shall be arranged by the municipal authorities with representatives of local resident welfare associations and non-governmental organizations.
3. **Storage of municipal solid wastes**

Municipal authorities shall establish and maintain storage facilities in such a manner as they do not create unhygienic and insanitary conditions around it. Following criteria shall be taken into account while establishing and maintaining storage facilities, namely:

- **i.** Storage facilities shall be created and established by taking into account quantities of waste generation in a given area and the population densities. A storage facility shall be so placed that it is accessible to users;

- **iii.** Storage facilities to be set up by municipal authorities or any other agency shall be so designed that wastes stored are not exposed to open atmosphere and shall be aesthetically acceptable and user-friendly;

- **iv.** Storage facilities or ‘bins’ shall have ‘easy to operate’ design for handling, transfer and transportation of waste. Bins for storage of bio-degradable wastes shall be painted green, those for storage of recyclable wastes shall be painted white and those for storage of other wastes shall be painted black;

- **v.** Manual handling of waste shall be prohibited. If unavoidable due to constraints, manual handling shall be carried out under proper precaution with due care for safety of workers; they may be provided with safety hand gloves and boots.

4. **Transportation of municipal solid wastes**

Vehicles used for transportation of wastes shall be covered. Waste should not be visible to public, nor exposed to open environment preventing their scattering. The following criteria shall be met, namely:

- **i.** The storage facilities set up by municipal authorities shall be daily attended for clearing of wastes. The bins or containers wherever placed shall be cleaned before they start overflowing;

- **ii.** Transportation vehicles shall be so designed that multiple handling of wastes, prior to final disposal, is
### Processing of municipal solid wastes

Municipal authorities shall adopt suitable technology or combination of such technologies to make use of wastes so as to minimize burden on landfill. Following criteria shall be adopted, namely:-

(i) The biodegradable wastes shall be processed by composting, vermicomposting, anaerobic digestion or any other appropriate biological processing for stabilization of wastes. It shall be ensured that compost or any other end product shall comply with standards as specified in Schedule-IV;

(ii) Mixed waste containing recoverable resources shall follow the route of recycling. Incineration with or without energy recovery including pelletisation can also be used for processing wastes in specific cases. Municipal authority or the operator of a facility wishing to use other state-of-the-art technologies shall approach the Central Pollution Control Board to get the standards laid down before applying for grant of authorization.

### Disposal of municipal solid wastes

Land filling shall be restricted to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing. Land filling shall also be carried out for residues of waste processing facilities as well as pre-processing rejects from waste processing facilities. Land filling of mixed waste shall be avoided unless the same is found unsuitable for waste processing. Under unavoidable circumstances or till installation of alternate facilities, land-filling shall be done following proper norms. Landfill sites shall meet the specifications as given in Schedule –III.

*Installing of central bins is becoming discouraged increasingly. These central garbage bins are a nuisance to the neighboring households and citizens.

**Demolition debris can be used for land reclamation methodically keeping in view the need for topographical preservation of rain water flow routes.
Schedule III

[see rules 6(1) and (3), 7(2)]

Specifications for Landfill Sites

(a) **Site Selection**

1. In areas falling under the jurisdiction of ‘Development Authorities’ it shall be the responsibility of such Development Authorities to identify the landfill sites and hand over the sites to the concerned municipal authority for development, operation and maintenance. Elsewhere, this responsibility shall lie with the concerned municipal authority.

2. Selection of landfill sites shall be based on examination of environmental issues. The Department of Urban Development of the State or the Union territory shall co-ordinate with the concerned organizations for obtaining the necessary approvals and clearances.

3. The landfill site shall be planned and designed with proper documentation of a phased construction plan as well as a closure plan.

4. The landfill sites shall be selected to make use of nearby wastes processing facility. Otherwise, wastes processing facility shall be planned as an integral part of the landfill site.

5. The existing landfill sites which continue to be used for more than five years, shall be improved in accordance of the specifications given in this Schedule.

6. Biomedical wastes shall be disposed of in accordance with the Bio-medical Wastes (Management and Handling) Rules, 1998 and hazardous wastes shall be managed in accordance with the Hazardous Wastes (Management and Handling) Rules, 1989, as amended from time to time.

7. The landfill site shall be large enough to last for 20-25 years.

8. The landfill site shall be away from habitation clusters, forest areas, water bodies, monuments, National Parks, Wetlands and places of important cultural, historical or religious interest. Using construction debris and such other waste for the purpose of landfilling, should ensure the upgradation of existing and future water
boidies. Natural rain water flows must not be diverted away from the existing water holes ad lakes in the name of urban development.

9. A buffer zone of no-development shall be maintained around landfill site and shall be incorporated in the Town Planning Department’s land-use plans. This buffer zone can be kept intact by raising urban forests in them.

10. Landfill site shall be away from airport including airbase. Necessary approval of airport or airbase authorities prior to the setting up of the landfill site shall be obtained in cases where the site is to be located within 20 km of an airport or airbase.

(b) **Facilities at the Site**

11. Landfill site shall be fenced or hedged and provided with proper gate to monitor incoming vehicles or other modes of transportation.

12. The landfill site shall be well protected to prevent entry of unauthorized persons and stray animals.

13. Approach and other internal roads for free movement of vehicles and other machinery shall exist at the landfill site.

14. The landfill site shall have wastes inspection facility to monitor wastes brought in for landfill, office facility for record keeping and shelter for keeping equipment and machinery including pollution monitoring equipments.

15. Provisions like weigh bridge to measure quantity of waste brought at landfill site, fire protection equipments and other facilities as may be required shall be provided.

16. Utilities such as drinking water (preferably bathing facilities for workers) and lighting arrangements for easy landfill operations when carried out in night hours shall be provided.

17. Safety provisions including health inspections of workers at landfill site shall be periodically made.

(c) **Specifications for land filling**
18. Wastes subjected to land filling shall be compacted in thin layers using landfill compactors to achieve high density of the wastes. In high rainfall areas where heavy compactors cannot be used alternative measures shall be adopted.

19. Wastes shall be covered immediately or at the end of each working day with minimum 10 cm of soil, inert debris or construction material till such time waste processing facilities for composting or recycling or energy recovery are set up as per Schedule I.

20. Prior to the commencement of monsoon season, an intermediate cover of 40-65 cm thickness of soil shall be placed on the landfill with proper compaction and grading to prevent infiltration during monsoon. Proper drainage berms shall be constructed to divert run-off away from the active cell of the landfill.

21. After completion of landfill, a final cover shall be designed to minimize infiltration and erosion. The final cover shall meet the following specifications, namely:

   a. The final cover shall have a barrier soil layer comprising of 60 cms of clay or amended soil with permeability coefficient less that $1 \times 10^{-7}$ cm/sec.
   b. On top of the barrier soil layer there shall be a drainage layer of 15 cm.
   c. On top of the drainage layer there shall be a vegetative layer of 45 cm to support natural plant growth and to minimize erosion.

(d) **Pollution prevention**

22. In order to prevent pollution problems from landfill operations, the following provisions shall be made, namely:

   a. Diversion of storm water drains to minimize leachate generation and prevent pollution of surface water and also for avoiding flooding and creation of marshy conditions;
   b. Construction of a non-permeable lining system at the base and walls of waste disposal area. For landfill receiving residues of waste processing facilities or mixed waste or waste having contamination of hazardous materials (such as
aerosols, bleaches, polishes, batteries, waste oils, paint products and pesticides) minimum liner specifications shall be a composite barrier having 1.5 mm high density polyethylene (HDPE) geomembrane, or equivalent, overlying 90 cm of soil (clay or amended soil) having permeability coefficient not greater than 1 x 10^-7 cm/sec. The highest level of water table shall be at least two meter below the base of clay or amended soil barrier layer;
c. Provisions for management of leachates collection and treatment shall be made. The treated leachates shall meet the standards specified in Schedule-IV;
d. Prevention of run-off from landfill area entering any stream, river, lake or pond.

(e) **Water Quality Monitoring**

23. Before establishing any landfill site, baseline data of ground water quality in the area shall be collected and kept in record for future reference. The ground water quality within 50 metres of the periphery of landfill site shall be periodically monitored to ensure that the ground water is not contaminated beyond acceptable limit as decided by the Ground Water Board or the State Board or the Committee. Such monitoring shall be carried out to cover different seasons in a year that is, summer, monsoon and post-monsoon period.

24. Usage of groundwater in and around landfill sites for any purpose (including drinking and irrigation) is to be considered after ensuring its quality.

25. **Ambient Air Quality Monitoring**.

26. Installation of landfill gas control system including gas collection system shall be made at landfill site to minimize odor generation, prevent off-site migration of gases and to protect vegetation planted on the rehabilitated landfill surface.

27. The concentration of methane gas generated at landfill site shall not exceed 25 per cent of the lower explosive limit (LEL).

28. The landfill gas from the collection facility at a landfill site shall be utilized for either direct thermal applications or power generation, as per viability. Otherwise, landfill gas shall be burnt (flared) and shall not be allowed to directly escape to
the atmosphere or for illegal tapping. Passive venting shall be allowed if its utilization or flaring is not possible.

29. Ambient air quality at the landfill site and at the vicinity shall be monitored.

30. The ambient air quality monitoring shall be carried out by the concerned authority as per the following schedule, namely:-

(a) Six times in a year for cities having population of more than fifty lakhs;

(b) Four times in a year for cities having population between ten and fifty lakhs;

(c) Two times in a year for town or cities having population between one and ten lakhs.

30. (f) Plantation at Landfill Site

30. A vegetative cover shall be provided over the completed site in accordance with the and following specifications, namely :-

(a) Selection of locally adopted non-edible perennial plants that are resistant to drought and extreme temperatures shall be allowed to grow;

(b) The plants grown be such that their roots do not penetrate more than 30 cms. This condition shall apply till the landfill is stabilised;

(c) Selected plants shall have ability to thrive on low-nutrient soil with minimum nutrient addition (planting of trees that may contribute to detoxify soil in landfill sites is desirable; this can be chosen after due consultation with forest and horticulture authorities);

(d) Plantation to be made in sufficient density to minimize soil erosion.

30. (g) Closure of Landfill Site and Post-care

31. The post-closure care of landfill site shall be conducted for at least fifteen years and long term monitoring or care plan shall consist of the following, namely :-
(a) Maintaining the integrity and effectiveness of final cover, making repairs and preventing run-on and run-off from eroding or otherwise damaging the final cover;

(b) Monitoring leachate collection system in accordance with the requirement;

(c) Monitoring of ground water in accordance with requirements and maintaining ground water quality;

(d) Maintaining and operating the landfill gas collection system to meet the standards.

32. Use of closed landfill sites after fifteen years of post-closure monitoring can be considered for human settlement or otherwise only after ensuring that gaseous and leachate analysis comply with the specified standards.

Schedule IV

[see rules 6(1) and (3), 7(2)]

Standards for Composting and Treated Leachates

The waste processing or disposal facilities shall include composting, incineration, pelletisation, energy recovery or any other facility based on state-of-the-art technology duly approved by the Central Pollution Control Board

1. In case of engagement of private agency by the municipal authority, a specific agreement between the municipal authority and the private agency shall be made particularly, for supply of solid waste and other relevant terms and conditions.

2. In order to prevent pollution problems from compost plant and other processing facilities, the following shall be complied with, namely :-

   a) The incoming wastes at site shall be maintained prior to further processing. To the extent possible, the waste storage area should be covered. If, such storage is done in an open area, it shall be provided with impermeable base with facility for
collection of leachate and surface water run-off into lined drains leading to a leachate treatment and disposal facility;

b) Necessary precautions shall be taken to minimise nuisance of odour, flies, rodents, bird menace and fire hazard;

c) In case of breakdown or maintenance of plant, waste intake shall be stopped and arrangements be worked out for diversion of wastes to the landfill site;

d) Pre-process and post-process rejects shall be removed from the processing facility on regular basis and shall not be allowed to pile at the site. Recyclables shall be routed through appropriate vendors. The non-recyclables shall be sent for well designed landfill site(s).

e) In case of compost plant, the windrow area shall be provided with impermeable base. Such a base shall be made of concrete or compacted clay, 50 cm thick, having permeability coefficient less than $10^{-7}$ cm/sec. The base shall be provided with 1 to 2 per cent slope and circled by lined drains for collection of leachate or surface run-off;

f) Ambient air quality monitoring shall be regularly carried out particularly for checking odour nuisance at down-wind direction on the boundary of processing plant.

5.8 PLANNING FOR SWM SYSTEM

Based on this study, proper planning of a SWM system can considerably improve the efficiency and cost-effectiveness of the system employed. A plan for a future SWM system needs to be formulated as the population, land use and road and traffic conditions, financial conditions of the city, the life-style of the people, and the availability of labor and equipment will change in course of time.

- In the first phase of a planning process, the factors affecting the design of a SWM system at present are studied and the trends are projected for the future. The key parameters determined during this phase include the population of the city and its spatial distribution, land use, potential waste disposal sites, road...
widths and pavement coverage, quantities and characteristics of waste generated, and available labor and equipment and estimated wages and costs.

- In the next planning phase, the design parameters of each functional element are determined. The determination process is often iterative, based on trial-and-error estimations of parameters. This is particularly true for the design of the collection system in which such parameters as collection zones, type and quantity to be collected, frequency of collection, mode of collection system, location of collection, on-site storage capacity, the type, and numbers of containers and vehicles required, collection of routes, the number of trips made by each vehicle, the necessity and number of transfer stations required, the type and number of workers, and the area coverage of collection service, are determined.

- Once the design parameters are determined, the financial needs of the planned system is examined. If not feasible, the system design must be modified (Ogawa, H. 1989, p. 80).

The required assessments in this direction have to be made as a part of a larger project of study. The planning and design processes in this connection require a large volume of information and technical manpower. The statistical wing of the Hassan Municipality has to be strengthened and its activities must be monitored and their findings should be published regularly.