RAINWATER HARVESTING IN LUCKNOW METROPOLITAN CITY

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Abstract

The other name of water is Life. It is the most important element for our living. Where there is no surface water, or where groundwater is deep or inaccessible due to hard ground conditions, or where it is too salty, acidic or otherwise unpleasant or unfit to drink, another source must be sought. In areas which have regular rainfall the most appropriate alternative is the collection of rainwater, called 'rainwater harvesting'. Falling rain can provide some of the cleanest naturally occurring water that is available anywhere. The city of Lucknow is the capital of Utter Pradesh situated on the banks river Gomati, farms a part of Sai-Gomati sub-basin of central Ganga plain and piles up of alluvial sediments of quaternary age can be classified as newer and older alluvium. Rainwater Harvesting is one of the most significant steps which should be taken to recharge those dying aquifers, from which the water is being continuously extracted in ample amount for meeting various domestic, agricultural and industrial demands. Since rainwater is purest form the water, which should b utilized for various purpose, rather letting it go waste.

Key Wards: *Rainwater Harvesting,* Water consumption, Water Management, *industrial demands etc.*

Introduction

The other name of water is Life. It is the most important element for our living. Other than, water is required in every aspect of life like cooking, washing, agriculture, industries etc. The sources mainly supply water for use is groundwater and surface water through treatment. Only 2.5% of the world's water is fresh, while 97.5% is ocean. And of that freshwater, only0.3% is available from rivers, lakes and reservoirs. Most Freshwater is locked up in polar ice, glaciers or

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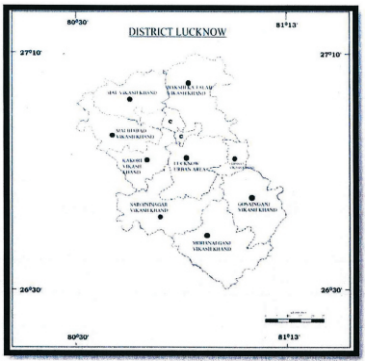
soil moisture. Unfortunately, more and more of that precious freshwater is contaminated each year.

Where there is no surface water, or where groundwater is deep or inaccessible due to hard ground conditions, or where it is too salty, acidic or otherwise unpleasant or unfit to drink, another source must be sought. In areas which have regular rainfall the most appropriate alternative is the collection of rainwater, called 'rainwater harvesting'. Falling rain can provide some of the cleanest naturally occurring water that is available anywhere. This is not surprising, as it is a result of a natural distillation process that is at risk only from airborne particles and from man-made pollution caused by the smoke and ash of fires and industrial processes, particularly those which burn fossil fuels. Most modern technologies for obtaining drinking water are related to the exploitation of surface water from rivers, streams and lakes, and groundwater from wells and boreholes. However, these sources account for only 40% of total precipitation. It is evident, therefore, that there is considerable scope for the collection of rainwater when it falls, before huge losses occur due to evaporation and transpiration and before it becomes contaminated by natural means or man-made activities. The term 'rainwater harvesting' is usually taken to mean 'the immediate collection of rainwater running off surfaces upon which it has fallen directly'. This definition excludes run-off from land watersheds into streams, rivers, lakes, etc. Water Aid is concerned primarily with the provision of clean drinking water; therefore the rainwater harvesting projects which it supports are mainly those where rainwater is collected from roofs, and only to a lesser extent where it is collected from small ground, or rock, catchments.

Area of the study

The area of study is Lucknow city. Lucknow city farms a part of Sai Gomati sub-basin of central Ganga plain and piled up of alluvial sediments of quaternary age and can be classified as newer and older alluvium. The city has a humid subtropical climate with a coal dry winter from December to February and a hot summer from April to June. The temperature extremes vary from about 45^0C in the summer to 3^0C in the winter. The city receives about 100 cm of annual rainfall

mostly from the southwest monsoons between July and September. Lateral slopes are towards the river Gomti which flows from north-west to south-west through the heart of the city dividing it into the trans-Gomti and Cis-Gomti regions.



Lucknow city is the capital of Utter Pradesh, lies between the parallels $26^0 45^{"}$ N to 27^0 N latitude and 80^0 $45^{"}$ E to 81^0 $05^{"}$ E longitude . Lucknow is surrounded in the north by the district of Sitapur, in the east by Barabanki, in the south by Raibareli, in the north west by Hardoi, and in the south west by Unnao.

Demographic data for the Lucknow Urban Agglomeration and Lucknow City from Census 2011 and other available documents was analyzed to understand the growth patterns. The Master Plan 2021 is the basis of information for the projected population and land use in peripheral areas where considerable private development has been taking place. Growth rates have been arrived at through projecting geometric growth, arithmetic growth and incremental growth rate methods and adding an additional population of 100,000 every five years for additional areas that might get incorporated within the city. It is a rapidly growing commercial, industrial, and trading centre of Uttar Pradesh and of northern India. The area and population of city has increased tremendously over the years. Because of rapid urbanization and industrialization of the city, severe strain is caused on the water resources especially groundwater. The over exploitation has led to a continuous decline in water table is different part of the city.

Methodology

This study is based on primary and secondary data. Primary data is taken from field survey and secondary data is taken from different kinds of books, newspapers, magazines, Indian census and remote sensing and GIS techniques etc. Some important points are given below -

- To specify and clarify the problems.
- Sampling plans.
- Data collection by remote sensing and other sources.
- Field survey and field observation.
- Coding, content and tabulation.

Objectives

The main objectives of the study are:

- To know about the present condition of the groundwater level in the city.
- To enable a better understanding know-how of the efficiency rainwater harvesting.
- To know about the role of the government in conserving the groundwater.

Analysis of Rainwater Harvesting

Rainwater harvesting is the mechanism of using rainwater before it reaches the surface water. The rainwater harvesting is considered as a possible answer to the global water use problem especially where rainwater is available but scope for development of surface and groundwater based water supply system is limited or costly. The existing situation prevailing in both the surface and ground water gives us a sign of imminent danger if pragmatic measures are not taken in this regard.

Rainwater harvesting systems are simple to install, operate, and maintain.

The demand of water is increasing exponentially with the huge increase of population. But the sauces are limited. Specially in Lucknow the situation is much more complicated. Lucknow City has a area of 1528 km with a population of around 48 lakh. It is the most densely populated metropolitan city Moreover the population is increasing every day. As a result the demand for water is also increasing exponentially. To meet this demand water is supplied from two sources. One of the two sources is surface water treatment which contributes only 15% of the total supply. The major pressure for water supply is on groundwater. Due to the abandon use of groundwater and not enough recharge is causing the level of groundwater table to fall

every year. As a result after few years groundwater table will fall so much that it will not be available for our use. So, an alternative source for water supply or effective steps is required to recharge groundwater. Rainwater Harvesting is a more likely alternative resource to supply a portion of water demand in Lucknow City. A portion of the harvested water can be used for groundwater recharge. So the potentiality of Rainwater Harvesting is high for Lucknow City.

Monsoons arrive in Lucknow by mid of June and and most of the rainfall takes place in the month of June, July, August and September. Barring couple of years, the annual rainfall in the city has been less than normal in the last one decade, resulting in depletion of groundwater level at the rate of 0.5 meters to 1.0 meters per year. Since 1992, average rainfall has been less than normal in the city. Except for year 2000 when total monsoon rains were 1093.7 mm, rainfall in Lucknow has been between 600 and 790 mm over the years.

1996 to 2010: Rainfall (at a glance in Lucknow)

Year	Rainfall
1996	638.7
1997	746.3
1998	606.4
1999	583
2000	1093.7
2001	585.7
2002	709.6
2003	785.6
2004	702.8
2008	1848.11
2009	962.17
2010	1001.1

The central Groundwater board had installed piezometers at 22 spots in the urban area and 28spots in the rural area to monitor the groundwater level. The groundwater table data collected by CGWB from various localities speaks volumes about the sinking water table. The situation is grave in urban areas because of concrete structures all over the city. Every year, groundwater table in the city is recording a fall

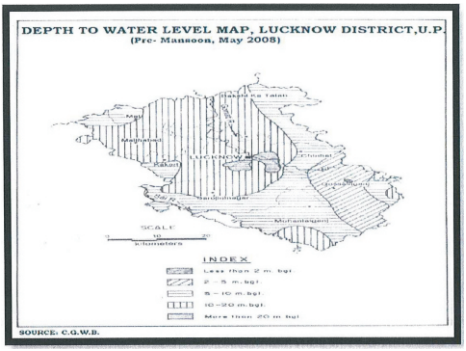
of 65 mm. In some areas, the fall in from 70 mm to 1 metre. Water table is depleting at the rate of one metre per annum in indiranagar, 60 to 70 cms in Dilkusha and cantonment area and around 60 cms in aminabad, hussainganj, daliganj, charbagh and naka. In other parts of the city the depletion rate is between 50 and 60 cms.

Status of Water Level (mbgl)Post

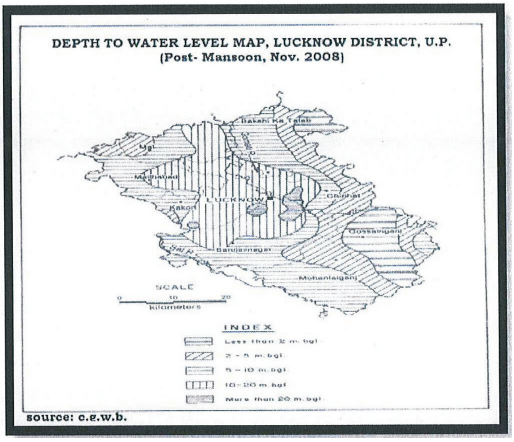
Sr.No	Well Name	Premonsoon (mbgl)	Postmonson (mbgl)	Fluctuation (m)
1.	Aat Garhi Sonra	11.98	9.10	2.88
2.	Arya Nagar	20.86	18.95	1.91
3.	Bakshi Ka Talab	13.04	8.62	4.42
4.	Bani	7.89	6.32	1.57
5.	Bhatoiya	11.99	9.64	2.34
6.	Behta bazar	8.14	2.69	5.45
7.	Bhujal Bhawan	19.73	18.14	1.59
8.	Bijnor	10.62	7.19	3.44
9.	Campbell Road	13.08	11.38	1.70
10.	Cantonment Lucknow	22.88	22.01	0.87
11.	Dilkusha	32.45	30.93	1.52
12.	Fatehganj	13.22	11.43	1.79
13.	Gopamau	14.80	10.79	4.01
14.	Gulistan Colony	32.60	32.11	0.49
15.	Itaunja	12.03	7.88	4.15
16.	Jehta	14.00	---	----
17.	Kumrahawan	6.55	1.45	5.10
18.	LucknowUniversity New Campus	14.15	11. 95	2.20
19.	LucknowUniversity Old Campus	28.90	27.57	1.33
20.	Mahanagar H Park	28.55	27.12	1.43
21.	MahilaCollege Aminabad	16.22	12.87	3.35
22.	Mal	12.17	9.28	2.89
23.	Malha	--	14.0	----
24.	Malihabad	15.69	1.36	3.33
25.	Mohanlalganj	7.83	4.17	3.66
26.	Narayanpur	8.79	7.61	1.18
27.	Narahi	32.00	32.47	-0.47
28.	New Hyderabad	24.23	20.36	3.87

Source: Central Ground Water Board

The data indicates that the water providing aquifers are not getting recharge as per the extraction of Groundwater therefore the water is so deep in the whole city. The table shows that the minimum dept of water is found in Aat Garhi Sonra, Bani, Kumrahawan, Mohanlalganj, Narayanpur, Rehmatnagar, Rehta, Sisendi and Tej Kishen Khera which is ranging between 2.00 to 10.00 mbgl, while the deepest water level condition has been recorded at Gulista colony, which exceeds 34.66 mbgl. In other way, it could also be seen that in Lucknow city, most of the places are having water level lying at the depth of 20 mbgl atleast, and that is alarming. The water level in the city is going down at own pace. The drift in the city area is exceeding net utilizable resources.



With the concentration of population, water consumption has increased. Though demand of water is increasing with the rate of 10 percent per year with the increase in population, due to low rainfall, underground water is not being recouped with the desired pace. The rate of groundwater exploitation in the state capital around 50 crore litres per day against recharging at the rate of around 2 crore per year. Thus there is sharp decline in water table in different localities mainly due to excessive exploitation of groundwater. Besides, increasing pace of construction



concrete structures and decline greenbelts has added to the groundwater woes. Thus there is urgent need to conserve groundwater in the city. Otherwise, in the coming era, water shortage will be the most aqute problem to be faced. Therefore applying the Rainwater Harvesting Techniques is must for the city. Rainwater Harvesting is one of the most significant steps which should be taken to recharge those dying aquifers, from which the water is being continuously extracted in ample amount for meeting various domestic, agricultural and industrial demands. Since rainwater is purest form the water, which should b utilized for various purpose, rather letting it go waste.

There are mainly two techniques used for the harvesting the rainwater i.e. Roof Top Rainwater Harvesting and run-off Rainwater Harvesting. The surface runoff water harvesting techniques mostly suitable for areas which have large open ground i.e. rural areas. Thus for urban area like Lucknow city having mostly concrete build up and less open spaces, Roof Top Rainwater Harvesting is best suited. In this techniques, water falling on Roofs in diverted to the recharge pits which directly recharges the underground aquifers through the artificial process of filtration.

To counter the problem of groundwater depletion the Government of U.P. has formulated rainwater harvesting policy and pre[are an action plan for its implementation. To adopt various techniques for groundwater conservation and rainwater harvesting for recharge purpose the government has issued certain directives. Firstly, plots having an area of 300 sq. Metre and above have to adopt rainwater harvesting system. Secondly, in future it is necessary to adopt rainwater harvesting system by all government building which are going to build and the government building which have already been build should have adopt rainwater harvesting system.

Besides this, there are many other alternatives which can reduce this problem to some extent:

- To meet the ever increasing demand for water. Water harvesting to recharge the groundwater enhances the availability of groundwater at specific place and time and thus assures a continuous and reliable access to groundwater.

- Groundwater harvesting should be done is flood plain area in the vicinity of perennial river Gomti by construction shallow wells of large diameter.
- To reduce the runoff which chokes storm drains and to avoid flooding of roads.
- There are quite a large number of abandoned deep tubewells in the city which can be utilized for recharging deep aquifers by rainwater harvesting.
- The roof top rainwater from the building may be diverted to the recharge well shaft and abandoned tubewells to allow the rainwater to recharge the groundwater.
- Reduces soil erosion in urban areas.
- Provision of roof top rainwater harvesting at initial stage of construction of large colonies of LDA and Avas Vikas should be mandatory so that large volume of rainwater can be harvested at very low cost.

Conclusion

Thus the Rainwater Harvesting is one of the simple methods of overcoming scarcity of water in the city. The idea is easy to implement and the cost are minimal but benefits are enormous. For this it is necessary to increase awareness of rainwater harvesting in the city. The municipal corporation must make it part and process of planning and development in the city. This will encourage conservation of water and enhance the water supply automatically. The regular monitoring of groundwater for observing in then hydrological regime is very important for its safe operations.

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