UNIVERSITY OF NAIROBI

APPLICATION OF GIS IN SOLID WASTE COLLECTION: CASE STUDY OF NAIROBI CBD

BY

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OUTLINE OF PRESENTATION

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➢ Problem statement

➢ objectives

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Background Information

Definitions

- Solid waste is the useless or unwanted material arising from various human activities, normally solids or semi-solids.

- Solid waste collection can be defined as the transfer of solid waste from the point of production to the point of treatment or landfill.

- Illegal dumping involves discarding solid waste in a location other than at a recycling center or permitted disposal site.

- Solid waste collection point in this study is used to refer to a point of temporary storage of solid waste resulting majorly from street sweeping and also direct dumping from points of generation.

Background Information

- Increase in trade activities in the CBD has led to increase in solid waste production. This has led to a great challenge in solid waste collection.

- There is need for effective and efficient solid waste collection information system.

- To achieve this, optimal location of solid waste collection points is essential.

- There is need for an efficient solid waste collection information system.

Background Information

- Solid waste collection in the CBD is under the Department of Environment, in Nairobi City council.
- It involves two major activities namely, litter collection and its transportation.
- Litter collection entails street sweeping and collection using litter bins.
- Waste from street sweeping is moved manually to collection points using wheeled bins and/or wheel barrows.
- Collected waste is transported from collection points and litter bins to the main dumpsite, located at Dandora, in Nairobi.

Problem Statement

- Solid waste collection points are inequitably distributed and inadequate.

- There exist numerous illegal dumpsites in some zones in the CBD.

- Inappropriate solid waste collection information system is also a challenge.

- Poor spatial and non-spatial data linkage.

Objectives

Main objective

- To create a geo-database that will enable storage and management of solid waste collection data and carry out spatial analysis to determine the suitable sites for location of collection points.

Specific objectives

- To identify and map the spatial distribution of the existing collection points.

- To identify and map illegal dumpsites in the CBD.

- To create a geo-database of spatial and non-spatial data on solid waste collection aspects.

- To carry out suitability analysis to determine suitable sites for location of collection points.

Area of Study

- The area of study is the Nairobi Central Business District (CBD). Nairobi is the capital city of Kenya.

- It is located within 36˚ 48' East, 1˚ 16'South and 36˚ 50' East, 1˚ 17' South.

- It is divided into seven zones namely zone 1 through zone 7.

The Area of Study
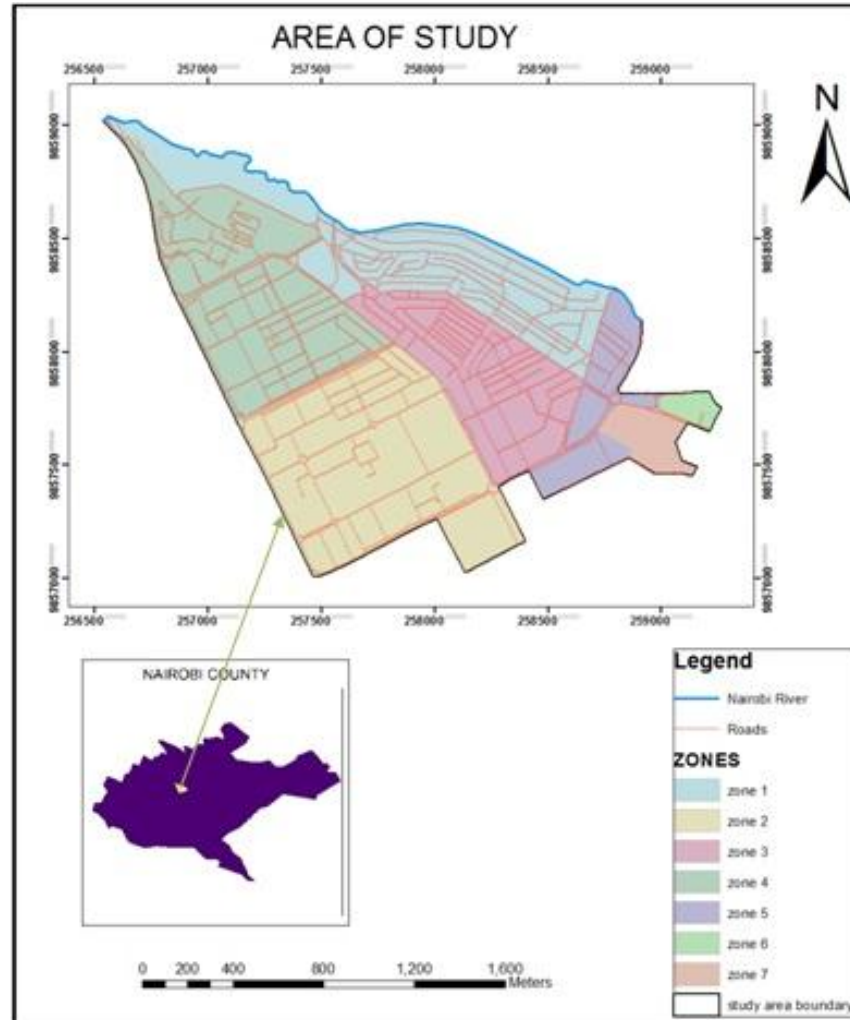
Tools

- **Hardware**
  - ❑ Computer with specifications of 250 GB memory, 2GB RAM and 2.20 GHz of speed.
 - ❑ A flash disk of 4 GB memory space
  - ❑ A handheld GPS (Garmin 60Cxs)
- **Software**
  - ❑ ArcGIS 10.1
  - ❑ Global Mapper v11
  - ❑ QGIS 2.0.1
 - ❑ Microsoft Office 2007 suite

Data and their Sources

| DATASETS	DATA SOURCE	CHARACTERISTICS
Digital maps of Nairobi	Survey of Kenya	Scale 1:2500
Open street maps	Open street maps website	Vector data
Coordinates of collection points and illegal dumpsites	Field work using handheld GPS	Coordinates in UTM projection, WGS1984 datum
Data on litter bins, sweepers, supervisors, road lengths, market-, park-,parking areas	Department of Environment, City Council of Nairobi	Tabulated data in soft copy form

Overview of Methodology
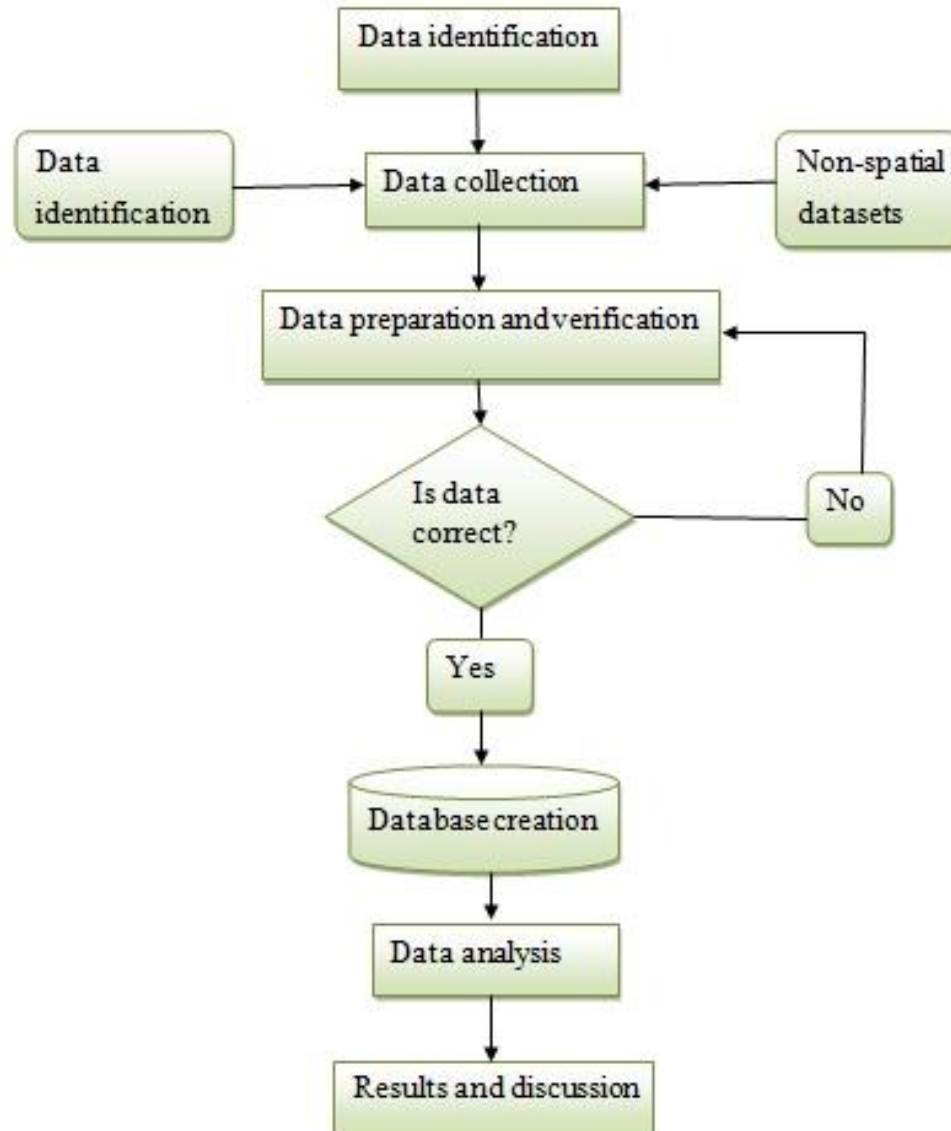
Results and Analysis

Geodatabase
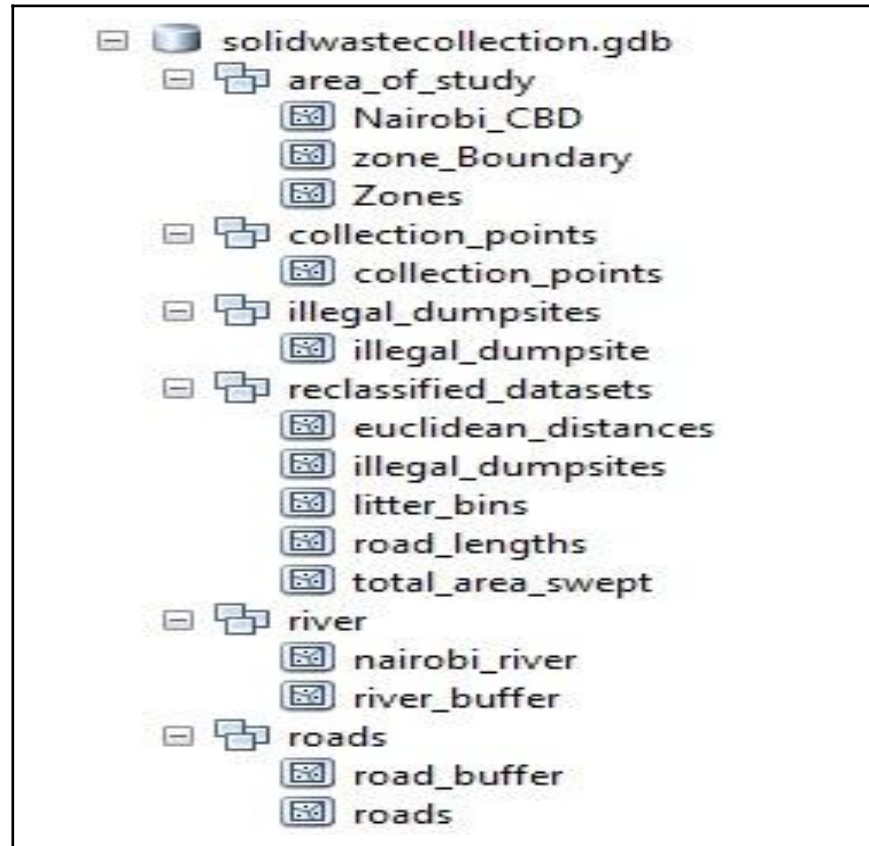
Spatial distribution of Collection points and illegal dumpsites
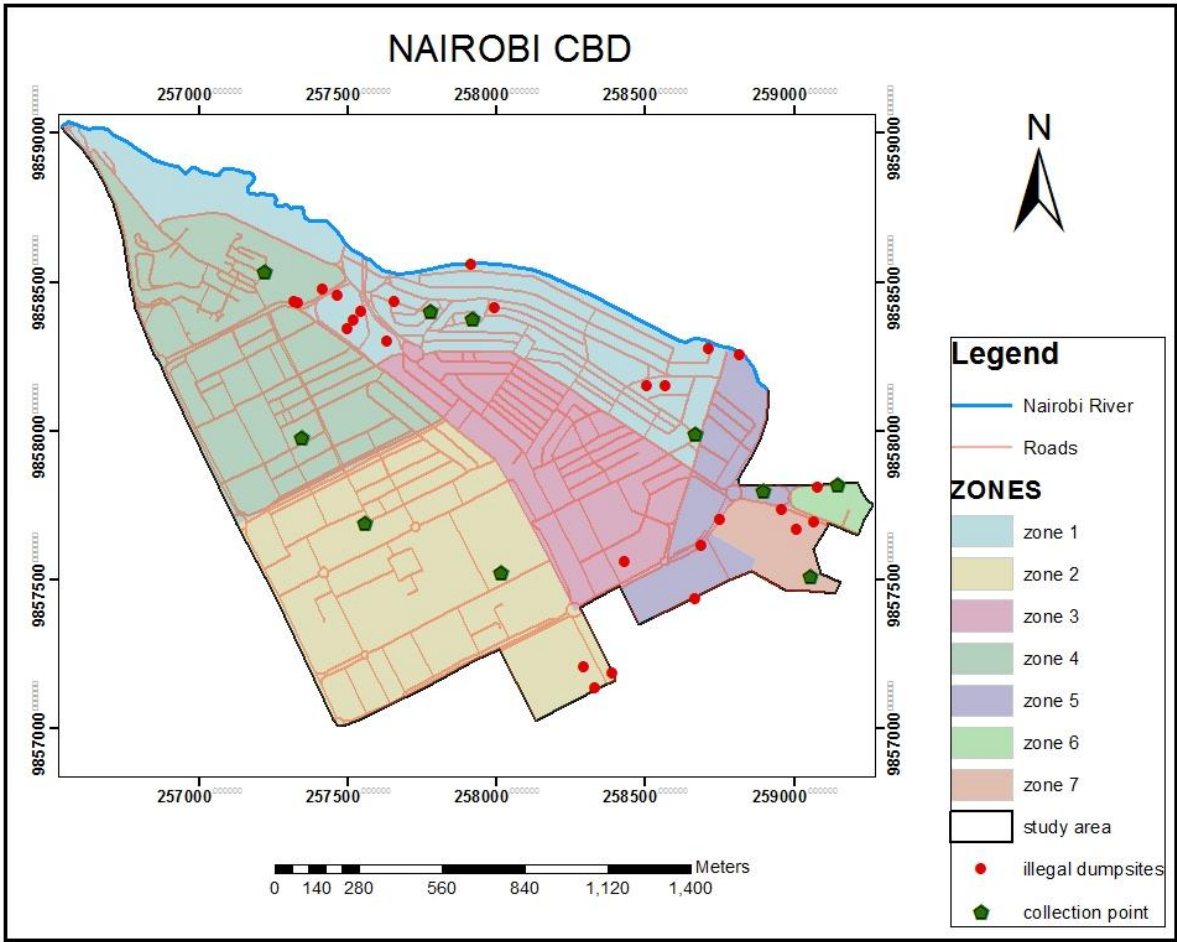
Thiessen Polygons
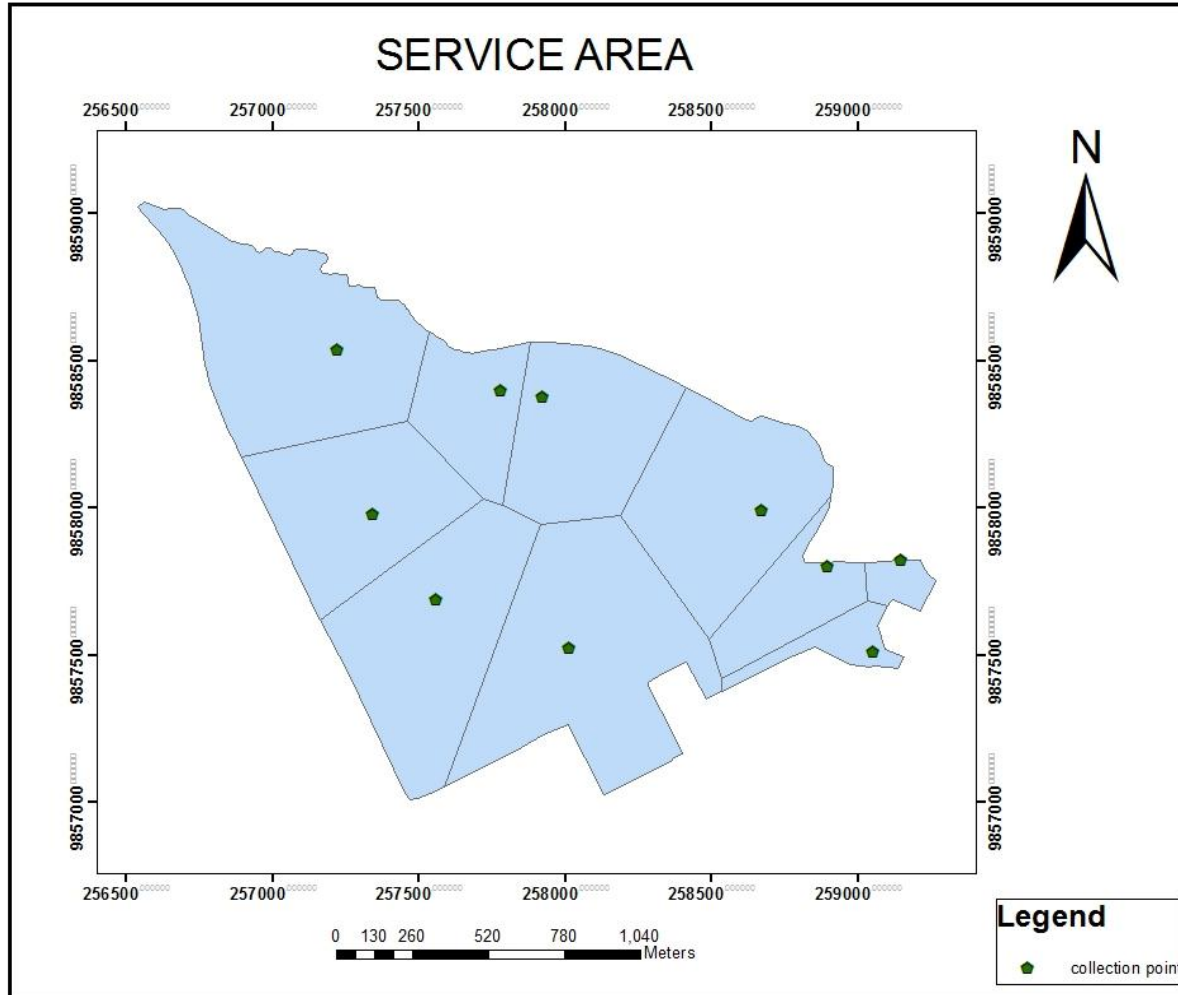
Suitability Analysis

Criteria

- Distribution of litter bins
- Distribution of illegal dumpsites
- Euclidean distances from the existing collection points
- Total area swept
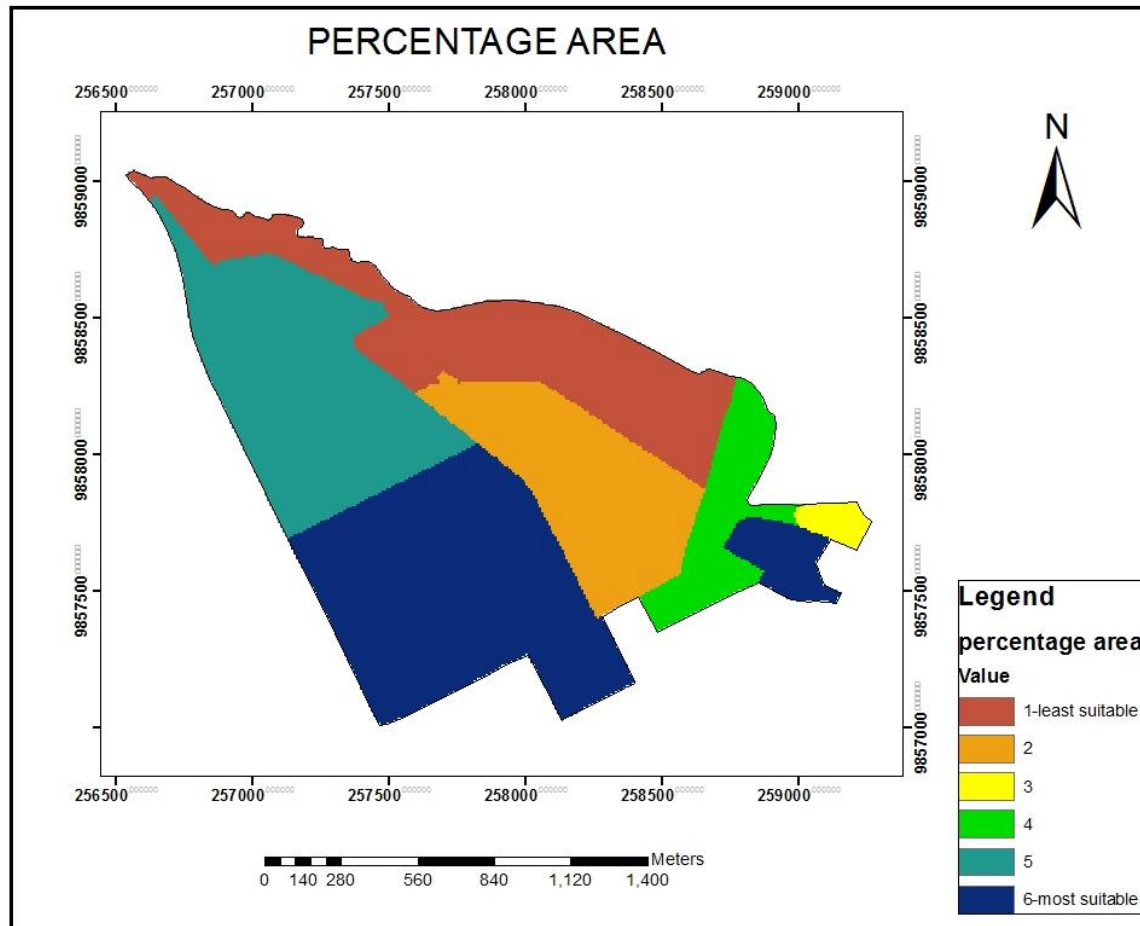- Total roads length

Suitability Analysis Process

- Definition of the problem
- Breaking the problem into sub-models
- Determination of significant layers
- Reclassification/transformation
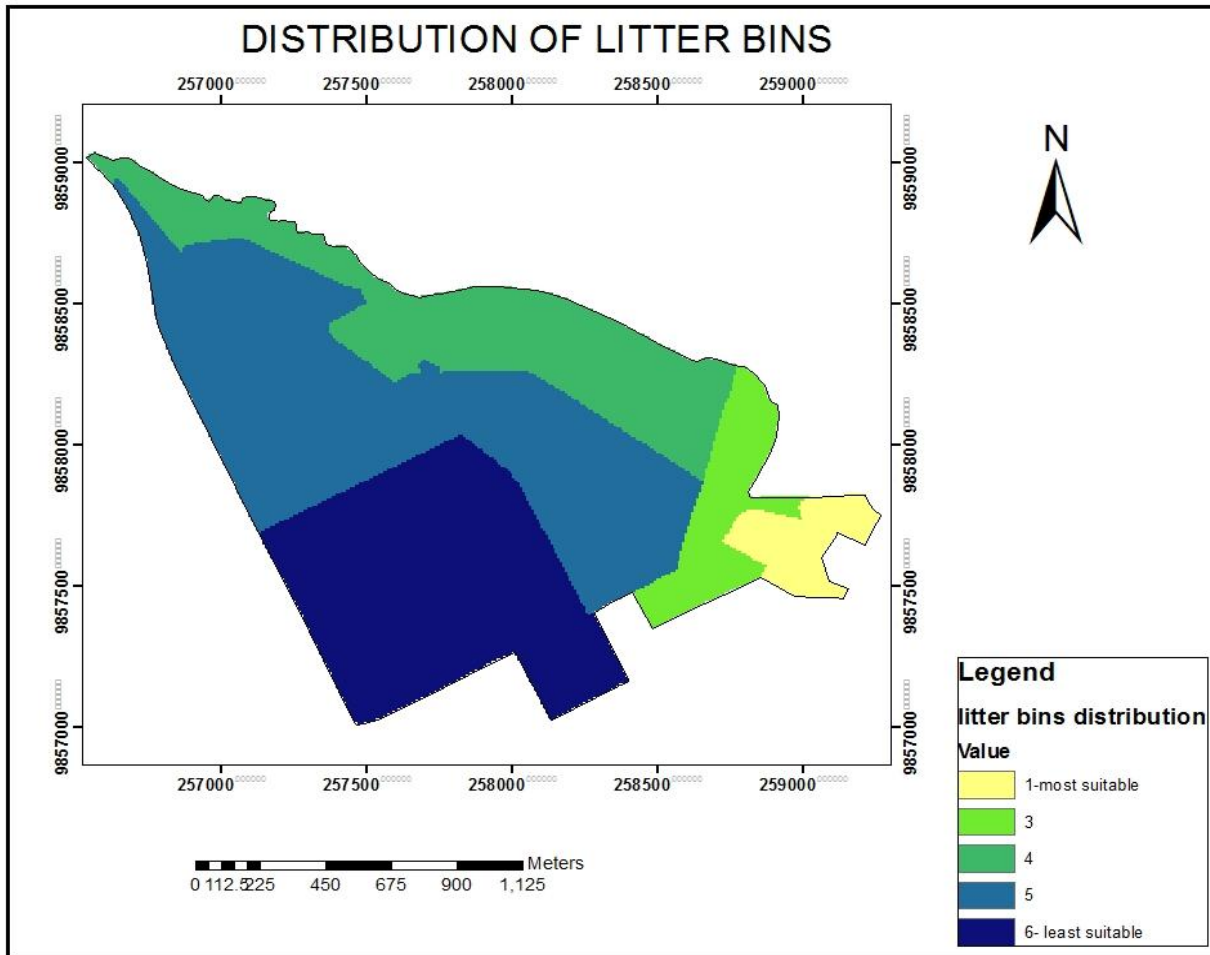- Weighting
- Weighted overlay
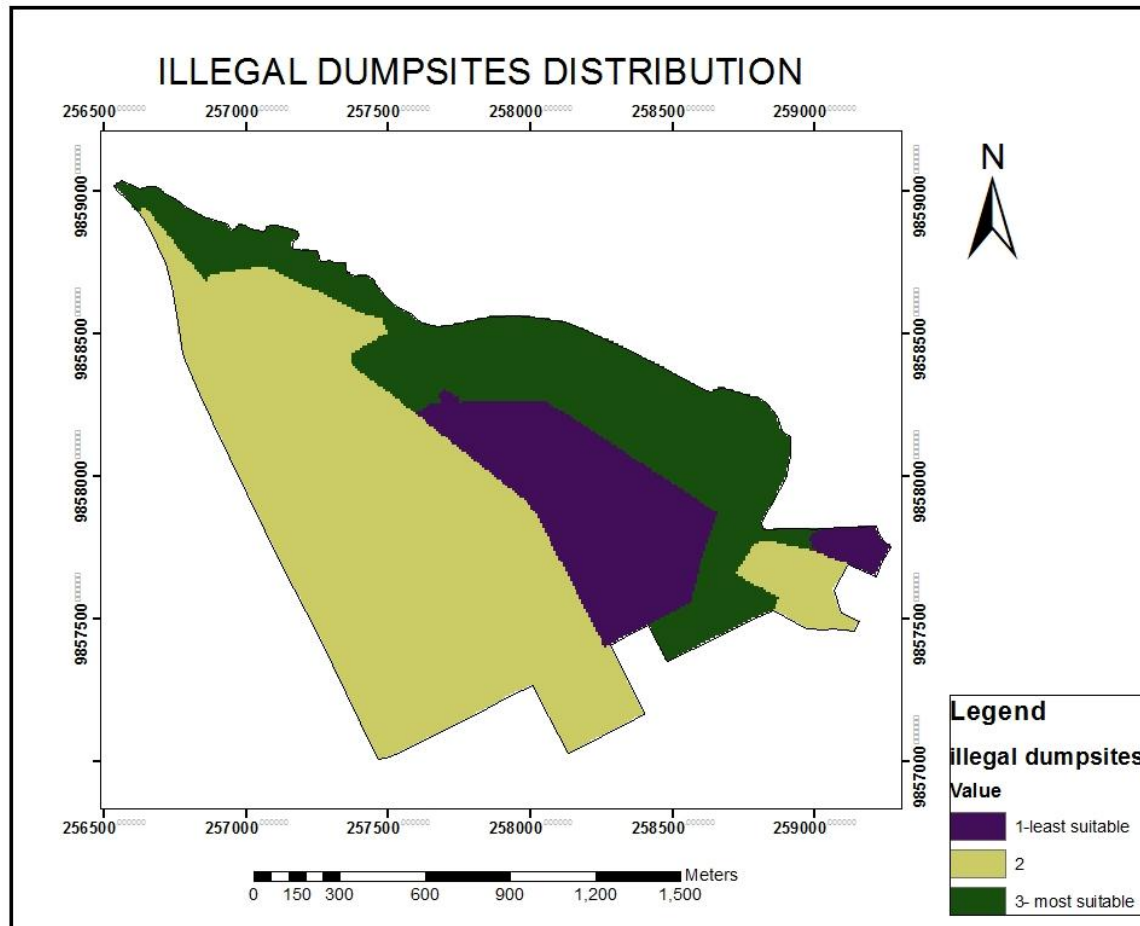- Analysis

Reclassified Euclidean Distances
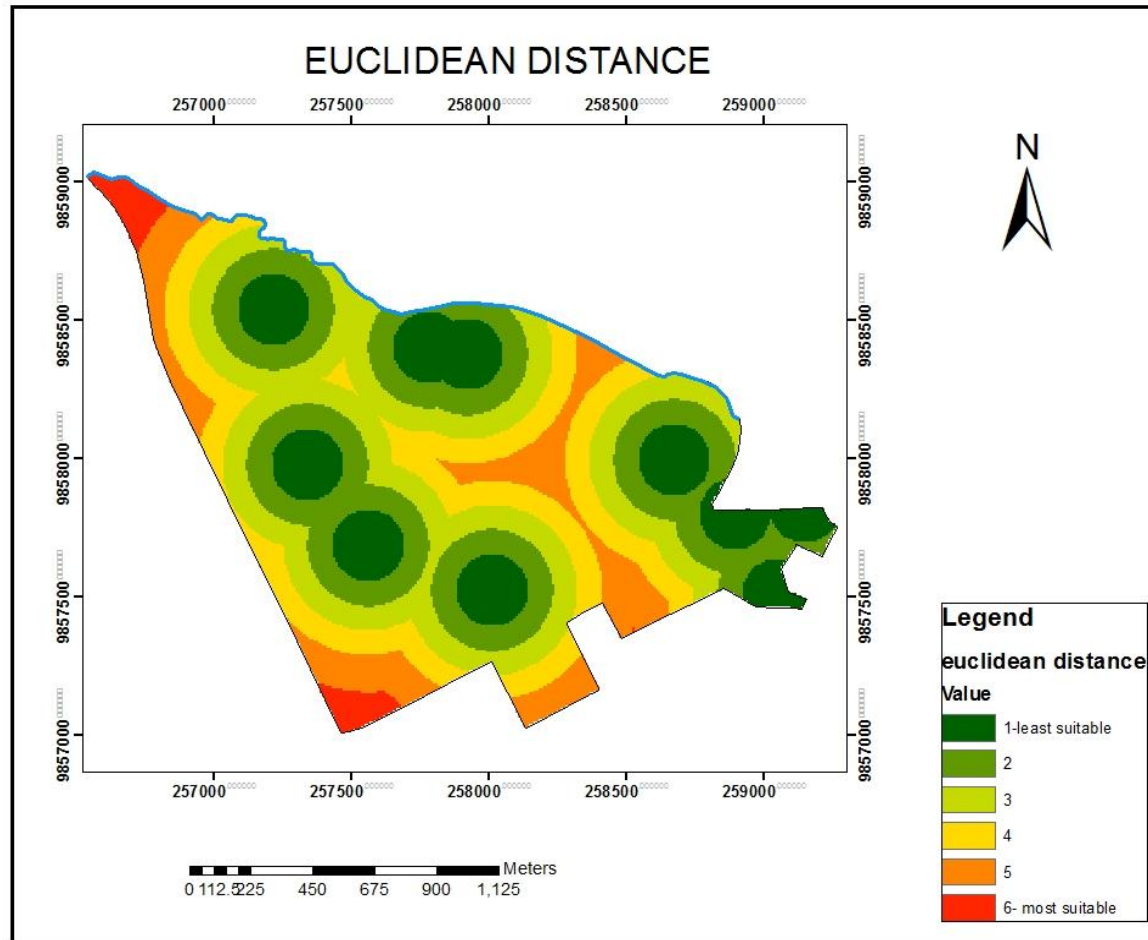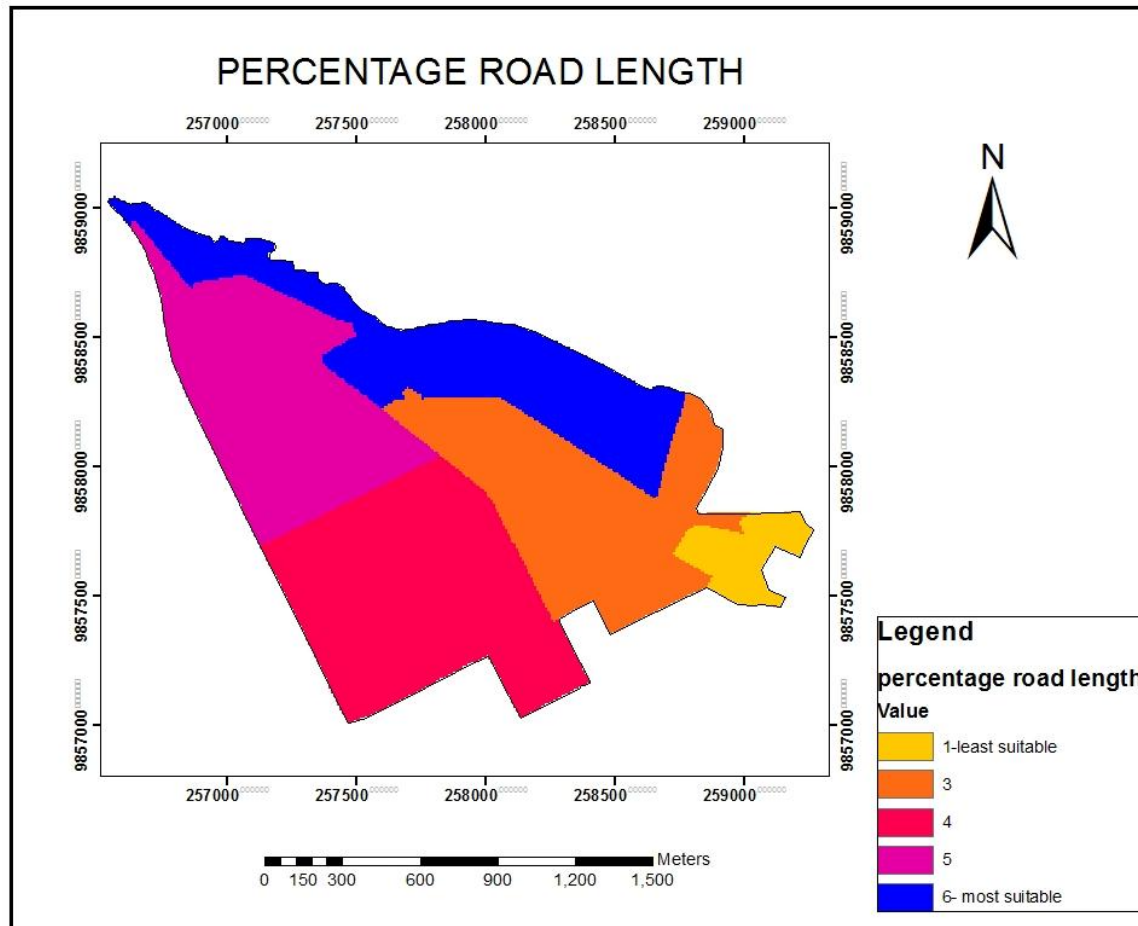
Reclassified Percentage Total Area

Reclassified Distribution of Litter Bins

Reclassified Illegal Dumpsites Distribution

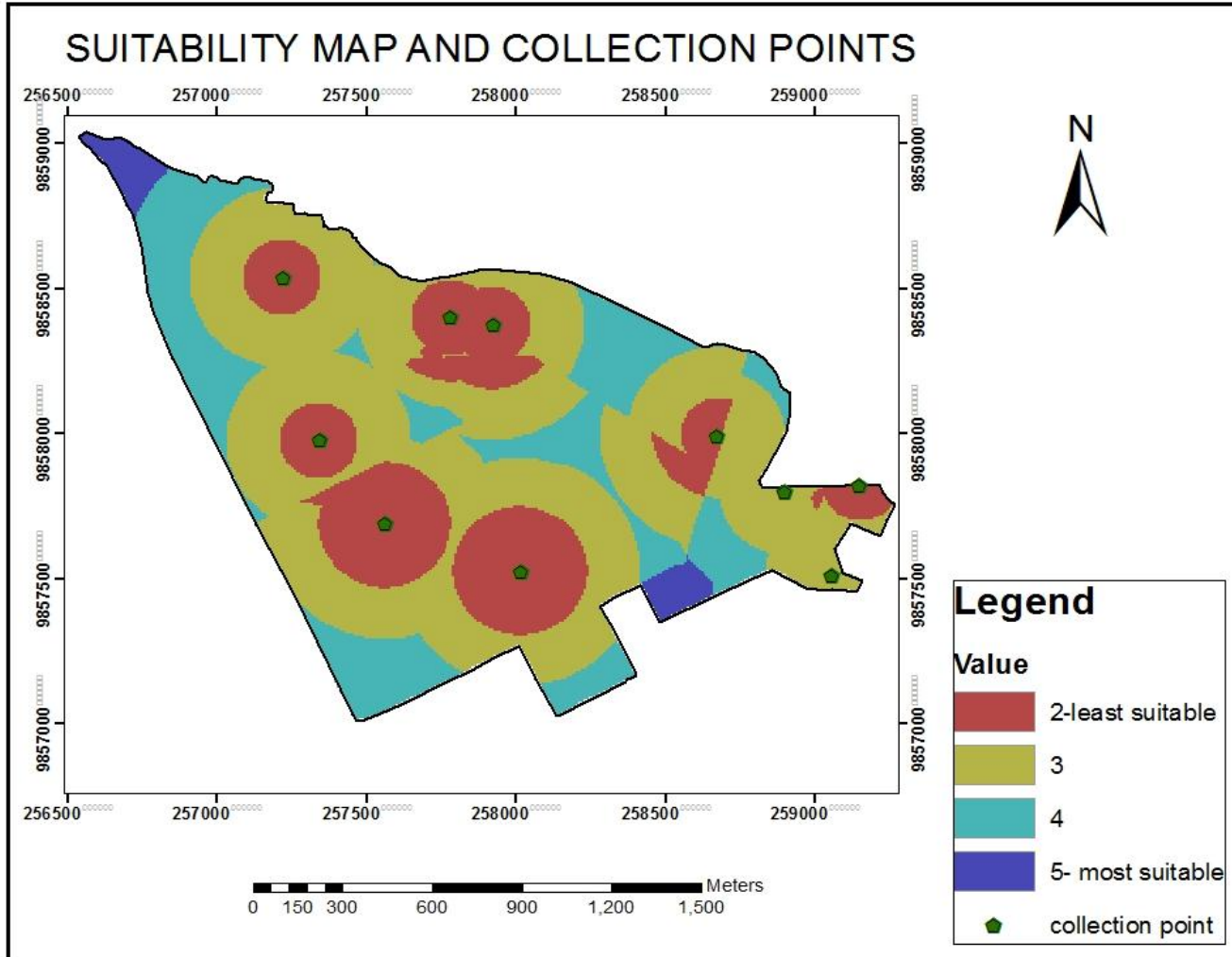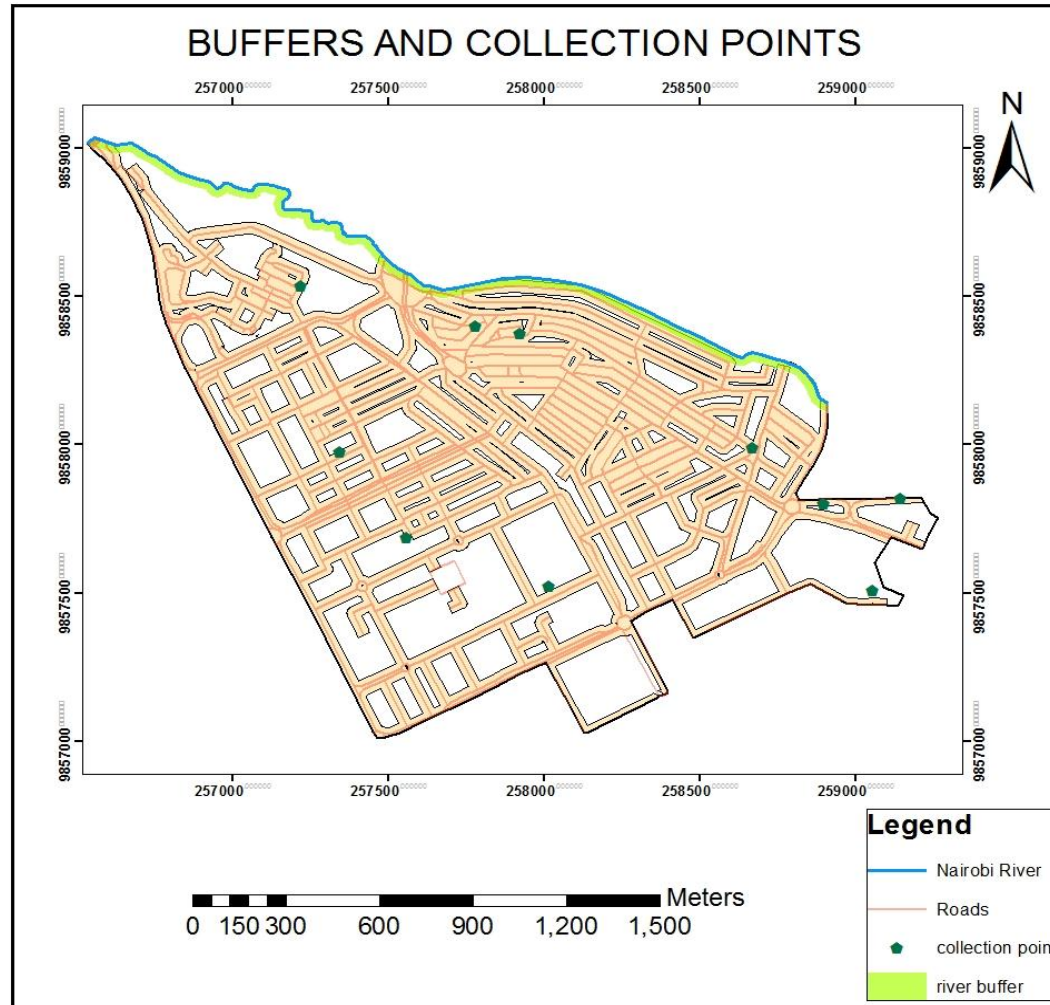# Reclassified Percentage Road Lengths

Weighted Overlay

Factor	Percentage Influence	Ratio of Influence
Distance to the existing collection point	33%	0.33
Litter bins distribution	27%	0.27
Distribution of illegal dumpsites	20%	0.20
Total areas	13%	0.13
Road lengths	7%	0.07

Suitability Map

SUITABILITY MAP AND COLLECTION POINTS

Collection Points and Buffers

Conclusion

- A digital map showing the spatial location and distribution of collection points was drawn.
- The illegal dumpsites were mapped for visualization purposes
- A map showing distances from the collection points was obtained from distance analysis.
- Successful suitability analysis carried out in this study led to the determination of suitability of various sites for collection points location.
- Road and river buffers maps were also made.
- This study demonstrates how powerful GIS is in spatial- and non-spatial database integration, management and analysis to identify trends and problems and making appropriate decisions.

Recommendations

- The number of collection points should be increased, and located in the suitable places proposed in this study.

- The identified illegal dumpsites should be eliminated if effectiveness in solid waste collection is to be realized.

- GIS should be adopted in solid waste collection management.

THANK YOU