iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** VI **Month of publication:** June 2023

DOI: https://doi.org/10.22214/ijraset.2023.54255

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

Conservation of Rain Water in Urban Area Using Ground Water Recharge

Prof Maharshi Saxena[1], Prof Juhi Sharma[2]
[1, 2]*Assistant Professor, Department of Civil Engineering, SRIIT Gwalior*

Abstract: ***Water scarcity is serious problem throughout the world for both urban & rural community. As the world population increases, the demand increases for quality drinking water. Urbanization, industrial development & increase in agricultural field & production has resulted in overexploitation of groundwater & surface water resources and resultant deterioration in water quality. The conventional water sources namely well, river and reservoirs, etc. are inadequate to fulfill water demand due to unbalanced rainfall. . Surface andgroundwater resources are being utilized faster than they can be recharged. Rainwater harvesting (RWH) is an option that has been adopted in many areas of the world where conventional water supply systems have failed to meet people's needs. It is a technique that has been used since antiquity. It is an environmentally sound solution to address issues brought forth by large projects utilizing centralized water management approaches. Water harvesting is the activity of direct collection of rainwater, which can be stored for direct use or can be recharged into the groundwater. Water harvesting is the collection of runoff for productive purposes.***

According to Kim et al. (2005), rainwater harvesting may be one of the best methods available to recovering the natural hydrologic cycle and enabling urban development to become sustainable. The harvesting of rainwater has the potential to assist in alleviating pressures on current water supplies and storm water drainage systems. Rainwater collection has the potential to impact many people in the world.

As water harvesting is an ancient tradition and has been used for millennia in most dry lands of the world, many different techniques have been developed the aim of the present study is to use rainwater andthus taking close to the concept of nature conservation. In this study, the rain water harvesting (RWH) system is analyzed as an alternative source of water in Gwalior Town in the state of Madhya Pradesh, India and the results were elated.

By our calculation we have come to the conclusion that 108 days water can be stored for the entire city by the means of rain water harvesting method and that too only if we assume that only 70% of the water is being stored and remaining 30% of the water is getting wasted in the form of runoff. Even though, after this we are able to get 108 days of water for the entire city.

Keywords: Rain Water Harvesting, Public, Conventional, Urban & Rural.

I. INTRODUCTION

Global water crisis – Water plays a very important role in our life.

Cape town (S. Africa) – It is going to be the first city in the world where not a single drop of water willremain. And it is growing so fast near 'Day zero condition'.

Note – [Day Zero refers to the day when a place is likely to have no drinking water of its own.]

Due to which in Cape town about 5 million people have become without water. And this condition is not only of Cape town city, rather that in the time to come big cities like Melbourne, Jakarta, London, Tokyo,Beijing, Istanbul and Mexico etc may suffer from this situation.

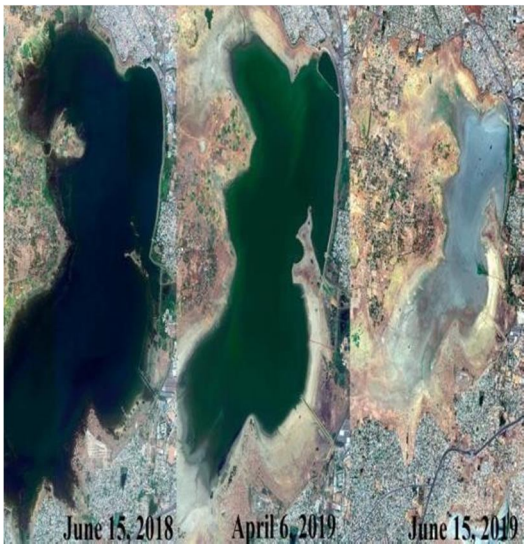
According to "Niti Aayog's Composite Water Management Index (CWMI)", Bangalore, Chennai, Delhi, and Hyderabad are among the most susceptible.

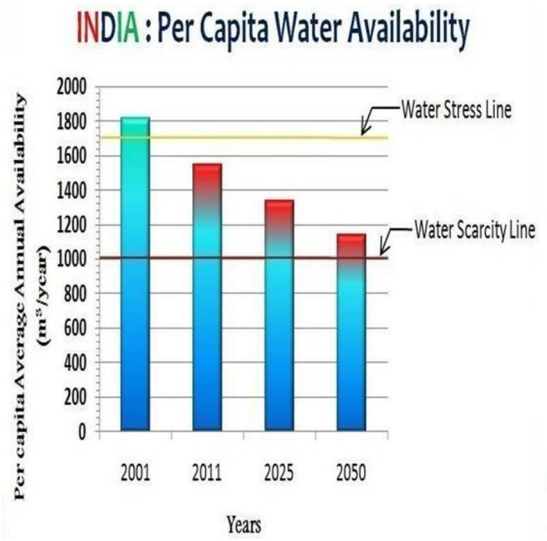
In the other way we have not a lack of water in the whole world, we have about as much water as 336 million trillion Gallons, our earth is covered by 71% of water, but from this much water about 97% water is salty (and we can not use this salty water), and 2% water is available in the form of ice in glacier and about less than 1% fresh water is available in the earth (and at this 1% water we human survive).

But from this 1% of water 65-70% water is available in the form of underground water, and which is very difficult and expensive to extract the underground water.

©IJRASET: All Rights are Reserved

Water crisis problem in India:





Satellite Pictures reveal the Acute Water crisis Chennai is Facing as Reservoir Turn Dry.

According to the report of central water commission (2017) – In India about 91 big reservoirs have about only 41% water are available in comparison to total capacity of reservoirs. This report indicates that from Tamil Nadu, Kerala, Karnataka, Telangana and Andhra Pradesh, 31 reservoirs have only 18% water is available.

India is the second most populous country in the whole world, because of increasing population, water consumption is also increasing, but availability of water are limited and decreasing day by day.

II. CASE STUDY

The historic city of Gwalior is suffering from acute drinking water crisis. The principal source of water, the Madhavrao Scindia Tighra Reservoir has only 731.30 feet of water left. This amounts to about 30 percent of the capacity and would last till June 22, 2022.

Present Scenario: In present condition all the water from houses are collected through combined sewer or sometimes the drainage water directly joins into the river.

Disadvantages: The following disadvantages are as follows:

1) Combined sewers are of big size thus it will be very costly.

2) Because of the open drainage systems which exist in Gwalior, flooding and Water loggingproblem occurs generally in rainy season.

III. SOLUTION TO OVERCOME THIS WATER MANAGEMENT PROBLEM IN GWALIOR

To overcome this problem it is suggested that, the black water (water from toilets) is carried by sewer lineand the Grey water (water from kitchen, bathroom, washing machine) combined with rain water (from therooftop) is discharged into the recharging pit through perforated pipe.

Advantages: There are various advantages are as follows:

1) Because the Grey water is not so harmful, it contains only soap (from bathroom), mud etc. So it can be reused for irrigation purpose or it can be joined into the recharging pit.

2) It reduces the water logging problem and flooding problem generally in rainy season.

3) The rain water which is wasted in present scenario, it can be utilized and recharges the underground water. Calculation shows that by storing only 70% of rain water, one can fulfill the water demand of 108 days for the entire city.

IV. CALCULATIONS OF HOW MUCH RAIN WATER CAN BE STORED

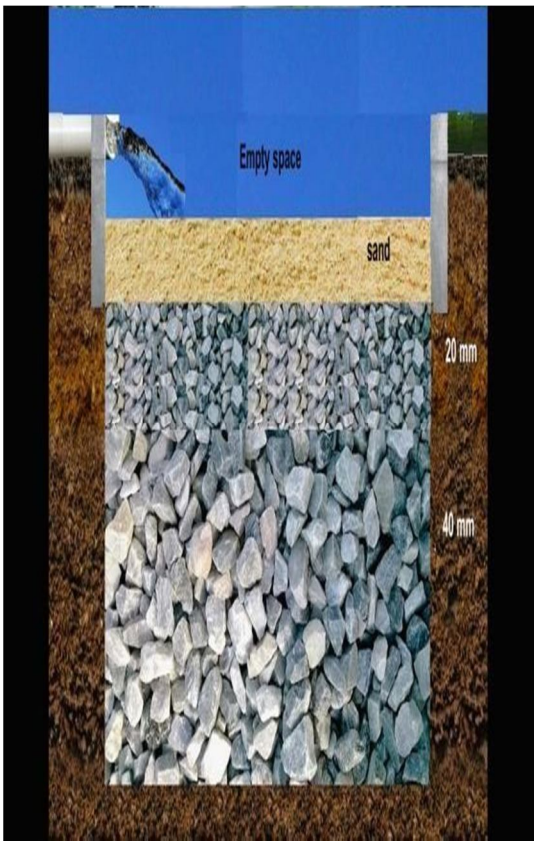
No of houses in Gwalior city = 2,81,598 (From Nagar Nigam Gwalior in 2022).
Average area of each flat = 1000ft² ≈ 93m² (Assumption)
Avg. annual rainfall of Gwalior = 897mm (From internet site of Meteorological Department, Gwalior)
Volume of water received = total area × Rainfall amount × runoff coefficientDischarge collected (by rainfall) = (2,81,598 × 93 × 0.897 × 0.7)/(365)

= 45.2 MLD.

Calculation of total discharge requirement – Population of Gwalior city = 14,10,000 (in 2021)Total discharge requirement = 14,10,000 × 110
= 155.10 MLD.
Thus from this 151.86 MLD total discharge requirement, 45 MLD water can be collected by Rainfall.Total no. of days, preserved water can be utilized = (45.2 × 365)/155

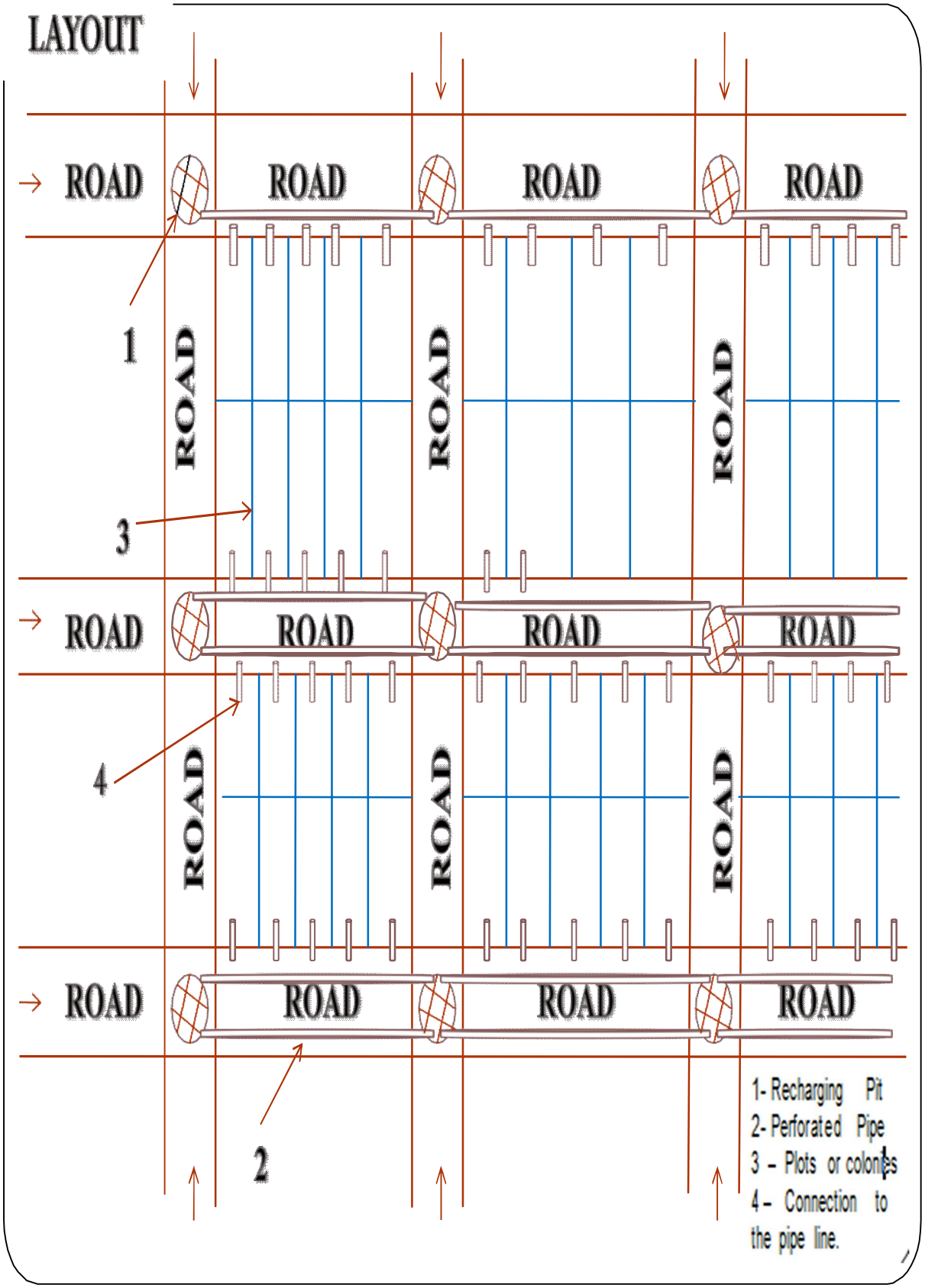
= 108 days.

Thus total 108 days of water can be stored by Rainfall.
The water requirement is fulfilled by providing bore wells located at each intersection.



Rainwater from the rooftop and surface runoff from the paved area of the houses will flow into the perforated pipe that will run on both sides of the main lane. Rain water from the pipe will be diverted into recharge pits constructed along the perforated pipe at strategic locations (at each intersection). Rainwater is diverted to recharge pits. The pits will also be filled up with layers of gravels and sand to ensure efficient filtration.

1) Top 15cm is of sand layer. (Minimum depth)
2) And bottom layers are provided of pebbles and gravels. (Minimum depth of Gravels layer is 20cm & of pebbles layer is 40cm)

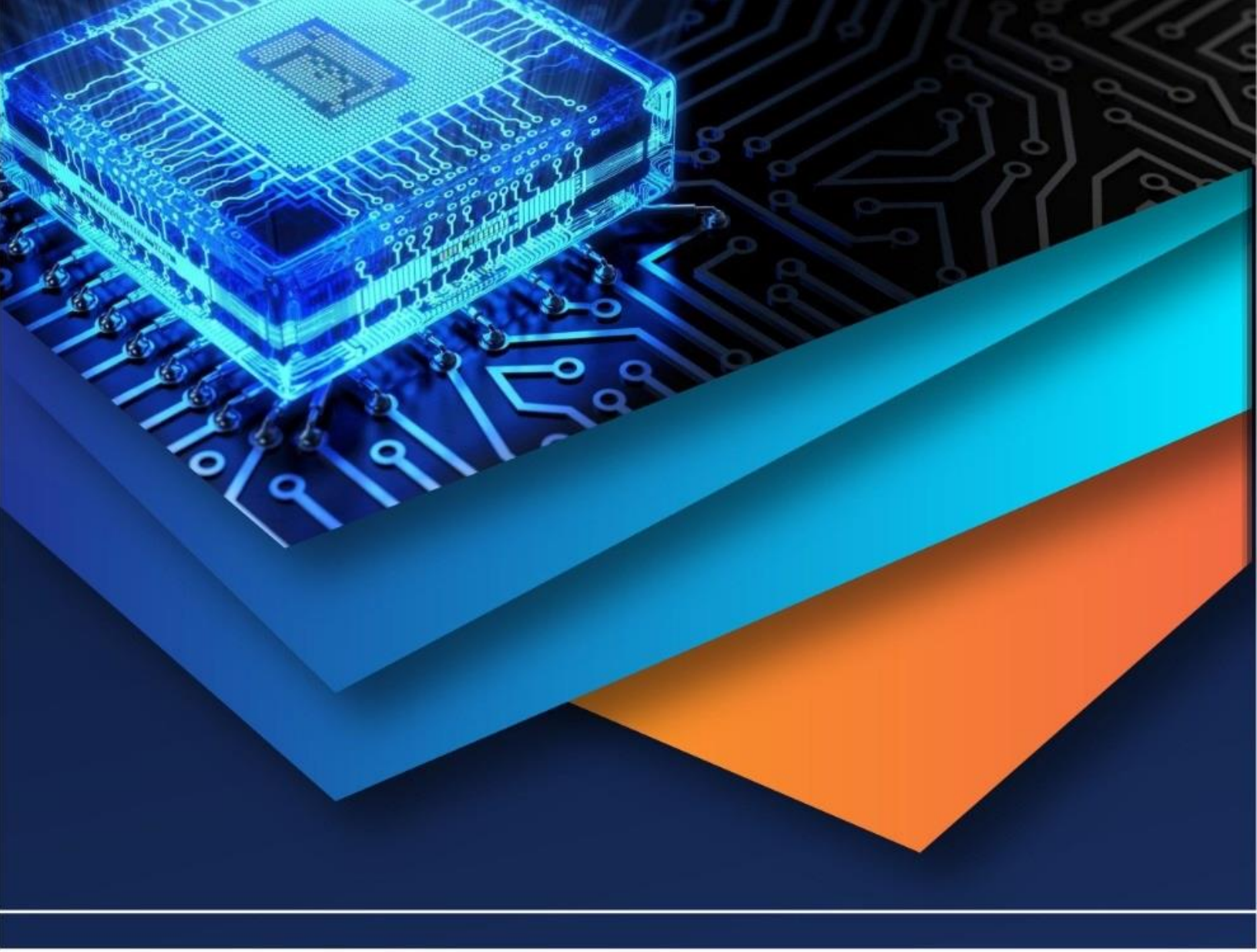

LAYOUT
ROAD
ROAD
ROAD
ROAD
1
ROAD
ROAD
ROAD
3
ROAD
ROAD
ROAD
ROAD
4
ROAD
ROAD
ROAD
ROAD
ROAD
ROAD
ROAD
ROAD
2
1- Recharging Pit
2- Perforated Pipe
3 – Plots or colonies
4 – Connection to the pipe line.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

V. CONCLUSION AND SUGGESTIONS

1) The main source of water in Gwalior is Madhav Rao Scindia TIGHRA Reservoir, which was made by the father of engineering Sir Mokshagundam Visvesvaraya.But, looking at the present conditions the level of water in the reservoir is decreasing day by day because of the rise in temperature of the town is leading to the drought conditions in the city. Taking such situation in mind Rain water harvesting can be a magic bullet for the water crisis problem.
2) At, present water is supplied to the city by the means of the pipe line which is being laid from Chambal River which is nearby to Morena city. The distance from Chambal River to Gwalior city is approximately 100 km because of which the water supply through pipe line becomes quite expensive and also considering the fact that disputes might arise regarding the water between both the cities.
3) By our calculation we have come to the conclusion that 108 days water can be stored for the entire city by the means of rain water harvesting method and that too only if we assume that only 70%of the water is being stored and remaining 30% of the water is getting wasted in the form of runoff. Even though, after this we are able to get 108 days of water for the entire city.
4) If we take into consideration that the water from kitchen and bathroom is also recharged througha single perforated pipe to the underground water table. Then, we can fulfill this demand for the entireGwalior city from 50%-60%.
5) It should also be kept into mind while laying the pipeline on the side of the road, it should be connected to the recharging pit which are made at intersections.
6) Recharging pits will ensure that water is properly collected from the entire city in a proper manner.
7) Looking at present conditions, the open drainage system is one of the biggest problems in the Gwalior city, due to which the problem of flooding occurs in the monsoon season and also increasing the risk of spreading of diseases due to flies and mosquitoes.

©IJRASET: All Rights are Reserved



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)