BURHANI FOUNDATION
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RAINWATER HARVESTING HANDBOOK

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TABLE OF CONTENTS

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Syedna Aaliqadr Mufaddal Saifuddin TUS expressed desire in Mombasa to implement rainwater harvesting on individual and community level. In alignment with these visionary directives on 3rd June 2023, strategic and effective steps were initiated to implement rainwater harvesting practices.

Burhani Foundation aims to:

- Enhance water resilience,
- Reduce dependence on centralized water sources,
- Empower communities through sustainable practices,
- Contribute to long-term environmental health.

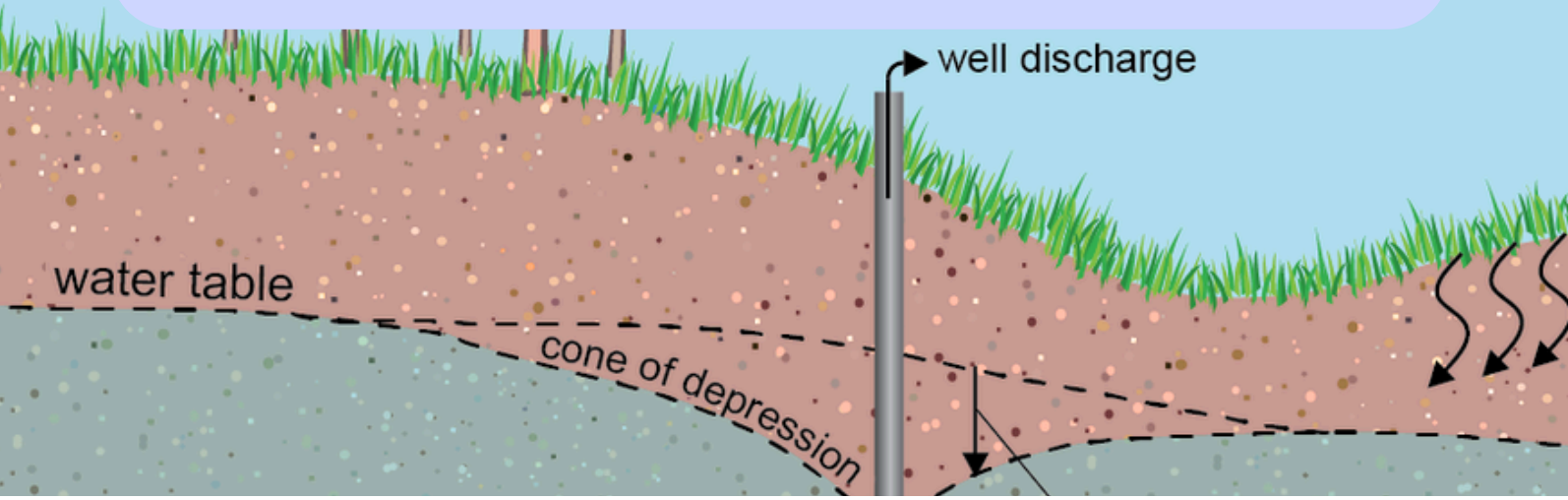
1 UNDERGROUND WATER EXTRACTION

The practice of extracting groundwater has been in use since ages, and has been a major source of water for mankind. Previously people were dependent on open wells that would tap water from shallow underground surfaces, called shallow aquifers. These shallow aquifers would in turn be replenished by rains.

With passing times mankind started drilling deep under the ground and extracting water from deep aquifers. Bore wells are made to reach the deep aquifers within earths surface and water is pumped out using water pumps.

Wells are created by drilling or digging. For bore wells a protective casing, typically steel or PVC is installed in it to prevent well collapse. Similarly filtration screens are incorporated for sediment filtration. Water from these wells is used in households, farms, industries, etc.

This centuries old method of unplanned and access extraction of groundwater has resulted in exploitation of this precious resource, thus creating the problem of depleting underground water tables and severe water scarcity.



2 WHAT ARE AQUIFERS?

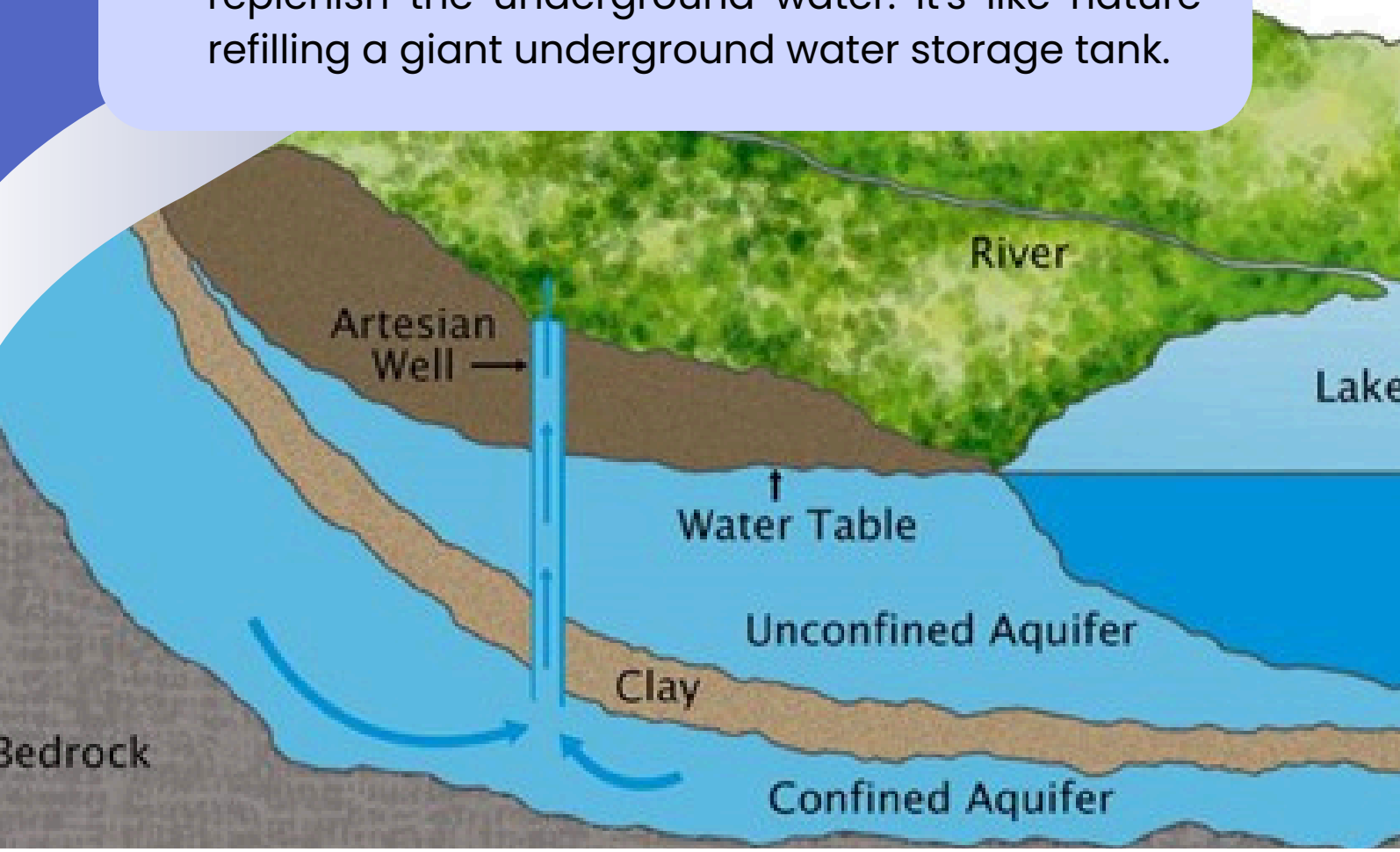
Aquifers are underground geological formations that contain water. These formations consist of permeable rocks or sediments that can store and transmit water.

Types of Aquifers:

- **Unconfined**
- **Confined**

Aquifer recharge:

- Aquifers get refilled when rainwater and surface water soak into the ground, seeping down to replenish the underground water. It's like nature refilling a giant underground water storage tank.



3 WHAT IS RAINWATER HARVESTING?

Rainwater harvesting is a method of collecting and storing rainwater. This practice is employed to harness rainwater that falls on roofs or any other surfaces, and then channel it to existing water bodies, storage tanks, cisterns, or other containers.

It is a common and age old technique that can be implemented at various scales, from individual households to large commercial or institutional buildings or residential societies.

4 WHY SHOULD WE HARVEST RAINWATER?

Life without water is unimaginable, however, freshwater sources are becoming scarce. Reports of several global agencies including United Nations indicate that if the current situation of water does not change and preventive measures are not taken, then the world will start to run out of fresh water by 2050.

Groundwater is a primary source of fresh water in many parts of the world. Some regions are becoming overly dependent on it, consuming groundwater faster than it is naturally replenished and causing water tables to decline unremittingly.

About 60,000 gallons of water runs off from your roofs and goes into the street, streams and then in seawater or sewage systems.

By installing a rainwater harvesting system you can easily store this water or divert it to existing water bodies or directly under the ground, thus benefiting yourself and the environment in more than oneways.

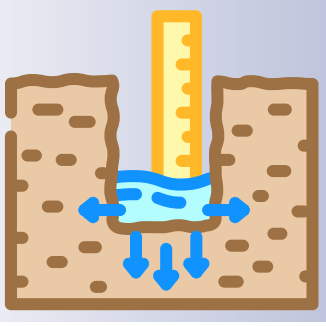
WHY SHOULD WE HARVEST RAINWATER?

1. **Reduced Percolation:** Concrete surfaces limit natural percolation of rainwater into the ground, leading to increased surface runoff.

2. **Groundwater Depletion:** Rapid groundwater depletion remains one of the most profound sustainability challenges that India is facing currently. Sustaining groundwater is essential for meeting the needs of food and water in the current and projected future climate.

3. **Future Water Stress:** Anticipated population growth and climate change are expected to intensify water stress, making sustainable water management crucial.

4. **Long-Term Benefits:** Statistically, RWH showcases long-term benefits in terms of reducing reliance on external water sources, managing stormwater, and contributing to groundwater recharge.

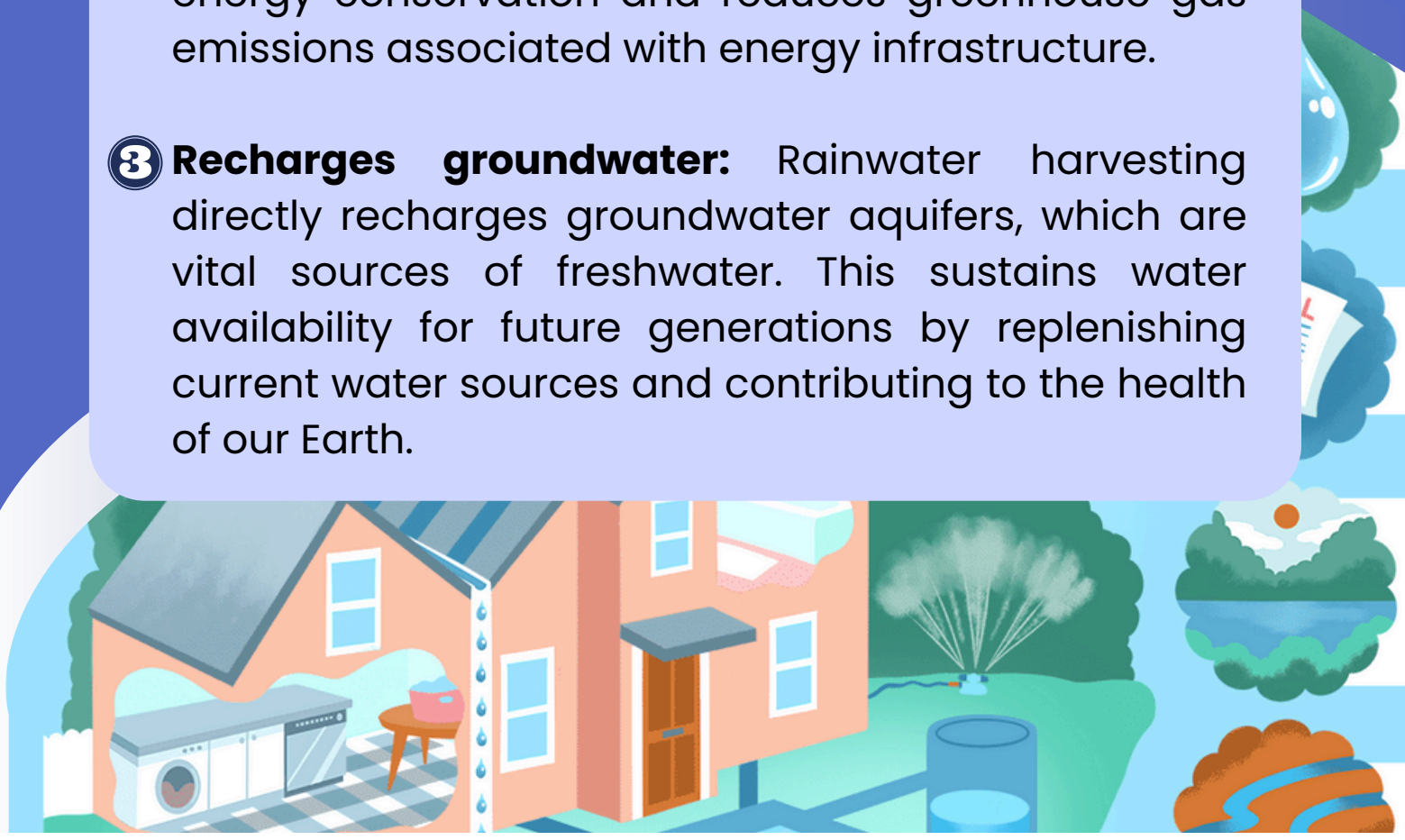


5 BENEFITS OF RAIN-WATER HARVESTING

1. **Reduces water scarcity:** Rainwater harvesting is a helpful and eco-friendly way to tackle water shortages. This method decreases the need for relying heavily on already stressed water sources. It's especially beneficial in places where rainfall is inconsistent or during droughts.

2. **Conserves energy:** When rainwater is harvested and used for tasks like landscape irrigation, it reduces the demand for energy-intensive water pumping and distribution. This contributes to overall energy conservation and reduces greenhouse gas emissions associated with energy infrastructure.

3. **Recharges groundwater:** Rainwater harvesting directly recharges groundwater aquifers, which are vital sources of freshwater. This sustains water availability for future generations by replenishing current water sources and contributing to the health of our Earth.

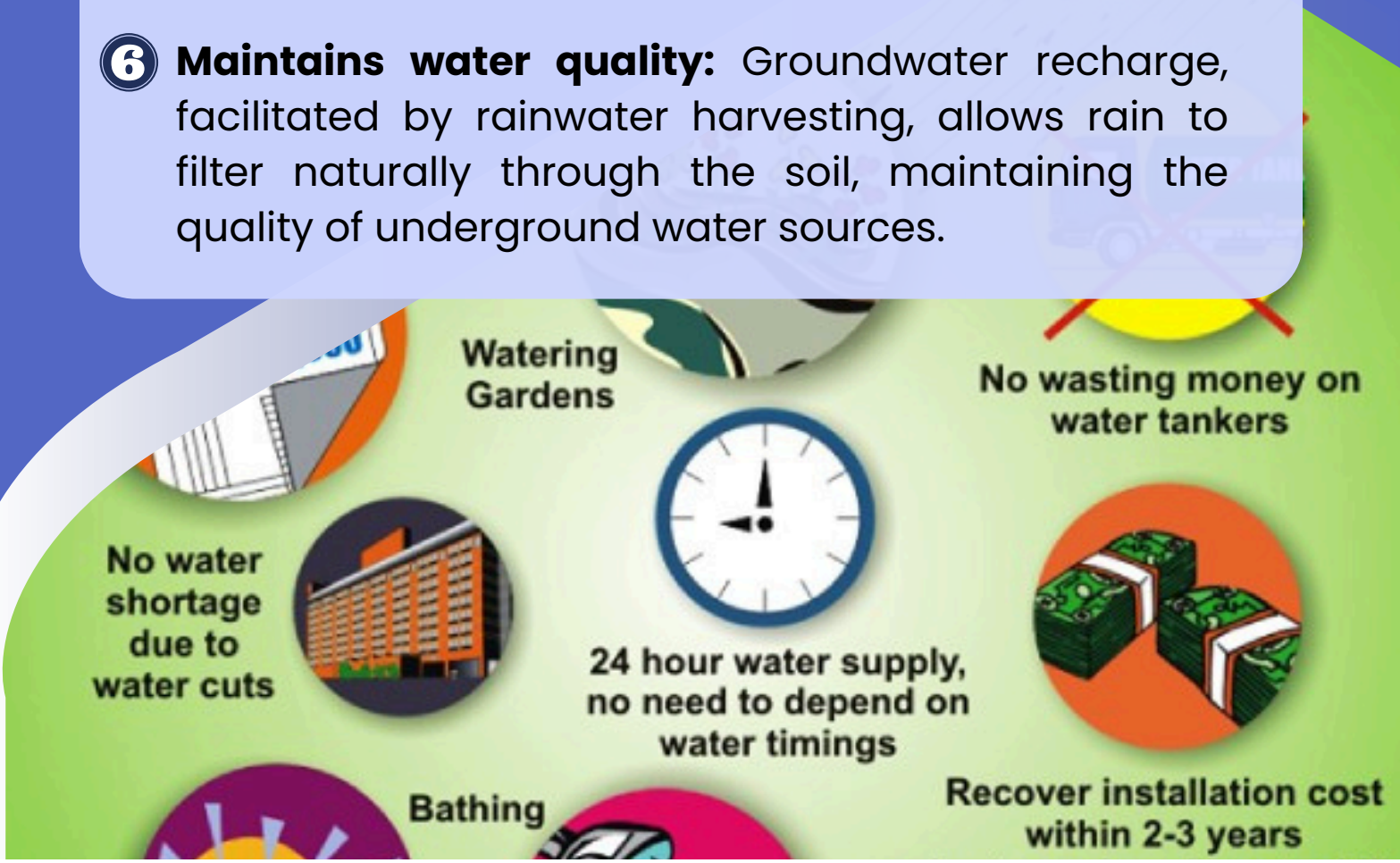


BENEFITS OF RAINWATER HARVESTING

4. **Prevents soil erosion:** Collecting rainwater helps in managing surface water runoff during heavy rains. This prevents soil erosion by controlling the flow of water across the land. By reducing the force of flowing water, rainwater harvesting safeguards topsoil, which is crucial for maintaining fertile and productive land.

5. **Reduces flooding:** Properly designed rainwater harvesting systems can help manage urban storm water runoff, preventing floods in low-lying areas. By storing excess rainwater and slowly releasing it into the ground, these systems reduce the strain on drainage systems and mitigate flood risks.

6. **Maintains water quality:** Groundwater recharge, facilitated by rainwater harvesting, allows rain to filter naturally through the soil, maintaining the quality of underground water sources.

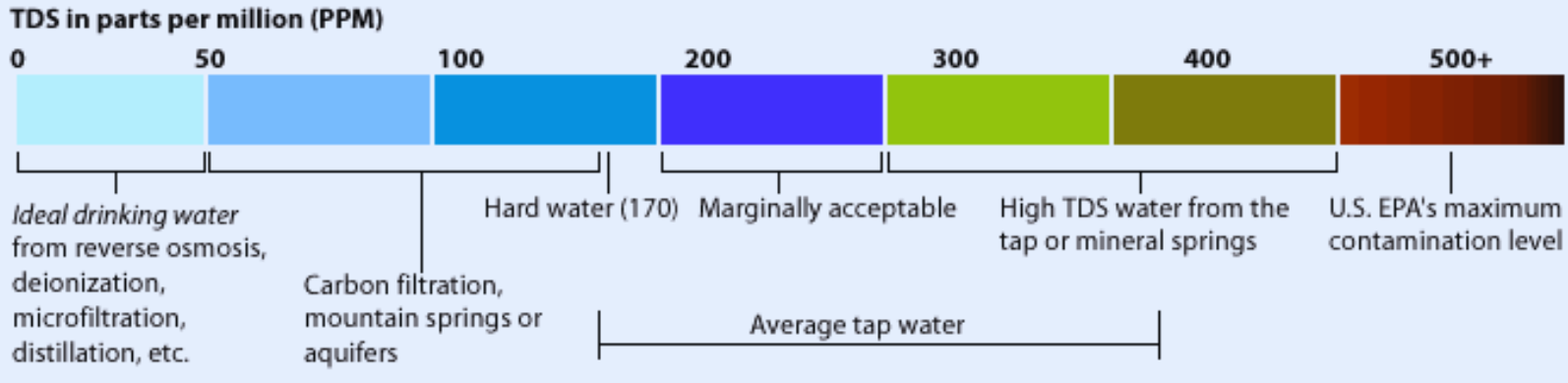


BENEFITS OF RAINWATER HARVESTING

7. **Reduces Urban Heat Island Effect:** In urban areas, rainwater harvesting contributes to cooling the environment by retaining the moisture in the earth thus mitigating with the urban heat island effect.

8. **Reduces Total Dissolved Solids (TDS):** TDS, indicates the concentration of dissolved substances in water, including minerals and organic matter. Rainwater, being relatively pure, has lower TDS than other sources. As it infiltrates the ground, it dilutes dissolved solids, reducing TDS.

9. **Maintains Ecological Balance:** Rainwater infiltration helps by providing moisture to the soil, supporting plant growth, and replenishing groundwater. This, in turn, contributes to the overall ecological balance of an area, supporting diverse flora and fauna.

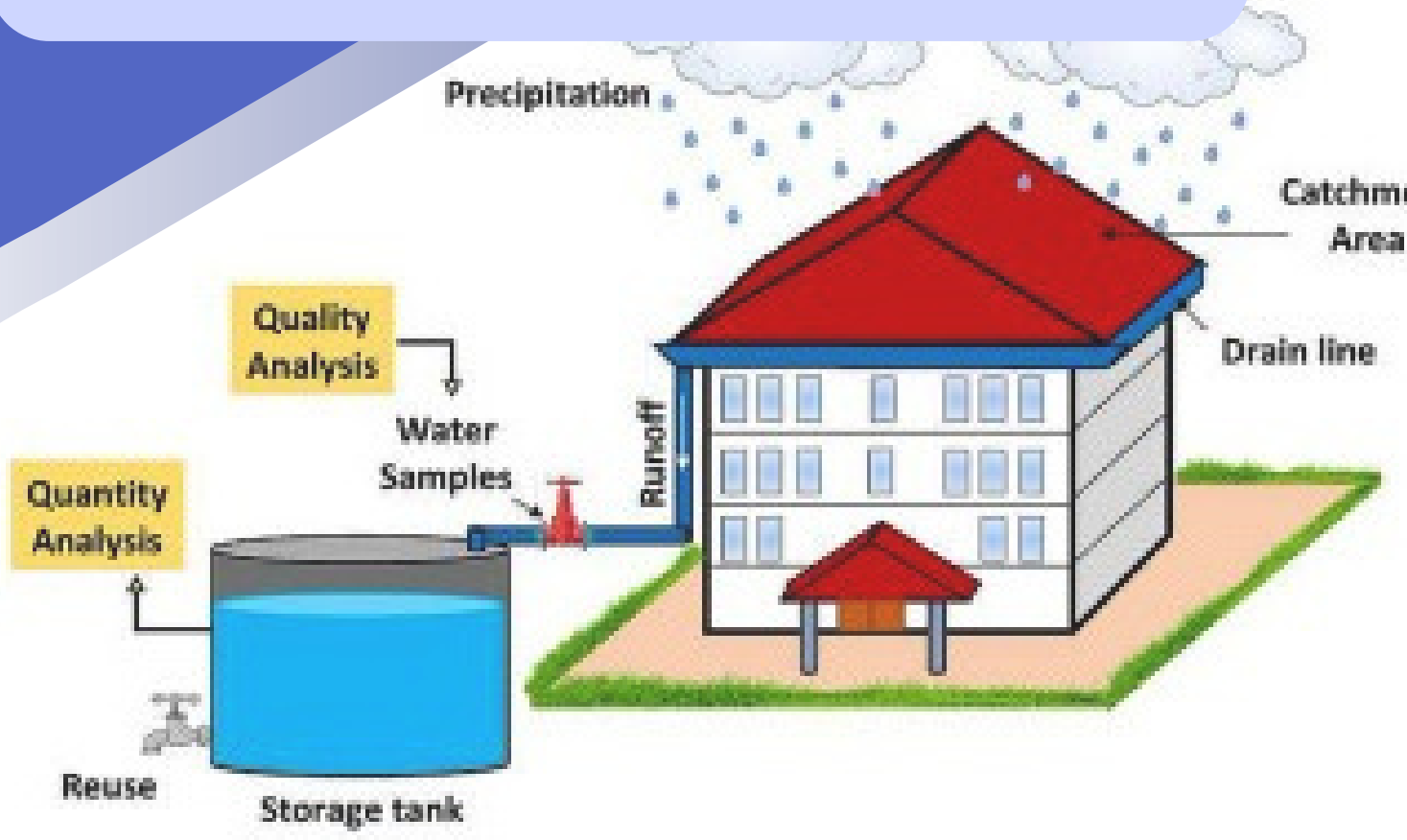


6 METHODS OF RAIN-WATER HARVESTING

1 ROOFTOP RAINWATER HARVESTING

In rooftop harvesting, the roof becomes the catchment, and the rainwater is collected from the roof of the house/building.

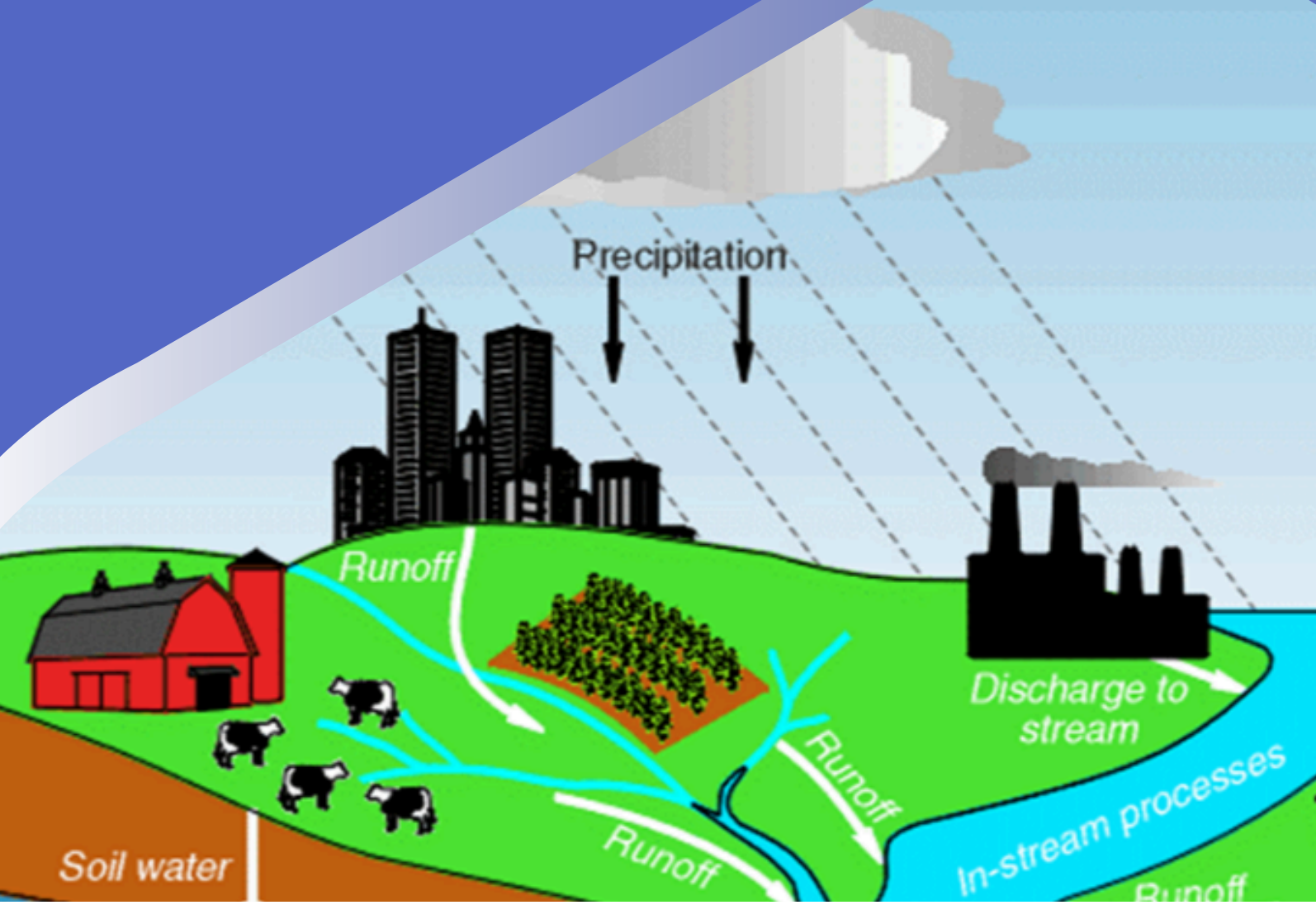
It can either be stored in a tank or diverted to an artificial recharge system. This method is less expensive, very useful and, if implemented correctly, helps in augmenting the groundwater level of the area.



METHODS OF RAINWATER HARVESTING

② SURFACE RUNOFF HARVESTING

Surface runoff harvesting involves collecting and utilizing rainwater that flows over the ground surface during precipitation events. This method captures runoff water before it enters drainage systems or bodies of water.



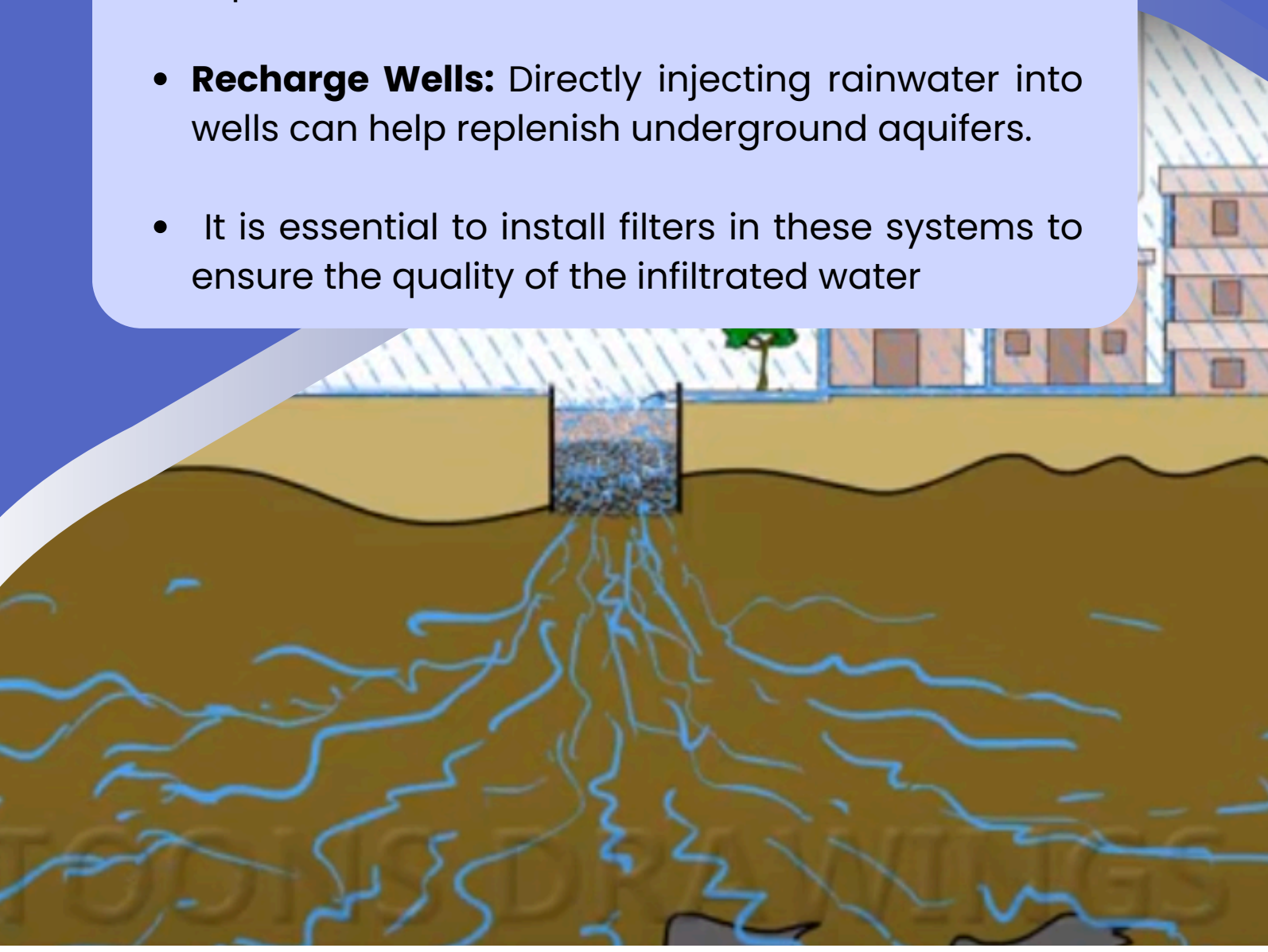
7 DIFFERENT USAGE OF RAINWATER HARVESTING

1 GROUNDWATER RECHARGE

- **Infiltration Basins/Percolation pits:** Designing systems to allow harvested rainwater to percolate into the ground can contribute to groundwater recharge, maintaining the health of aquifers.

- **Recharge Wells:** Directly injecting rainwater into wells can help replenish underground aquifers.

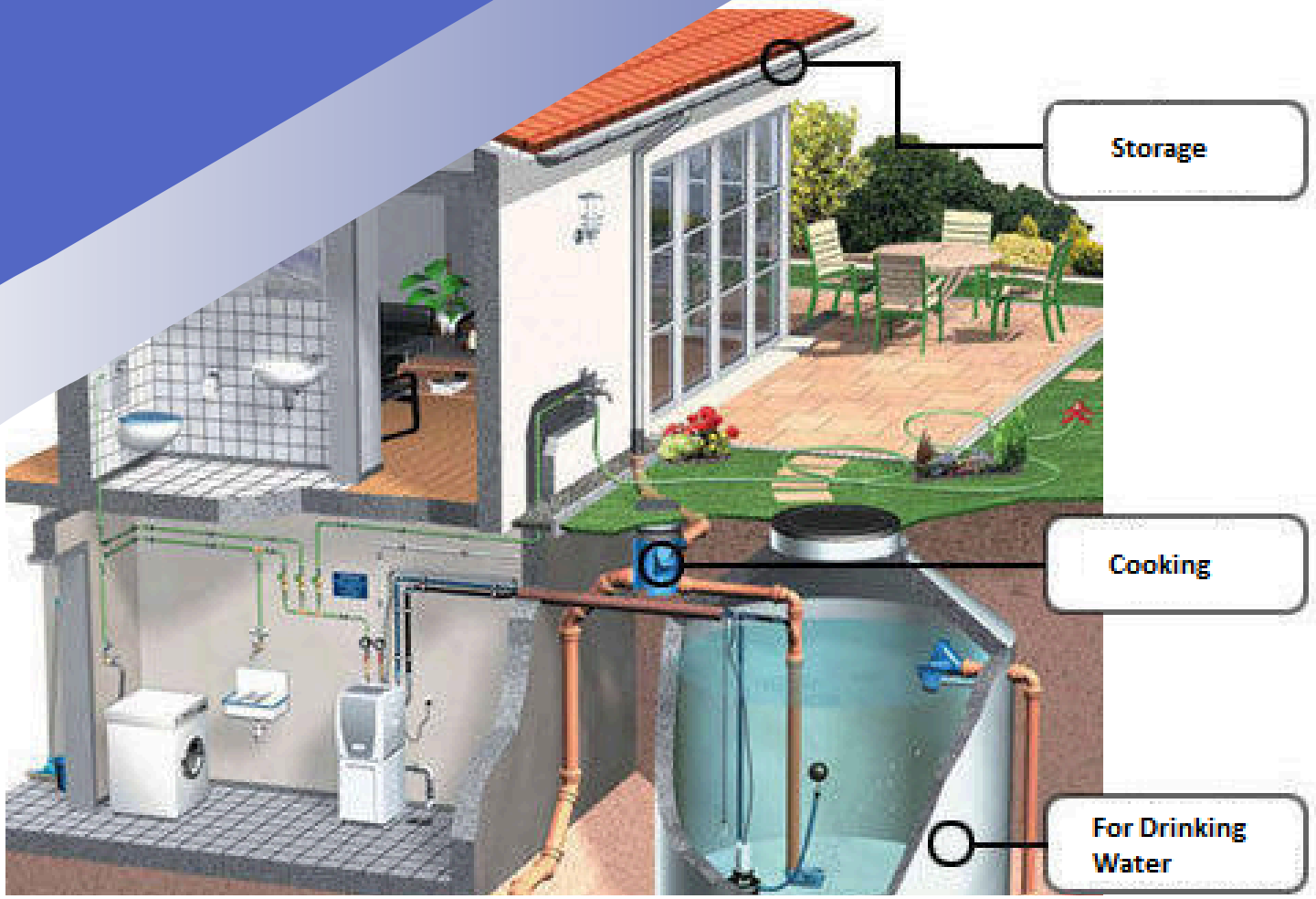
- It is essential to install filters in these systems to ensure the quality of the infiltrated water



DIFFERENT USAGE OF RAINWATER HARVESTING

② DIRECT USE FOR DOMESTIC PURPOSES

- **Drinking Water:** Filtered and purified rainwater can be used as a direct source of drinking water.
- **Cooking and Food Preparation:** Harvested rainwater can be used for cooking and preparing food.



DIFFERENT USAGE OF RAINWATER HARVESTING

3 AGRICULTURAL APPLICATIONS

- **Irrigation:** Rainwater can be stored and used for irrigating crops, reducing the reliance on traditional water sources and mitigating the impact of droughts.

- **Livestock Watering:** Harvested rainwater can provide a reliable source of water for livestock in rural areas.

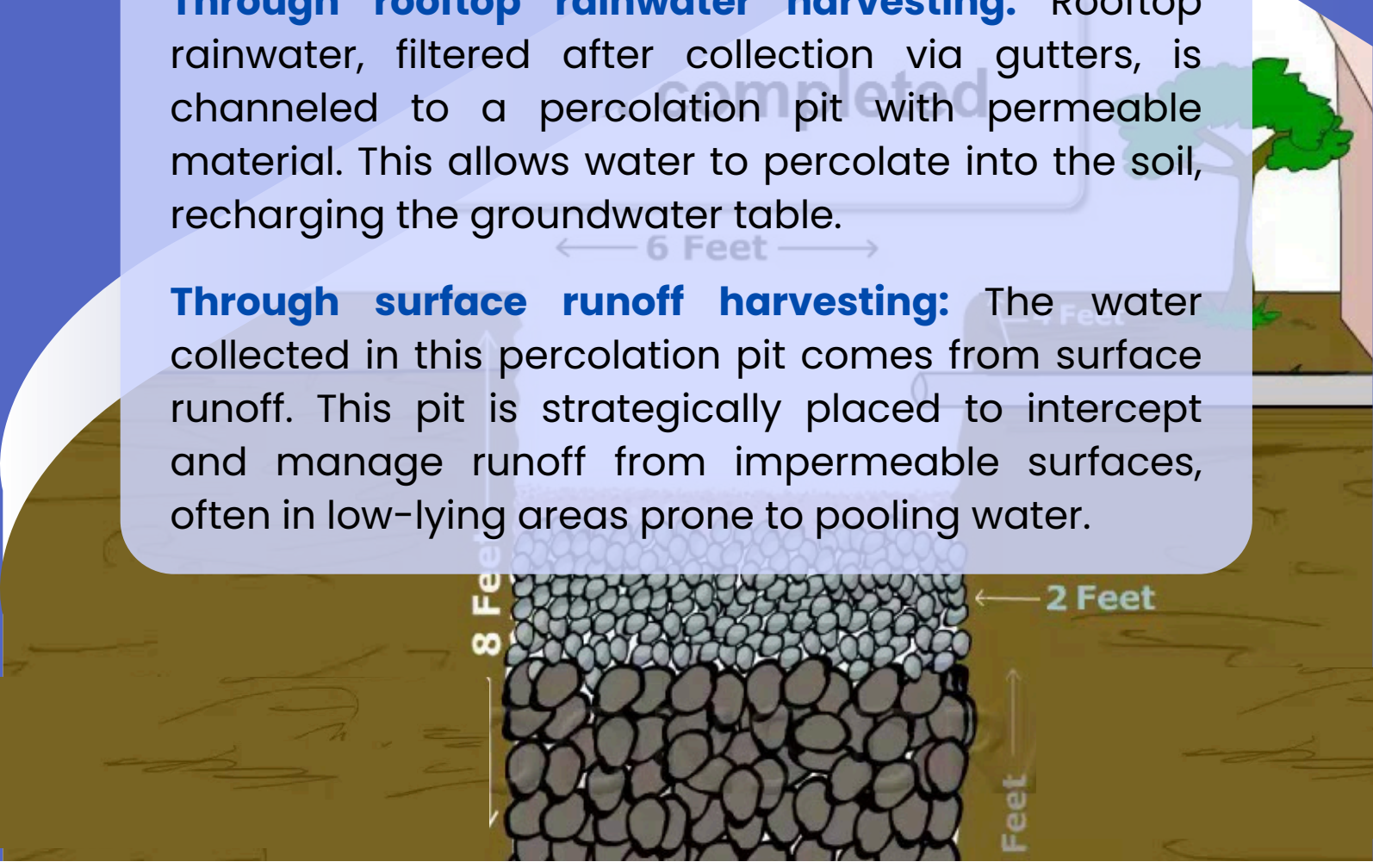
8 TECHNIQUES OF RAINWATER HARVESTING

1 PERCOLATION PITS

Percolation pits, typically constructed with permeable materials such as gravel or coarse sand, allow water to gradually infiltrate into the soil. For effective groundwater recharge, it's advisable to use porous rocks, with around 40-60% of the pit filled with these materials. This design ensures efficient groundwater recharge while preventing runoff.

Through rooftop rainwater harvesting: Rooftop rainwater, filtered after collection via gutters, is channeled to a percolation pit with permeable material. This allows water to percolate into the soil, recharging the groundwater table.

Through surface runoff harvesting: The water collected in this percolation pit comes from surface runoff. This pit is strategically placed to intercept and manage runoff from impermeable surfaces, often in low-lying areas prone to pooling water.



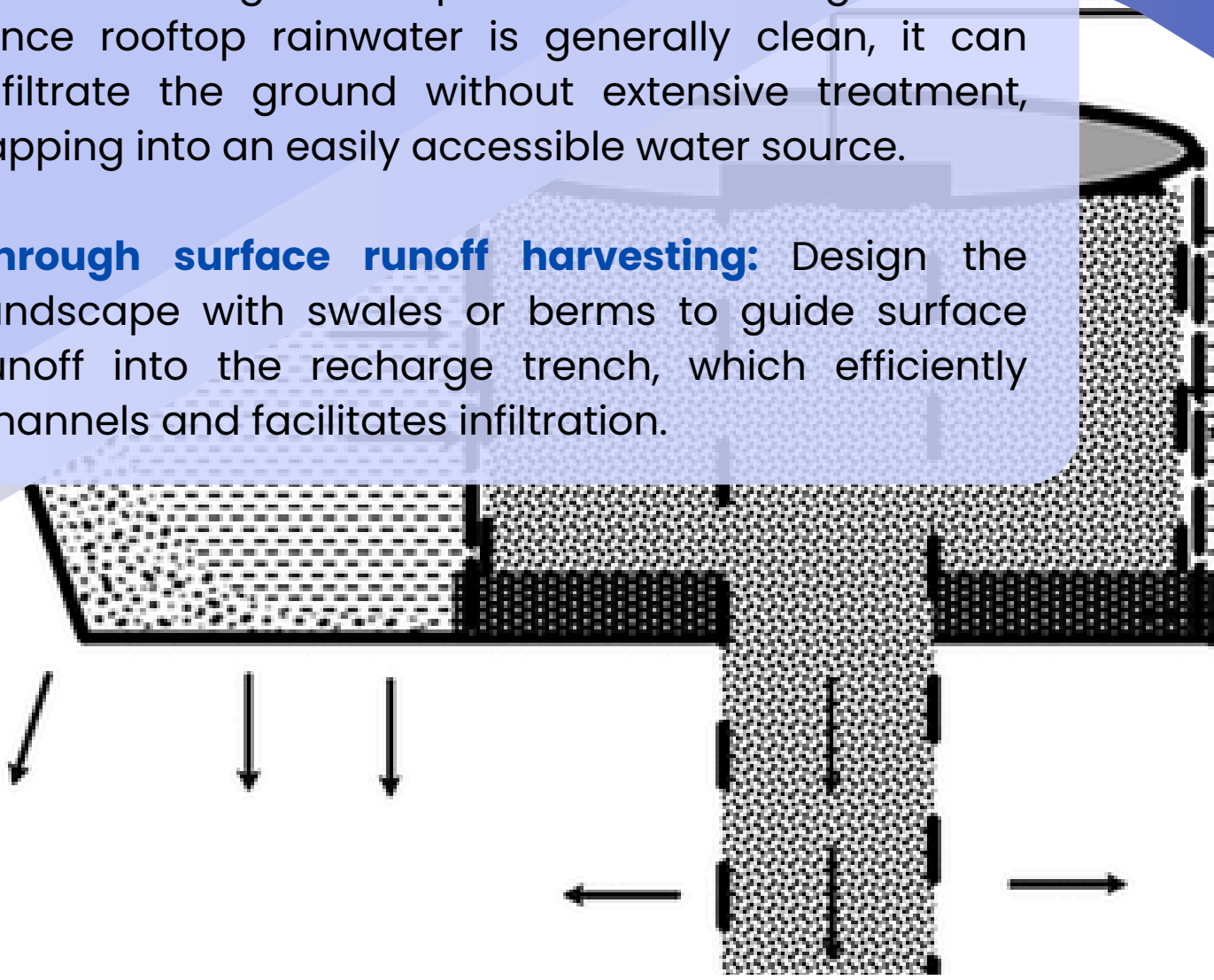
TECHNIQUES OF RAINWATER HARVESTING

2 RECHARGE TRENCH

A recharge trench is an elongated subsurface structure, typically resembling a trench or a long narrow pit. It is constructed below the ground surface and is filled with permeable materials such as gravel or coarse sand to allow water to percolate into the soil.

Through rooftop rainwater harvesting: Install gutters on the rooftop to capture rainwater and direct it through downspouts to the recharge trench. Since rooftop rainwater is generally clean, it can infiltrate the ground without extensive treatment, tapping into an easily accessible water source.

Through surface runoff harvesting: Design the landscape with swales or berms to guide surface runoff into the recharge trench, which efficiently channels and facilitates infiltration.



TECHNIQUES OF RAINWATER HARVESTING

3 RECHARGE OF WATER BODIES

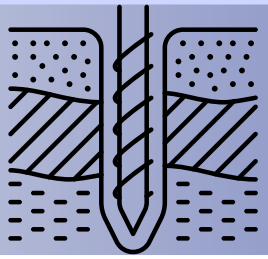
Dug Wells are used to access shallow groundwater for supplementary water sources. Rainwater can be channeled in these wells through proper pipping to increase the water level and quality. Installing filter is a must to avoid contamination of water.

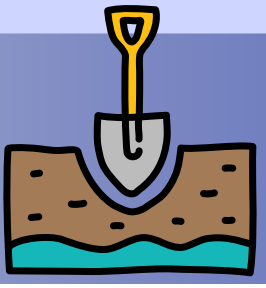
Drilled Wells / Tubewells / Borewells: The construction methods and depths of these wells vary, influencing their suitability for different aquifer types and depths.

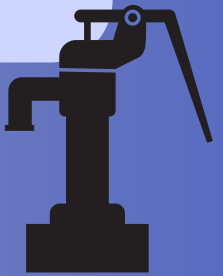
Tube wells are often used for shallow aquifers, while borewells and drilled wells can access both shallow and deep aquifers.

Proper integration of these wells with RWH systems ensures a diversified and sustainable water supply, reducing dependency on a single source.

Recharge Wells are specifically designed to inject rainwater directly into the water-bearing zones in to the ground, facilitating the recharge of underground aquifers enhances groundwater levels and ensures sustained water availability.







9 INSTALLATION PROCESS

1 Site Assessment:

Survey: Conduct a thorough survey of the site to determine the best locations for rainwater harvesting components, such as gutters, downspouts, and storage tanks.

2 Calculations:

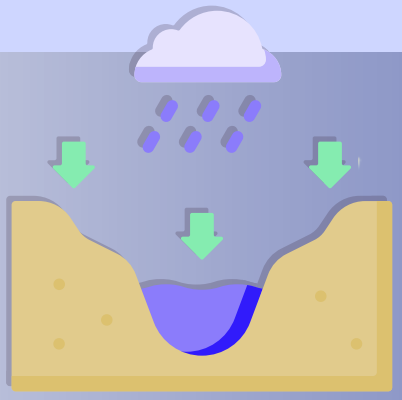
Catchment Area: Calculate the total catchment area of the roof. This is the area from which rainwater will be collected.

Rainfall Patterns: Consider the local rainfall patterns to estimate the potential amount of water that can be harvested.

3 Design:

Filter System: Ensure installation of a water filter to remove debris and contaminants from the flowing rainwater.

Overflow System: If rainwater is diverted to a tank, incorporate an overflow system, where the water flows to a secondary storage or diverted underground.



10 GOVERNMENT POLICIES

1 JAL SHAKTI ABHIYAN

"Jal Shakti Abhiyan: Catch the Rain" (JSA: CTR) in 2021 with the theme "Catch the Rain Where it Falls When it Falls" to cover all the blocks of all districts (rural as well as urban areas) across the country.

2 ATAL BHUJAL YOJANA

It is a Central Sector Scheme in identified water-stressed areas of 8,220 Gram Panchayats (GPs) under 229 blocks in 80 districts of 7 States viz. Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, and Uttar Pradesh to arrest the decline in groundwater level through community-led sustainable groundwater management.

3 NABARD

A separate scheme on Dug well recharge was prepared for Tamil Nadu, Gujarat, Madhya Pradesh, Karnataka, Maharashtra, Rajasthan, and Andhra Pradesh states, covering 4.455 Million irrigation dug wells falling in 1155 blocks. The Scheme was implemented through NABARD. Under this scheme, farmers were given funds directly for the construction of recharge pits near the dug well at an average cost of Rs.4000/- which varied from Rs.3600/- (Maharashtra) to Rs.5700/- (Andhra Pradesh).

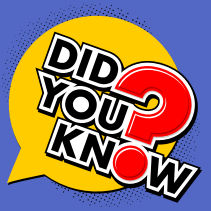
WHAT DOES UNITED NATION SAY FOR RWH

UN spotlights rainwater recycling, artificial wetlands among 'green' solutions to global water crisis.

We need new solutions in managing water resources so as to meet emerging challenges to water security caused by population growth and climate change, stated by Scientific and Cultural Organization (UNESCO)
If we do nothing, some five billion people will be living in areas with poor access to water by 2050.

"Rainwater harvesting is critical to agricultural production across Africa but telling people what to do will never be enough. Rather, we must empower people through education," says Jaime Webbe, an education specialist in UN Environment.

11 FACT'S ABOUT RWH



1. **Rainwater harvesting is an ancient practice that dates back to ancient civilizations. Many traditional water-harvesting techniques are still relevant and used today.**

2. **Harvested rainwater can be used for non-potable purposes, leading to reduced reliance on municipal water supplies and lower water bills for households and businesses.**

3. **In every inch of rainfall 1,000 square foot roof collects approx. 600 gallons (2,271.2 L) water.**

FACT'S ABOUT RWH

4. Only 2.5% of Earth's water is freshwater

5. Over 4 billion people (2/3rd of the world's population) experience water scarcity for at least one month during the year. 1.8 billion to 2.9 billion experience water scarcity for at least 4-6 months of the year!

6. Global water demand is expected to increase 50% by 2050

7. The average household leak can account for nearly 10,000 gallons of wasted water in the span of a year. Even worse, roughly 10% of homes have leaks! Fixing leaks is one of the most effective ways to reduce your water footprint.

8. The average person uses 80-100 gallons of water per day. If you have collected 4500 gallons of water, you can take care of 3 people for about 15 days.

12 FAQ'S

Q1) WHERE CAN I INSTALL RAINWATER HARVESTING SYSTEMS?

- RWH systems are applicable in both urban and rural environments, contributing to water sustainability and reducing the strain on existing water resources.
- Residential Buildings can have rooftop rainwater harvesting systems where rainwater is collected from the roof and stored.
- Commercial and industrial establishments can implement RWH systems to meet non-potable water demands, such as landscaping or cooling processes.
- In Agricultural Lands RWH is valuable for irrigating crops.
- Schools and universities can install RWH systems to reduce dependence on municipal water supplies for purposes like sanitation etc.
- Community centers and gathering places can implement RWH systems to contribute to local water sustainability efforts.

Q2) WHAT CAN BE DONE IF THERE IS INADEQUATE STORAGE CAPACITY DURING HEAVY RAINFALL?

- Consider increasing the size of the storage tank to accommodate larger volumes of rainwater.
- Implement overflow systems that divert excess water to alternative storage or drainage systems.
- Explore options for connecting multiple tanks in a cascading configuration to increase capacity.

Q3) SHOULD I INSTALL RWH EVEN IF THERE IS NO WATER SCARCITY?

Yes, installing a rainwater harvesting (RWH) system is beneficial even in areas without severe water scarcity. It promotes sustainability, cost savings, reduced strain on infrastructure, environmental impact mitigation, groundwater recharge, serves as a backup water source, contributes to community awareness, and may align with regulatory compliance or incentives.

Q4) WHAT CAN RAINWATER BE USED FOR?

Rainwater can be used for a variety of purposes, including:

- Irrigation of gardens, lawns, and crops.
- Flushing toilets and washing clothes.
- Cleaning vehicles, premises or outdoor areas.
- Supplying water for livestock or pets.
- Some systems can also be designed to provide treated rainwater for drinking and cooking purposes.

Q5) WHAT PRECAUTIONS SHOULD BE TAKEN BEFORE INTSALLING RWH SYSTEMS

- Check local regulations and obtain permits.
- Checking underground water table level
- Should not install near sewage line, incase of flooding it can contaminate the water stored in tanks/wells.
- Install RWH components away from the foundation avoiding soil erosion and reducing pressure on walls.
- Assess the site for suitability.
- Test rainwater quality and install filtration.
- Check the roof material for potential contaminants.
- Implement a first flush system for better water quality.
- Choose appropriate tank material
- Design percolation areas for efficient groundwater recharge.
- Consider professional installation for larger systems.

FAQ'S

Q6) CAN I CONNECT THE RAINWATER HARVESTING SYSTEM TO MY EXISTING PLUMBING?

Yes, rainwater harvesting systems can be connected to existing plumbing for various uses. However, it's important to ensure that the plumbing connections are properly installed, and backflow prevention devices are in place to prevent contamination of the potable water supply. Consulting with a plumber or rainwater harvesting professional can help ensure the proper integration of the system into your existing plumbing.

Q7) HOW CAN I ENSURE THE QUALITY OF STORED RAINWATER?

To maintain the quality of stored rainwater:

- **Install appropriate filtration systems, such as sediment filters and fine mesh screens, to remove contaminants.**
- **Use a first-flush diverter to divert the initial runoff that may contain higher levels of pollutants.**
- **Regularly clean and maintain the storage tank to prevent the growth of algae or bacteria.**
- **Implement UV sterilization or other treatment methods if potable water is desired.**

Q8) WHY SHOULD I CONTACT BURHANI FOUNDATION?

- **Community education and awareness materials, providing information about the benefits of rainwater harvesting and promoting responsible water use.**

- **By leveraging experience and knowledge, BFI can help individuals or communities implement cost-effective rainwater harvesting solutions that align with budget constraints.**

13 VOCABULARY ESSENTIALS

1 MITIGATE

"Mitigate" means to alleviate, reduce, lessen, or make something less severe, intense, or harmful.

2 REPLENISH

"Replenish" means to refill, restore, or renew something that has been used up, depleted, or diminished.

3 AUGMENT/AUGMENTING

"Augmenting" means to increase, enlarge, or enhance something in size, quantity, or intensity.

4 GUTTERS

"Gutters" refer to the channels or troughs attached to the edges of roofs to collect and direct rainwater.

5 SWALES

"Swales" refer to shallow ditches or depressions designed to channel and manage the flow of rainwater.

VOCABULARY ESSENTIALS

6 BERMS

"Berms" are raised mounds or embankments of soil. They are strategically constructed to manage the flow of rainwater.

7 AQUIFERS

“Aquifers” are underground water-bearing formations that store and transmit groundwater.

8 CATCHMENT AREA

A “catchment” area is where rainfall collects and drains into a common outlet, like a river or lake.

9 PERMEABLE

"Permeable" refers to the quality of a material or surface that allows liquids, gases, or substances to pass through it.

10 PERCOLATION

Percolation refers to the process of water moving through the soil or other porous materials, typically downward, driven by gravity. It is a natural phenomenon that plays a crucial role in the water cycle and groundwater recharge.

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