International Journal of Humanities and Social Science Invention (IJHSSI)
ISSN (Online): 2319 – 7722, ISSN (Print): 2319 – 7714
www.ijhssi.org ||Volume 1 Issue 1 || December. 2011 || PP. 18-27

Availability of Potable Water (A Case Study of Bhilwara City)

Dr. Sandhya Pathania
Lecturer, Department of Geography,
Government Meera Girls College,
Udaipur(Rajasthan).

Abstract:
Despite good rains and various ongoing projects to keep the city's beauty infinite, Bhilwara, Rajasthan's "city of textiles and looms," lacks water in general and potable water in particular. However, the availability of portable water (water that can be carried from one location to another, such as river water) does not solve the problem of potable water (water that can be stored and used for drinking purposes), because potable water has certain standards with allowable limits that must be met.
The portable water supply in Bhilwara is adequate due to the good rains, but the problem is a lack of potable water in relation to the population.
This is causing concern among planners. Based on primary and secondary data, this paper highlights the gap between the demand and supply of potable water in Bhilwara city in relation to increasing population, urbanisation, and industrialization. Data is represented using graphs and maps created with Arc GIS 09, Coral, T.N.T. Lite, and Adobe Arcade.

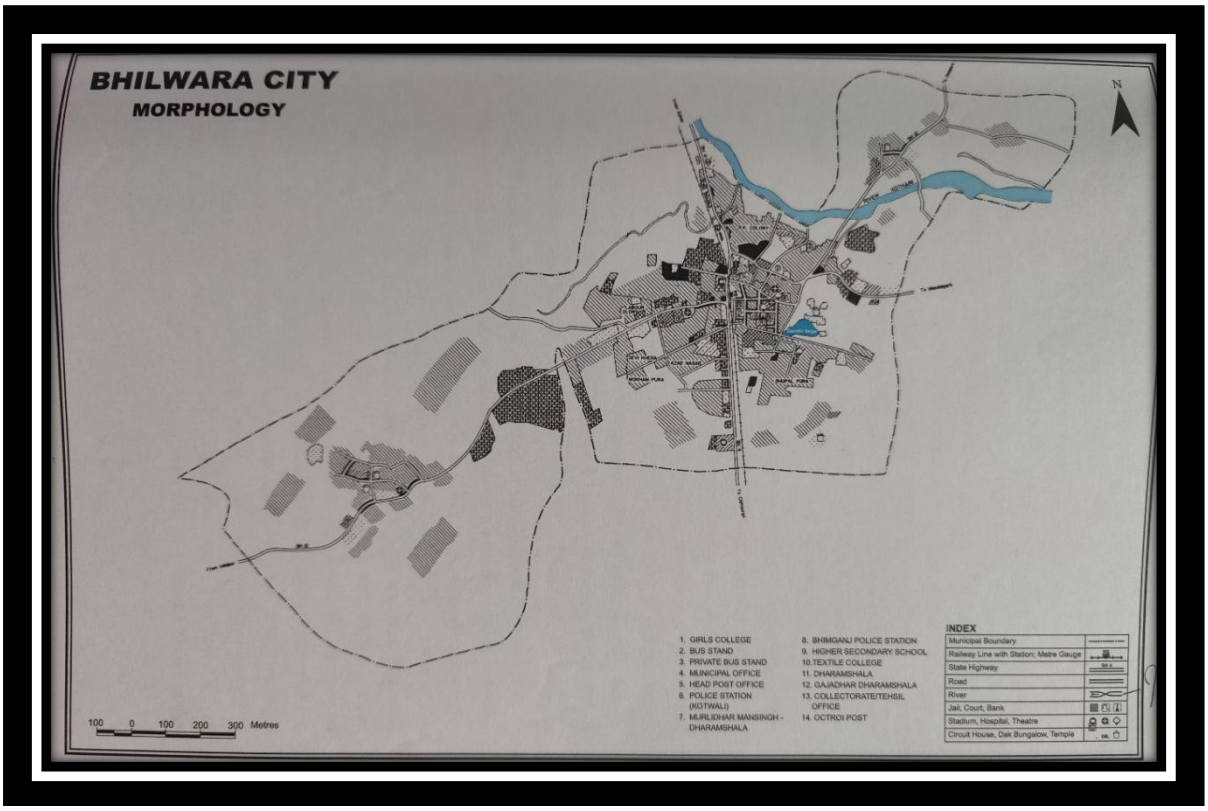
Key Words
mld - Million Litres Per Day
lpcd - Litres Per Capital Per Day
llpd - Lakh Litre Per Day
bcum - Billion Cubic Metre
mbgl - Metres Below Ground Level

I. INTRODUCTION

.Water - Water everywhere, but not a drop to drink. Water covers three-fourths of the earth, hence the name "Blue Planet." Only 2% of the total available water is fresh water. There is 68.7% in the form of glaciers and snow, 30.1% in the form of underground water, and 0.9% in the form of surface water.

Many countries around the world, including India, have experienced a 'water crisis' in recent years. Rain and snow are the two most important sources of fresh water in India. India receives 4,000 billion cubic metres of average annual rainfall, which is unevenly distributed both spatially and temporally. The majority of the rain falls during the monsoon season, which lasts from June to September. A 'water crisis' has occurred in recent years, with precipitation ranging from 100 mms per year in Western Rajasthan to over 9,000 mms per year in North Eastern Meghalaya.

Rajasthan has a unique geographical location, relief structure, climatic conditions of constantly high temperatures, low humidity, drier desertic circumstances, environmental, ecological structure, and waterrelated problem. Rajasthan is unfortunate in that it lacks a single perennial river. Water is a scarce resource, but it is essential.Rajasthan state is the largest in terms of area and the tenth in terms of population in India. However, Rajasthan has only 1% of India's available water resources.



II. MORPHOLOGY

It is the degree of urbanization which is an indication of level of economic and social development of a region. A lower level of economic development is indicated by a lower degree of urban development from the very beginning and at least chronologically till 1951: the region functioned under the shadow of a feudal system, plagued by political instability arising out of dangers of frequent invasion and warfare. The town of Bhilwara is one of the two class 1 urban places, and the second largest of the region . It is unique in several ways and therefore deserves some detailed treatment. Though its hazy beginning can be traced down to eleventh century AD. but its transformation into an urban place did not come through till the earlier part of the 17th century, when the than Maharana not only took the place under control, but also settled the jaat farmers in the adjoining rural areas for efficient farming. invited the trading communities and encouraged the various artesian groups like black and brass smiths, weavers, dyers and printers for the development of associated industries and even the bhils for watch and ward duties.Bhilwara took the shape of town about two hundred years ago. From the early 17th century to the beginning of 19th century the commercial, industrial and cultural institutions got established and the original nucleus shifted towards west round a newer area of Baramandir temple with its good road network. In 1818 not only its population reduced to zero as authenticated by Tod" because of Pindari and Mahratha incursions but later it touched 2700 number in 1822. Since than the population of Bhilwara has shown a steady growth except from 1891 to 1911 when its population declined by 15.3% due to terrible famines and pestilence, from 1941 onward, the maximum growth rate of 95.88% was recorded from 1941-1951, followed by 88.87% the second highest from 1961-1971 but only 49.26% between 1971-81. Bhilwara became a lakh city in 1981. The number of wardsincreased from 11 wards in 1956 when it had an area of 50.50 sq km to twenty wards in 1963. Thirty five wards distributed in an area of 70 sq km in 1981 and fifty wards in 2001. Bhilwara had been known for its tinned utensils, a mint, a ginning factory and cotton press. Modern means of transportation had connected the town with other parts of the country since 1881. During the earlier decade of the 20th century not only contributed towards the growth of population and spatial spread of the town but also its commercial and industrial growth. Bhupalganj evolved as a new commercial and residential area till 1947. After that the town started growing westward under the influence of Bhilwara Udaipur state highway no. 12, the later functionally continued to be residential commercial- associated with the secondary and tertiary activities of the town,

Morphologically the town of Bhilwara is one of its own originating. developing and continuing as a mart oriented urban place. The older having irregular, narrow and crooked streets with kuccha houses and shops with tiles. The Kuchchha and Pucca houses near Baramandir. The newer part of the town had been planned by an Englishman, C.G.C. Trench in the 1913. It had residential. commercial, industrial, administrative,

transportation and miscellaneous, having more liberal use of space as shown in figure given below which throws on the municipal limit of Bhilwara city in 2001.

Though the livelihood pattern of the town of Bhilwara is indicative of its being a multifunctional one, yet its importance as a commercial and industrial town cannot be denied because commercial activities has been the primary factor in the origin, continuance and development of Bhilwara as a urban place. Besides, the town has flourishing business in processed and semi-processed commodities of local origin, such as cotton, synthetics and woolen textiles including hosiery, cotton seed, brass wares and several others. The commercial activities are confined to the older part of the town and Bhupalganj. Bhilwara has been also known for its handicrafts and cottage industries till 1935 which include cotton spinning, dyeing and printing, pottery, brass and iron wares, carpentry, leather tanning and shoe making are the important ones. The power-driven industries are located west of the railway line and to a limited in the Bhupalganj area.

All these activities have added to the demand of water in Bhilwara city which is continuously at threat to meet with the supply.

OBJECTIVES OF THE PROPOSED RESEARCH WORK

- To study the Hydrology and the Hydrograph and the status of potable water in the Bhilwara City.
- To study quality of the water and its distribution pattern in various cities of the Bhilwara City.
- To study the conservation and management of potable water in the citiesof the Bhilwara City.

HYPOTHESIS

With the increase in population the demand of potable water increases but water being a natural resource is limited. Hence future seems to be bleak.

METHODOLOGY & DATA SOURCES

The collection of data was done at primary and secondary level for theresearch work.

a) **Collection of Primary Data**

Primary data was collected wardwise through schedule and water sample were also collected. Water samples were collected and tested by SwachSansthan and schedules were filled.

b) **Collection of Secondary Data**

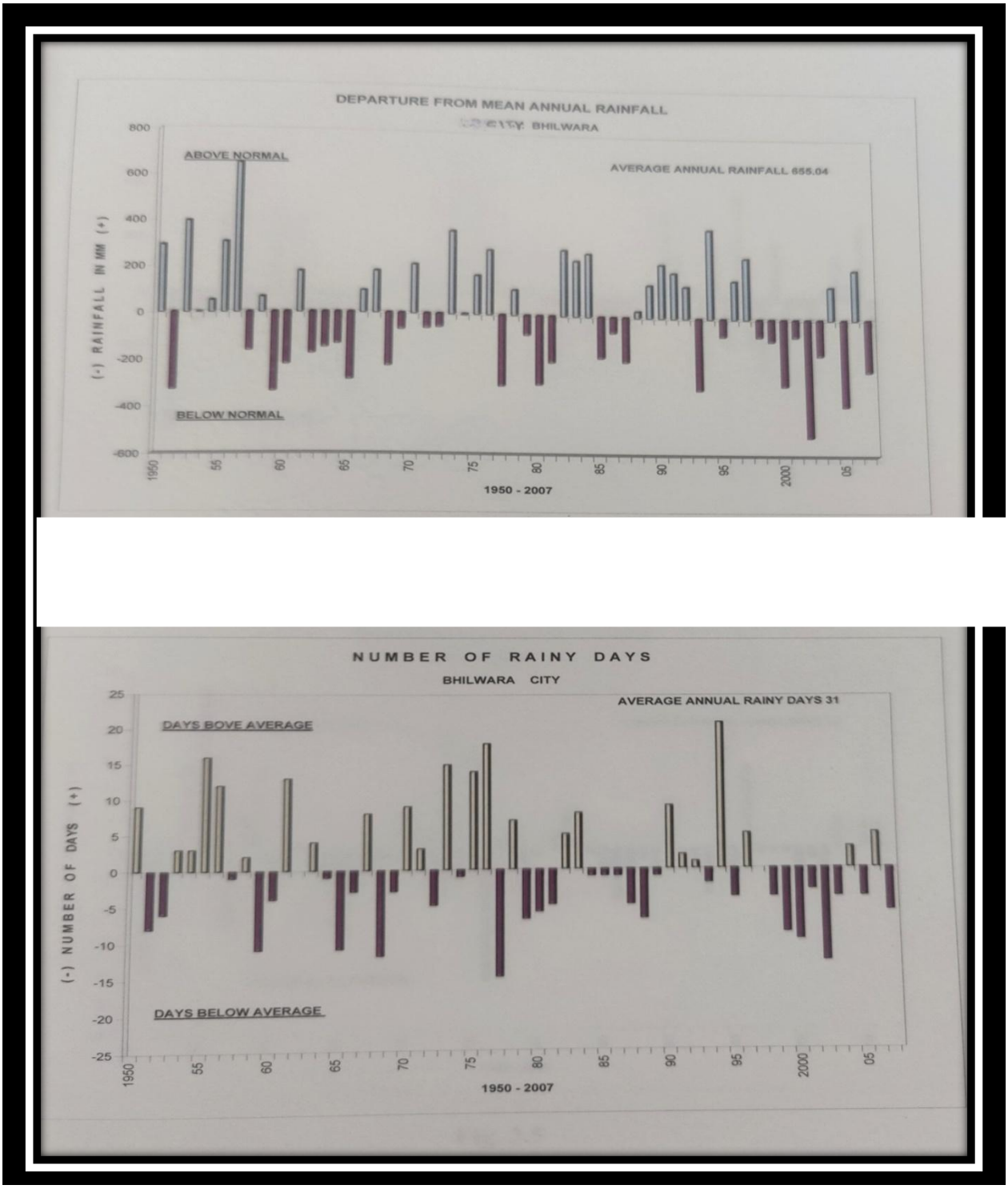
Secondary data was collected from various government and non government organizations. Data related to water demand, supply, duration, interval, pressure, distribution zone was collected from PHED deptt. of Bhilwara City. Data related to future strategy of water supply was collected from PHED and RUIDP. Data related to temperature was collected from Indian Meteorological Department, Jaipur. Besides all these data to underground water was collected from Under Ground Water Department, Bhilwara,

It becomes clear that the mean maximum temperature ofthe districts under study had remain between 40°C to 49°C and mean minimum temperature has been between 0°C to 8°C resulting into great variation in maximum and minimum temperature thus proving the fact that the region under study experiences extremes of climate i.e. very hot in summer and cold in winter.

In respect of rainfall in Bhilwara it is important to mention here that a partof the Arabian Sea current moves northwards over Kachchh-Saurastra, Western Rajasthan & Western Mewar region which are the centres of low pressure. But curiously enough, these areas get least amount of rainfall. This phenomenon is, in part, the result of the absence of a mountain barrier in Kachchh and because of the system positional attitude, which is parallel to the direction of the wind that offers no resistance to force air to ascend up its slope. This phenomenon affects the rainfall in Bhilwara.

HYDROLOGY:

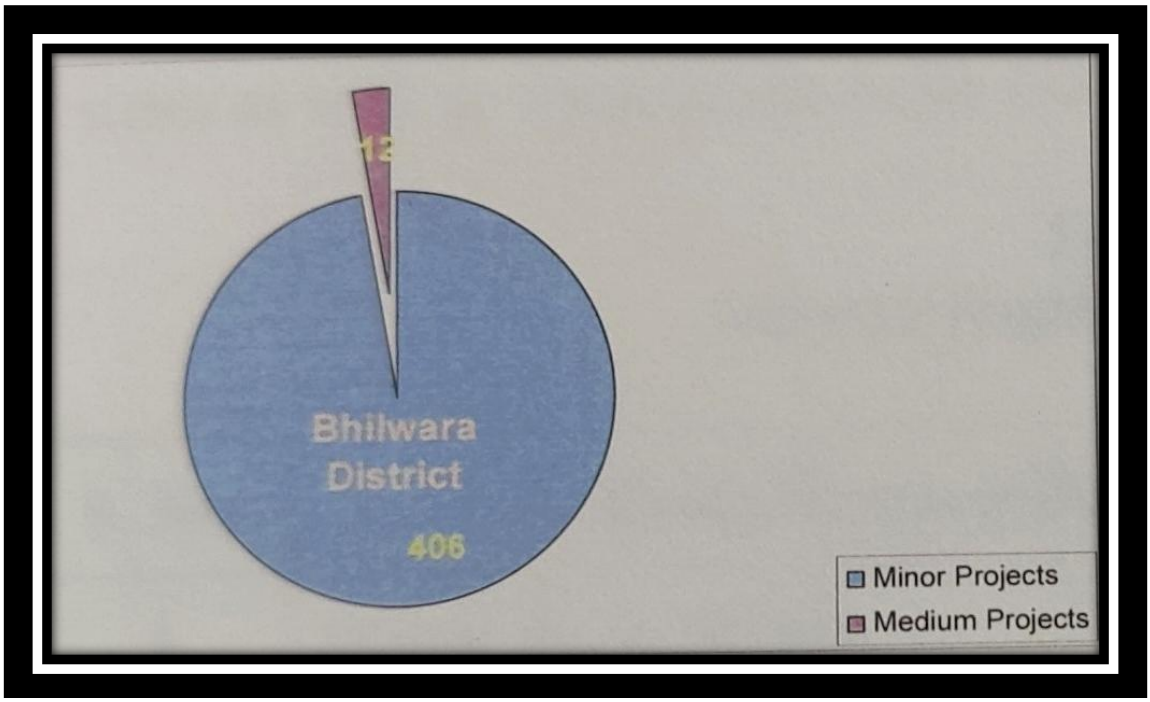
Bhilwara city rainfall data depicts average annual rainfall of 655.04 mm from 1950 to 2007. Twenty-nine years had less than average rainfall similarly 32 years had a smaller number of rainy days than the average of 31 days maximum rainfall was recorded in 1956 which was 1303.8 mm and minimum rainfall recorded was 137.0 mm in 2002. Figure given below shows that the last decade had a smaller number of rainy days and annual rainfalls than the average.



Rainfall from 1991 to 2007 had been mostly in the months of July. August and September. The maximum number of rainy days in a month had been 18 days in August in 2003 in Bhilwara.

Rivers:

Kothari River is a second major tributary of Banas.it rises in the Aravalis near Dewair, a place in north of Udaipur district. After flowing for about 145 km in the plain area it joins Banas River near Nandraj just a few kms north of Bigod in the Kotri tehsil of Bhilwara district. Meja dam is made on Kothari river which is about 8 km away from the Mandalgarh tehsil of Bhilwara district. Near about 10,000 hectare of land is irrigated of Bhilwara district besides providing the region (Bhilwara town) with water for domestic purpose.



Lakes
(A) GANDHISAGAR

Gandhisagar of Bhilwara city lies in the center of city ward number 34, 20 with ward number 33 in its East and ward number 19 in its West with ward number 31 towards its South.

(B) DHANDOL TALAB

DhandolTalav is also in Bhilwara city. It lies in ward number 26 of

Bhilwara city with Ashok Nagar in its North.

(C)KOLPURA

In Bhilwara is an overhead tank. It is in South West of the Jawahar Nagar of Bhilwara.

(D) MEJA TALAB It is in North-West of Bhilwara city. The left main canal of Meja damn passes from north of it.

Underground Water

The underground water development work started in 1950 with the establishment of "Underground Water Board". In 1971 it was renamed as "Ground Water Department". A systematic and scientific based study started in 1965. It was from 1984 that a continuous watch was kept on the water level of the wells. Its head office is in Jodhpur. Its subdivisional offices are at Jaipur. Jodhpur, Udaipur and Bikaner.

Data is collected after monitoring the water level at pre monsoon and post monsoon which helps in comparative analysis and annual recharge is found. On the basis of underground water level all the blocks, districts are divided into 3 zones-safe, semi critical and critical.

Safe zones are those areas where water exploitation is less than 70% than water recharge. The Semi critical zones have 70% to 90% and 90% to 100% are critical zones. 100% exploited zones are called over exploited. In East of Rajasthan deth of water is in between 10 m to 25 m, Western Rajasthan has water level in between 20 m to 80 m. The fluctuation is in between 2 m to 5 m. Eastern Rajasthan has fluctuation in hard rocks, it is in between 1 m to 10 m.

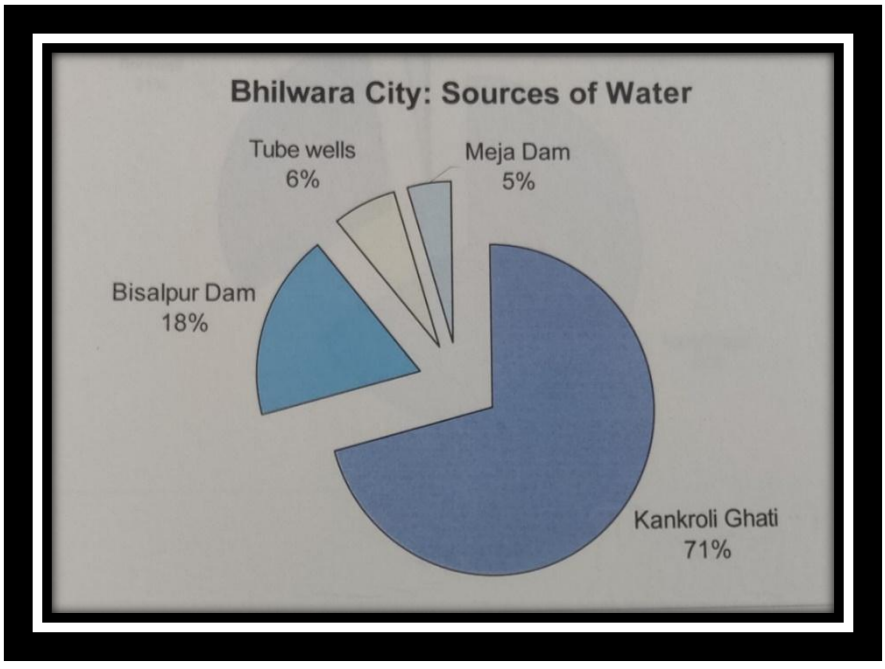
Bhilwara district total area is 10455 sq km. Potential zone area is 9355 sq km, potable water area is 8794 sq km. It comes under safe zone. Chittorgarh district area is 10856 sq km. Potential zone area is 8278, potable water area 8195 comes under semi critical zone. Rajsamand district has a total area of 4635 sq km. Area of potential zone is 3540. Water table area is 3398 sq km. It comes under semi critical zone.

Ground water has been important to mankind since the very beginning as it is widely distributed resource of the earth as it gets its annual replenishment by infiltration from precipitation. Ground water is a renewable source. The yield of water from acquifers is dependent upon the nature of the underground rocks. The availability of it varies from one place to another following the various water bearing formation. The region displays a variety of rocks of which the most common are phyllites, mica, schists and Another rock formation of wide spread occurrence comprises of mixed rocks, schists and gneiss, amphibolite's and quartzites. These rocks are found in three major tracts, of Bhilwara district. Marble and crystalline limestone is found in several elongated narrow belts in Central and North Eastern areas of Bhilwara district. These rock types occur in the midst of extensive areas of mica, schists, phyllites and quartzites. The use of ground water depends mainly upon the accessibility. dependability and quality. In Bhilwara, the availability of ground water varies greatly from region to region following the various water bearing formations.

Dealing with the geological structure, Bhilwara city is a zone of gneisses. In 2008 pre monsoon depth to water was 8.50 which had been 16.30 in the year 2001 and 6.00 mbgl (metres below ground level) in 2005 but the post monsoon depth to water was 7.95 in 2001, 3.90 in 2005 and 1.85 in 2008 indicating an upraise in the ground water level due to good precipitation. Here it is very essential to mention 2002 ground water conditions which were severe. The pre monsoon depth to water was 13.50 and the post monsoon depth to water was 16.20. The fluctuation was -2.70, which shows that the rainfall conditions during this year was less than the average and minimum of the decade that is from 1998 to 2008.

In Bhilwara out of the total groundwater extracted 16 million cubic metre is used for drinking. 7 million cubic metre is used for industries and 429 million cubic metre for irrigation. Due to continuous extraction of groundwater in last 20 years there has been continuous downfall in the underground water level, near about 0.30 m every year. This has been due to excessive growth in population, increase in industrialization and increase in irrigated area with three crops a year and more water consuming crops.

As under ground water plays an important role in meeting the demand of potable water in the city . Bhilwara has 177 handpumps, 36 tube wells and 5 open wells.



Above figure throws light on the percentage of the sources of water which potable water in the city. City of Bhilwara gets water supply of about 110 Ilpd from KankroliGhati, 28.40 Ilpd from Bisalpur Dam, 10 llpd from tube wells location at various places of the city and about 7 llpd from Meja Dam.

Water being a renewable resource can be recycled but that is a costly affair. Availability of portable as well as potable water is limited. Potable water being portable is getting degraded day by day due to varied reasons and is becoming unfit to be used as potable.

In the past when the population was less, environment was less exploited and degraded, there was larger forest cover and the spans of rain were sufficient enough to recharge the surface sources as well as underground water at that time the surface water reservoirs like lakes, kunds, baovries etc. were enough to meet the local demand of Bhilwara city. With the increase in population the areas of these cities extended and their landuse pattern changed in which more non-agricultural activities increased including urbanization.

industrialization. This directly and indirectly affected the availability of water in relation to the quality and quantity.

The city of Bhilwara is facing numerous problems related to water, since last few years. The city of Bhilwara has transformed into drought prone area due to frequent drought occurrence in the past decade because of erratic nature of rainfall. During this period the city has experienced hot and dry spells. The water sector of the city faced multifaceted effects on their economy. Bhilwara being industrial faced water crisis during last few years.

AVAILABILITY OF WATER

Water availability is a concern because rainfall is insufficient in relation to the existing population. The availabil ity of water refers to the amount of water available as surface water sources or underground water sources in rel ation to the existing population of the units.

Water can be found in all of the units' rivers, lakes, baovries, tanks, panghats, open wells, tube wells, and bore w ells. This water is available to mankind, but to be more specific, we determine water availability by considering demand in relation to the extent to which available water resources can be exploited.Water requirements vary gr eatly from region to region and from location to location.

Number of persons using water.

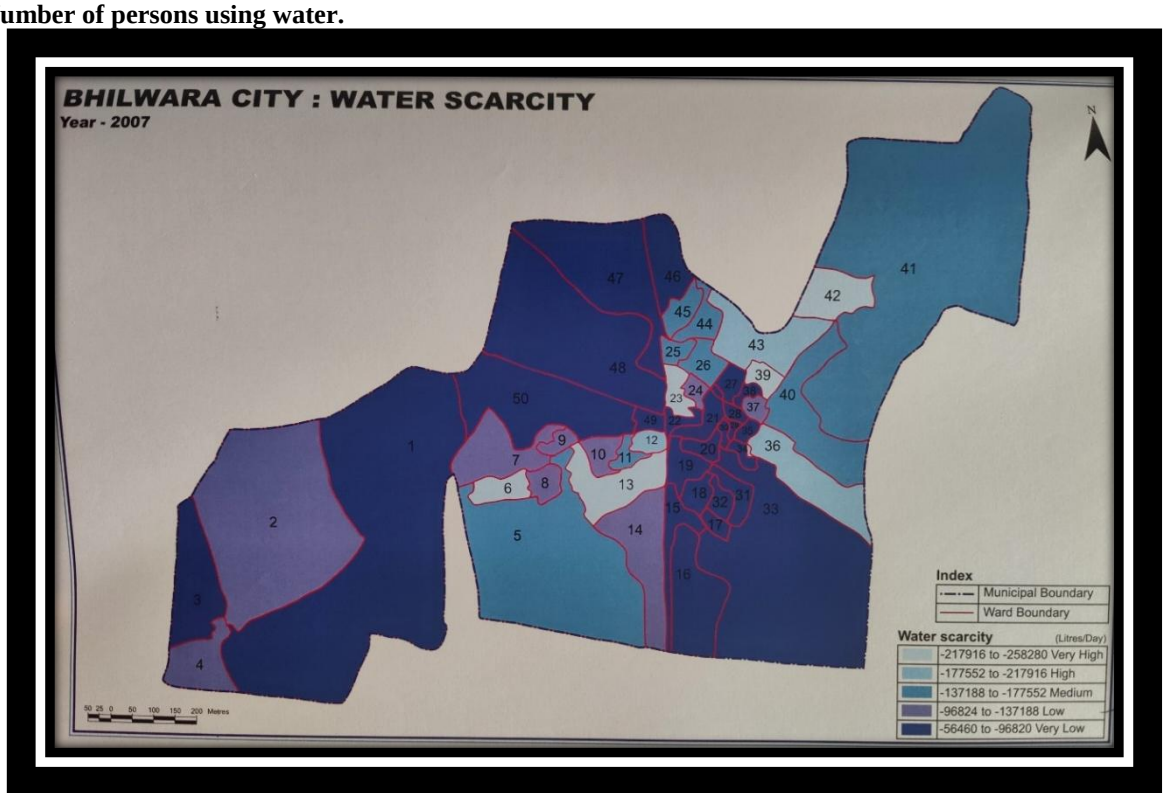


Figure above shows that ward 5, 6, 11, 12, 13, 24, 26, 36, 39, 40, 41, 42, 43 44, 45 have demand more than 10 llpd and the supply of the six wards, ward no. 6, 13, 23, 36, 39, 42 is a little more than 5 lakh litres per day. Therefore, showing scarcity of nearly 50% in most of the wards but more than 50% in the wards discussed above. Whereas in 2007 very high scarcity was found in ward no. 12, 23, 39 and 42 as shown in figure given above.

Minor Projects:

Minor projects are those which cover small area with a comparatively little storage capacity. Thus, in size the project is comparatively small covering the area falling near by the project itself. The financial income bend is lesser than those of medium projects. So far the need and requirement of the local areas is concerned they serve better to the people because their maintenance is easier. But these minor projects are normally constructed on those rivers and river streams which are seasonal. These rivers have been checked and check dams and anicuts have been constructed.

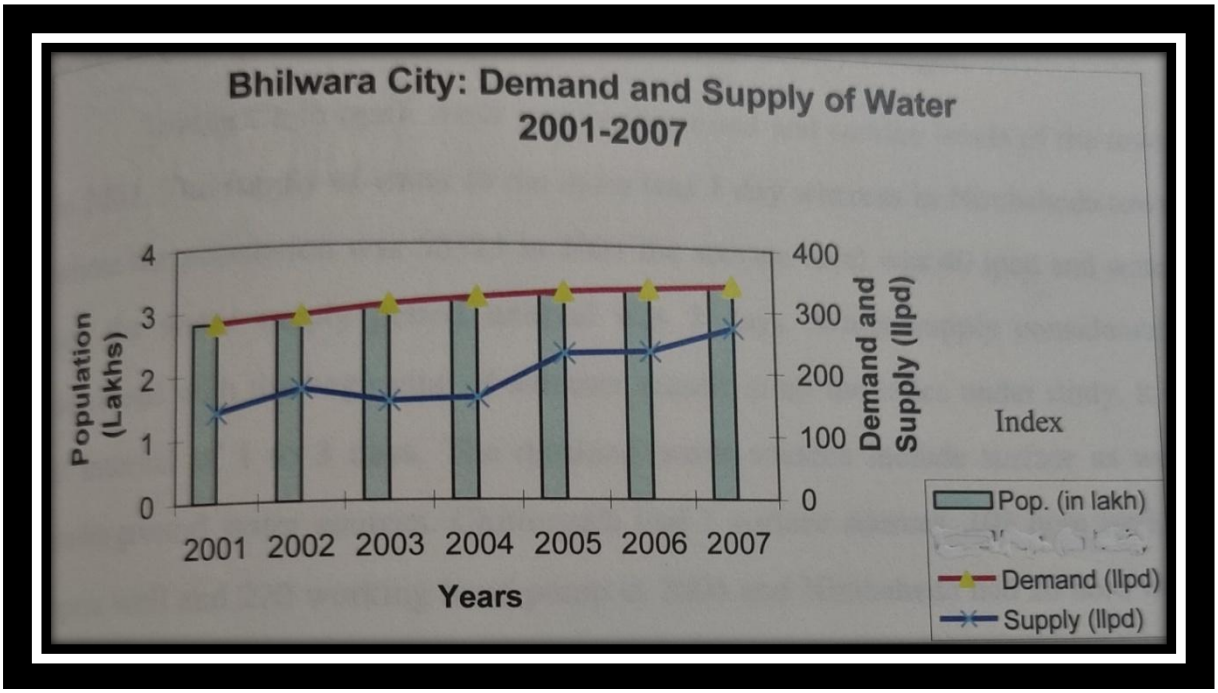
Traditional step wells are called bav or bavadi in Gujarat, or baolis or baovries in Rajasthan and Northern India. Built by the nobility usually for strategic and/or philanthropical reasons, they were secular structures from which everyone could draw water. Most of them are dysfunctional today. A major reason for the breakdown of this traditional system is the pressure of centralization and agricultural intensification. Low and erratic rainfall force the mankind to make the maximum use of water available either on the surface or below it. Now a days in urban areas most of the potable water demand is met by ground water sources in the form of borings, hand pumps, open wells, tube wellsetc.There are number of handpumps, tube wells, wells in the Bhilwara city which contributes in fulfilling the demand of potable water in the city of Bhilwara.

Potable Water Demand & Supply in Bhilwara City:

Water demand is the amount of water required for drinking purpose and the supply is the amount of water given to meet the requirement. The water demand is established on the basis of design criteria as per the guidelines given by PMC, which states that 85% domestic and 15% slum figure has been considered as per the field situation which out to be 135 lpcd for domestic and 70 lpcd for slums.

For communities with population upto 20,000, water supply through stand post should be 40 Ipcd (min) and 70 lpcd for house connection Communities with 20,000 to 1,00,000 it should be 100-150 Ipod. And for communities above 1,00,000, it should be 150-200 Ipod (as per manual central Public Health and Environmental Engineering Organisation, New Delhi)

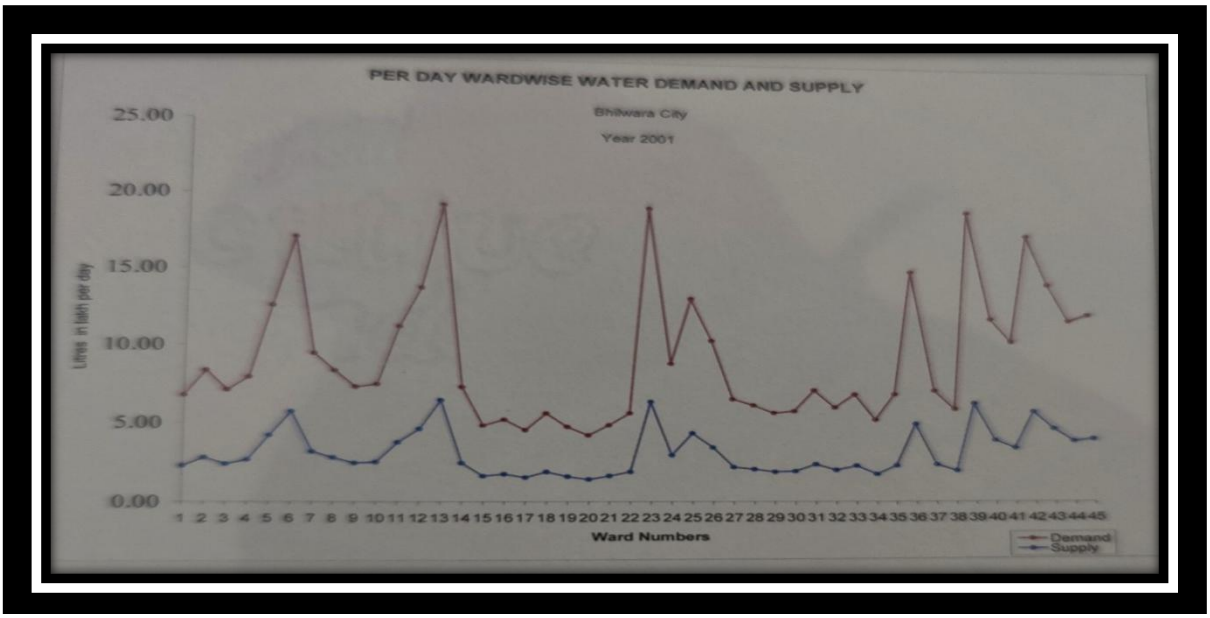
Demand of potable water is Bhilwara city was 280 llpd and the supply was 140 llpd in 2001 . The demand reached to 340 11pd against the supply of 272 Ilpd in 2007 which in 2009 was 350 Ilpd as demand in relation to which the supply of water drastically low and that 165 llpd. The supply of water was met by Meja dam, KankroliGhati, Banas River, Pai, tube wells located at KankroliGhati and 36 tube wells on Meja dam also provided water to Bhilwara city.



Above figure shows the demand of Bhilwara city in an ascending order along with the increase in population but the supply had been low till 2004, when scarcity was maximum also followed an increasing trend from 2005 to 2007. But there is scarcity of water in the city from 2001 to 2007 which is clear from the figure.

Interval and Duration:

So far the interval and duration is concerned in different units it is the major problem people are facing in different parts of the city area. Here the interval means that the water supply through the taps by the PHED with the time interval which takes it days or hours. Normally it has been observed that general limitations of the days of supply is to 5 days for BhilwaraCity.For the interval and duration of water supply along with the wards may well be visualised from the interval of water supply as shown in graph below.



Interval and duration of water supply taking Bhilwara City in all the wards the duration of water supply is for one and a half hour and is after 72 hours amongst the wards, 12 wards had the facility of hand pumps. The drilling of all the hand pumps had taken place during summer season especially during pre monsoon period at a depth between 125 feet to 150 feet dept.

Problem

If we look at the availability of water demand and supply along with the existing population ward-wise. We find a gap between the demand and supply of potable water in the city under study. The picture of this variation throws light on the population, the demand and supply of potable water in the city from 2001 to 2007. The graphical representation of demand & supply as per 2001 census makes it very clear that even ward wise the situation in these cities is critical. The V.I.P. areas and some other special areas receive water more in comparison to other areas of the cities. With the help of Karl Pearson's correlation was found between the demand and supply of the city .Correlation derived was positive and was in-between 0.5 to 0.9 that means Bhilwara gets about 80% to 90% water of their demand. This shows that problem is not very severe but alarming for the future but on the whole it is affecting environment and other aspects.

Peoples Participations

To mitigate the problem of potable water it is important that people are educated for their civic responsibilities which will ensure that there is no misuse/ as also water theft. Although government has belatedly banned digging of the borewells in the urban areas however the ban is only on the paper with hardly any effort being made to implement the ban by the authorities when this activity is taking place. Besides by making general public conscious about the seriousness of the problem, wastage by way of keeping the taps running, using excessive water in activates which can be perform with much lesser requirement and so on will help in conservation of water.

One major consumption points for water is the increasing use of desert coolers. In a recent report it was estimated that desert cooler in cities consume between 40 to 50 million litres of water per day. As a matter of fact, if we assume that about 20% to 30% of the population have the privilege of using desert cooler the per head consumption will jump to 50 to litre per person per day on this account alone.

Recycling of water and use of recycled water in activities like gardening, toilets and desert coolers etc will greatly reduce pressure on the demand of potable water. However, it is only possible once proper infrastructure for recycling of water in towns is created and a separate pipe line is laid down. Another important area where the peoples' participation will greatly enhance potable water availability is educating the general masses about the ways of rain water harvesting which will to a great extent help in recharging the underground water table.

III. CONCLUSION

The main problems from the above study in the Bhilwara city related to potable water is:

• Unplanned residential expansion in cities
• Rainfall that is erratic.
• Limited surface and underground water sources.
• Rapid population growth.
• Significant increase in water demand.
• A scarcity of water.
• Lack of coordination among departments (e.g., Cigation, PHED, Nape Palika, UIT, RUIDP, and so on.)
• Absence of a water supply management system

- Excessive use of underground water.
- Unpredictable growth (new colonies extension, tourist centres, els & restaurants, new constructions).
- Lake depth is decreasing due to heavy silting, which reduces capacity.

IV. SUGGESTIONS

Looking to the erratic nature of the rainfall most of the water received during season is wasted. Therefore, it is suggested that the wastage of water should be checked through rain water harvesting techniques.

- This method will aid in raising ground water levels.
- People's water-using habits, such as bathing in a tub or washing cars with a pipe, must be changed.
- Water consumption should be reduced.
- There should be an adequate supply of water.
- There should be a standard procedure for boring wells.
- The use of lake water should be done with caution.
- Water from other surface sources should not be overexploited (talab, baovries etc.)
- Hotel water waste should be investigated.
- Lakes and other bodies of water should be protected from pollutants such as garbage, solid waste, hotel sewage, and excessive boating, among other things.
- Tourists visiting tourist attractions should be guided and directed by tour guides or tour conductors to check for unwarranted activities, or the guide or tour conductors should be penalised for that act.
- Rooftop harvesting, as well as rainwater harvesting, should be legally mandated for new construction.
- A treatment plant for polluted (dirty) water should be built.
- Old pipelines should be replaced, and leaks in pipes should be checked immediately to prevent water waste.

That it is my firm belief that if the various measures suggested in this work are honestly implemented, the doomsday forecasters for mankind will be proven incorrect, and man will continue to enjoy the use of good quality potable water for a long time to come, and the doomsday fears will have to eat their words as they will be proven incorrect. The preceding concluding suggestions are not the end in themselves, but rather guidelines for future development.

REFERENCES:

[1]. Babel ,Kaushalya&N.C.Gupta(1994);Urban Water Supply,RawatPublication,Jaipur..
[2]. Guide to investing in Rajasthan -India 2002
[3]. Indian Metrological Department ,Jaipur
[4]. Rajasthan Census Handbook-2001
[5]. Water works Department ,Bhilwara.