CHAPTER IV

METHODOLOGY
METHODOLOGY

4.1 Overview

Site selection is a semi-structured process because it involves consideration of several factors before an optimal solution is obtained. Therefore there is need of a decision support tool for timely and optimal results. To simplify the identification of suitable sites, the Geographical Information Systems (GIS), as decision support tools, have a great advantage (Mahamid and Thawaba, 2010).

The selection of waste disposal sites in Kakinada city involves primarily the selection of the preliminary criteria to be considered for site selection followed by grouping of these criteria into exclusionary and non-exclusionary criteria. The factors of exclusionary directly decide the suitability by YES or NO. If a selected site does not satisfy these considerations, it has to be excluded. Non-exclusionary factors need ranking and each individual factor will have the weightage of suitability. The non-exclusionary weightage will be assigned only to the locations left after the exclusionary screening.

The weighted overlay analysis gives the facilitated way in decision-making in which, the factors are sorted according to their relation and importance to the site of dumping which is called a hierarchy of importance. To derive the decisive factors of exclusionary and non-exclusionary and to apply the weighted overlay analysis, the baseline digital database is necessary and this database is created on GIS platform.
4.2 Introduction

Application of GIS in landfill siting methodology is a relatively simple technique that is based on the overlaying of data sets and areas that satisfy certain suitability criteria. In this study, the GIS-based landfill site selection approach combines the spatial analysis tools provided by GIS to integrate and evaluate different datasets based on certain evaluation criteria was used in order to determine potential landfill sites (Sumathi et al., 2008).

The study relied on the existing spatial data of the study area. Data were extracted from land use maps and satellite imagery of the study area. The digitized datasets were interpolated with Arc GIS (Software) to generate operation of different dataset layers. Afterwards spatial analysis was carried out to identify potential sites. A final composite map was then produced, which presents all areas suitable for landfill siting.

4.2.1 GIS Data Sources

Geographic Information System is a method used for selecting suitable landfill sites. The functions of GIS include the accurate processing of spatial data from remotely sensed data and from other sources, providing spatial tools for efficient storing, retrieving, manipulating the geo referenced maps, analysis of information and best product generation (AnjiReddy, 2004).

Nowadays, GIS is used widely in many resource application areas. In landfill siting, GIS can be used as a tool to aid the decision-supporting and decision making process (Shahabi et al., 2012). GIS can process large amounts and different types of data in a short time and also help in understanding of all the features and the relationships that influence for
the proposed study. This process reduces the financial resources and valuable time in the process of identifying suitable sites for landfill. In the present study, the landfill siting was carried out using GIS.

### 4.3 GIS for Landfill Site Selection

One of the most critical needs that GIS can serve in solid waste management is siting landfills. With increasing land use pressure and impacts of landfill on the environment, finding potential sites for landfills can be complex and time consuming. Before the advent and widespread application of GIS in waste management, such as landfill siting, a special committee of professionals that consist of municipal planners, environmentalists, developers, public and other municipal board officials were mandated to investigate and find potential sites suitable for waste disposal.

With the application of GIS, the task of finding potential sites can be done efficiently and effectively. It also reduces time and costs and improves timeliness of the information. GIS is a method used for effectively selecting suitable landfill sites. GIS can be utilized in the search for suitable new landfill sites because it allows accurate processing of spatial data from a variety of sources, efficient storage, retrieval, analysis and visualization of information and enabling tailored solutions to be furnished. However, the capability of GIS can be hampered due to digital data availability.
4.4 Data Base Generation

In the present study, broadly two types of database are generated for site selection process. The two types of database are spatial database and non-spatial/attribute database (Asadi et al., 2007). The spatial data comprises of all the thematic and topographic maps viz., Land use/land cover, geology, geomorphology, soil, drainage, watershed, physiography, base details, slope etc., and the other derivative maps like ground infiltration, ground water table etc. The non-spatial data is composed of population details, solid waste generation rates and ground water quality data. In this chapter, the steps involved in deriving all these data products, the sources of data products, the sources of data acquisition and the ways of transforming these data products suitable for GIS software are described.

4.4.1 GIS Data Types

In the present study, the GIS data used are classified as follows. Basically all the GIS data used in this study are classified as:

i. Topographical data

ii. Thematic data

iii. Collateral data

The topographical and thematic data reclassified as spatial data and the collateral data as attribute data.
4.5 Spatial Data

The spatial data consist of topographic, thematic and other derivative maps derived from satellite sensing and SOI toposheets. The satellite sensors of ETM+ (Enhanced Thematic Mapper Plus) sensors of LANDSAT-7 satellite and SOI toposheet series of 65L1, 65L5, 65K4, 65K8 & K12 on 1:50000 scale are used.

4.5.1 LANDSAT 7 Data

Landsat 7 is the latest in a series of satellites that have provided a continuous set of essential land surface data to both national and international users since 1972. When compared to the other satellite data, Landsat 7 is the most accurately calibrated Earth Observing Satellite (EOS) because its measurements are extremely accurate and Landsat 7’s sensor has been called “the most stable, best characterized Earth observation instrument ever placed in orbit.” The data sets and details of 8-band LANDSAT-7 (ETM+) that have been interpreted and evaluated for the present study area are shown in table 4.1.

Table 4.1 LANDSAT 7 (ETM+) Satellite Data Used in the present Study

<table>
<thead>
<tr>
<th>System</th>
<th>Data Acquisition date</th>
<th>Path/Row</th>
<th>Resolution (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LANDSAT 7</td>
<td>8th Dec 2000</td>
<td>141 – 48</td>
<td>15 m</td>
</tr>
<tr>
<td>LANDSAT 7</td>
<td>23rd Nov 2006</td>
<td>141 – 48</td>
<td>15 m</td>
</tr>
<tr>
<td>LANDSAT 7</td>
<td>4th Oct 2011</td>
<td>141 – 48</td>
<td>15 m</td>
</tr>
</tbody>
</table>
4.5.2 Characteristics of Remote Sensors

The resolution of the system depends upon the following aspects and the features of 8-band LANDSAT-7 satellite data are shown in table 4.2.

A. Spatial resolution
B. Spectral resolution
C. Radiometric resolution
D. Temporal resolution

Table 4.2: Features of 8-band LANDSAT-7 Satellite Data used in the Present Study

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spatial Resolution</td>
<td>15 m</td>
</tr>
<tr>
<td>Spectral Resolution</td>
<td>8 bands</td>
</tr>
<tr>
<td>Radiometric Resolution</td>
<td>8 bits</td>
</tr>
<tr>
<td>Temporal Resolution</td>
<td>16 days</td>
</tr>
<tr>
<td>Spectral range</td>
<td>0.52-0.90 µm</td>
</tr>
<tr>
<td>Swath</td>
<td>185 km</td>
</tr>
</tbody>
</table>

4.5.3 Landsat Enhanced Thematic Mapper Plus (ETM+)

The Landsat Enhanced Thematic Mapper (ETM+) data cover the visible, shortwave, near infrared and thermal infrared spectral bands of the electromagnetic spectrum and was introduced with Landsat-7. Landsat Enhanced Thematic Mapper Plus (ETM+) images consist of eight spectral bands. For band 1 to band 7, the spatial resolution is of 30 meters and for band 8, the resolution is about 15 meters. All The features of LANDSAT-7 (ETM+) are shown in table 4.3.
Table 4.3: Features of LANDSAT-7 (ETM+)

<table>
<thead>
<tr>
<th>Landsat 7</th>
<th>Wavelength (Micrometers)</th>
<th>Resolution (Meters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Band 1</td>
<td>0.45-0.52</td>
<td>30</td>
</tr>
<tr>
<td>Band 2</td>
<td>0.52-0.60</td>
<td>30</td>
</tr>
<tr>
<td>Band 3</td>
<td>0.63-0.69</td>
<td>30</td>
</tr>
<tr>
<td>Band 4</td>
<td>0.77-0.90</td>
<td>30</td>
</tr>
<tr>
<td>Band 5</td>
<td>1.55-1.75</td>
<td>30</td>
</tr>
<tr>
<td>Band 6</td>
<td>10.40-12.50</td>
<td>60 * (30)</td>
</tr>
<tr>
<td>Band 7</td>
<td>2.09-2.35</td>
<td>30</td>
</tr>
<tr>
<td>Band 8</td>
<td>0.52-0.90</td>
<td>15</td>
</tr>
</tbody>
</table>

4.5.4 Procedure for Preparing the Spatial Data

The procedure for preparing the spatial data for the entire study area is discussed as follows:

**Step-1:** Satellite data processing using image-processing software like ERDAS (Earth Resource & Data Analysis System) and hardcopy generation.

**Step-2:** Generation of thematic maps viz., land use/land cover, geomorphology, geology, Infiltration rate and soil by visual interpretation of satellite imagery and SOI Toposheets.

**Step-3:** Generation of topographical maps showing physical characteristics of the study area. The topographical maps extracted from SOI toposheets are base, road network, drainage, watershed and slope.
Fig: 4.2: Methodology for Spatial database creation

DATA COLLECTION

DATA INPUT
Scanning manual entry

DATA CONVERSION
Digitization using

DATA BASE CREATION

Spatial Data

SOI Toposheet

Geo-referencing
(extraction of GCPs)

Mosaicing

Final Rectified
Toposheet

Satellite Imagery

Loading

Preprocessing

Enhancement

Geo-referencing
转让转移的GCP on
image

Visual Interpretation

Topographic layers

Base map
Drainage map
Road network
Map
Watershed Map

Attribute Data

Ground water quality
Ground water level

Solid waste collection
Solid waste quality details
Population details

Ground water quality Map
Ground water table Map

Population density map

DATA INTERPRETAION AND ANALYSIS

AREA CALCULATION
**Step-4:** Generation of maps from the collateral data.

**Step-5:** Digital spatial database generation using Arc GIS 9.3.

### 4.5.4.1 Satellite Data Processing

In this study, digital remote sensing data of 8-band LANDSAT-7 (ETM+) is used. Base map on 1:50,000 scale obtained from SOI toposheets covering the entire study area is used to extract the Ground Control Points (GCPs) and to demarcate the boundary of the study area on imagery. This information is then used for image registration of 8-band LANDSAT-7 using ERDAS image processing software. Fig 4.1 shows the satellite imagery of the study area.

#### 4.5.4.1.1 Image Processing

Image processing is applied to compensate data errors and geometric distortions, to enhance and extract features related to thematic subjects being under investigation and to suppress redundant information. In this study, the standard tools of image processing have been used for digital processing of the satellite data. Digital image processing was used to:

- Register the originally orbit oriented raster data over the UTM coordinate system.
- Enhance and to extract features that indicate targets of interest in the data.

In this study, the image processing processes were conducted by image registration and image enhancement.
4.5.4.1.2 Image Registration (Geo-referencing)

Toposheets covering the entire study area on 1:50,000 scale are scanned and raster file is created. These are further geo-referenced based on the latitudinal and longitudinal coordinates. After geo-referencing all the maps are edge-matched and a digital mosaic is prepared which depicts the continuation of the study area. Geo-referencing is carried out using ERDAS imagine processing software. The geo-referenced image is further mosaicked and then feature matching is carried out. At the end of this process the digital data free from all distortions is available for digital image enhancement and thematic preparation with the help of visual image analysis techniques.

4.5.4.1.3 Image Enhancement

Image enhancement is the modification of an image in order to alter its impact on the viewer. Generally, image enhancement changes the original digital value and it should be carried out after Geo-referencing. The purpose of image enhancement is to make the images more interpretable for specific applications. For generating better quality image, the techniques like Histogram Equalization and Noise reduction were performed for spatial, spectral and radiometric enhancements.
4.5.4.2 Generation of Thematic Maps

A Thematic map is a type of map specially designed to show a particular theme connected with a specific geographic area. Thematic maps serve three primary purposes.

- Thematic maps provide the specific and detailed information about particular locations.
- They provide general information about spatial patterns.
- They can be used to compare patterns on two or more maps.

The requirements for thematic maps, in terms of scale, information content, classification system / legends depends on the purpose for which the maps are to be used. Both, visual interpretation and digital analysis techniques are being used for preparation of thematic maps from satellite images. The base maps thus prepared are utilized in the preparation of thematic maps for transferring the thematic details derived from the satellite data.

In the present study, the thematic maps namely, land use/land cover, geomorphology, geology, ground water prospects map and soil are generated from hard copy of the satellite digital data. The data types, important features and corresponding data sources used for the generation of thematic maps are listed in table 4.4.
Table 4.4: Data Types and Sources for the Generation of Thematic Maps

<table>
<thead>
<tr>
<th>S.No</th>
<th>Data type</th>
<th>Features</th>
<th>Source of Acquisition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Land use/Land cover</td>
<td>Built-up land, Farmland, water bodies, waste lands, mangroves, Salt pans and Others. (Fig.6.7)</td>
<td>Toposheets of survey of India, Satellite data and from forest department.</td>
</tr>
<tr>
<td>2</td>
<td>Geomorphology</td>
<td>Coastal Plain Older and Younger, Deeply weathered Pedi plain, Deeply buried Pedi plain, Deltaic plain older, Flood plain, Mangrove swamp, Pediment, Mud flat, Palaeo mud flat, Salt flat and Sand flat. (Fig.6.17)</td>
<td>Satellite data and SOI Toposheet</td>
</tr>
<tr>
<td>4</td>
<td>Soil</td>
<td>Clay, loamy etc., (Fig.6.18)</td>
<td>Satellite data, Land use and soil survey department</td>
</tr>
<tr>
<td>5</td>
<td>Geology</td>
<td>Fluvial alluvium, Coastal alluvium and Rajahmundry sandstone. (Fig.6.22)</td>
<td>Satellite data and SOI Toposheet</td>
</tr>
<tr>
<td>6</td>
<td>Infiltration rate map</td>
<td>High, medium and low zones depending on infiltration rate (Fig.6.22)</td>
<td>Soil map, agriculture department, infiltration and geomorphology map</td>
</tr>
</tbody>
</table>
4.5.4.3 Generation of Topographic Maps

GIS spatial database generation involves data capture and analysis process. The geographical data are available in many forms such as aerial photographs, toposheets, satellite imageries and other published information. The toposheets are used for primary studies and in the present study, the base layers generated from toposheets are:

- Base map
- Drainage map
- Transportation network map
- Watershed map
- Slope map

The generated topographic maps are then converted to digital mode using scanning and automated digitization process. These maps are prepared to a certain scale and show the attributes of entities by different symbols or colors. The location of entities on the earth’s surface is then specified by means of an agreed co-ordinate system. In GIS all the spatial data should be located with respect to a frame of reference. The data types, important features and corresponding data sources used for the generation of topographic maps are listed in table 4.5.
Table 4.5: Data Types and Sources for the Generation of Topographic Maps

<table>
<thead>
<tr>
<th>S.No</th>
<th>Data type</th>
<th>Features</th>
<th>Source of Acquisition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Base map</td>
<td>Major roads, water bodies, railways, Villages, Canals and drains. (Fig.6.1)</td>
<td>Survey of India Toposheet</td>
</tr>
<tr>
<td>2</td>
<td>Drainage map</td>
<td>Drainage pattern, Drains, Canals. (Fig.6.3)</td>
<td>Toposheets of survey of India updates using the satellite data</td>
</tr>
<tr>
<td>3</td>
<td>Road network map</td>
<td>National Highway, State highway, Major district roads and minor roads (Fig.6.2).</td>
<td>Survey of India Toposheet</td>
</tr>
<tr>
<td>4</td>
<td>Watershed map</td>
<td>Watersheds (Fig. 6.4)</td>
<td>Survey of India Toposheet</td>
</tr>
<tr>
<td>5</td>
<td>Slope map</td>
<td>Slope classes (Fig.6.5)</td>
<td>Survey of India Toposheet</td>
</tr>
</tbody>
</table>

4.6 Attribute Data

The attribute data in the present study consists of collateral data, which includes demographic details, solid waste generation rates, ground water levels, ground availability data and water quality data acquired from various government organizations like Andhra Pradesh Pollution Control Board (APPCB), Central Ground Water Board, Bureau of Economics and Statistics (BES), Kakinada Municipal Corporation (KMC) etc. The data types, important features and corresponding data sources used for the generation of ground water prospect maps and demographic map are listed in table 4.6.
Table 4.6: Data Types and Sources for the Generation of Ground Water Prospect Maps

<table>
<thead>
<tr>
<th>S.No</th>
<th>Data type</th>
<th>Features</th>
<th>Source of Acquisition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Demographic map</td>
<td>Population density (Fig.1.2)</td>
<td>Bureau of Economics and statistics division</td>
</tr>
<tr>
<td>2</td>
<td>Ground Water table map</td>
<td>High, medium and low zones depending on depth of water table (Fig.6.21)</td>
<td>Central/State Ground Water board</td>
</tr>
<tr>
<td>3</td>
<td>Existing ground water quality data</td>
<td>High, medium and low zones depending on water quality (Fig.6.23)</td>
<td>Central ground water board, State Ground Water Department and APPCB</td>
</tr>
<tr>
<td>4</td>
<td>Ground water availability</td>
<td>Ground water availability (Fig.6.24)</td>
<td>State Ground Water Department</td>
</tr>
</tbody>
</table>

4.7 Weighted Overlay Analysis

For the present study, spatial-weighted overlay analysis technique was applied to identify and rank potential sites for solid waste disposal. Weighted Overlay is one of the overlay analysis tools included in the Spatial Analyst extension commonly is used to solve multi criteria problems such as optimal site selection or suitability modelling. It is a technique for applying a common scale of values to diverse and dissimilar inputs to create an integrated analysis (Mc.Harg, 1969).
4.7.1 Overlay Operation

In the present study, the overlay function was performed to determine the suitability site map when all factor datasets were completely analyzed. Based on this, a final analyzed composite site map was generated.

4.7.2 Introduction

A weighted overlay evaluates the relative influence of the input rasters. Weighted overlay overlays several rasters using a common measurement scale and weights are assigned according to its importance. The thematic maps, which are prepared, are converted into raster form, as the weighted overlay analysis uses only raster files. The conversion tools are used to convert vector layer to raster layer. The raster layers itself generates its own numbering to different fields. All the converted rasters are reclassified, which is used to reclassify the fields into different groups and assigned new values to rasters according to the classification. The weightages are given to each reclassified rasters, according to their importance with respect to the site selection.

4.7.3 Principle

Weighted-Overlay mapping techniques combine Multi-Criteria Analysis (MCA) and GIS. This technique is based on the ability of GIS to combine multiple datasets in a spatially-specific manner (Suman, 2012) and their capacity to integrate relative values of significance in each of the datasets/layers. This technique allows for the systematic aggregation of factors and their weights. The weighted-overlay results help to identify areas of varying vulnerability according to a given perception (i.e. Weight).
4.7.4 Criteria for Selecting Potential Sites for Solid Waste Disposal

The primary factors that contribute significantly to the site selection criteria include the topographical information, geological criteria and factors ensuring environmental accessibility, hydrological factors and physical feasibility.

Geological criteria

- Soil
- Geology

Topographical criteria

- Transportation network
- Slope
- Land use / land cover
- Geomorphology

Environmental criteria

- Ground water quality
- Ground water availability

Hydrological criteria

- Drainage pattern
- Infiltration rate
- Ground water table

These factors were classified into two groups namely the exclusionary criteria and the non-exclusionary criteria.
4.7.4.1 Exclusionary Criteria

Relevant exclusionary criteria were obtained from the guidelines of municipal solid wastes (management and handling) Rules, 2000, from the Technical EIA Guidance Manual for Common Municipal Solid Waste Management Facilities and the Ministry of Environment and Forests. Some of the exclusionary criteria considered for the present study include the following.

- No landfill should be constructed within 200mts of any lake or pond to ensure protection of surface water resources from pollutants in the waste and to ensure that the ecological value of the waters will be maintained.

- No landfill must be constructed within 100mts of a navigable river or stream.

- No landfill should be constructed within a 100mts of a 100 yr. Flood plain (EPA Guidelines, 1998) to avoid landfill washout if a significant flood event occurs.

- No landfill should be constructed within 200mts of any state or national highway.

- A landfill site must be at least 1000mts from a notified habitat area.

- No landfill should be constructed within 300mts of public parks.

- No landfill should be constructed within critical habitat areas.

- No landfill should be constructed within wetlands.

- A landfill should not be constructed in areas where the water table is less than 5m below ground surface.
• No landfill should be constructed within 200mts of an airport to ensure that air traffic is not exposed to bird hazard.

• No landfill should be constructed within 500mts of any water supply well to prevent deterioration in the quality of the ground water.

• A landfill should not be sited in a coastal regulation zone.

• A landfill should not be located in landslide prone areas, fault zone etc. which are potentially unstable zones.

Based on these exclusionary criteria, buffer maps depicting the unsuitable areas surrounding the major roads, water bodies and habitation for construction of a landfill are prepared.

4.7.4.2 Non-Exclusionary Criteria

Land use, infiltration, soil, ground water table, ground water quality and geomorphology factors are also categorized into two groups viz., non-acceptable classes which include the features that are not suitable for landfill siting and acceptable classes which include the features which can be considered for landfill siting and which are further weighted giving priority of importance.
4.7.5 The basic Weighted Overlay Analysis Procedure

- All input rasters must be integer and only the non-exclusionary criteria are used as input rasters. Before using the weighted overlay process, a floating-point raster must first be converted to an integer raster. For this purpose of conversion, the Reclassification tools provide an effective process and result.

- Each value class in an input raster is assigned a new value based on an evaluation scale. These new values are redistribution of the original input raster values.

- For exclusionary criteria such as salt pans, sea, water bodies, mangroves and pediment weathered a restricted value is used.

- According to the importance of the criteria, each input raster is weighted and the weight is a relative percentage, and the sum of the percent influence weights must equal 100 percent.

- The scale value used in weighted overlay tool is 1 to 9.

The pattern for the calculation of a multiple criteria analysis between several rasters in the weighted overlay table is as follows:

- Raster — the criteria of the input raster being weighted. Ex: Land use / land cover

- Influence — depends on the importance of the criteria of the input raster and the influence of the raster is as a percentage of 100. Ex: 25

- Field — the category of the criteria of the input raster used for weighting. Ex: Built up land
• Scale value — the scale value from 1 to 9 based on the weights of the criterion. Ex: 9
In addition to the numerical scale value of the fields of the criteria, some options are available as follows:

• RESTRICTED - For the exclusionary categories of the present study such as wetlands, mangroves etc., the assigned scale value is restricted.

• All these issues are taken into consideration in the weighted overlay table.

The input rasters are weighted according to their importance and added together to produce an output raster. On a common evaluation scale, the input rasters are reclassified and the steps are summarized below:

1. A numeric evaluation scale taken was between 1 and 9.

2. The cell values for each input raster in the analysis are assigned values from the evaluation scale and reclassified using the scale.

3. Each input raster is weighted a percent influence based on its importance to the model. The total influence for all rasters equals 100 percent.

4. The resulting cell values are added together to produce the output raster.

4.7.6 The Steps for Running the Weighted Overlay Process

The steps for running the weighted overlay process are as follows:

a) Select an evaluation scale

b) Add rasters

c) Set scale values
d) Assign weights to input rasters

e) Run the Weighted Overlay tool

a) Select an Evaluation Scale

In the Weighted Overlay table, an evaluation scale is selected to be used. Values may vary from one criterion to another based on their importance. Before that, rasters were reclassified using a scale of 1 to 9. The evaluation scale 1 to 9 used based on their importance viz., scale value 1 is used for the most suitable field or category of the criterion and 9 is used for least suitable field or category of the criterion in the weighted overlay table.

b) Add Rasters

Click the Add raster row button to open the Add Weighted Overlay dialog box. Click the Input raster drop-down arrow and click a raster, or click the Browse button to browse to an input raster and click Add. Click the Input field drop-down arrow to change the field if desired. Click OK. The raster is added to the Weighted Overlay table. Click the Add raster row button again to enter the next raster, and so on.

c) Set Scale Values

According to the importance of the field, the values are assigned are as follows: Land-use raster added has values representing the land-use type (farm land = 9, waste land = 1, built up land = 9, salt pans = Restricted, water bodies = Restricted, mangroves = Restricted). For ground quality type, good = 9, medium = 2. For geomorphology type, flood plain = 9, salt flat = 9, mud flat = 4, coastal plain younger = 3, coastal plain older = 2, sand flat = 9, deltaic plain older = 9, palaeo mud flats = 2, deeply weathered Pedi plain = 1, mangrove
swamp = Restricted. For ground water table type, good = 9, medium = 2. For soil type, loamy soils =9, clayey soils = 1, cracking clayey soils =1. Depending on the land use types which are more suitable for site selection has given the scale value 1 and according to the importance of the land use type, the scale values are given.

d) Assigned weights to input rasters

Each input raster can be weighted or assigned a percentage influence, based on its importance. The total influence for all rasters must equal 100 percent and given as 25% for land use and land cover, 25% for geomorphology, 15% for ground water table, 10% for ground water quality and 25% for soil.

e) Run the Weighted Overlay tool

The cell values of each input raster are multiplied by the raster's weight or percent influence. The resulting cell values are added to produce the final output raster.
Fig.4.3: Weighted Overlay Process