International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 05 | May 2019 www.irjet.net p-ISSN: 2395-0072

SITE SELECTION FOR RAINWATER HARVESTING STRUCTURES USING GIS SOFTWARE FOR THE AUGMENTATION OF GROUND WATER

H D HANUMESH[1], LAVANYA A[2], LOHITH KUMAR M B[3] NISHMITHA A R[4]

[1]H D HANUMESH, Student, Dept of Civil Engineering
[2]LAVANYA A, Student, Dept of Civil Engineering
[3]LOHITH KUMAR M B, Student, Dept of Civil Engineering
[4]NISHMITHA A R, Student, Dept of Civil Engineering
[5]SUDHA P HADADI, Professor, Dept. of Civil Engineering, S. T. J. Institute of Technology, Karnataka, India
[6]D S MAGANUR, H.O.D, Dept. of Civil Engineering, S. T. J. Institute of Technology, Karnataka, India

---

Abstract - *Groundwater is a precious resource and need to be carefully protected since withdrawal rates exceed recharge rates at many places in the world. In order to augment the groundwater resource, rainwater harvesting is to be adopted. Geographic Information System (GIS) is the tool currently available to handle large volume of spatial data along with attributes. The study area selected is Ranebennur city Haveri (dist.), Karnataka, India. Maps like soil distribution, slope, geology, geomorphology and lineament were classified using Arc View GIS. The Model Builder in the Arc View GIS was used to give Weightage for various layers and select site suitable for recharge structures. Suitable locations for rain water harvesting to augment groundwater were selected for Ranebennur city.*

Key Words: **GIS Software; Arc GIS; Rainwater harvesting structure; Site selection; Soil tests.**

1. INTRODUCTION

GIS in recent times has transformed into Geo Information technology with the integration of Mapping techniques, Surveying, Remote sensing & Satellite Imagery, Photo grammetry, Geography, Geology, Cartography and Global Positioning Systems (GPS). The benefits of using GIS in sectors like Agriculture, Rural development, Irrigation, Industries & Minerals, Energy, Transport, Communications, Science, Technology and Environment. GIS can be used for scientific investigations, resource management, and development planning. GIS used in Computer Science, Civil Engineering, Mathematics, Statistics and Operations Research.

Arc GIS 10.5is a full release of the Arc GIS platform. It includes enhanced functionality, stability improvements and better support for connectivity, security and enterprise readiness. Arc GIS 10.5 introduces several new products. Portal for Arc GIS is now a core product that you deploy on your internal network to share maps, applications, and other geographic information with other members of the organization, with the introduction of new extension to Arc GIS for server called Arc GIS GeoEvent Processor, organizations can process extensive real- time data on the fly and display relevant information from the feeds in Arc GIS clients. Other enhancements in Arc GIS 10.5 include improve support for using maps in the field in an enterprise, many new geoprocessing tools, support for new data formats and data basis, and better search capabilities for raster's and imagery.

2. AIMS and Objectives

2.1 Aim

The aim of this study is to produce a groundwater recharge potential map using GIS.

2.2 Objectives

1. To demarcate the ground water recharge potential zones using GIS technique.
2. To create a digital data base for ground water development for future.
3. To locate suitable sites for implementing artificial recharge structures.
4. To promote and guide the implementation of web based applications that facilitate access to geographic information.
5. To improve public access to online government services through GIS technology.

3. STUDY AREA

Ranebennur is the city Municipal Council in Haveri District in Karnataka, India. It is situated 300kms north west of Bengaluru other nearby cities include Hubli(105km), Shimogga (88km),and Davangere (37km).The temperature here averages 25.4º.April is the hottest moth of the year at an average temperatures 29.3º.It is a city of around 2lakh population geographically located at the4 center of the Karnataka state. It is a major business center and the biggest city in the Haveri District. Latitude of Ranebennur city is 14.623801 and Longitude is 75.621788.The samples are collected near by the Shaneshwara temple and Adavi hanumappa temple and open lands of Gangapura village.

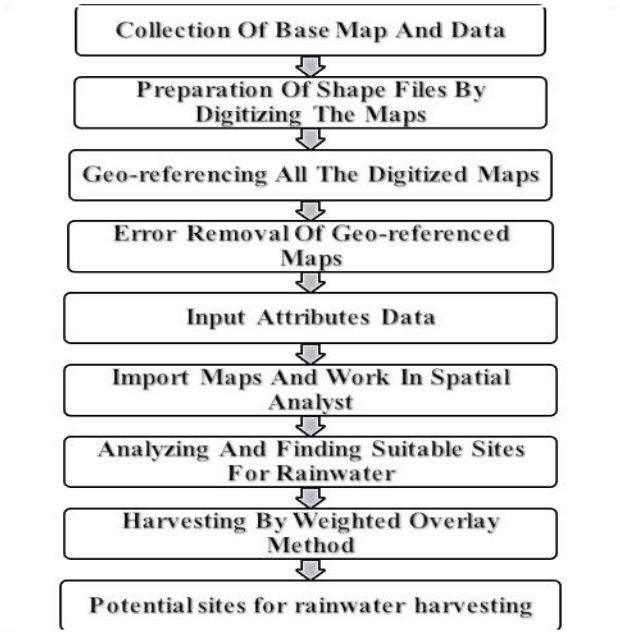
Figure 1 Ranebennur city

4. RAINWATER HARVESTING STRUCTURE

These are used to store the excess rainfall using check dam, Lake Farm pond, and bunds and recharge pits and bore wells. Coimbatore city has got eight lakes to store the rain water. But this alone is not sufficient. There is a need to store the rain water through recharge structures at various parts of the city to augment the groundwater and take maximum chance of using rain water this structure filters runoff water and recharges the clean water into the ground through a drilled bore well. Due to hard rock strata of Coimbatore region, it is important to construct recharge bore well, recharge pit and filter materials like sand, boulders, blue metals etc. The intake capacity of the bore well depends upon the number of crack zones getting encountered during the vertical drill. Constructing rain water harvesting structure around such bore well pits is an innovative initiative to harness the storm-water marooning on low-lying areas and to recharge the same as groundwater.

5. METHODOLOGY

Following is the flow chat of the research work,



6. GROUND WATER

Ground water is the water present beneath Earth's surface in soil pore spaces and in fractures of rock formations. The study of the distribution and the ground movement of groundwater is hydrogeology, also called **Groundwater hydrology.** Water that falls as an precipitation flows along the surface of the ground. The surface water infilters into ground surface and is held in soil pore spaces and in the fractures of rock formations. Gaining access to groundwater sources therefore requires digging or drilling through the ground and into an aquifer.as we know that groundwater is depleting day by day there is a necessity of recharging of groundwater. This process usually occurs in vadose zone below plant roots and, is often expressed as a flux to the water table surface. Groundwater recharge also encompasses water moving away from the water table farther into the saturated zone. Recharge occurs both naturally and through anthropogenic processes, where rainwater and or reclaimed water is routed to subsurface

7. SOIL

Major part of the Ranebennur taluk is covered by red sandy soil followed by the medium black soil and deep black soil. The red loamy soil and lateritic soil are in very small parts of the taluk.

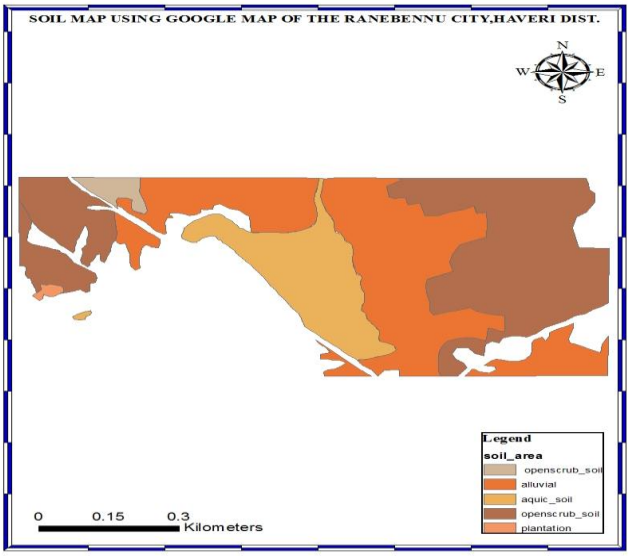


Figure 2 SOIL MAP

8. GEOMORPHOLOGY

Geomorphology, Ranebennur is generally a gently undulating plain, except for the hilly area on the western most part of the taluk. The general slope in the taluk is in southeast direction .One of Karnataka's most important river-Tungabhadra-flows along the border of Ranebennur taluk in the south. Another river-Kumadvathi-which

originates from Madaga Masur Lake flows all the way from Hirekerur taluk & passes inside Ranebennur taluk & finally joins river-Tungabhadra – in Ranebennur Taluk. All the rivers in the district together with their tributaries exhibit dendritic drainage pattern and them from part of Krishna river basin.

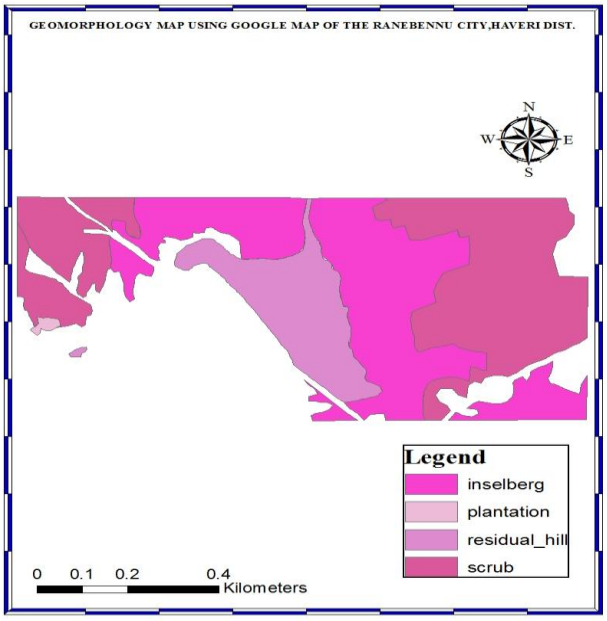


Figure 3 Geomorphology Map

9. Geology

The district lies on the Deccan plateau and comprises Dharwad system as it bed rocks Dharwad and Haveri. The major portion of this cellist belt has no mineral deposits of any commercial importance, excepting the eastern part of Haveri district. The rocks shows a considerable variation in texture, are usually massive and are pink to grey in colour. Bands of conglomerates occur in the northern region of the district and pebbles and holders comprise granite felsite's appetite, quartzite and schist's. Laterite too is found to occur in several parts, but chiefly in the west as capping over granite, gneiss and quartzite. The mineral wealth of the district includes gold copper iron and manganese besides granite which is most useful as a construction material and is extensively quarried in all parts.

10. Weighted Sum Map

In decision theory, the weighted sum model (WSM) is the best known and simplest multi-criteria decision analysis (MCDA) multi-criteria decision making method for evaluating a number of alternatives in terms of a number of decision criteria. It is very important to state here that it is applicable only when all the data are expressed in exactly the same unit.

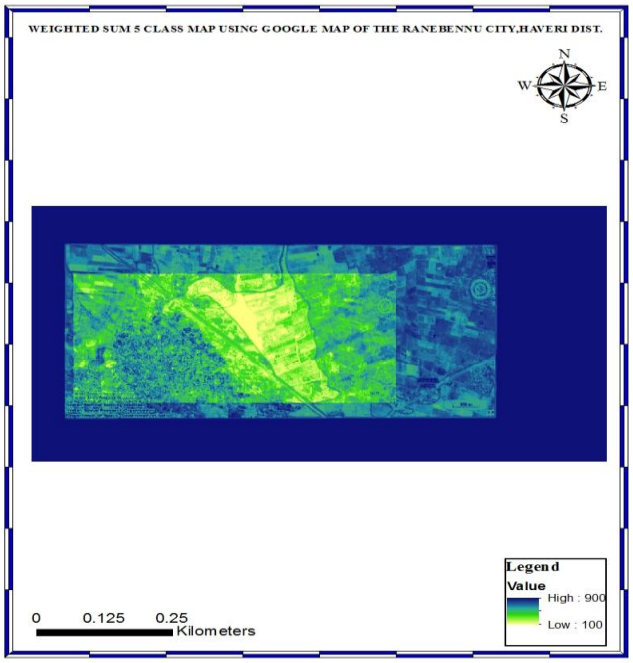


Figure 4 Weighted Sum Map

11. APPLICATIONS:

1. Currently, groundwater levels are quickly being dep leted by agricultural, industrial, and domestic uses. Various thematic layers were chosen to identify suit able water harvesting locations and then they were prepared, weighted, and analyzed using GIS.
2. As a result, maps showing the most effective locatio ns for rainwater harvesting were produced.
3. GIS is one of the major application in water resource information system. It emerged a significant support tool for this system in particular and it provide a consistent method for many ground water applications and to prepare input data for groundwater flow and quality model.
4. GIS is also playing an important role in mapping groundwater quality and quantity assessment and monitoring process.
5. GIS has been a fast developing technology in spatial information processing. It can easily enter, store, retrieve process and display spatial information from different data sources.

12. CONCLUSIONS

1. The study has provided suitable sites for construction of the Rain Water Harvesting structures in Ranebennur city. Rainwater harvesting structure if built can prove to be very effective in saving water for future use .the study has demonstrated the capabilities of using

Geographic Information System for identifying potential sites for rainwater harvesting structures.

2. By the above chemical tests we have got the suitable results for the soil sample taken. By this we came to know about the chemical properties of the soil, percolation and infiltration capacity of the soil. By this we have concluded that the soil situated in the sites which are selected for the construction of the rainwater harvesting structure is suitable for the collection of the rainwater.

REFERENCES

[1]. **Elangovan K and Selva kumar(2018)** Site Selection for Rainwater Harvesting Structures Using GIS for the Augmentation of Groundwater.

[2]. **GeethaS, Elangovan K(2009)** Hydro geochemistry analysis of groundwater in Noyyal river basin. Int J Applied Engineering Research4(2): 211-227.

[3]. **Arumugam K, Elangovan K(2009)** Hydro chemical Characteristics and Groundwater Quality Assessment in Tirupur Region, Coimbatore District, Tamil Nadu, India. Environ Geology 58(7): 509-1520.

[4]. **Arumugam K, Elangovan K (2010)** Quality Characterization of Groundwater in Tirupur Region, Tamil Nadu, India, IJAER 5(1): 9-24.

[5]. **DurgaRao KHV, Bhaumik MK(2005)** Spatial Expert Support Harvesting Structures. Geocarto Int 18(4): 43-50.

[6]. **GhayoumianJ, Mohseni MS, Feiznia S,Nouri B,Malekian A(2006)** Application of GIS techniques to determine areas most suitable for artificial groundwater recharge, in a coastal aquifer in southern Iran. J Asian Earth Sci 30(2): 364-374.

[7]. **Abdallah BM, Ismail C(2007)** The Groundwater recharge study in arid region. Minerals Resources and Environment Laboratory, Department of Geology, Faculty of Sciences of Tunis, El Manar, Tunisia. Computers & Geosciences 36(6): 801-817.

[8]. **GavadeVV, PatilRR, PalkarJM, Kachare KY (2011)** Site suitability analysis for surface rainwater harvesting of Madhatahsil, Solapur, Maharashtra: ageo informatics approach.12thEsri India User Conference 4(8):455-462.

[9]. **GeethaSelvarani A, Maheswaran G, Elangovan K(2014**) Evaluation of groundwater potential zones using GIS , and remote sensing in Noyyal Basin, Tamil Nadu, India. Int J Environ Tech Manag 17(5): 377392.

[10]. **Geetha Selvarani A, Maheswaran G, Elangovan K, Siva Kumar C (2015)** Identification of artificial recharge sites for noyyal watershed using GIS and fuzzy logic. Int J Applied Engineering Res 10(4): 11189-11208.

[11]. **Samson S, Elangovan K(2015**) Delineation of Groundwater Recharge Potential Zones in Namakkal District, Tamilnadu, India Using Remote Sensing and GIS.J Indian Society of Remote Sensing 43(4): 769778.

[12]. **Maheswaran G,GeethaSelvarani A, Elangovan K(2016)** Groundwater resource exploration in salem district, Tamil Nadu using GIS and remote sensing. J Earth System Science 125(2):311-328.

[13]. **GeethaSelvarani A, Maheswaran G, Elangovan K,(2017)** Identification of Artificial Recharge Sites for Noyyal River Basin Using GIS and Remote Sensing. J Indian Society of Remote Sensing 45(1):67-77.

[14]. **Selvarani AG, Elangovan K, Kumar CS(2016)** Evaluation of groundwater potential zones using electrical resistivity and GIS in Noyyal river basin, Tamil Nadu. J Geological Society of India 87(5):573582.

BIOGRAPHIES

H D HANUMESH
Student,
Dept of Civil Engineering
S T J I T Ranebennur

LAVANYA A
Student,
Dept of Civil Engineering
S T J I T Ranebennur

LOHITH KUMAR M B
Student,
Dept of Civil Engineering
S T J I T Ranebennur

NISHMITHA A R
Student,
Dept of Civil Engineering
S T J I T Ranebennur

SUDHA P HADADI
Professor,
Dept of Civil Engineering
S T J I T Ranebennur

D S MAGANUR
H O D,
Dept of Civil Engineering
S T J I T Ranebennur