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Watershed Development by Using GIS and Remote Sensing For Water Budgeting

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Abstract - *The aim of the project is to develop an action plan for watershed management. Watershed management is the process of creating and implementing plans, programs, and projects to sustain and increase watershed functions that affect the plants, animal and human communities inside watershed boundary. The recent technologies like remote sensing and GIS support us to giving a quicker and cost effective analysis of various applications with accuracy for planning. It also gives a better perspective for understanding the problems and therefore helps planners evolve a better solution for sustainable development. From the final output of these themes generate, recharge wells, percolation tank and check dams are recommended for the study area, mainly to control sedimentation from the catchments. To increase the ground water recharge and vegetative cover* to control soil erosion, various action plans like *construction of recharge structures, afforestation etc. has been proposed. This project describes in brief the work carried out for the study area using remote sensing and GIS.*

Morph metric analysis is a quantitative description and analysis of landforms as practiced in geomorphology that applied to a particular kind of landform or to drainage basins. Remote sensing (RS), Geographical Information System (GIS) has proved to be an efficient tool in delineation of drainage pattern and water resources management and its planning. In the present study.

Keywords: *Watershed, Watershed Development, Arc-GIS, LISS III Image, DEM, Drainage Map, Flow Accumulation Map, Malshiras Region.*

1 INTRODUCTION

1.1 General:

With the start of a new millennium, humankind faces environmental challenges greater in magnitude than ever before because the scale of the problem is shifting from local to regional and even to global ones.

A watershed is a geo-hydrological unit, which drains at a common point. Rain falling on the mountains starts flowing down into small rivulets. Many of them, as they come down, join to form small streams. The small streams form bigger streams; and finally the bigger streams join to form a nallah to drain out excess water from a village.

Watershed is a region (or area) delineated with a well-defined topographic boundary and outlets. It is a region within which Hydrological conditions are such that water becomes concentrated within a particular location, for example, a river or a water reservoir, by which the watershed is drained.

A watershed is made up of its physical and hydrological natural resources as human resources.

Therefore, watershed management is the process of guiding and organizing land use and use of other resources in the watershed to provide desired goods and services without adversely affecting soil and water resources. Embedded in this concept is the recognition of the in this concept is the recognition of the inter-relationships among land use, soil and the linkages between uplands and downstream areas.

Fig No: 1 (Watershed Management)

1.2 Water Budgeting:

It is considered that the main recharge to the ground water is mainly through the infiltration of precipitation, as it occur and percolates from surface storage to the ground.

Water budgeting equation as follow:

Total precipitation = (Runoff + Evaporation + Stored water on ground + Infiltration + Soil moisture + Recharge)

1.3 Study Area:

In the present context we opted for Malshiras Region in Purandar Tehsil. The fan shape catchment area of Malshiras Region which we opted for our study was peculiarly chosen as this region because due to the hilly region at the origin of the stream, there is high rate of losses due to run off and since last decades the ground water level in our region is constantly depleting, it also lead to drought like condition in this region. To overcome this issue occur in region frequently after rainy season to store the rain water more efficiently.

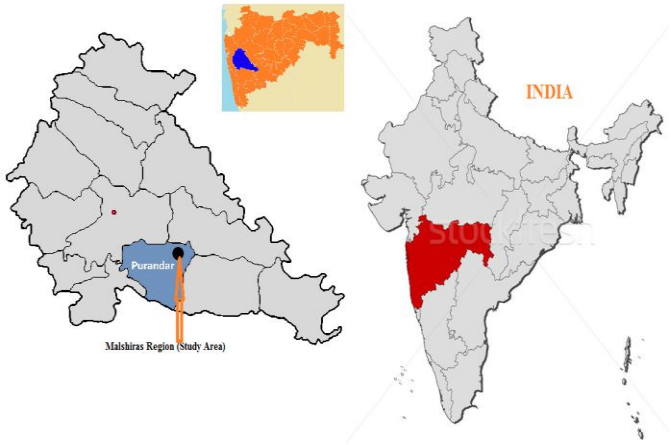

Fig No: 2 (studied region in Tehsil Map)

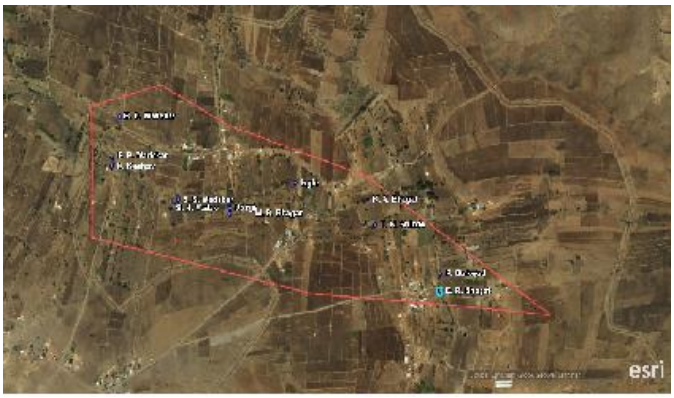

Fig No: 3 (Satellite image of studied area from Arc GIS)

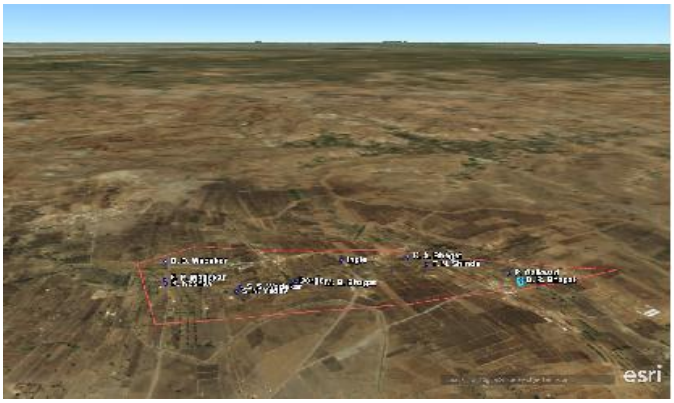

Fig No: 4 (Satellite 3D image of area from Arc GIS)

1.4 Objectives:

1 To decide dimensions of proposed water conservation & soil conservation structures.

2 To develop watershed in rural area for storing water for agriculture & other purpose during non-rainy season.

3 To calculate storage capacity of watershed.

4 To analyze & recharging water level of ground water table.

5 Developing accuracy with the help of 3D modelling of GIS & Remote sensing to analyze & develop watersheds & ground water table.

6 To decrease rate of waterborne disease.

7 To analyze efficiency and de-efficiency of water with the help of population census.

2. PROBLEM STATEMENT

India is affected with unevenness of weathering conditions. Every state and regions of nation has different topographical conditions, due to this the rate of rainfall and its intensities are different within every region.

In past few years in Maharashtra most of the region are facing drought due to uncertainty of rainfall. To overcome from this issue there is need to implement the effective method to increase the ground water table and natural resources of water.

3. METHODOLOGY

1. Site Selection:

   Malshiras Region is situated in Purandar tehsil, Pune District in the Estern part of Maharaqshtra in India. It has 7.840km^2, It is bounde by 18^{0}23′19″N and 74^{0}12′42″E, The average annual rainfall varies from 468mm to 628mm.

2. Pre field Work:

   In pre field work we collected Topographical sheet of Malshiras Region of scale 1:25000 from Survey of India and studied previous literature data about Watershed management and development in India.

3. Field Investigation:

a) Survey of Watershed: In preliminary survey we studied about the selected region considering on various parameters.

b) Observation of previous soil and water conservation structure: After analyzing existing soil and water conservation structure we concluded that

most of structures needs maintenance and repairing work,

c) Well Inventory: The well inventory consist of 37 wells, out of which sampling location consist of 22 wells. Samples were collected throughout the year and information collected by communicating with local farmers. Sample were collected in sealed containers with appropriate labeling and care throughout collecting and transportation for laboratory work.

4. Laboratory Work: In this process we conducted various test related to water sample collected from field.

a) pH

b) Alkalinity

c) Total Hardness

d) Chloride

4. RESULT AND DISCUSSION

Sr. No	Tests	Readings	Permissible Value
1.	Temperature	24	-
2.	Odour	Odourless	Odourless
3.	pH	7.53	6.5-8.2
4.	Chloride	121.43	250-1000mg/lit
5.	Total Alkalinity	205.27	200-600mg/lit
6.	Total Hardness	400.22	300-600mg/lit

Results of quality of water based on well inventory survey, as per the standard norms, detailed well inventory work in three repetitive seasons were carried out systematically from upstream to downstream direction.

The values of pH, Alkalinity, Hardness are within the permissible limit. But on the other hand, the value of Chloride is less than minimum permissible limit.

5. CONCLUSION

We have used number of techniques to study the area before visit such as Toposheet (Survey of India), Remote Sensing, satellite images & GIS software to develop map of proposed watershed region for proper understanding based on this data some thematic maps of study area were prepared.

Base on the result of water quality it is clearly observed that the pH, Alkalinity, hardness of the collected sample from predefined well shows the concentration is below the maximum permissible limit, except Chloride content is below the minimum permissible limit which causes human diseases and also not good for agricultural purpose. Hence this water quality exhibits these wells are yielding overall normal character of water which is potable except one parameter.

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