

Unit 2 : Water Conservation

Chapter 4 : Water Recharge

Groundwater recharge:

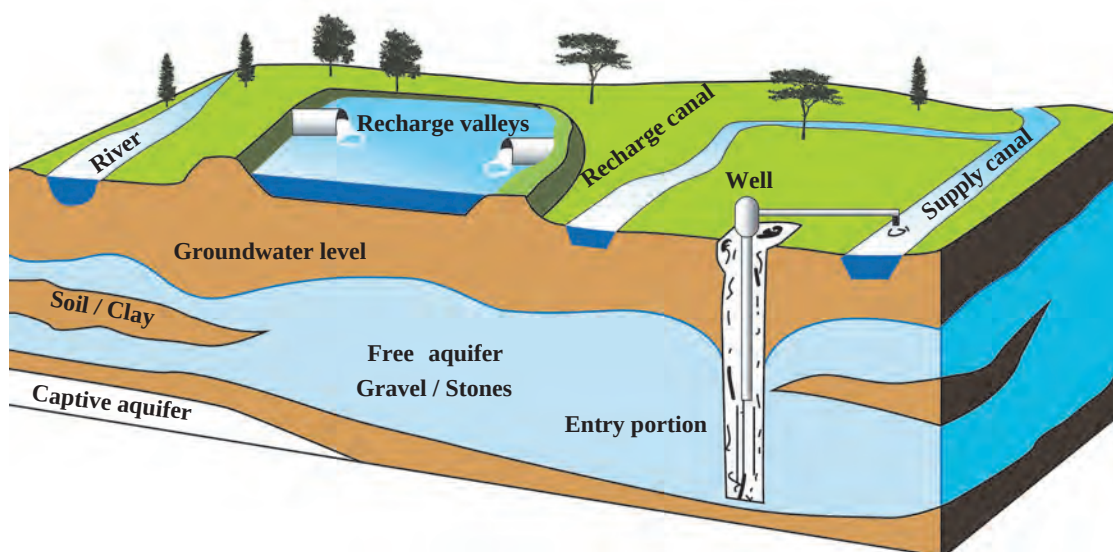
Groundwater recharge is the process of infiltrating rainwater into the soil in various ways to increase groundwater storage. Water recharge can be done in different ways. Storing rainwater for a certain period of time.

Groundwater

Groundwater is the water which stored under land. The rainwater seeps into the soil. As the upper soil layer becomes saturated, water continues to flow into the lower layer. This water is absorbed through the loam in the soil and the cracks in the rock. The rate at which water seeps into the soil depends on the geological condition of the place. The higher the slope, the less water is absorbed. Conversely, if the slope of the land is low and slow, the rate of waterlogging is high. The second factor is the porosity of the rocks. Porous soils, jointed rocks, fractured rocks, fused porous rocks, and rocks with cavities are more prone to waterlogging. Naturally, more groundwater reserves are formed. This groundwater is used for drinking and agriculture.

The need for groundwater recharge

We are surrounded by borewells and wells without water. The main reason for this is the lowered water level in the soil. This requires a collective effort to recharge the water. Where water is not available through river the canals, wells, borewells are used. Agricultural water is also obtained through the borewells. Currently, the water level of these springs is about 400 to 500 feet deep. As groundwater level is declining day by day, wells and borewells need to be recharged. Groundwater is not being recharged in the proportion it is being pumped out, so the groundwater level is getting deeper day by day. In order to increase the ground water level, it is necessary to try to infiltrate rain water wherever possible. At the same time, it is also necessary to use the available ground water sparingly and scientifically. Groundwater reserves are depleted due to various reasons. As a result they need to be recharged.



2.4.1 Groundwater Recharge

Efforts are made to infiltrate rainwater by digging ditches, absorption pits, in different places in the soil and at different distances, in different layers of the soil. Attempts are made to restore groundwater levels by storing as much groundwater as possible. At present, due to depletion of open space and soil in urban areas and significant increase in the amount of concrete or pavement, the natural recharge is very low and we are beginning to feel the loss. For this, there is an urgent need to study the scientific method of how to absorb the maximum amount of rain water in the ground and to take measures according to the location and with the participation of local people.

Care to be taken while recharging groundwater:

Appropriate care should be taken when recharging groundwater or using rainwater for it. When infiltrating water in any place, it is very important to filter the rain water through a proper filtration system. Rainwater may be acidic sometimes or the roof surface may be unclean. Therefore, after the onset of rains, the first one or two rainwater recharges should be avoided. We can purify the polluted water on the ground. But if the groundwater source is contaminated, it is impossible to purify the water in it.

Infiltration of water in the ground alone is not enough. When borewells are drilled, every borewell must be refilled. Due to the characteristic structure of the groundwater you have, if you do not refill, it can dry out suddenly at any time.

Recharging groundwater and sources not only increases their water holding capacity, but also has the added benefit for urban areas. If rainwater is diverted to groundwater or sources, there will never be water logging or flooding in the area.

In short, the most important and necessary thing is to try to get water throughout the year, efforts must be made in the rainy season. The most important and necessary thing to do is to take measures according to the location so that the available water can be used after the end of the rainy season by properly reciprocating the available water. It needs to be done with the guidance of the right expert and experienced person. Doing so will create a year-round source of water and groundwater.

Groundwater recharge and rain:

Before adopting various methods of groundwater recharge, you need to know the amount of rainfall in the area. The amount of water that can accumulate in the area can be calculated based on the amount of rainfall.

Rainwater Mathematics:

Area of the premises = 500 square meters

Roof area of the building = 100 square meters

Total annual rainfall = 2.2 m

Total amount of water = Area of the surrounding $\times$ Total rainfall

For 500 square meters = 500×2.2
= 1100 cubic meters (11,00,000 liters)

Assuming we only take 60% of the water,

Water content = $11,00,000 \times 0.6$
= 6,60,000 liters

Water on the roof of the building = 100×2.2
= 220 cubic meters (220,000 liters)

If 80% of this water is taken,

Water content = $2,20,000 \times 0.8$
= 1,76,000 liters.

Generally, one person needs 10 liters of water a day. So, if you think about the above mathematics, that water will be enough for about 50 people to drink only for a year.

The amount of rainfall varies according to the geographical conditions and the amount of water in each place will change accordingly.

Filtration system required for filtration of rainwater:

An important part of the rainwater filtration system is the suction pit. For recharge of water in sources like well or borewell, the suction pit acts as a filter. Also, if you want to recharge the source with your roof water, there are different filtration systems.

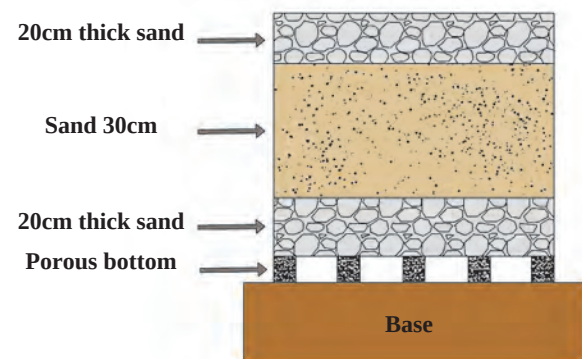
Suction pit design:

To absorb the water, a pit is dug at that place in which the water is to be recharged. The size of the suction pit is decided on the basis of component (well, bore well, roof water) to be recharged. The proportion of elements in the suction pit, i.e. stone, sand is also taken according to the size of the pit. At the bottom is a pipe of three or four inches in diameter, carrying the filtered water. The filtered water from this pipe goes to wells, borewells and underground. The pit is divided into three to four sections with large stones at the bottom. Then small stones of the same type are thrown. Above this layer, is a layer of thick sand and at the top, a very fine layer of sand. Rainwater or the water (free from silt or other components) from the source is released on this fine sand layer. This water is filtered through these three-four layers. This water accumulates in the soil, wells and borewells.

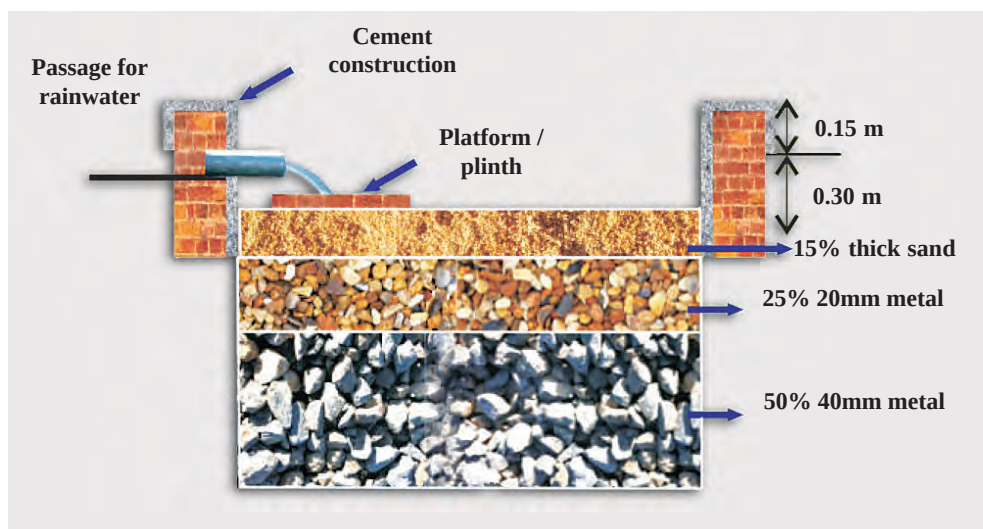
Different types of filtration devices:

You can't use rainwater directly from the roof. It has to be filtered. For that you have to prepare a filter. When preparing it, their size and the proportions of the components in it, it is decided on the amount of water to be recharged. According to the components in the filtration system, following types are found-

- 1. Sand filter :** A container of suitable size has layers of fine sand and gravel on top of each other. On one side there is a layer of porous material. On top of that there is a layer of medium sized gravel. Then there is a layer of fine sand. The topmost layer is of gravel. The water to be recharged is released from this layer and the water is filtered out of the porous layer. Its structure is shown in the figure below.

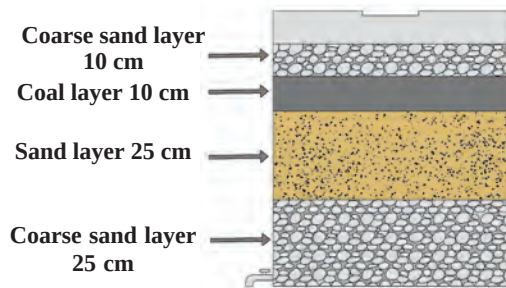


2.4.3 Sand filter



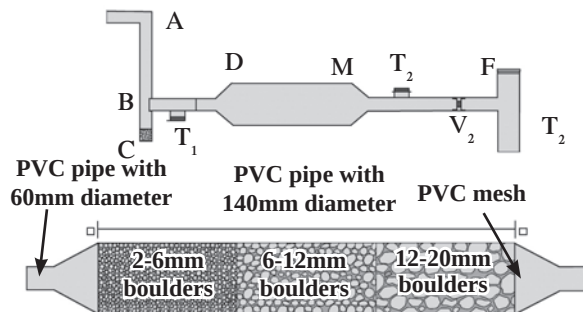
2.4.2 Absorption pit

- 2. Coal filter:** It is similar in structure to sand filter but on the top there is a layer of fine coal as shown in the figure. Recharge water is released from this top layer. The water is filtered and can be taken from the bottom layer for use. Its structure is shown in the figure below.



2.4.4 Coal filter

- 3. Filter in Pipes:** The filter shown in the figure below is made in a plastic pipe. The pipe is approximately 140 mm in diameter and 1.2 m in length. There are three layers of fine to large gravel. The first layer is made of gravel of size 2-6 mm. The second layer is a layer of gravel 6-12 mm thick and the third layer is a layer of 12-20 mm thickness. The water to be recharged is released from the side with the fine gravel and the filtered water recharges the water source as it flows out from the other side. The wells are recharged with this filter. This filter has been constructed by Rural Engineering Services Devas (Madhya Pradesh). That is why it is called a "Devas" filter.



2.4.5 Filter in a pipe

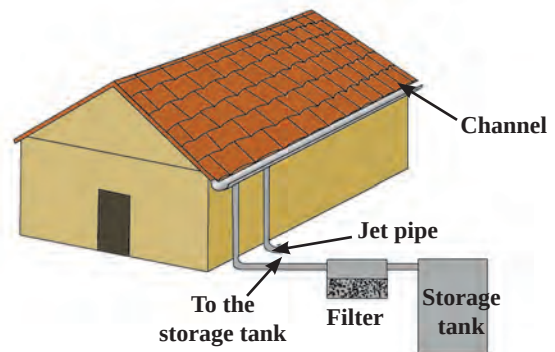
After the various filtration components, we will study the different methods of water recharge.

Rooftop rainwater recharge:

Rainwater is first considered through both reuse and recharge. Rainwater harvesting is the process of recharging with rainwater. There are different types. In the first type, rainwater is stored in a tank and is used for drinking or other purposes. The second type is that the rain water is infiltrated in the soil through the suction pit. Such water becomes part of the groundwater.

1. Storing rainwater in the tank:

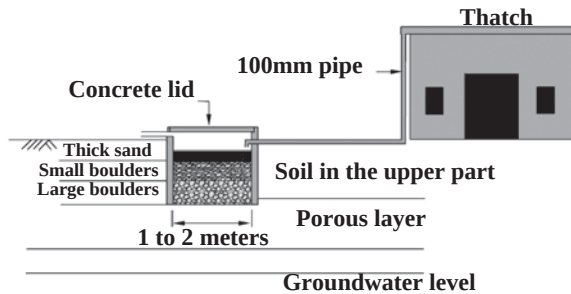
For the purpose of saving water and in places where drinking water is not available, rain water falling on the roof can be stored in a closed tank for drinking purposes. After cleaning the roof with a couple of showers, the rain water should be collected through a channel / pipe (panhali), filtered and stored in a tank. A special type of filter is used for this. Water should not be used without filtering through the filter. Use the recommended amount of liquid chlorine or tablets when drinking water.



2.4.6 Rainwater harvesting

2. Recharge of Soil with Rainwater:

Raising groundwater level is a need of the hour. For this, recharge of rain water is important. Rainwater is collected from the roof and allowed to pass through a mesh, leaving mulch or other elements trapped. The filtered water is discharged into the suction pit.

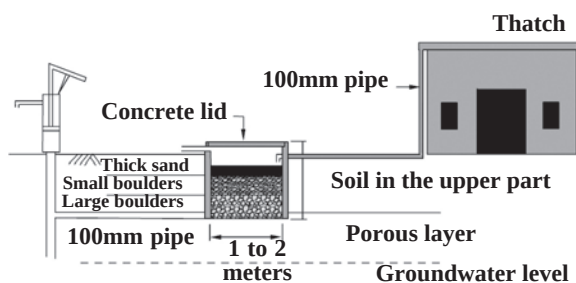


2.4.7 Absorption Pit

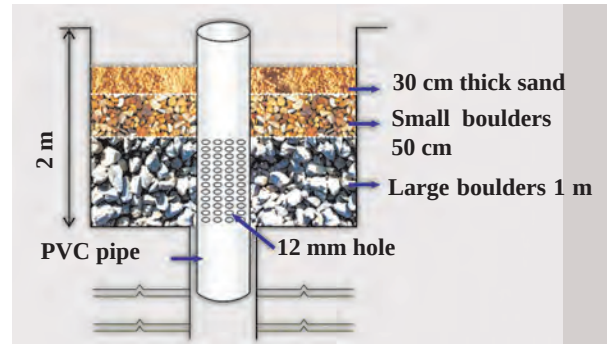
For this proper type of suction pit is dug. Its structure is shown in the accompanying figure.

3. Recharge of borewell with rainwater:

This type of refill is used for dry borewell in farms, villages or in the vicinity of large housing societies. In order to recharge the borewell in the field, the water of the runnel or stream is diverted as the source. The roof water is diverted to the suction pit to recharge the household or village borewell. A pit, two meters wide and two meters deep is dug around the borewell or a pit of suitable size is dug. In the area of the casing pipe of borewell, holes of specific diameter are drilled at a distance of 1-2 cms on all sides. Coconut strings (kaathya) are wrapped tightly or a plastic mesh is placed on these holes as a filter. The pit is divided into four sections, filled with rocks at the bottom, gravel above it, then coarse sand, and fine sand at the top. The water from the source is released at the top as shown in the figure. The



2.4.8 Recharge of the bore well



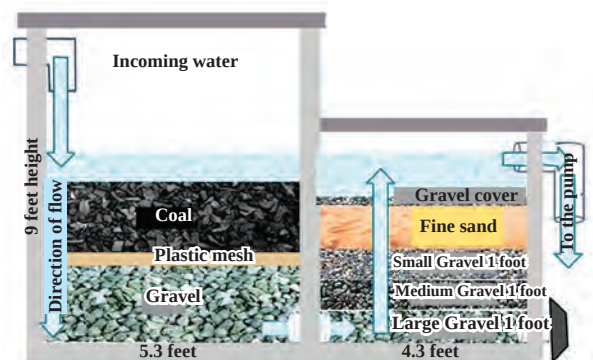
2.4.9 bore well structure

water that goes down through the filtration process becomes part of the groundwater.

4. Recharge of wells with rain water:

Two separate pits of three meters and two meters length are dug between the well and the stream.

The first pit is dug three meters long, three meters wide and one meter deep. The second pit is dug at a distance of three meters from the first pit. The second pit is dug two meters long, 1.5 meters wide and two meters deep. Taking a horizontal hole in the center of the first pit, this pit is connected to the second pit by a six inch PVC pipe. The first pit is filled with stones. The bottom of the second pit is filled with a 0.45 m thick layer of gravel. A 0.45 m thick layer of sand is applied on that layer. Then it is filled with a 0.45 m thick layer of fine sand and a 0.15 m thick layer of coal is spread on it. The pit is connected to the well by a four-inch PVC pipe from the bottom. The mulch, waste, etc. from the river water will settle in the first pit and the water without particles will go through the pipe to the second pit. The clean water filtered from the second pit will go through the well pipe and recharge the well.



2.4.10 Recharge of wells

Precautions to be taken while filling well and borewell:

1. The water coming to the stream should be free from salts and chemicals.
2. Water should be piped to the bottom of the well.
3. There should be two filter pits before refilling.
4. Remove the sludge from the well before refilling.
5. Recharge should be done with filtered and clean water only.
6. Water on the area where salt has spilled i.e. salts have accumulated, should not be used to recharge wells.
7. The filter made up of sand and gravel should be cleaned once before the rainy season.

Do You Know ?

In 1946, the 'Department of Engineering Geology and Groundwater' was set up independently at the Geological Survey of India. An agreement on technical cooperation was signed between India and the United States after independence.

In the scheme prepared under the agreement following were the aims -

Near about 2650 tube wells and borewells would be dug in the Ganga river basin from Punjab to Bihar. Underground geological information would be obtained. Sample wells would be drilled and future action plans would be planned. Currently,

groundwater survey and development systems have been set up in every state and union territory in addition to the Geological Survey of India. Groundwater Survey and Development Agency was established on 16th July 1971 in Maharashtra also. The function of this organization is to conduct groundwater survey, research, groundwater assessment, development, monitoring, management for drinking water, agricultural and industrial needs as well as survey and research for groundwater emergence.

Internet my friend :

<https://gsda.maharashtra.gov.in/index.php/GWRechargePriorityMap>

The above site belongs to Maharashtra Groundwater Development Authority. A map of your village and maps of artificial water recharge priority maps are also available to raise the groundwater table of your village on this site.

Your village is guided through a variety of colors as to what type of artificial water recharge works are expected to be done in which area. With that, we can undertake the task of artificial water recharge.

Government Departments and Symbols:



Exercise

1. What are the methods of water conservation?
2. Explain the need of water recharge in brief.
3. Explain the importance of suction pits in the process of water recharge.
4. What care should be taken while recharging a well or borewell ?
5. Explain with reason the most useful method of water filtration in your area.