Rooftop Rainwater Harvesting for Borewell Recharge — A Vadodara Based Project

This project evaluates the potential **groundwater recharge through rooftop rainwater harvesting (RWH)** by installing **five filtration units** on **five separate 1,000 sq ft rooftop areas**, each connected to an existing borewell. The initiative focuses on **retrofitting and restarting under-utilized borewells** in Vadodara to function as recharge structures, thereby enabling **stormwater and rooftop runoff to percolate directly into the aquifer** rather than becoming surface runoff or causing localized waterlogging.

Each rooftop is equipped with a **first-flush system and a sand–gravel filter**, ensuring that the collected rainwater is adequately cleaned before entering the borewell. By strategically placing these **five independent filtrations–bore systems**, the project demonstrates how multiple decentralized recharge points can collectively contribute to substantial groundwater replenishment over time.

Using **2025 rainfall data for Vadodara** released by IMD and standard hydraulic assumptions (runoff coefficient and filtration losses), we calculated the potential recharge volumes per bore and then extrapolated for all five systems over a five-year period.

Key Assumptions

Parameter	Value / Assumption
Roof area per bore	1,000 sq ft (≈ 92.9 m²) - The average value of 5 bores is taken
Annual rainfall (Vadodara, 2025)	836.9 mm (0.8369 m)
Runoff coefficient (RCC terrace)	0.8
First-flush + filtration loss	20–30 %

Sample Calculation (per 1,000 sq ft rooftop, per year)

1. **Gross rooftop runoff**

Rainfall depth × Roof area = 0.8369 × 92.9 = 77.65 m³ ≈ 77,650 L

2. **Apply runoff coefficient (0.8)**

77,650 × 0.8 = 62,120 L

3. **Deduct first-flush and filtration losses (20–30 %)**

- 20 % loss → 62,120 × 0.8 = **49,700 L**
- 30 % loss → 62,120 × 0.7 = **43,500 L**

Net harvestable volume per year per bore ≈ 43,500 – 49,700 L

Over 5 years ≈ 218,000 – 249,000 L

Projected Recharge Volumes

Rooftop–Bore Setup	Per Year (liters)	Over 5 Years (liters)
1 bore (1,000 sq ft)	44,000 – 50,000	218,000 – 249,000
5 bores (5 × 1,000 sq ft)	220,000 – 250,000	1,090,000 – 1,245,000

Significance for Urban Recharge

Implementing rooftop–borewell recharge systems on multiple rooftops shows clear cumulative benefits. Even in a **moderate rainfall year like 2025**, the installation of **five rooftop RWH filter systems**, each on 1,000 sq ft areas, can enable the recharge of **over 1.1 million liters of water in just five years**.

This decentralized strategy can be scaled up for **housing societies, institutional campuses, and industrial estates** to improve aquifer recharge, reduce urban runoff, and restore borewell functionality — all while using existing infrastructure with minimal new construction.