International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor (2018): 7.426

Emerging Scarcity and Sustainable Water Management in Ahmednagar District

Anand Niranjan Gholap[1], Ganesh Dinkar Gawali[2]

[1, 2]Pune University, DVVPCOE, Department of Civil Engineering, Vilad Ghat, 414111, India

Abstract: ***Due to growing population, during last few decade's large scarcity of water is observed in every region of world. There are immense new techniques and methods developed, but there are some flaws due to which we can't get complete outcome from the technologies. This paper is focused on water resources and its management in Ahmednagar district and how we can minimize the deficiency of water by using automation as a tool in water management systems. It includes the study of areas like Hiware bazar, Ralegansiddhi, Syria which have overcome there shortage of water by implementing proper approach and how small steps can also make a huge difference. Policies and procedures for attaining sustainable development of water resources.***

Keywords: Water management, Water origin, Population Expansion, Water need, Automation, PLC and SCADA

1. Introduction

Water is a crucial resource for all life on the planet and is very necessary for world economy and approximately 70% fresh water used by human being is mainly used for agriculture. The moment of water on, above and below the surface of the earth is called as hydrological cycle. Flowing water often gets collected into river, lakes, ponds, dams some water is diverted for irrigation and agriculture purposes, Groundwater is extracted artificially in wells. Water storage is very important since clean and fresh water is needed for each and every living being to survive on the planet, as it is necessary even for a small microorganism like amoeba to a large mammals like elephants. Although it is the most vital resource on earth it is not handled properly.

The most important use of water in agriculture is for farming, which is a major component to cultivate ample food. Irrigation takes up to 82% of water in India. Few decades ago, the common concept was that water was a never ending resource. But today the population has inflated over 7.7 billion and the consumption of water is rising due to which availability of water is decreasing leading to drought conditions in major parts of the country. It is forecasted that by the year 2050 the population of earth will rise up to 9 billion which will hike the demand of water immensely but the resources available will be the same, which will lead to a serious problem. To avoid this consequences we have to take some major steps. Continuation of today's food production and environmental trends would lead to crises in many parts of the world. To avoid a global water crisis, farmers will have to strive to increase productivity to meet growing demands for food, while industry and cities find ways to use water more efficiently.

Effort taken in water resource management is directed at optimizing the use of water and environment. The observation of water as an integral part of the ecosystem is based on integrated water resource management, where the quantity and quality of the ecosystem help to determine the nature of the natural resources. As a result, alternative management strategies are sought for in order to avoid setbacks in the allocation of water resources.

Automation is the best possible alternative for water management because it reduces the amount of water used in agriculture, by calculating and applying amount of water needed for farming it is distributed to the crops at the roots in proper manner giving the exact amount of water needed, for growing the ideal crop. Man power needed is also reduced and the errors are also minimized due to the programmed software. Due to this benefits automation has a great scope in future leading to new invention in water management techniques.

Ahmednagar district has also faced such huge problems of water management leaving some exceptions like Hiware bazar and Ralegansiddhi, which have overcome such types of problems by implementing various techniques and methods which led to an abundant saving of water.

2. Research Methodology

2.1 Geographical conditions of Ahmednagar District.

There are various land forms in Ahmednagar district. There are hilly off-shoots of the Sahyadris in the western part of the district. They are called Kalsubai, Adula, Baleshwar and Harishchandragad hill ranges. Kalsubai, the highest peak in the Sahyadris, lies in Ahmednagar district. Harishchandragad, Ratangad, Kulang and Ajuba are some other peaks in the district. We see the Vita ghat on the way to Randha falls and the Chandanpuri ghat on the Pune-Sangamner road. If we consider the physical setup of ahmednagar district we see that there are 3 physical divisions those are:

- Western hilly region.
- Central plateau region.
- Region of northern and southern plain.

Ahmednagar is the largest district of Maharashtra State in respect of area. It is situated in the central part of the State and lies between north latitudes 18°19' and 19°59' and east longitudes 73°37' and 75°32' and falls in parts of Survey of

India degree sheets 47 E, 47 I, 47 M, 47 J and 47 N. It is bounded by Nashik district in the north, Aurangabad and Beed districts to the east, Osmanabad and Solapur districts to the south and Pune and Thane districts to the west. The district has a geographical area of 17114 sq. km., which is 5.54% of the total State area. It is divided in to 14 talukas:

- Ahmednagar.
- Rahuri.
- Shrirampur.
- Newasa.
- Jamkhed.
- Karjat.
- Srigonda.
- Parner.
- Akola.
- Sangamner.
- Kopargaon.
- Rahata.

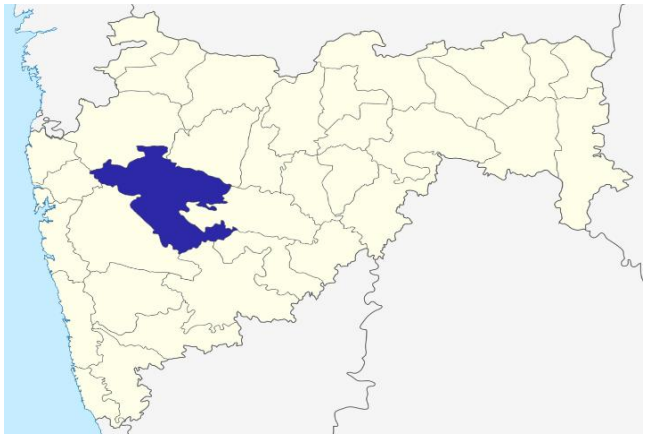

Figure 1: Location of Ahmednagar District in Maharashtra

Out of these talukas many of them are facing the problem of drought every year. Which results into low yield of crops resulting into poor economic conditions in this region. The population of the district is 4,543,159 as per 2011 census with density of 265 persons per sq. km. There are 18 towns and 1581villages in the district, out of which 2 villages are not habited. The district has 14 Panchayat Samitis, 8 Nagar Parishads, 1 Municipal Corporation and 1310 Gram Panchayats. As per the land use details (2011), the district has an area of 134 sq. km. occupied by forest. The gross cultivable area of district is 15097 sq.km. Whereas net area sown is 11463 sq.km. The climate of the district is characterized by a hot summer and general dryness throughout the year except during the southwest monsoon season, i.e., June to September. The mean minimum temperature is 12.3°C and mean maximum temperature is 39.1°C.The normal rainfall over the district varies from 484 mm to about 879 mm. Rainfall is minimum in the northern parts of the district around Kopargaon and Sangamner and it gradually increases towards southeast and reaches the maximum around Jamkhed. The district being situated in "Rain Shadow" zone of Western Ghats, it often suffers the drought conditions. Almost entire district covering Ahmadnagar, Rahuri, and Nevasa, Shevgaon, Jamkhed, Karjat, Srigonda, Pathardi and Parner talukas comes under "Drought Area".

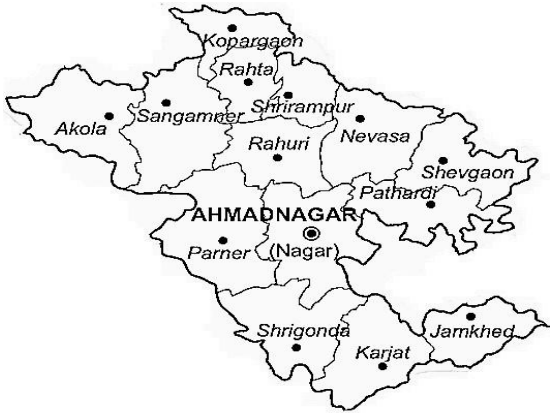

Figure 2: Taluka wise region of Ahmednagar

2.2 Resources in Ahmednagar district

Godavari and Bhima are the major rivers of the district. The Pravara is the tributary of Godavari. The Mula, the Adhale and the Mahalungi are the important tributaries of the Pravara. The southern part of the district consisting of Parner, Ahmednagar, Pathardi, Shrigaonda and Karjat tehsils constitutes the Bhima basin with the tributaries Kukadi and Ghod. In ahmedagar district following dams are constructed for storage purposes:

- Mula Dam.
- Ghatghar Dam.
- Palashi Dam.
- Visapur Dam.
- Nalwande Dam.
- Hanga Dam.
- Lonimavla Dam.
- Dhoki Dam.
- Mandohol Dam.
- Seena Dam.
- Khairi Dam.
- Rui Chatrapati Dam.
- Ghod Dam.
- Tikhol Dam.
- Adhala Dam.

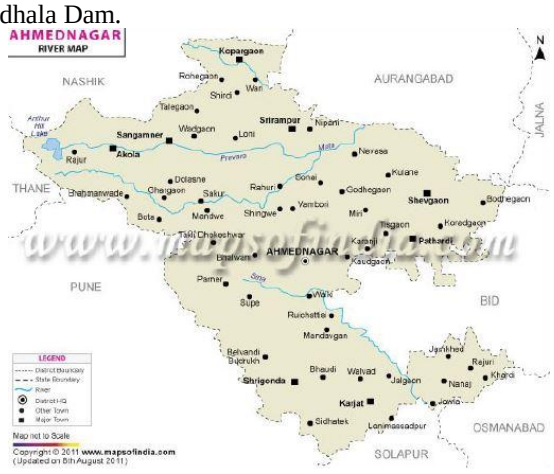

Figure 3: Rivers of Ahmednagar

2.3 Present population scenario

According to census 2001 population of Ahmednagar district was 40, 40,642 out of which
Male population- 20, 83,053

Female population- 19, 57,589

After Ten years that is in 2011 population was increased by 12.44% and was 45, 43,159 out of which
Male population- 23, 42,825
Female population- 19, 57,589
By assuming the same growth rate i.e. 12.44%

Growth of population in 10 years = population in 2011- population in year 2001
= 45, 43,159- 40, 40,642
= 5, 02,517

Now we will calculate the population in 2019, So the number of years between 2019 and 2011 are 8 years.

5, 02,517 ⟶ 10 years
X ⟶ 8 years

Where X is increase in population in 8 years.

X= 4, 02,014

Therefore,
Population in year 2019= population in 2011 + increase in population in 8 years
= 45, 43,159 + 4, 02,014
= 49, 45,173

As per the bureau of Indian standard, IS: 1172-1993, a minimum water supply of 200 liters per capita per day (lpcd) should be provided in cities.
Therefore, water needed for population in 2019 calculated as above will be
= 49, 45,173 x 200
= 98, 90, 34,600 Liters

As we can see the amount of water needed by the population is very immense approximately 99 crore liters. By taking in consideration Agricultural and industrial need of water in ahmednagar district there is a certain amount of scarcity of water due to which drought condition arrises. To overcome these situation we have to take some measure steps like building reservoirs, Automation in water management, excavating CCT, Rain water harvesting and also by gathering local people and spreading awareness of water scarcity, etc.

3. Case Study

To reduce the scarcity of water we have to adopt some techniques and methods which are discussed in the following case studies.

3.1 Hiware bazar

Hiware bazar lies in the drought-prone district of Ahmednagar in Maharashtra, population of village is about 1360 residents. In this village agriculture is the major source of income for the native people. Farming mainly depends on rain water. Water retention is limited due to poor permeability of the land. Water that is available is poorly managed, farmers use more amount of groundwater without taking in account their neighbors and future.

During year 2016 worst Drought condition arrived, due to which many small villages like HiwareBazar faced drought condition, water tankers were also provided by Government authorities.but in the case of Hiware bazar they had adequate amount of water for Drinking as well as farming purpose. All this happened due to observation and strict rules implemented by Mr.Popatrao Pawar who is Sarpanch of the village. Groundwater table of village is maintained by various techniques like

- Percolation tank.
- Continous contour trenches (CCT).
- Cement nalla bund.
- K.T. Weir.
- Farm pond.
- Loose Boulder structure.
- Gabion Bund.

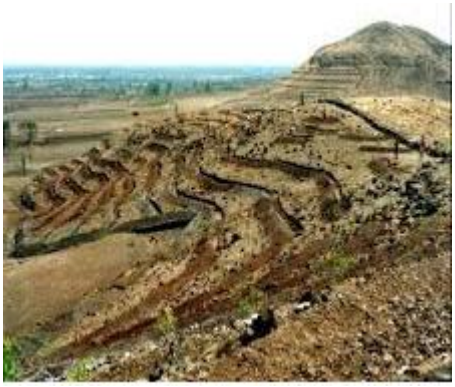

Figure 4: CCT in Hiware bazar

The objective was to create Enhanced geothermal system [EGS], continuous contour trenches and earthen bunds these are completed by the process of shramdan done by the local people, Rise in water level 70-80ft to 200-255ft, change in cropping pattern and increase in cropping intensity.

3.2 Ralegansiddhi

It is a small village located in the drought-prone and rain-shadow zone of parner Tehsil of Ahmednagar district in central Maharashtra. It is situated on latitude 19*22'N and longitude 74*27'E of altitude about 755m. It is at a distance of 51 km from Ahmednagar. Agriculture is the vital source of income for the villagers. Other than agricultural field, employment opportunities are very few.

The village has an area of 982.31 ha. The village is surrounded by small hills, 30-35 m in height on the northeast and southern sides. Before 1975, most of the rainwater was wasted owing to water runoff, which also led to loss of valuable topsoil. Area under the forest is 136 ha. Population of Ralegansiddhi is 2317 of which 434 are households. Total 2200 acres of land is available by contour trenches and 500 acre of land by loose boulder structure.

The villagers are cultivating only one crop on 300 to 350 acre. Average rainfall ranging between 200 and 400 mm per year and current year rainfall intensity is 200 mm

Figure 5: Raleganssiddhi village

To save water they have adopted techniques like earthen nalla bunds, well, farm pond, gabion bunds and RCC. Most surprising thing of these village is that there are no borewells. Number of structures present are as follows:

- Earthen Nalla bunds = 48
- Well = 135
- Farm ponds = 15
- Gabion bund = 16
- RCC = 28

4. Water saving through Automation

Due to continuous development of technologies. Hard work is overtaken by smart work in many aspects, Automation is one of them in which same amount of work is performed in very less time as compared to our traditional techniques and the required man power is also minimized. Leading to accurate implementation of work and errorless method. Water can be saved in agriculture by using electrical technologies. There are various software's and hardware's available but PLC is proven to be most promising.

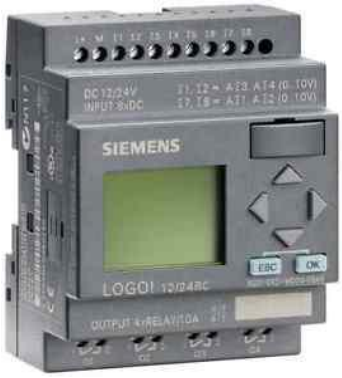

Figure 6: Programmable Logic Controller (PLC)

For using PLC first we have to take a survey of the land, and then plan a network of water distribution pipes, after that hard wiring of PLC is done. The area needed for controlling system is very small and can be located in any corner of the farm, as it is convenient to user. PLC can save a lot of water by, calculating the amount of water needed for a particular crop a system can be programmed so that only the specific amount can be given for proper growth of the crop. Water is delivered directly to the roots by using drip avoiding a lot of wastage of water.

5. Conclusion

The objective of this research paper is to solve water problem of drought-prone region. Scarcity of water is always been a major problem in Ahmednagar district and as the population growth is very fast due to migration of people this problem need to be solved otherwise it will lead to huge crisis. So now it is a high time we should take steps for saving such a vital and important resource. As per the calculation's taking into consideration the population growth and the water needed in the future. New policies should be implemented and strictly supervised and followed. Ideal village like Hiware bazar and Raleganssiddhi should be considered as role model and Automation plays an important role in saving water

References

[1] Khakare RD and Erande MR;"Contribution of water management in sustainable Agriculture development in Ahmednagar district" Int. J. of Life Sciences, Special Issue A3 September, 2015
[2] Rebecca Hui, James L. Wescoat Jr.;"Visualizing peri-urban and rurban water conditions in Pune district, Maharashtra, India" Geoforum, ELSEVIER
[3] Sankar P, Hermon R, Alaguraja P and Manivel M; "Comprehensive water resources development planning Panoli village blocks in Ahmednagar district, Maharashtra using Remote Sensing and GIS techniques" Int. Journal of Advances in Remote Sensing and GIS, Vol. 1, No. 1, 2012
[4] Size, growth rate and Distribution of population; Provisional Population tools. https://www.mapsofindia.com/census2011/decadal-growth-rate.html
[5] Government of India ministery of water resources central ground water board; for Ahmednagar district.

Author Profile

Anand Niranjan Gholap born in Ahmednagar, Maharashtra, India in 1998. Pursuing B.E in Civil Engineering from the University of Pune, India.

Ganesh Dinkar Gawali born in Ahmednagar, Maharashtra, India in 1998. Pursuing B.E in Electrical Engineering from the University of Pune, India.