International Journal of Advanced Research in Engineering and Applied Sciences

ISSN: 2278-6252
Impact Factor: 5.795

GROUND WATER PROSPECTS MAPING OF CHIGICHERLA WATERSHED USING REMOTESENSING AND GIS TECHNIQUES

Dr. V. Gope Naik*

B. Ramanarasimha Rao**

Dr. K. Bhupal***

Abstract: *Anantapur District experiences semi-arid climate. The summer months are very hot and the Mercury rises to + 42^0 Celsius. Winter months are pleasant, when the night temperature is about 13^0 Celsius to 15^0 Celsius. Winter months are ideal for fieldwork. However, a few field traverses were taken for this work in the summer months also. Rainfall is generally scanty. The average rainfall per annuam is 530.00 mm. In the year 2008, the recurrence of drought increased considerably and unless collective measures are initiated on a permanent basis the situation will become grim in future. Chigicherla watershed in Anantapur District is selected to demonstrate the capability of high resolution satellite data in ground water mapping at village level. This watershed is located in Survey of India toposheet Nos. 57F/10,57F/11,57F/14 and F/15. This watershed with an area of about 209 sq.km is underlined by hornblende biotite gneiss, Closepet Granite and metabasalt traversed by dolerite dykes. Ground water prospecting mapping was carried out on 1:10,000 scale using IRS-P6 LISS-IV satellite data. The satellite data facilitates to update the extent of built-up area, road and drainage network. Further, the revenue villages enclosed in the watershed are digitized, mosaiced and superimposed on Ground water prospecting map. This helps to give site specific recommendation on ground water prospects land forms wise i.e. for individual units. In addition, the impact analysis of check dams constructed in the watershed is also discussed. Studies showed that after construction of tentative check dams the water levels in well- increased Well inventory data confirmed that the various geomorphic units are classified as favorable, moderately favorable, and poor zones of groundwater.*

Key Words: *Integrated Ground water Prospect mapping, Watershed, Rainfall, Geomorphology*

*Assistant Professor, Dept. of Geology S.V. University, Tirupati, A.P.

** Research Scholar, Dept. of Geology S.V. University, Tirupati, A.P.

***Post Doctoral Fellow, Dept. of Geography, S.V. University, Tirupati, A.P.

INTRODUCTION:

The synoptic view provided by satellite remote sensing offers technologically the appropriate method for studying land and water resources, characterizing the coherent agricultural zones, and identifying the constraints/ecological problems at micro level. socio-economic and meteorological data in GIS helps arriving at locale specific prescriptions to achieve sustainable development of natural resources of any drought affected region. Remote sensing data in conjunction with sufficient ground truth data provides information on Geology, Geomorphology, Hydrology, structural/lineaments, Drainage pattern and recharge conditions which ultimately define ground water regime. Anantapur is a hot and semi arid District, falls in rain shadow zone with a very low annual rainfall of 550mm . Monsoon evades Anantapur District due to its location in the rain shadow region. South-West monsoon is prevented by the high altitudes of Western Ghats, making Anantapur District a rain shadow area and hence, agricultural conditions are more often precarious. Being far away from the East Coast, it does not also enjoy the rainfall benefit of the North-East monsoon. The recurrence of droughts increased considerably and unless collective measures are initiated on a permanent basis the situation will become grim in future. In order to demonstrate the capability of high resolution satellite data in ground water prospecting map at mandal level part of Chigicherla watershed in Anantapur District is selected. The objective of the study is groundwater prospect map corresponding to survey of India toposheet on 1:50000 scale, covering all habitations. The map shows (a) prospective zones for ground water occurrence (b) Tentative locations for constructing recharge structure. the information provided in the ground water prospects maps from a suitable database for narrowing down the target zones and systematic selections of sites for d riling of counteracting fallow up ground surveys to establish drinking water source to all non covered and partially covered habitation besides providing information for selection of sites for construction of recharge structure therefore ultimately resulted in sustainable development of watershed.

STUDY AREA:

Chigicherla watershed area Anantapur District, Andhra Pradesh state longitude 77° 48' 8.373N" latitude14 °36'45.762E" watershed area around 209 sq km. Five mandals are covered namely Anantapur, Rapatadu, Kanaganipalle, Battalapalle and Dharmavaram. The

ISSN: 2278-6252
Impact Factor: 5.795

Study area is mostly 90% plain land and western part is residual hills ,denudational hill and some pediment are there, Anantapur district The area experiences semi-arid climate .The summer months are very hot and the Mercury rises to + 42^0 Celsius. Winter months are pleasant, when the night temperature is about 13^0 Celsius to 15^0 Celsius. Average rain fall per annum 550 mm in the year of 2013.

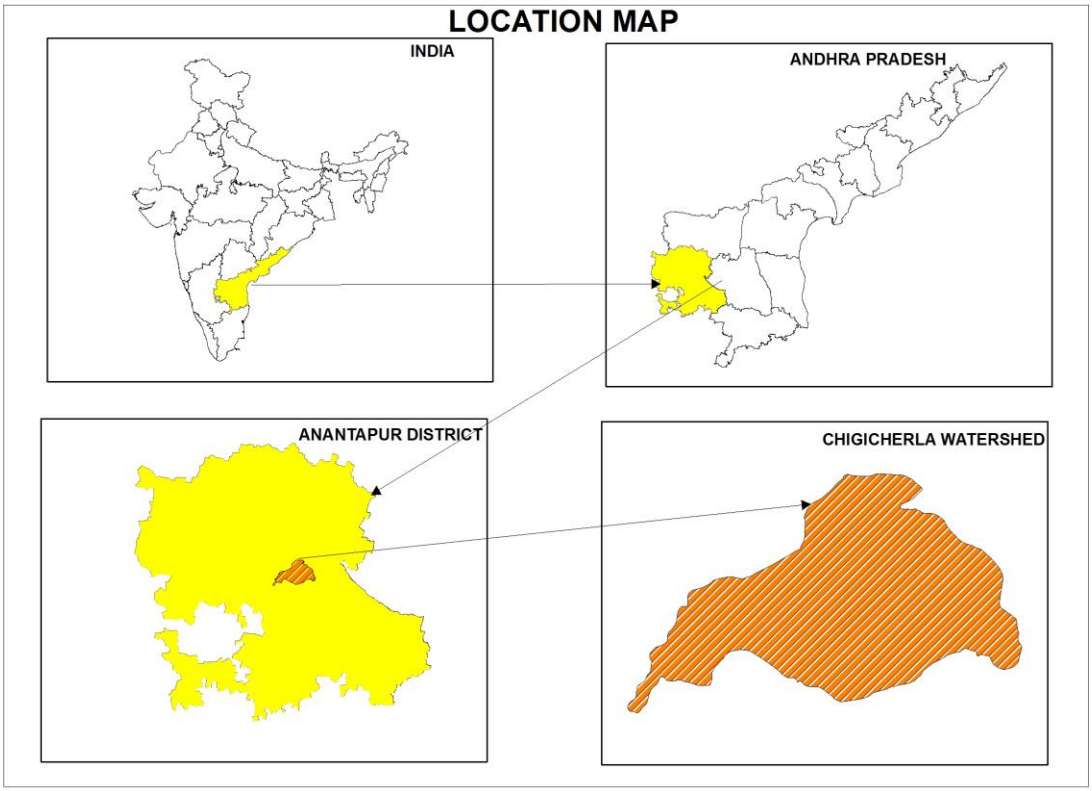


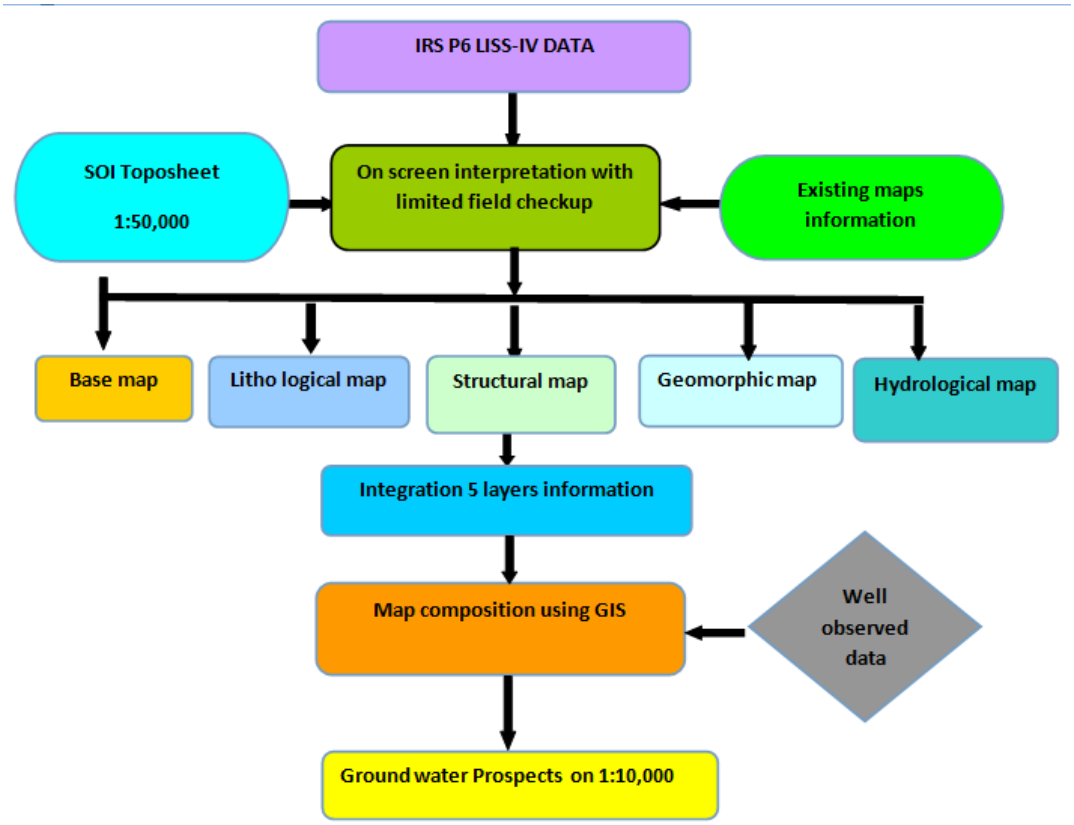
Figure: 1 - Location map

METHODOLOGY:

Thematic layers is digitized and delineated using the Survey of India (SOI) toposheet of scale 1:50,000. , and IRS-P6-LISS-IV Satellite data Block and Check boundaries were delineated from the features resulted from surface modeling tools, topo map and digitized Road network. The digitized canal network The methodology is designed keeping in view the concept surplussed above it is basically a systematic procedure evolved to prepare a ground water prospects map using satellite data and GIS techniques in conjunction with limited field work various steps involved in the preparation of ground water prospects maps are furnished as a now flow chart in below:

ISSN: 2278-6252
Impact Factor: 5.795

FLOW CHART OF GROUNDWATER PROSPECTS



The total methodology can be divided into two main parts. The first part deals with the declination of hydrogeomorphic units considered parameter influencing the hydro geological properties. It consist of a) preparation of individual thematic maps i.e. lithology, Geomorphology, structures, hydrology and base map details based on the visual interpret ion of standard FCC of satellite data in conjunctive with limited field existing data and b) derivation hydrogeomorphic units by integrating the thematic data the second part deals with the evaluation of ground water condition in each hydrogemorphic unit. It consists of i) evaluation of ground water prospects based on hydrogeologial characteristic of each and every parameter. and ii) semi quantification of ground water availability by taking in account the well observatory data and iii) selection of tentative location for taking up artificial recharge structures.

The data thus generated at different stages, is converted into a digital database as per the specified standards .It is in the form of two outputs 1) all the four parameters as individual thematic maps base map also gen-rated as separated map and 2)ground water prospect map as a final output.

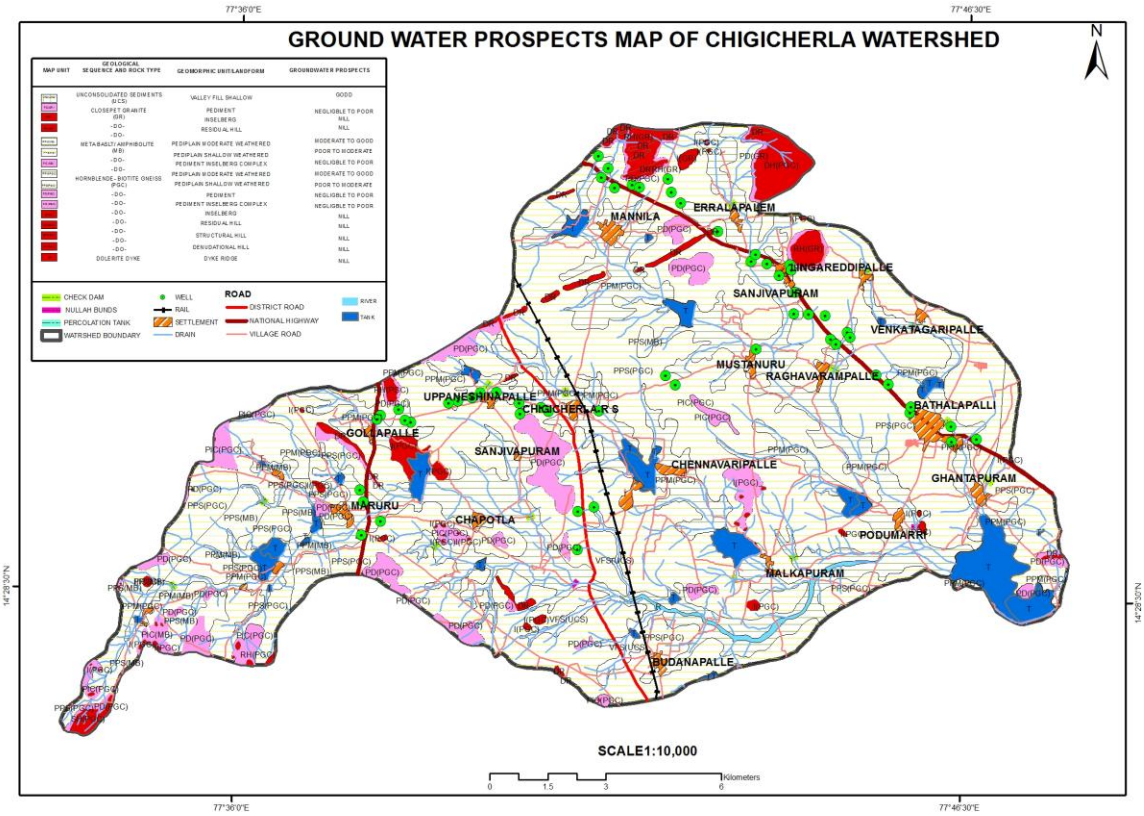


Figure:2 - Groundwater Prospects Map of Chigicherla watershed, Anantapur District, A.P

Hydro geomorphology:

Geomorphology deals with the study of land forms. The applied aspect of geomorphology is the application of descriptive geomorphology in analyzing and in understanding the conditions of occurrence of ground water. Satellite data has been used in the identification of land forms considering their spectral signatures and have been verified by extensive field work. The land forms based on their origin can be classified as Denudational, Depositional and structural in the decreasing order of incidence.

Fluvial Landforms:

VFS (Valley Field Shallow): It constitutes unconsolidated sediments such as boulders, cobbles, pebbles, gravel, sand and silt deposited by streams/rivers normally in a narrow fluvial valley. It forms moderately productive shallow aquifers with very good ground water prospects. But, the ground water prospects vary depending upon the thickness of the fill material and its composition.

Denudational Landforms:

DH (Denudational Hill): It is a narrow linear ridge with heap of boulders of dolerite composition or steep massive ridge standing above the ground level or sometimes highly

jointed. Negligible to poor yields are expected in this landform. Moderate yields are expected in the upstream direction.

PPM-Gr (Pediplain moderately weathered): This unit is mostly observed along the channel fills with a little lateral spread. It is also seen in the ayacut areas of tanks. The secondary porosity in the form of fractures and the loose gravely material help in the infiltration. As a result the percolation rate is much higher compared to the Shallow Weathered Pediplain. The aquifer will be in the underlying fractured rock. The ground water prospects can be considered as good.

PPS-Gr (Pediplain Shallow Weathered): The Pediplain shallow develops partly by erosional and partly. This will have a thin deposition of weathered material, i.e., up to 10mts. Weathered material can't have an aquifer. But the in the field quite a few bore wells are observed. Yielding considerable quantity indicating ***moderately good*** ground water prospects. This clearly points to the fact that there must be secondary porosity that helps the surface water to infiltrate in to the sub-surface. The underlying fractured rock acts as an aquifer.

PD- Gr (Pediment): It is a gently sloping smooth surface of erosional bedrock of granite gneiss between hill and plain with thin veneer of detritus. This unit forms runoff zones with limited prospects along favorable locales. In general, the ground water prospects in this landforms are poor.

PIC (Pediment Inselberg Complex): As in the above case, the ground water conditions are limited if the unit is dissected by lineaments and poor if it un-dissected and unweathered.

DR (Dyke Ridge): It is a narrow linear ridge with heap of boulders of dolerite composition or steep massive ridge standing above the ground level or sometimes highly jointed. Negligible to poor yields are expected in this landform. Moderate yields are expected in the upstream direction.

Structural Land forms: As stated earlier this has restricted distribution. The prospects are also restricted especially in an un weathered outcrop. The weathered pediment may have ***limited*** prospects, but the un weathered one will have ***poor*** prospects.

SH-MB (Structural Hill): These are linear to arcuate hills of Meta basalt with narrow valleys showing definite trend lines. The ground water prospects are negligible. Moderate prospects are observed along valleys.

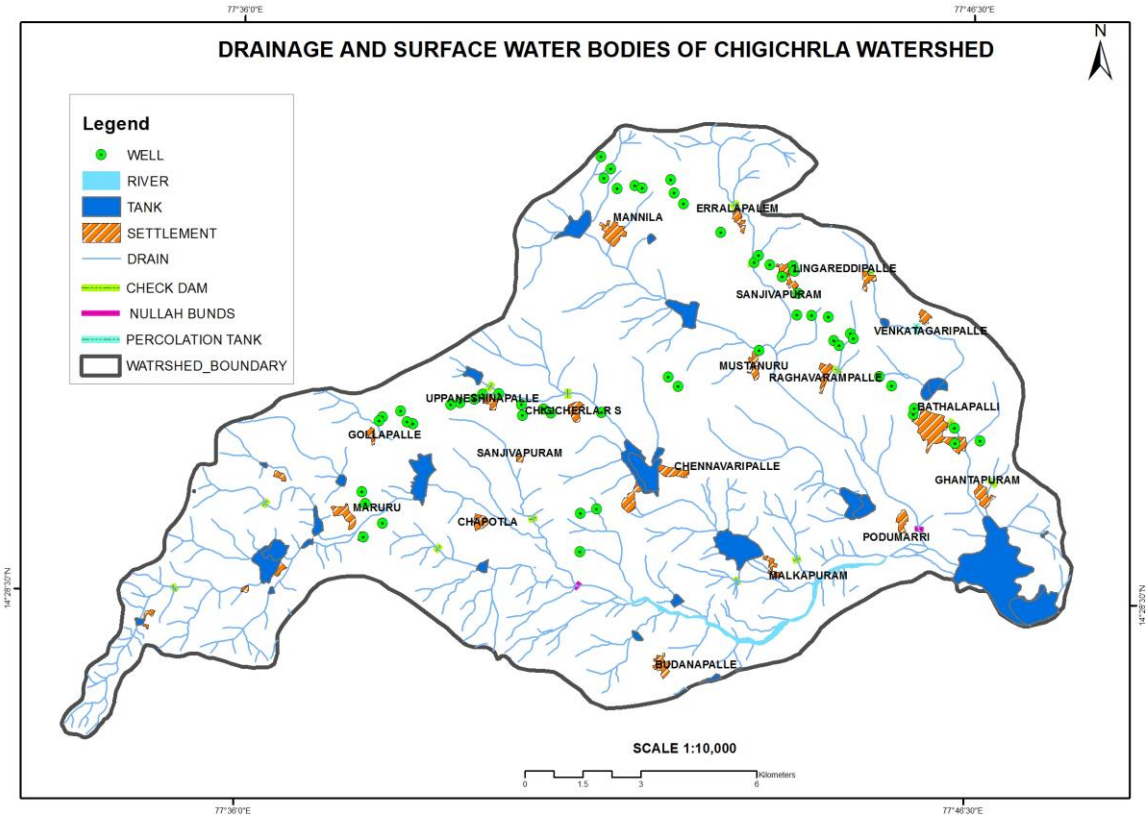


Figure: 3 - Drainage and surface water bodies of Chigicherla watershed Anantapur district, A.P

CONCLUSIONS:

The Indian Remote Sensing satellite (IRS P6 LISS-IV) data with a spatial resolution of 5.8m can be enlarged even up to 1:4,000 scales. With the help of high resolution data, expansion of rural settlements, drainage and road network is updated. The boundaries of all geomorphic units are drawn more precisely. With the advent of high resolution satellite data, site-specific recommendations for ground water exploration at for effective management of ground water resources at smallest possible revenue boundary i.e. The effect of check dams resulted in stabilizing the water levels in the wells, increasing the pumping hours, rejuvenating the abandoned wells, and resulting increase in irrigated area.

REFERENCES:

[1] **APSRAC (A.P. State Remote Sensing Applications Centre) 1997,** Integrated Study to Combat Drought, Anantapur District, Andhra Pradesh, Project Report,102p.

[2] **Eswar Reddy, G., 2011,** Integrated hydrogeological studies of ground water using spatial technology, in parts of Anantapur district, A.P, India. Unpublished Ph.D. Thesis, S.V. University, Tirupati, Andhra Pradesh.

[3] **NRSA (National Remote Sensing Agency) 2008**, Ground Water Prospects Mapping Using Remote Sensing and Geographic Information System, Rajiv Gandhi National Drinking Water Mission Project, Manual,256p.

[4] **Raghu, V., & Mruthyunjaya Reddy, K., 2011,** Hydrogeological Mapping at village level mapping of Akuledu vanka Watershed Anantapur District A.P.

[5] **Ramkumar, T., Venkatramanan, S., Anita Mary, I., Tamil Selvi, M., and Ramesh, G. 2010,** "Hydrogeochemical quality of groundwater in Vedaraniyam town", Tamilnadu, India. Res J Environ Earth Sciences 2: 44-48.

[6] **Sambasiva Rao, T., 1987,** Hydrogeology of upper Nagari river basin, Chittoor District, Andhra Pradesh, India. Unpublished Ph.D. Thesis, S.V. University, Tirupati.

[7] **Sreenivasa Rao. Y., Krishna Reddy, T.V., and Naidu, P.T., 1997**, Hydrogeomorphological studies by using remote sensing application in Niva River Basin, Chittoor District, A.P. J. Indian Soc. Remote Sensing,25(3P):187-194.

[8] **Tijani, M.N., 1994,** Hyrogeochemical assessment of groundwater in Moro area, Kwara State, Nigeria, Journal of Environmental Geology. Springer- Verlag 24, pp. 194- 202.