

Solid Waste Management of Satara City Using Qgis

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ABSTRACT - Besides, The Geographic Information Systems (GIS) is an important tool to optimize decision-making in solid waste management based on the analysis of geo-referenced information collected. The objective of this study was to identify the potential of GIS to implement precision systems on dairy cattle. Fifty articles identified from the consultation of specialized bibliographic databases, under an interpretive exercise, were analyzed; and simple correspondence analysis and cluster analysis, complemented with one-dimensional frequency distributions was used. Grazing optimization, fertilization and irrigation optimization, epidemiological surveillance as well as environmental impact prospecting, were identified as areas of potential use of GIS in precision farming. Waste management is a global environmental issue which concerns a very significant problem in today's world. There is a large amount of disposal of solid waste without proper segregation which leads to both economic and environmental sufferings. It is still practiced in many cities. There is a tremendous amount of loss in terms of environmental degradation, health hazards and economic decline due to direct disposal of waste. Therefore, with the help of GIS in solid waste management this paper would deal with how Geographical Information System can be used as a decision support tool for planning waste management.

A model is designed for the case study area in an Indian city of Satara for the purpose of planning waste management and segregating it successfully. The waste management issues are considered to solve some of the present situation problems like proper allocation and relocation of waste bins, check for unsuitability and proximity convenience due to waste bins to the users, proposal of recyclable waste bins for the required areas and future suggestions. The procedure will be implemented on the Satara city's case study area data for the analysis and the results will suggest some modification in the existing system which is expected to reduce the waste management workload to a certain extent. Due to application of GIS in the area the result will determine how waste can be eliminated or recycled for further use. Hence, proper waste management protocols should be adapted for successful solid waste management without polluting the environment.

Key Words: Solid waste management , geographic information system (GIS) , Satara city .

I. INTRODUCTION

• Satara city:-

The city is located in Satara district, Maharashtra State, India. The city get its name by the seven forts (sat- Tara) around the city. As per 2011 census India, the city had population of 3, 26,079 .



Fig 1 SATARA CITY MAP

- **Songaon Dumping Site :-**

Songaon Dump Site is located around 8 kms from Satara city. 18.82 acre land is available at Songaon site. The quantity of existing waste is around

2, 25,000 cubic meters. Songaon dump site is existing from 1985 and Satara Municipal Corporation have no other land available for Solid Waste Management facility .



Fig 2 Songaon dump site

- **Quantification of MSW in Satara :-**

The residential areas, slums & commercial areas are major source of generation of solid waste. The average per capita generation of solid waste in satara was found to be ranging from 300-400 grams per day based on the varied income level. The waste generated from high income & low income groups was found to be in the order of 400-450 grams & 200-250 grams/day/capita respectively. On an average per capita generation of 300gms/day/capita seems to be realistic to estimate the total waste generation from households .

- **Land Availability for MSW :-**

Presently 7.62 Hectare land is available at songaon site, satara. It will be useful for a period of 20 years for processing and disposal of MSW including management of legacy waste.

- **Water availability for MSW:-**

Presently potable water pipeline is already provided by SMC at site which is suitable for present requirement and can be augmented for future demand.

- **Power availability for MSW:-**

Presently solar street lamps already provided at site by SMC has applied for or electric meter for future requirements of site.

1.1 PROBLEM STATEMENT:-

Satara is a well tourism city. So the city beautification is necessary. The Songaon dump yard is located adjacent to road leading Kaas plateau. At that place all the waste is stored openly. In day and night because of the burning of waste there is less visibility also it creates foul smelling in the area. There is an adverse effect of diseases like malaria, dengue in nearby area. Very few peoples segregate their waste. So the solid waste management in the city is very important because of the above problems in the city.



FIG 3 SONGAON DUMPING SITE

1.2 OBJECTIVE OF THE WORK

- Application of advance tools and techniques for solid waste management.
- Prepare solid waste management plan with use of the QGIS.
- Study and analysis of the present situation of solid waste in Satara city.
- It gives more accurate results as compared with other conventional method.
- Select a site where the greatest protection of environment is provided using the latest techniques of GIS.

1.3 SCOPE OF STUDY

The scope of the work is to use the latest techniques of GIS to select a favorable site for solid waste disposal in urban area like Satara city. The efficiency of the solid waste disposal depends upon selection of proper site and there are several issue that impact for site selection.

II. LITERATURE REVIEW

1. Hatemlah R.I et al (2019) proposed the idea of effective collecting and transporting solid waste management to reduce pollution to the environment. This idea of his reduced cost, time and effort and further reduced harm to the environment. Therefore, the municipal services adopted his idea of transporting and collection of solid waste management and thus the pollution is reduced and the environment is clean in the city of Saudi Arabia.
2. Minghua et al. (2009) stated that in order to increase recycling rates, the government should encourage markets for recycled materials and increasing

professionalism in recycling companies. Other factors mentioned by other scholars are financial support for recycling projects and infrastructures (Nissim et al., 2005), recycling companies in the country, drop-off and buy back centers and organization of the informal sector. Waste management is also affected by the aspects or enabling factors that facilitate the performance of the system.

3. In relation to the pricing for disposal Scheinberg (2011), analyzing the data from “Solid Waste Management in the World’s Cities” Scheinberg et al., 2010, notes that there are indications that high rates of recovery are associated with tipping fees at the disposal site. High disposal pricing has the effect of more recovery of waste generated, that goes to the value chains or beneficial reuse of waste. In relation to recycling Gonzalez-Torre and Adenso-Diaz (2005) reported that social influences, altruistic and regulatory factors are some of the reasons why certain communities develop strong recycling habits.

4. The original computer model was developed as a part of a thesis (Sufian, 2001) and it was constructed using STELLA Research software (HPS, 1996) designed for dynamic feedback modeling of complex systems. Full details are available in Sufian (2001). The model described here is a theoretical framework for examining urban solid waste generation and its management system in Dhaka city and also to assess electrical energy generation potential to meet the electrical energy consumption requirements of Dhaka city. There is a large gap between the waste generation and management system, which results environmental pollution.

III. METHODOLOGY

3.1 WASTE GENERATION :-

TABLE 1. SATARA CITY ANALYSIS

Sr No	Description	Numbers
1	Households	33844
2	Commercial Shops (0 to 500 sq.ft)	4813
3	Commercial Shops (500 to 1000 sq.ft)	1835
4	Commercial Shops (>1000 sq.ft)	33
5	Government Institution	102
6	Schools	77
7	Colleges	12
8	Hotels	37
9	Restaurants	132
10	Banquet Halls	12
11	Large Vegetable Markets	4
12	Hospitals	102

- **No of large markets (VEGETABLES, MEAT AND FISH) :-** There are four major vegetable markets in the city viz. Pratap Singh Market, Phule Market, APMC market yard and Sadar Bazaar market. The only fish market in the city is located near the Phule Market area. The meat shops are all around the city.
- **SLUMS AND OTHER INFORMAL SETTLEMENTS :-** There are total 21 slum settlements in Satara city. The total slum population is 9,513 and number of Households (HHs) is 1,902. Slums are either situated on Municipal land or State Government land. The council has provided individual and public stand posts in the slums. Some households have individual toilets and rest of the slum dwellers access public and community toilets. Few of the slums are either connected by Pucca lined open drainage network or Kuccha drainage network. At few places closed drainage network is also

observed. Very few HHs is having individual toilets.

- **HEALTHCARE ESTABLISHMENTS :-** Satara city has Civil Hospital. Along with this the city has various private hospitals, maternity homes, dispensaries etc. Besides, there are Government Hospitals for T.B. and for Leprosy patients. For mentally challenged people private hospitals are also available in the city. The total number of hospitals in the city is 102 .

3.2 COLLECTION :-

Wet waste collection will be done on daily basis while the dry waste will be collected on alternate day basis. Planning for waste collection from source such as residential, commercial, Institutional etc. The waste segregation at source would be adopted .



FIG 4 WASTE COLLECTION

Physical Characterization of waste was carried out through "quartering coning method". The waste composition data is essential for evaluating feasible technology for treatment .

Following procedure/ steps are followed for collection of samples through this method:

1. Identifying major waste sample collection point considering the population and locations.
2. The sample collection points are selected such that all the type of area such as residential, commercial, industrial, markets (vegetable market, meat/ fish market, mix market etc.) and slums etc. are covered.
3. Sampling points are further identified on the classification based on economic status of the area such as high , middle and low income (slum) group localities .
- 4 . From the identified spots , 10kg of municipal solid waste is collected from outside and inside of the waste collection bins.
5. All the collected samples were heaped at one place and mixed thoroughly.
6. One quarter of this thoroughly mixed heap is taken out and this quarter portion is again thorough mixed and quarter portion of it is taken out.

Doorstep collection - Households

At present , door to door collection system is in practice in all wards , further strengthening of the system is required for improvement . The door to door collection of waste shall be done on day to day basis . The SMC Office shall ensure that infrastructure is made available for undertaking this activity in compliance with MSW Rules 2016. For the door to door collection of waste from households, auto tippers with requisite number of manpower are required for the collection of waste. Each ward is covered by one Auto tipper for regular door-to-door collection, each ward area dwellers shall be notified with general collection timings on various streets within the ward. Exactly on the scheduled time a waste picker along with Auto will arrive at the place pre-notified and ring a specially

designed gong to alert the residents. He will then pick up the waste from individual household and load it in to auto tipper. Separate auto tipper for wet waste and dry waste will be used. Wet waste collection will be done on daily basis while the dry waste will be collected on alternate day basis. Dry waste vehicles will be colour coded with white colour and will be assigned to Different wards on different days of the week in a staggered manner in order to Uver all wards and providing service on alternate day ba sis , This W ensure the seperate collection of the wet and dry waste and maintain separate stream of these Waste leading to the processing facility.

Doorstep collection - Commercial Establishments

A direct and separate collecti on system is recommended f or Large and Medium Hotels , Restaurants , Hostels . Wet waste from these sources should be collected and transported to different propose d d ecentralized facilities suc h as pit compost and Biomethantion plant . Dr y waste should be collected in separate dry waste collecting v ehicle and transported to M aterial Recovery Facility (MRF) proposed at Songoan site .

Collection - Vegetable Market

The vegetable market waste should be collected by existing wet waste container (dumper placer), whereas we proposed another container for dry waste collection

3.3 TRANSPORTATION

Dry waste vehicles will be colour coded with white colour and will be assigned to different wards on different days of the week in a staggered manner in order to cover all wards and providing service on alternate day basis . The waste transportation with requirement of Transfer Station (TS) would be analyzed. The requirement of transportation vehicles and equipment would be calculated as per waste generation and its projection for project design period, i.e. 20 years.

TABLE 2. TRANSPORTATION SYSTEM

SR NO	TYPES OF GENERATOR	TYPES OF VEHICLES
1	Household	Auto tipper
2	Commercial waste	Truck tipper
3	Street sweeping	Tractor trolly
4	Compactor bins and concrete bins	Compactor truck
5	Dumper placer container	Dumper placer

SMC would identify private operator(s) for carrying out this activity. The transportation vehicles and other equipment would be procured by the private

operator (s) who would also be responsible for O&M of the same. The funds required for procurement would be provided by SMC and the duration of service

agreement (between SMC and the private operator) would be co-terminus with the age of the vehicles. The private operator would also be required to make arrangements for parking its vehicles.

3.4 TREATMENT AND PROCESSING

This is inferred from the screening of several technologies as given in above section that following two technologies would be suitable for Satara .

1 . The wet waste quantity 37TPD is around 53 % of total waste (70TPD) . It will be collected from different waste generation sources by collection vehicles , will be diverted strategically for processing at the decentralised Compost pit facility , Boimethanation facility and centralised windrow compost facility .

- Pit Compost processing is proposed in 3 different facilities, it will process total around 3 TPD.
 - Boimethanation plant will process around 2 TPD .
 - Conventional Windrow composting will process around 31 TPD.
- 2 The dry waste quantity 18 . 9TPD is around 27 % of total waste (70 TPD) . It will be collected from different waste generation sources by collection vehicles , will be diverted strategically for processing at the centralised facility prope Songaon site. It will be processed through the MRF facility, como recyclables, plastic to granule making, RDF baling.

Residual and inert waste quantity 14TPD is around 20% of total waste (and off i n the generated from the above waste processing facilities will be disposedom " scientifically design sanitary landfill. The sanitary landfill shall be operato maintained for the active period and will be closed/ capped at the end of the aum period of operation.

• RECYCLABLE WASTE

Presently there is no facility available in the Satara city for treatment of recyclable waste but the waste pickers are picks out recyclable material from dumping site and sells to private recycler vendor.

• BIODEGRADABLE WASTE

The solid waste generated in the city is presently being simply dumped in the dumping site there is no centralized scientific treatment facility. The wet waste from Pratap Singh Bhosale vegetable and fruit market (Mandai) around 300-400 kg per day is treated within the premises of the Mandai. This wet waste is treated by compost pit technique and also getting end product as manure in a small quantity, SMC is getting dedicated wet waste from ward number 18 ; waste is transported to Songaon site and treated in landfill site by convention pit composting method . Apart from this , institutions like Sainik School are also developing compost pit facility .

• NON-BIODEGRADABLE WASTE

There is no facility for processing of Non Biodegradable waste.

• CONSTRUCTION AND DEMOLITION WASTE

The construction and demolition waste comprising mostly of inert and non biodegradable material such as concrete, plaster, metal, wood, plastics etc is being dumped haphazardly and a part of this waste is getting mixed up with the municipal waste. It is also being utilized by local people for plinth filling works .

3.4 DISPOSAL

The waste is transformed into compost pit at the Compost pit facilities is sold to the farmers whereas rest of the waste in the city is dumped in the Songaon dumpsite without any scientific processing. There are waste pickers who pick useful and recyclable materials from the dumped waste at the Songaon dumpsite and there is occasional fire due to high temperature and methane emission from the Biodegradable waste in the dump site. SMC ensure compliance to the SWM rule2016 through daily and intermediate soil cover in order to control the bird menace and fire.

IV. CONCLUSIONS

All possible environment aspects have been adequately assessed and necessary control measures have been formulated to meet statutory requirements. Thus implementing the proposed project will not have any appreciable negative impacts. Moreover, the landfill area requirement will reduce significantly if a major fraction of inert waste is converted into some usable form by innovative technologies like RDF pellet manufacturing or burning in cement kilns or steel furnaces nearby Satara region

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