International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-8 Issue-6, March 2020

Water Storage Assessment of Khapri Watershed through Geospatial Techniques

A.L.Guruji, P.G.Agnihotri

Abstract: ***Khapri watershed is mountainous region having average 2255 mm rainfall every year. In the last few months of hydrological year i.e. April & May, there is an acute shortage of drinking water. To overcome this short fall, it is necessary to manage natural watersheds available in the region. water harvesting is a system that collects rainwater from where it falls around its periphery rather than allowing it to go as runoff. The strategy of "Think Globally, Act Locally" should be used in this area for management of water. Local water that is rainwater stored using Rainwater Harvesting Structure and Conservation used optimally before it goes in drain or river.The subsurface reservoirs are very attractive and technically feasible alternatives for storing surplus monsoon runoff. But in the study region, this is not possible as there is a basalt rock. Recharging is not advisable as water table in post monsoon just touches ground level. So, Rainwater harvesting structures for direct use of water may be the possibly best solution.For community requirement rainwater may be stored in checkdams or depressed area naturally available. Construction of small barriers across small streams to check and store the running water also can be considered as water harvesting structure. This may fulfil the drinking water requirement of their cattles.***

Check dams in the watershed has been ascertain using Geospatial techniques and few of them verified by visiting the sites. In site visit it is found that open wells near the stream has water level above stream water level. At few places farming is done in check dam reservoir or in stream itself.

Keywords : Check dams, Rainwater Harvesting Structure.

I. INTRODUCTION

Water is the most precious resource on the earth which is essential for the existence of life. Though Khapri watershed in Dang district, Gujarat, India receives an average rainfall of around 2255 mm in monsoon. It experiences water scarcity in Vaishakh and Jyeshta (April, May) seasons. Peculiarities such as steep slope and undulating terrain accelerate surface flow and hence most of the water received as rainfall goes as unutilized. So to meet the requirement of water round the year, it is essential to effectively trap the surface runoff in monsoon season and retain it so long as to get infiltrated or stored on surface which can be done by proper management of excess rainwater available in monsoon season.

II. METHODOLOGY

A. Water Storage Structures using RS-GIS

The Khapri watershed is highly hilly region with steep slope. This site is not favorable for recharging structure as in last face of monsoon ground water level in almost all open well touches ground level. So, checkdams may be constructed and here one hundred and twelve checkdams has been identified using Remote Sensing Techniques. checkdams are very clearly observed and they are demarcated using line tool available in this software. Lines are marked on visible checkdam and that line is stored in .kmz format . This file again open in QGIS 3.8 version, and then .kmz Format file converted in the shape file. This file can be open in any other compatible software for further analysis. Such 112 checkdams are identified in watershed and stored in .shp format. The length of all checkdams stored in this file with it's location. This has been ascertain using GPS hand held tool and all are shown in figure1.

B. Depression Analysis using contour map of watershed

In this method using DEM (Digital Elevation Model) of study area, contour map generated and with interval of 5 m contour lines, analyze whole area where natural depression available in the watershed. By this way there are about 25 sites found in this area where natural depression available. Few of them are in river valley itself and few are at top of hilly region. For constructing Rainwater Harvesting Structure such depression are advantageous. These depressions are marked in QGIS using polygon function and a shape file has been generated. These sites are shown in fig. 2.

Manuscript received on March 15, 2020.
Revised Manuscript received on March 24, 2020.
Manuscript published on March 30, 2020.
* Correspondence Author
A.L.Guruji*,(Ph.D.Student) Civil,The Maharaja Sayajirao University of Baroda, Vadodara, India. Email: ashish.guruji-polyced@msubaroda.ac.in
Dr.P.G.Agnihotri, Civil,Sardar Vallabhbhai National Institute of Technology,Surat,India. Email: pga@ced.svnit.ac.in

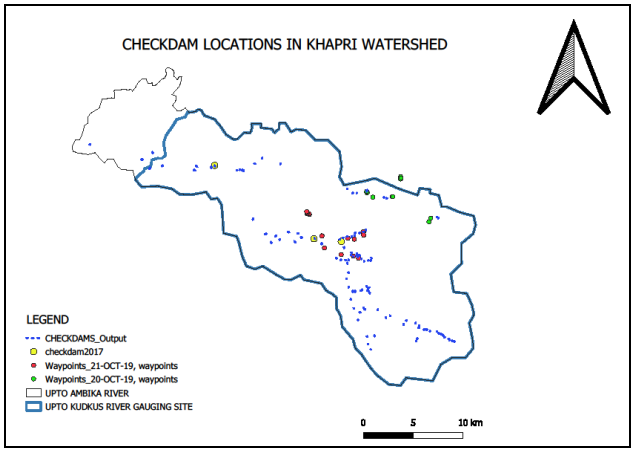

Fig. 1. Checkdam locations in Khapri watershed

C. Site visit of Khapri watershed

As a part of checking the remotely sensed data,field verification has been done.GPS points are collected using hand held GPS instrument on 20th and 21st obctober,2019.The waypoints in .gpx format extracted from instrument and call in QGIS using Vector tool bar. It will display points on screen and it will look like Figure 1.Figure 3 shows half of checkdam reservoir filled with clay and cultivation has been practiced in that area. Fig. 4 shows one side of stream near causeway practiced for cultivation. Fig. 5 shows water level in open well above stream water level. Figure 6 shows water level in open well touches almost ground level.

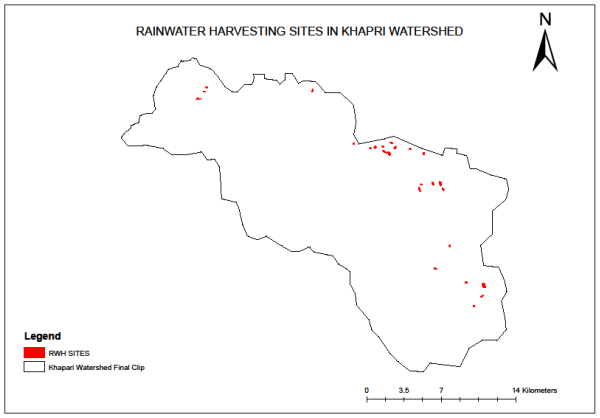

Fig. 2. Rainwater Harvesting sites in Khapri watershed

Fig. 3. Half of Checkdam covered with Cultivation

Fig. 4. One side of causeway stream filled with cultivation

Fig. 5. Water Level in Open well near stream above River Water Level

Fig. 6. Water level in Open well almost touching Ground level in Ahwa (21st october,2019)

III. RESULT AND DISCUSSION

1) From depression analysis of Contour map of watershed there are about 25 water harvesting spots from which few are following in river valley itself.[Fig.2]
2) There are 112 checkdams identified from geospatial technique and few are verified with GPS hand held instrument.[Fig.1]
3) From site visit, it is observed that one check dam reservoir filled with clay and used for farming.[Fig. 3]
4) At other location in the watershed, one side of causeway, farming done in stream and other side water is flowing.[Fig. 4]

5) Above third and fourth point clearly indicate the heavy erosion and settlement in the stream which is alarming.
6) Few of open wells observed in the watershed, in the month of October, i.e.post monsoon season, they are almost touching to ground level. One open well near stream, water level is higher than stream water level.[Fig. 5],[Fig. 6]
7) The above sixth point indicates that there is very little scope for recharging ground water.

IV. CONCLUSION

From result and site visit, rainwater may be efficiently stored in streams itself and recharge to ground water is not possible as after monsoon ground water level touches the almost ground level. The technique of rainwater harvesting to collect the rain from localized catchment surfaces such as roofs, plain /sloping surfaces for direct use(Rooftop Rainwater Harvesting System,(RRHS))for individual family may be suggested to overcome drinking water problem in last two months of hydrological cycle.[1],[2].

ACKNOWLEDGMENT

I wish to express my sincere thanks and deep sense of gratitude to my esteemed guides **Dr.P.G.Agnihotri,** Professor in Civil Engineering Department, SVNIT, Surat for their personal and keen interest in my work. At every difficult stage, they inspired me to work hard in order to overcome the difficulties. **Dr.S.M.Yadav**, Professor and Head in Civil Engineering Department, encourage me for my research work by giving very key instruction to improve my performance.

REFERENCES

1. Central Ground Water Board "Manual on Artifical Recharge of Ground Water". Faridabad: Governementt of India,2007.
2. Gujarat State Watershed Management Agency, Technical Manual, "Integrated Watershed Management Programme", Commissionerate of Rural Development, Gandhinagar, Government of Gujarat, 2011.

AUTHORS PROFILE

A.L.Guruji M.E. in Hydraulic Structures from The Maharaja Sayajirao University of Baroda and just now doing Ph.D. from SVNIT,Surat. Published about 08 papers in national and International conferences, working on problem of water scarcity in hilly region of Gujarat State., Life member of ISRS(Indian Society of Remote Sensing),won first prize in paper presentation at EIOCD, International Conference in 2015,Gujarat,India.

Dr.P.G.Agnihotri He has total experience of about 28 years. His areas of interest are water resources engineering, geospatial technologies including GIS, GPS and Remote Sensing. His Research area is Flood Mitigation and Management under Geospatial Platform. He has published about 45 research papers in peer-reviewed journals and conferences of repute. He has completed 01 research projects and 10 consultancy projects. He has guided 1 Ph. D. research Scholar and is supervising 8 Ph.D. research Scholars at present. He is member of 5 technical societies. He has delivered 15 expert lectures. He has visited countries like UK, Canada and Thailand for presenting papers in international conferences.