Chapter-8

ENVIRONMENTAL MANAGEMENT AND CONCLUSION

ENVIRONMENTAL MANAGEMENT AND CONCLUSION

R. S & G. I. S. BASED ENVIRONMENTAL MODELLING

8.1 INTRODUCTION :

Remote sensing technology and Geographic Information System have been extensively used in exploitation of surface and groundwater in many areas. Now time has common to use these technologies to realize the concept such as artificial recharge, water harvesting and water management. These technologies have the potential to help in reaching the ultimate goal of water management so that every one can get water.

Water resource management of a region involves a detail study of the surface and sub surface water. To integrate the entire surface and subsurface data manually requires huge manpower and time. By adopting the GIS techniques the result obtained will be faster and more accurate. Till recently, groundwater resource management was based on laboratory investigation, but the advent of satellite technology and GIS has made it very easy to integrate various databases.

Geographical distribution on earth surface has been inherently complex, revealing more information at higher spatial resolution apparently without limit. Modeling these distributions in to geographical reality is a process of discretization that converts a finite number of data base records or objects. The environmental process in the real world are computer based, mathematical models that stimulate spatially distributed and time dependent, which are increasingly recognized as fundamental requirement on the reliable, quantitative assessment of complex

environmental issue of local regional and global corner. Spatial representation is critical to environmental problem solving but GIS currently excel the predictive and related analytical capabilities necessary to examine, complex problem at least to some extent. The environment system, which emphasized here, is to understand the water system of the earth.

Geographical Information System (GIS) is a state of the art tool for efficiently capturing storing, updating, manipulating, analyzing and displaying all forms of geographical data.

From the structural point of view, GIS is very similar to conventional Data Base Management (DBMS), except for the fact that the database of GIS is more sophisticated and has the capability to associate to manipulate the enormous volume of spatially referenced interrelated data.

GIS stores spatial and non-spatial data into two different databases. The geocoded spatial data defines an object that has an orientation and relationship with other objects in to two or three-dimensional space. It is also know as topological data and stored in topological database. The data that describe the objects are known as attribute data stored in a relational database. GIS links the two databases by maintaining a one-to-one relationship between record of the objects attribute in relational database by using end-user which defines common identification index or code.

GIS uses three types of data to represent a map or any geo-referenced data, namely, point type, line type, and area type or polygon type. It can work with both vector and raster geographic models. The vector model is generally used for describing discrete features, while the raster model is used for continuos features.

8.2 DATA PRODUCT USED :

For preparation of thematic map toposheet 55H/5, 6,7,9 and 10 of Survey of India 1:50,000 and IRS-1C LISS III satellite data have been used. The various information used are rainfall data, groundwater level data, borehole lithological data and water quality data.

8.3 METHODOLOGY :

The methodology involves data acquisition, input, storage and management, and output. Both Spatial (geographical) and non-spatial data (attribute data) is used for the project development. Geo-relational model is used to maintain the connection between features and their respective attribute data.

Map preparation and Spatial data input

Using Survey of India toposheet and satellite data thematic map was prepared. This map is well drafted to allowed easy digitization. The thematic map prepared contains elements such as geographic co-ordinates along with details of landuse, drainage, contour, roads, terrain elevation (Fig. 8.1) etc. Thematic map was scanned using flatbed scanner and all the themes are stored in form of layers. After completion of digitization the raster image is detached and the vector layer is exported to ARC/INFO.

Non-spatial data :

The attribute data of the coverage are stored in Feature Attribute Tables (FAT). The Data Attribute Table (DAT) are created to store additional data.

Data Creation and Management

The steps involve the conversion of raw data into format ready for analysis

1. Topology creation
2. Identification of errors
3. Error rectification
4. Reconstruction of Topology

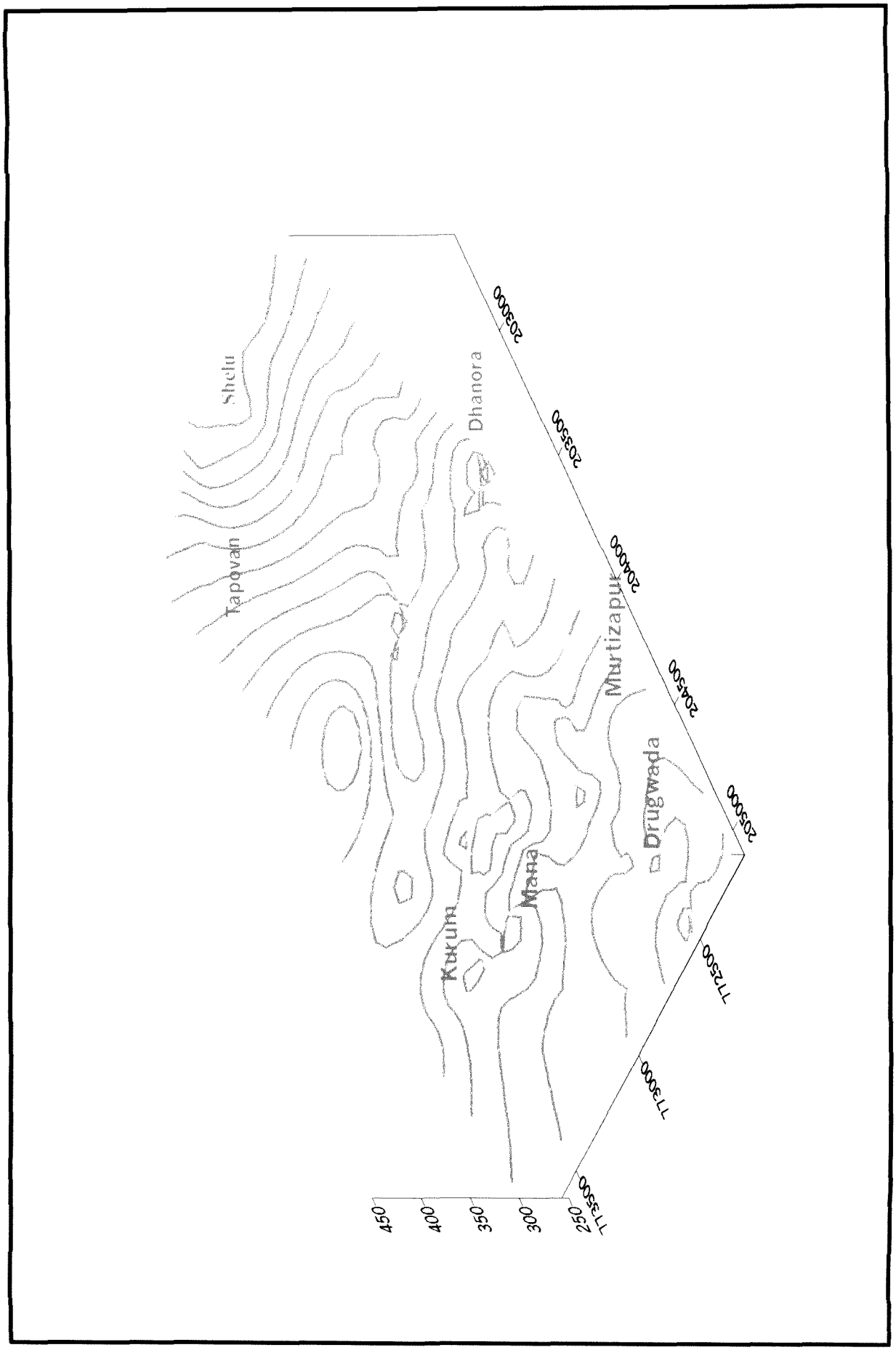

Figure 8.1 : Surface elivation map of Uma River Basin

The common commands used are given in table 8.1

Table 8.1 Command Used in preliminary analysis

COMMAND USED	DETAILED DISCRIPTION
DXFINFO <dxf_file>	Reads an raster (DXF) file and display information about.
DXFARC <in_dxf_file> <out_cover> {text_width} {attrib_width}	Converts an raster file into an ARC/INFO coverage.
CLEAN <in cover > {out_cover} {dangle_length} {fuzzy_tolerence} {POLY | LINE}	Bgenerate coverage with correct polygon or arc-node topology. To do this, CLEAN edit and corrects geometric co-ordinate errors, assembles arcs into in to polygons and creates features attri but information for each polygon or arc.
BUILD <cover> {POLY|LINE|POINT|NODE|A-NNO<sub class>}	Creates or updates a feature attribute table for a coverage.
PROJECT <COVER |FILE> <input> <output> {projection_file}.	Converts a geographic data set between two co-ordinate system.
TRANSFORM <in cover > <out_cover> {AFFINE|PROJECTIVE|SIMIL-ARITY}	Changes coverage co-ordinates using an affine similarity or projective trasformation based on a set of control points (tics).

8.4 GEOGRAPHICAL ANALYSIS:

The thematic maps prepared from remote sensing data and conventional field as given in various chapters in the same study are exported to ARC/INFO GIS software. Depending on relative importance on groundwater exploration the themes are assigned specific weights as indicated in Table8.2. Geomorphology is given the highest weight of 34 while surface water body is given with a value of 4 is at bottom. The rank of each thematic map is scaled by the weight of the theme. All the thematic maps are then registered through ground control points and integrated step by step using the normalized aggregation method in GIS for each feature and final map is prepared using four classified groups such as Highly favorable, moderately favorable, less favorable and poor for recharge (Fig 8.2).

Table8.2: Thematic map weight and feature ranking

No.	Theme	Features	Rank
1.	Geomorphology	Forms of fluvial origin	15
		Forms of Denudational origin	7
		Forms of structural origin	12
2.	Lithology	Younger Alluvium	10
		Older Alluvium	8
		Basalt	7
3.	Soil		5
4.	Drainage Density (per Km)		10
5.	Slop (%)		5
6.	Land Use		5
7.	Surface water body		4
8.	Water quality (EC)		5
9.	Rainfall		7

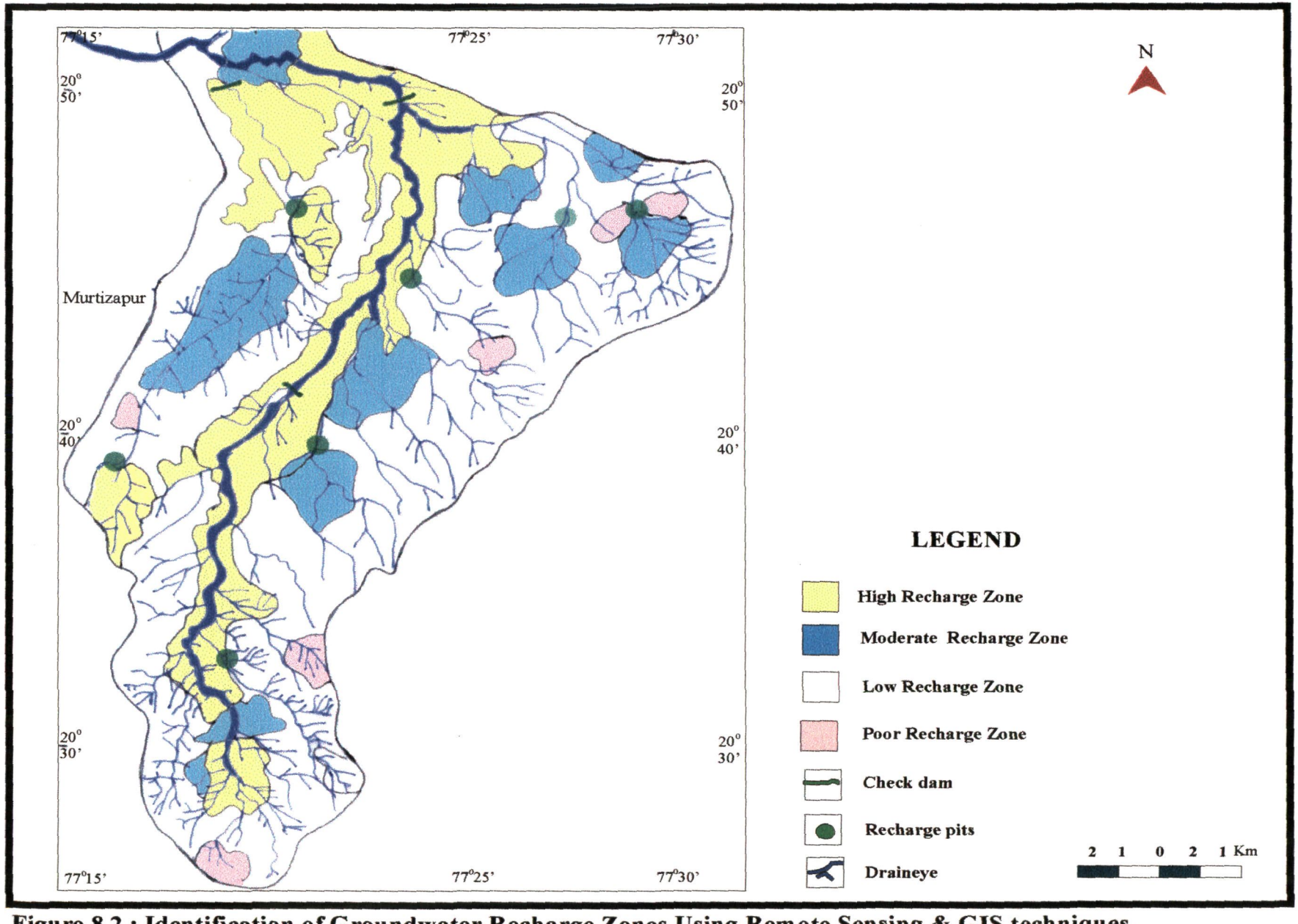

Figure 8.2 : Identification of Groundwater Recharge Zones Using Remote Sensing & GIS techniques.

8.5 RECOMMENDATION :

After detailed analysis using the above methodology the following recommendations were made –

Highly Favourable Zone:

Highly favourable zone for recharge includes gravel sand and clay of varying lithology. The zone is characterized by moderate infiltration runoff zone with moderate slop of <1.5%. The suitable recharge structures suggested are percolation ponds and check dams.

Moderately Favorable Zone:

A moderately favourable zone for recharge includes moderately dissected plateau area with moderately thick soil cover and weathered rock. The zone shows moderate infiltration rate with moderate runoff and comparatively moderate slop. The suitable recharge structure recommended are percolation pond and check dams.

Less Favorable zone:

Less Favorable zone for recharge includes denudational slop with weathered basaltic plateau exposing very thin soil. The zone shows moderately high runoff with moderate slope. The suggested suitable recharge structures are recharge pits or recharge trenches.

Poor Favorable zone:.

These areas have poor possibilities for recharge; they include denudational hills and isolated outcrops with moderate dissection forming moderately high-up land. The zones have poor infiltration rate with high slop. Generally no recharge structures are suggested.