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Geospatial Engineering on Hydrological Behaviour of Catchments at River Basin

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Abstract: ***water is the most important parameter to be considered for improving living standards of the people at any area, which is being supplied to the public with various distribution systems from the sources of water supply. Generally water is available and being supplied to the public from two different sources such as surface water and groundwater. Surface water is available in the form of catchments, ponds, rivers etc. catchment is a hydrological body which has the source of water through precipitation and the runoff from the nearby areas. Every drop of catchment normally enters either into the river or it may evaporate if the water is not being used, at most of the areas catchments are serving as potential water resource for drinking, agriculture and for various daily day to day activities. The hydrological behavior of Catchments near to the rivers is greatly influenced by the quality of river water as the contaminants enter in to the catchments either directly or through infiltration. In the present study catchments at every village near to the river basin of Krishna River were selected to assess the quality of water and its level of suitability for consumption. Total eight water samples were collected in sterilized glass bottle by covering all the corners of the catchment and all the tests were conducted by adopting standard analytical procedures, the results were correlated with Surface water quality criteria for different uses (specified by CPCB, 1979 and the Bureau of Indian Standards, 1982.) and then results were projected in GIS maps.***

Keywords: Catchments, Contaminate, Hydrological, River, Surface water

I. INTRODUCTION

In the world scenario river banks are the significant potential resources behind the flourished civilization of human kind, however now a days they are getting disturbed due to rapid urbanization, increased and uncontrolled population along with unpredictable climatic conditions such as extended summer periods with reduced rainy seasons. Recognising and protecting catchments are the most important assignment to meet the continuous increase of water demand for human kind. Catchment is nothing but an area where the water enters either by rainfall or runoff then eventually flows back as single stream in to the nearby river basins or seas.

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In most of the areas catchments serves as source for drinking and also for agricultural to uplift the yield of agricultural productivity.

As water resources are depleting gradually there is a pressure on effective management of catchments which can be done by taking measures such as reducing average runoff contamination in catchment areas, improving conditions for effective hydrological cycle through which major quantity of rainfall enters into the catchments along with maintenance of perfect equilibrium between the protecting and utilization of water resources for sustainable development of catchments at river basin.

There is a significant development in the fields of geospatial engineering for developing a model to obtain the information on water resources by adopting overlaying techniques. GIS helps to access the information of entire catchment area and its quality of water more accurately than any other available technologies. By keeping this in view we have initiated this study for affective utilization and improved management of catchments by using geospatial engineering to uplift the hydrological characteristics with respect to its quality along the river banks. In this study six catchments from six villages in two mandalas very near to the Krishna River falls under the jurisdictions of guntur district andhra pradesh were identified to address the existed water quality scenario of catchments.

II. OBJECTIVE

To assess the quality of water in the catchments of study area and creation of GIS maps for water quality along with design of suitable strategies to promote sustainable environmental conditions along the river banks.

III. METHODOLOGY

A.Sampling locations:

1. By considering the topographical conditions of the catchment we have identified eight sampling locations for collecting water samples by covering centre part at all the catchments nearby river zone in the study area.
2. Samples were collected in sterilized bottles.
3. All the samples were labelled with location names.

B.Water quality Analysis:

1. Basic water quality influencing parameters like P^H, chlorides, Hardness, Total solids, and Total dissolved solids were examined
2. All the samples were analyzed by standard water quality analysis methods
3. The results were correlated with Surface water quality criteria for different uses (specified by CPCB, 1979 and the Bureau of Indian Standards, 1982) to understand the existed scenario of water quality in the catchment areas

C. Collection of Spatial data:

1. The data of both PAN and LISS-III satellite were geometrically corrected with proper enhancement.
2. Cubic convolution re sampling technique and principle component methods were adopted to integrate LISS and PAN satellite data then projected with 1:50,000 scale in FCC.

D.Creation of spatial data base:

1. Base map and settlements maps were prepared by applying visual image interpretation techniques.
2. Arc view and Arc info software's were used for scanning and maps digitization.
3. With the reference to field survey all the required corrections were done to produce final map.

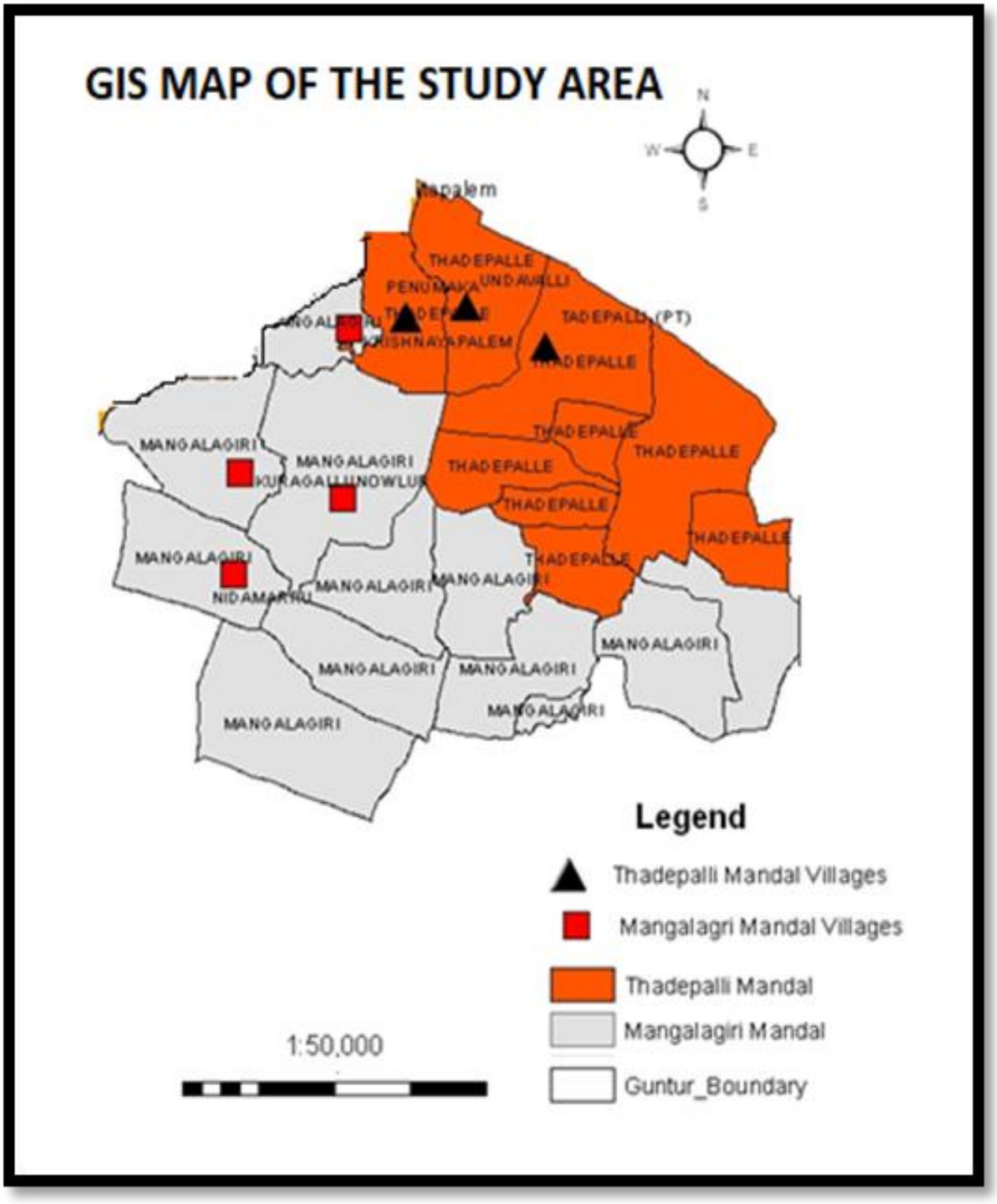

Figure: 1 GIS map for the study area

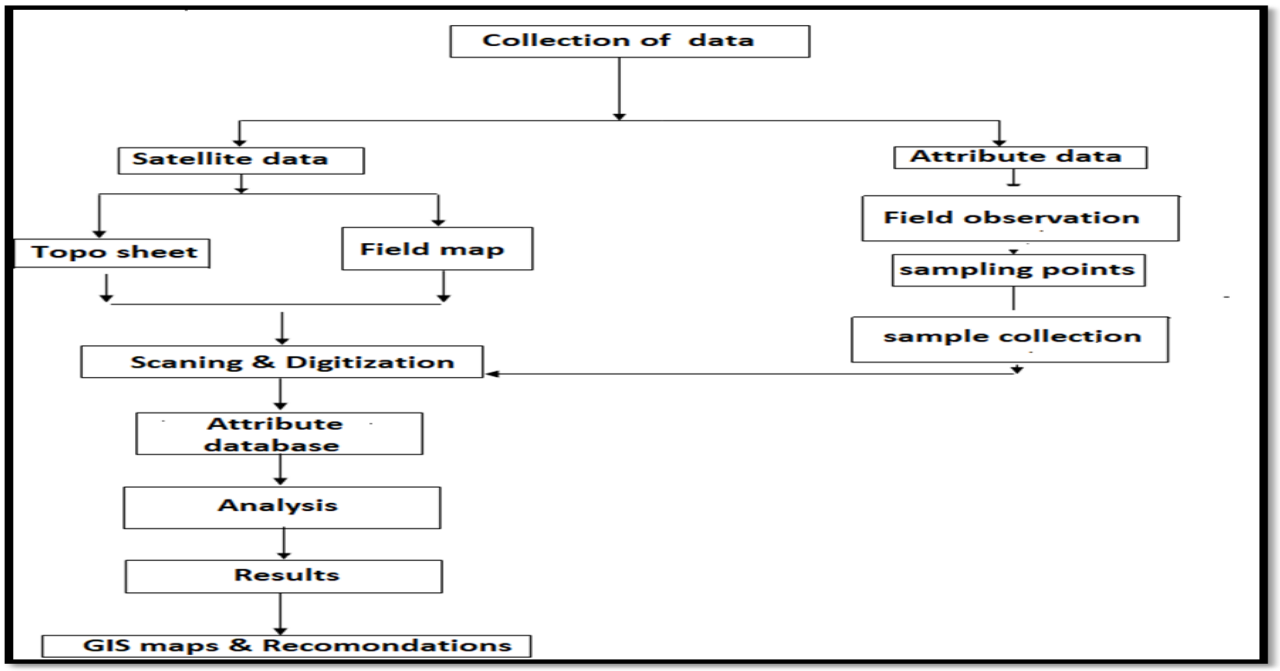

Figure 2: Flow chart of methodology

Table 1: Water quality analysis at study area

VILLAGE NAME	PH			CHLORIDES			HARDNESS			TOTAL SOLIDS			TOTAL DISSOLVED SOLIDS		
	DEC	JAN	FEB	DEC	JAN	FEB	DEC	JAN	FEB	DEC	JAN	FEB	DEC	JAN	FEB
UNDAVALLI	7.1	7.2	7.2	235	240	226	264	276	291	384	378	365	378	365	354
PENUMAKA	7.4	7.4	7.8	241	231	228	284	286	274	376	361	356	369	345	345
KR PALEM	7.1	7.6	7.4	244	250	236	291	291	282	371	384	382	354	372	365
NIDAMARRU	7	7.8	7.6	235	240	250	256	265	276	382	385	391	369	381	369
KURAGALLU	7.6	7.6	7.8	234	239	234	271	285	284	362	354	372	354	344	358
NAVVULURU	7.5	7.4	7.5	245	238	240	282	286	298	365	382	362	358	372	349

Table 2: Average values of three months results

VILLAGE NAME	PH	CHLORIDES	HARDNESS	TOTAL SOLIDS	TOTAL DISSOLVED SOLIDS
UNDAVALLI	7.1	233	277	375	365
PENUMAKA	7.5	233	281	364	353
KR PALEM	7.3	243	288	379	363
NIDAMARRU	7.4	241	265	386	373
KURAGALLU	7.6	235	280	362	352
NAVVULURU	7.4	241	288	369	359

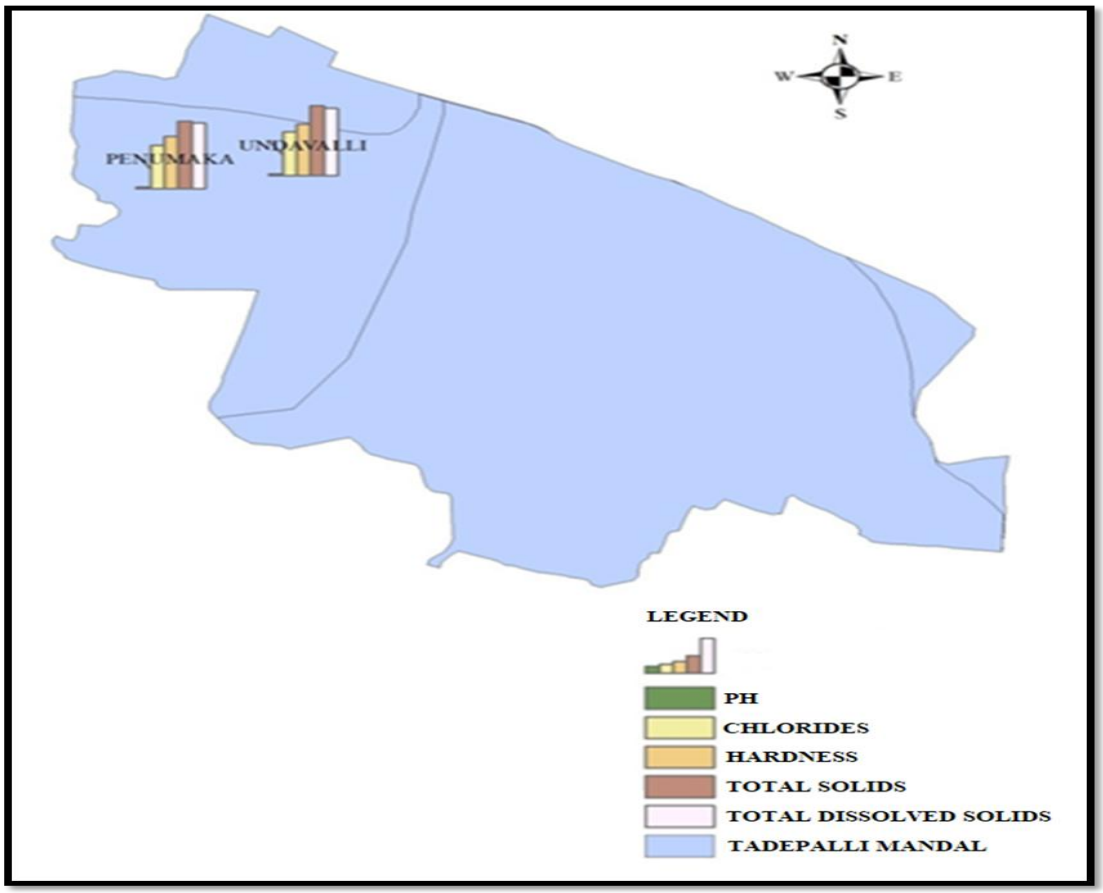

Figure 3: GIS map for catchment water quality in tadepalli mandal

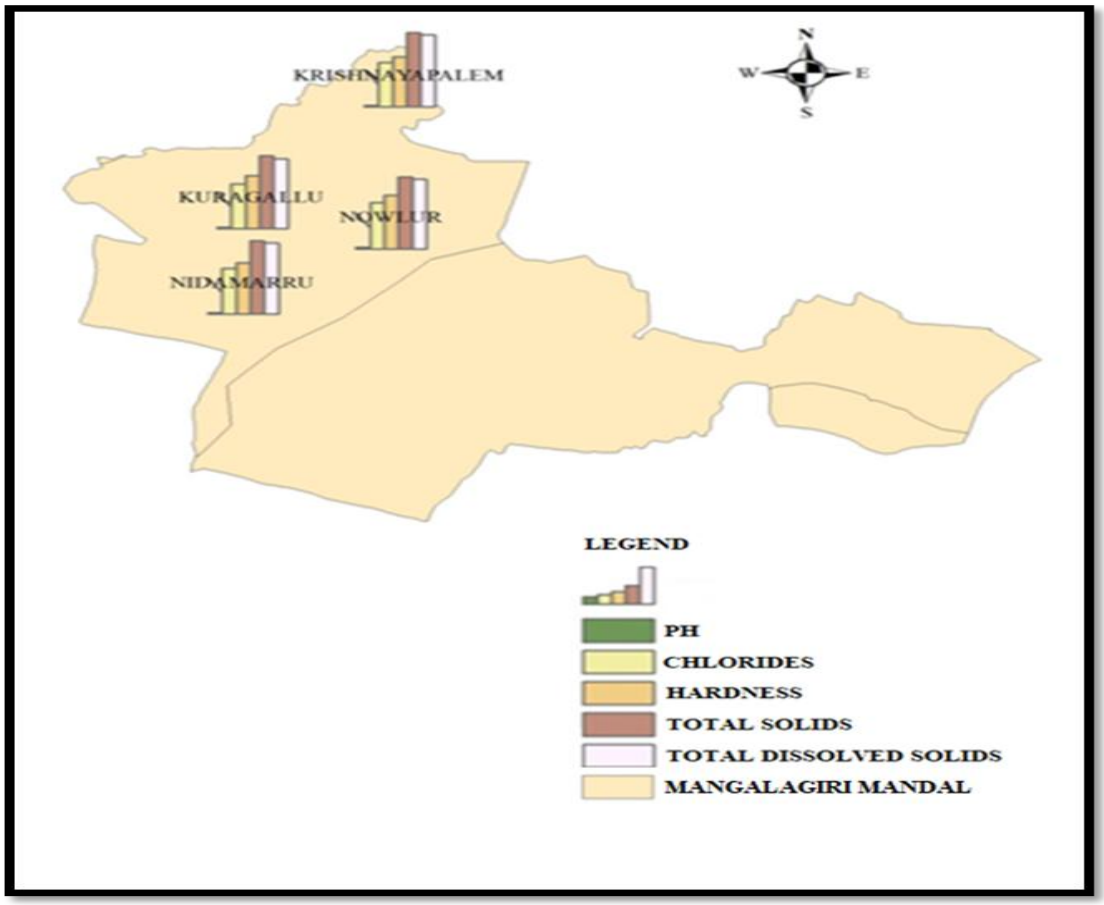

Figure 3: GIS map for catchment water quality in mangalagiri mandal

IV. RESULTS AND DISCUSSIONS

S.NO	PARAMETER	EXPLANATON
1	P^H	The P^H of the water samples correlated with Surface water quality criteria for different uses (specified by CPCB, 1979 and the Bureau of Indian Standards, 1982) drinking water quality standards and it shows that P^H of the water samples were within permissible levels
2	Chlorides	The alkalinity of water samples was within the permissible level as per Surface water quality criteria for different uses (specified by CPCB, 1979 and the Bureau of Indian Standards, 1982)
3	Total dissolved solids	Total dissolved solids of the catchments at all the areas represents Category 'A' type water body which needs treatment of water with disinfectants before consumption as per Surface water quality criteria for different uses (specified by CPCB, 1979 and the Bureau of Indian Standards, 1982)
3	Hardness and Total Solids	Both hardness and total solids were within the acceptable limits can be used for consumption with basic treatment to meet the requirement of water at study area.
4		1. Geo spatial engineering provides spatial images helps to understand the concentration of runoff that enters into the catchment and also to find out the flow pattern at catchment areas. 2. Spatial images of catchments can be utilized as source of reference to monitor the series of changes during the period of time. 3. Geo spatial engineering is very much advanced tool to predict all the possible changes likely to be occurred by referring previous satellite images of catchment areas. 4. Different maps were prepared by incorporating the results of water quality for monitoring the hydrological characteristics of catchments. The present status of catchment water is within the acceptable limits and can be utilized with basic treatment for the requirements of the people at study area.

V. CONCLUSIONS

1. The quality of catchment water is always in dynamic stage as it is influenced by quality of water flow from the rivers and the nature of contaminants enters into it through runoff.
2. Catchments must be maintain and monitored regularly to avoid the runoff contamination nearby coastal belts.
3. Geospatial engineering plays vital role in decision making for policy makers to promote environmental sustainable conditions by integrating water quality data of various seasons with spatial data base for making maps to be used as future reference in and around the study area.

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