# Suitable Site Selection for Urban Solid Waste Management using GIS Technique- a Case Study of Dhanbad Block

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***Abstract-****In the recent past few years' growth of population and uncontrolled urbanization has made solid waste management an important issue for Environmental sustainability. In the recent years GIS is one of the powerful tool for suitable site selection for urban solid waste management. Using toposheet map & Landsat TM-5 satellite data for generation of road, water body, river, settlement & land cover map the existing disposal site were located from the distance of road 100mt, river 300mt, settlement 200mt, and water body 200mt. the disposal site were located to Gorbudih, Baludih, Petia, Bhaga Bandh, Shiyalguri, Kantapahari, Kustor, Bhuli, Kurmidih, Patraku and Damodarpur at Dhanbad block. Major suitable site is situated in the southern part of the study area. The selected site for solid waste dumping is 1-1.5 km of the residential area and the area under grass land and open space area.*

***Keyword:*** *GIS Technique, Remote Sensing, TM-5 Satellite Data, Toposheet, Arc GIS, ERDAS, Map Layer, Overlay Analysis, NIMBY.*

## 1. Introduction:

The increasing level of municipal solid waste is, now a days, a serious problem in urban area of the world. Municipal solid waste management is regarded as one of the major problems for city planners, administrators and researchers all over the world (Shah.S.A, et al-2014). Solid waste management issues are one of the global environmental problems at an increasing frequency, as population and consumption growth result in increasing quantities of waste. Solid waste has become a major consequence of economic growth, development and rapid population growth, yet some of the greatest challenges to its management are most keenly felt in less developed countries of the world (Elizabeth, 1998, Emeka Amakihe, 2011). In India alone, the urban population has increased from 11% in 1901 to 26% in 2001 (M.K. Ghose et al). The unsuitable method for waste dumping at water body and free abandoned land without proper treatment have lead to serious

environmental pollution and health related problem. Geographic Information System (GIS) and Remote Sensing are such computerized systems which can be integrated to get optimal solutions for sustainable management and planning of solid waste (Achi, H. A.-2012).

**2.0 Study Area:**

The study area Dhanbad Block (Fig-1) is underlying by Dhanbad district part of Jharkhand State, India. The latitude & longitude of the area is 86$^0$18'46.73"E to 86$^0$29'23.40"E longitude & 23$^0$51'8.31"N to 23$^0$42'3.82"N latitude. The large quantity of coal is available in Dhanbad & its surrounding area. Dhanbad is located in the Golden Quadrilateral Highway connecting New Delhi – Kolkata. Also it is connected with the major cities in Jharkhand such as Ranchi, Jamshedpur. The study area has good connectivity with other districts of Jharkhand and various parts of the country. All villages are provided with all season roads. The National Highway no.2 linking Kolkata with Delhi runs very close to the study area. The NH–32 which traverses through the study area connects the study area with the Bokaro Steel City and Chas on one side and connects to NH-2 on the north eastern side.

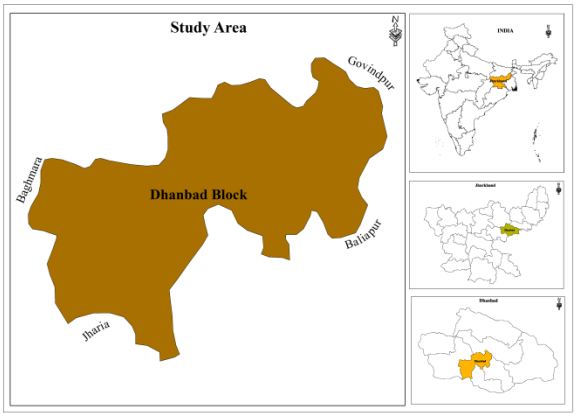


**Fig-1:** Location Map of the Study Area

**3. Data & Software Used:**

The toposheet map and Landsat TM-5 satellite data used to prepared suitable site selection for solid waste dumping zone. The road, water body, settlement and river layer generated using toposheet map and land cover map generate using satellite data. The use of Arc GIS and Erdas software generated different layer and its buffer zone in the study area.

**4. Methodology:**

The present study was conduct to the different parameter analysis of the study area. The creating different feature layer like road, water body, settlement and river using toposheet map and land cover map prepared using Landsat TM-5 satellite data. After creating the feature layer corrected the topology error then created buffer layer using suitable distance from the feature wise in other hand corrected the classification error

and creating accuracy assessment on Land use map. After creating the entire buffer layer overlay analysis were done using all thematic layer and finally created the suitable solid waste dumping zone and mark some point for solid waste dumping at the Dhanbad block.

## 5. Result and Discussion:

### 5.1. Proximity to River & surface water:

The solid waste dumping zone must not be located near any surface streams, lakes, rivers or wetlands. For this reason, a 300-meter buffer placed of rive and 200-meter buffer place of water body using the function in Arc GIS software (Fig-2 & 3), which will be used to generate the buffer around all surface waters such as streams, lakes and wetlands. (The created buffer layer with riparian reserve guidelines produced by the Drainage and Irrigation Department, Sabah).

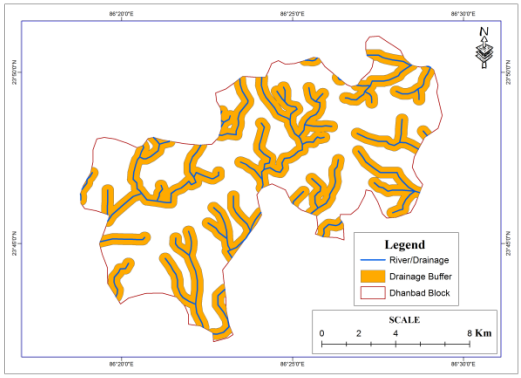


**Fig-2:** Distance From River

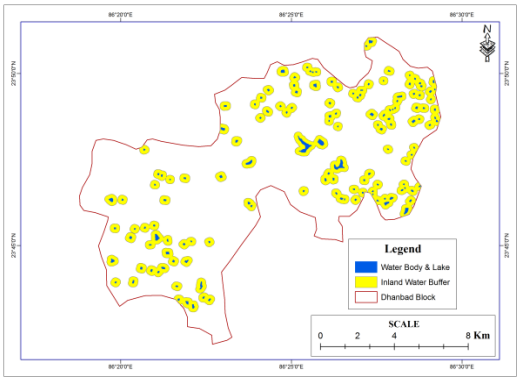


**Fig-3:** Distance from Water Body

### 5.2. Distance from transportation routes:

Aesthetic considerations would be of good practice for good planning and based on this principle, landfills shall not be located Within 100 meters of any major highways, city streets or other transportation routes (Fig-4). The 100 meters was chosen based on the current practice provided under supplementary guidelines for development of residential, industrial and commercial sites under the Department of Town and Regional Planning, Sabah.

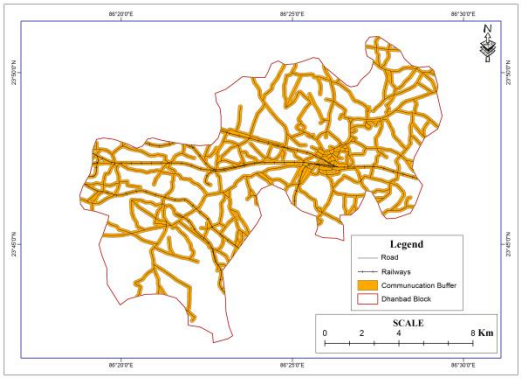


**Fig-4:** Distance from Road & Rail Network

### 5.3. Distance from urban areas:

Landfills should not be placed too close to high-density urban areas in order to mitigate conflicts relating to the Not in My Back Yard syndrome (NIMBY). This guards against health problems, noise complaints, odour complaints, decreased property values and mischief due to scavenging animals. For this reason the buffer zone created 200-meter from the settlement area (Fig-5).

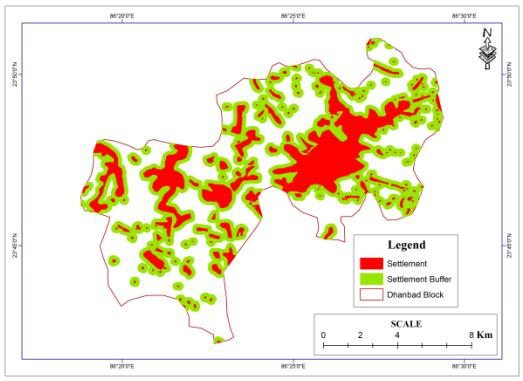


**Fig-5:** Distance from Residential Area

### 5.4. Land use/land cover:

The Land use and Land cover must be known in order to determine which areas are more suitable for a landfill. Land use types such as grassland, forests and cultivated land would be considered and assigned an appropriate index of land use suitability (Fig-6). The Department of Agriculture, Sabah has identified several classes of land cover and for the purpose.

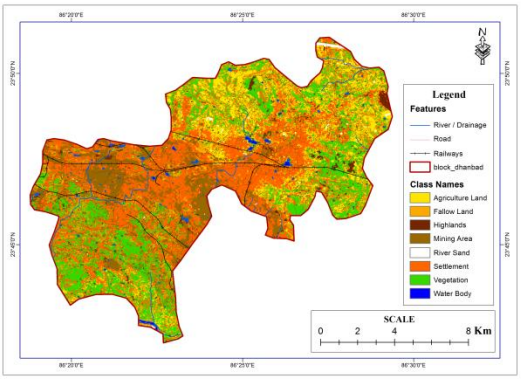


**Fig-6:** Land Use / Land Cover Map

### 5.5. Suitable Solid Waste Dumping Zone:

The major goal of the landfill site selection process is to ensure that the disposal facility is located at the best location possible with little negative impact to the environment. Using Arc GIS 10.1 software creating different thematic layer and overlay analysis were done and identify eleven point (Gorbudih, Baludih, Petia, Bhaga Bandh, Shiyalguri, Kantapahari, Kustor, Bhuli, Kurmidih, Patraku and Damodarpur) for suitable solid waste dumping zone at the Dhanbad block (Fig-7). The major suitable zone for solid waste dumping is situated in southern part of the Dhanbad block. The all selected zone is present open free space and grass land area. All location are selected in-between 1.5 km from the residential settlement area.

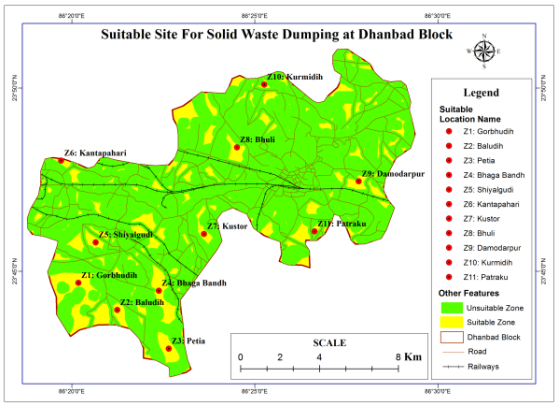


**Fig-7:** Suitable Site map for Solid Waste Dumping

## 1.0. Conclusion:

This study used the integration of GIS and Remote Sensing in identifying the best sites for the dumping the solid waste material in a typically urbanizing city. A multi-criteria approach was employed in conjunction with GIS-based overlay analysis to identify the most suitable site for solid waste dumping in the Dhanbad block. The study was based upon a set of key criteria, which were selected in relation to already available knowledge from research literature as well as the pre-existing local level factors of the area. A set of eleven (11) potential sites were identified in the most suitable sites for solid waste dumping. The integration of GIS and Remote Sensing techniques contributed to the achievement of the results obtained. Remote Sensing techniques made it possible to study the various land cover types within the study area whereas GIS aided in the modeling and preparation of needed maps. Indeed, it has been an effective and efficient tool in carrying out this study.

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