



WORKSHOP ON SOURCE  
SUSTAINABILITY AND GREYWATER  
MANAGEMENT IN RURAL AREAS OF  
RAJASTHAN  
January 30, 2026

CENTRE FOR SCIENCE  
AND ENVIRONMENT,  
DELHI

**Orientation workshop on  
“Source sustainability and greywater management in rural areas of Rajasthan”**

Date: January 30, 2026

Venue: Malaviya National Institute of Technology, Jaipur

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## **Proceedings of the workshop**

### **Background and Purpose of the Workshop – Sushmita Sengupta**

The workshop was organized to discuss the sustainability of rural drinking water sources and management of greywater in rural areas of Rajasthan. It aimed to move the focus beyond creation of infrastructure under Jal Jeevan Mission (JJM) to long-term functionality, source sustainability, and effective operation and maintenance, with special emphasis on community institutions.

The specific objectives were to:

- Review field evidence on source sustainability and gaps in rural water supply systems.
- Share technical approaches for groundwater recharge and sustainable groundwater use.
- Discuss options for greywater management at household, community, and village levels.
- Deliberate on institutional and operational issues related to O&M, VWSC functioning, and convergence with watershed and other programmes.

Anchoring the workshop on “Source sustainability and greywater management in rural areas of Rajasthan”, Sushmita emphasized that at CSE, we focus not only on water supply but also source sustainability. Community involvement is most important aspect towards sustainability of drinking water programmes, but currently it exists only on paper. The communities must be trained and capacitated. She highlighted that traditional knowledge of community has to be used to attain the sustainability of water sources. She also discussed the challenges of climate change and over-extraction of groundwater, and its implications on water security. With this, she announced the formal start of the workshop.

### **1. Welcome address – Subrata Chakraborty, CSE**

Subrata Chakraborty, Director, Water Programme, CSE started the workshop with a welcome address. He addressed the keynote speakers and participants and also discussed the objective of the workshop. He thanked the speakers and participants for joining the workshop and creating this platform for initiating the discussion on source sustainability of drinking water sources, greywater management and community institutions.

### **2. Setting the Agenda – Upscaling Sustainability in a Climate-Risk World – Susmita Sengupta, CSE**

Susmita Sengupta set the context by highlighting India's experience with rural drinking water and sanitation and the risk of "slip-back" when systems are not maintained. She underlined that earlier programmes often created infrastructure, but villages slipped from covered to uncovered status and toilets became defunct due to lack of water and poor maintenance.

She explained that JJM is a next-generation reform which insists on "functional" tap connections, source sustainability, water quality monitoring, and greywater management so that the 80 per cent return flow is used for recharge and reuse rather than becoming a pollution load. Climate change, with more intense and variable rainfall and rising temperatures, will sharpen water stress, make storage losses higher, and increase demands across sectors, which makes local water management critical.

Key agenda points emphasized were:

- Capture every drop of rain through rooftop and landscape rainwater harvesting as rainy days decrease.
- Map and integrate village water assets (ponds, tanks, watershed structures) into village water security plans through convergence with other schemes.
- Treat greywater as an opportunity to improve water balance in villages by promoting soak pits and reuse in agriculture.
- Strengthen Village Water and Sanitation Committees (VWSCs) so that they plan, oversee, and sustain infrastructure rather than exist only on paper.

### **3. Watershed Development and Soil Conservation for Source Sustainability – Sushila Yadav, WDSC**

Sushila Yadav presented the experience of the Watershed Development and Soil Conservation Department in Rajasthan, structured around the "Five J's" of watershed management – Jan(people), Jal (water), Jaanwar (livestock), Jungle (forest), and Jameen (land). She explained that the watershed approach aims at socio-economic development through optimum utilisation of natural resources, water harvesting for surface storage and groundwater recharge, soil conservation, fodder development, and livelihood support.

She described technical strategies such as ridge-to-valley treatment, in-situ moisture conservation, staggered trenches, afforestation, field bunding, micro-irrigation, and multiple water-harvesting structures including farm ponds, percolation tanks, and tankas. The presentation highlighted the use of scientific tools—GIS, high-resolution data, and water budgeting—to identify economical sites for structures and to design them based on catchment, slope, and land use.

The impacts shared included:

- Increase of more than 1.19 lakh ha in cropped area in 82 per cent of studied projects.

- Reduction of ravine lands and conversion of wasteland into agriculture and horticulture through mini percolation tanks and pasture development.
- Significant increase in water impounding area in lakes, ponds, and reservoirs.
- She also underscored the social strategy: entry point activities, equity-oriented livelihood support, participatory planning, and building community organisations and Watershed Development Funds for post-project maintenance.
- Pointed out gaps in watershed management awareness among PHED personnel and stressed the need for convergence-oriented planning.
- Stated that watershed management must integrate technical interventions with social strategies for effectiveness.
- Cited successful examples such as Piplantri watershed, where water harvesting contributed to income generation.
- Highlighted the Tanka system as a successful Rajasthan model with potential for wider replication, particularly in areas with poor groundwater quality.
- Detailed key features of watershed programmes including GIS/RS-based planning, geotagging, user committees, integrated IT-based monitoring, and convergence among line departments.
- Reported outcomes of watershed interventions, including construction of water harvesting structures, improvement in groundwater recharge, agricultural expansion, and enhanced water availability.
- Strongly advocated for dedicated fund allocation for source sustainability, warning of future water scarcity if such measures are not prioritized.

She emphasized the role of MNIT in providing technical support in areas of GIS and Remote Sensing and making scientific approach based DPRs for groundwater structures. She also highlighted the role of CGWB in conducting highly efficient heliborne surveys to assess the potential groundwater recharge zones, which can be used for planning of source sustainability under Jal Jeevan Mission.

#### **4. Ashok Kumar, Superintending Engineer, PHED, Rajasthan**

Ashok Kumar stated that PHED must systematically address **source sustainability**, as current practices focus predominantly on extraction rather than recharge. He also emphasized the importance of geotagging of handpumps and tubewells to facilitate watershed-based revival of sources. He shared field experience from Alwar, where repeated tubewell failures led to community resistance due to extraction without recharge. Apart from this, he also highlighted the need for convergence with watershed programmes and referenced sustainable tubewell practices adopted in Haryana as a learning example. Noted that Village Water and Sanitation Committees (VWSCs) are not functioning optimally and that related policy issues are under review.

#### **5. Devshree Purohit, Senior Programme Manager, Tata Trusts**

Devshree discussed on seasonal public health issues in Karauli, including skin and abdominal ailments, linked to water quality and lack of chlorination awareness. She highlighted Pokhran as a low-rainfall area with an annual rainfall of 250 mm where revival of traditional water bodies (nadis) and community-led management have shown promise. Devshree stated that water use in villages should be addressed holistically rather than in silos (drinking vs. irrigation). She highlighted that greywater management is a critical gap requiring community acceptance and scalable solutions as piped water supply expands.

Highlighting Tata Trusts' knowledge partnership with CSE, she explained Trusts' strategy of studying the situation of source sustainability and greywater management, and its impact on rural communities.

## **6. Groundwater Source Sustainability: Hydrogeological Perspective – Dr Shailendra Singh, Senior Scientist, CGWB**

Dr Shailendra Singh underlined why Rajasthan must urgently focus on rejuvenating local water sources, given the state's high dependence on groundwater for drinking water and irrigation. He presented data showing that 80-85 percent of assessment units in the state are over-exploited or in a critical category, with stage of groundwater development consistently exceeding 140 per cent in recent years.

His presentation showed that maps of depth to water level for May and November 2024 depicted very deep pre-monsoon water levels in western Rajasthan and mixed but often 20–40 m depths in central areas, with only limited shallow zones post-monsoon. Decadal comparisons suggested that while a majority of wells show a rising trend, a substantial proportion still show decline, indicating local stresses and uneven recharge.

He explained major national and state initiatives relevant to Rajasthan, including:

- Jal Jeevan Mission's norms for quantity, quality, and sustainability of rural drinking water supply.
- Jal Shakti Abhiyan – Catch the Rain, focusing on water conservation, geo-tagging, and water bodies' inventory.
- Atal Bhujal Yojana and Jal Sanchay Jan Bhagidari for participatory groundwater management and large-scale recharge.
- Informed that groundwater assessments are now conducted annually as per Government of India directions.
- Highlighted technical concerns regarding depletion of shallow aquifers and the risks of unsustainable abstraction from deeper aquifers.
- Emphasized that increased rainfall alone does not ensure sustainability without appropriate harvesting and recharge structures.
- Recommended categorization of drinking water sources based on sustainability parameters and restoration of traditional water bodies where non-committed runoff exists.

- Referred to MGNREGS provisions prioritizing water conservation works and identified districts targeted by Government of India for such interventions.

The Standard Operating Procedure (SOP) for groundwater source sustainability under JJM was described as an eight-step framework—from data collection and demand–supply assessment to runoff estimation, risk assessment, selection of recharge and protection measures, groundwater monitoring, and technical–financial support. A detailed case study from Ajeetgarh block (Sikar) showed how wells and villages were categorised as good, moderate, or poor in terms of sustainability, and how limited run-off and aquifer potential required focus on rejuvenation of traditional water bodies along with carefully chosen artificial recharge structures.

### **7. Source Sustainability and Greywater Management: Field Insights from Pali District – Pradeep Kumar Mishra, CSE**

Pradeep Kumar Mishra presented learning from a landscaping and village-level study in three blocks and 15 villages of Pali district, undertaken to understand the status of local water sources and piped schemes. He outlined the criteria for village selection—topography, hydrogeology, population, and Jal Jeevan Mission coverage—along with a snapshot of household coverage, rock types, and scheme types (SVS/MVS).

Using JJM dashboard data, he showed that while some villages have 100 per cent household tap connections, others have very low coverage or non-functional systems. Survey findings indicated that though about 70 per cent of surveyed households had tap connections, only around two-thirds of these were functional, and 40 per cent of surveyed villages were not receiving reliable household water supply due to infrastructure and operational issues.

Key field observations included:

- Inadequate quantity and irregular supply (often once in two to four days) led households to depend heavily on local wells and borewells, even in MVS areas.
- A large fraction of local sources—about 40 per cent of open wells, 55 per cent of handpumps, and 32 per cent of borewells—were found abandoned, with no recharge structures planned for them.
- Household surveys on supply duration and water shortage showed high prevalence of daily shortages and coping strategies such as reducing use, fetching from other sources, and buying tankers.
- Community participation and VWSC functioning, noting that committees existed but were often inactive, with unclear roles in O&M despite JJM guidelines.

Pradeep emphasized that scientific planning using GIS and Remote Sensing, convergence of government departments and involvement of community institutions are key steps towards making drinking water sources sustainable.

#### **8. Making Groundwater Sources Sustainable in Desert Districts – Mahender Choudhary, MNIT Jaipur**

Mahender Choudhary focused on the desert districts of western Rajasthan, where groundwater is the primary lifeline for drinking water and irrigation. He summarized the hydro-climatic context of low rainfall (often 100–300 mm), high evapotranspiration, frequent droughts, sandy soils, and low natural recharge that together create acute stress on aquifers.

Presenting recent assessments, he showed that annual groundwater draft in Rajasthan exceeds recharge, with groundwater use surpassing 100 per cent of available resources and around 80 per cent of blocks falling in semi-critical, critical, or over-exploited categories. He also highlighted water quality problems, including widespread salinity, high fluoride and nitrate levels, and large areas where groundwater is unfit for direct drinking use.

He defined groundwater sustainability as a balance between recharge and extraction, quantity and quality protection, ecosystem needs, and inter-generational equity, calling for integrated technical, institutional, and social responses. A six-pillar framework was proposed, covering recharge enhancement, demand management, water quality protection, governance and regulation, community participation, and technology and monitoring, supported by a basin-level sustainability plan with indicators, baseline conditions, and a monitoring and evaluation system.

#### **9. Use of Advanced Tools for Mapping Potential Groundwater Recharge Zones – Vivek Kumar Sah, CSE**

Vivek Kumar Sah introduced the role of remote sensing and GIS in identifying potential groundwater recharge zones to guide investments under JJM, MGNREGA, MISA, and other programmes. He explained how remote sensing provides synoptic information on terrain and land use, while GIS enables storage, analysis, and overlay of spatial data for decision-making.

The presentation detailed the key thematic maps required for recharge planning—geology/lithology, soil, land use–land cover (LULC), drainage, lineaments, and digital elevation models (DEM). He described how each map contributes: rock types, porosity and permeability, soils determine percolation behaviour, LULC controls runoff and infiltration, drainage patterns indicate flow paths

and accumulation zones, lineaments reveal fractures and potential recharge corridors, and DEMs help identify ridges, valleys, and depressions.

He stressed that generating individual maps is not sufficient; superimposition (overlay analysis) of multiple layers is essential to delineate priority recharge zones. Examples were shown where combinations such as geology–lineament–drainage, geomorphology–lineament–drainage, and DEM–drainage–lineament highlight locations where streams intersect fractures in favourable formations, offering high recharge potential. He concluded by referring to the CSE toolkit on managing groundwater sustainably in rural areas as a step-by-step reference for practitioners.

#### **10. Options for Managing Greywater to Ensure Safe Water Sources – Swati Bhatia, CSE**

Swati Bhatia focused on greywater—wastewater from kitchens, bathrooms, and cloth washing—which constitutes 60–70 per cent of domestic water use and is a major, often unmanaged, flow in rural areas. She explained the difference between blackwater and greywater and presented typical ranges of BOD, COD, solids, and coliforms in various wastewater streams to emphasise that greywater, while less polluted than sewage, still requires appropriate management.

She described current practices in many villages where greywater is discharged into open areas and poorly designed drains, leading to dirty surroundings, vector breeding, contamination of surface water bodies, and unseen groundwater pollution. Findings from CSE surveys and the water census indicated that a large number of rural water bodies are affected by pollution or neglect, and that greywater, animal waste, pesticides, detergents, and other contaminants combine to worsen health and environmental outcomes.

The presentation outlined:

- Field challenges such as lack of funds for household systems, inadequate solid waste and sanitation, poor design of drains, and weak O&M of village-level treatment systems.
- A typology-based approach considering soil type, groundwater table, density, space availability, and climate to choose appropriate solutions.
- A menu of technologies at household (kitchen gardens, soak pits, leach pits, “magic pits”), intermediate (community soak pits, settler plus constructed wetlands), and end-point (waste stabilisation ponds, DEWATS, constructed wetlands) levels.

She emphasised that “one size does not fit all”; solutions must be tailored to soils, groundwater conditions, cost, and community acceptance, especially as water consumption increases with JJM coverage.

#### **11. UNICEF Perspective on O&M and Community Systems Strengthening – UNICEF**

The UNICEF presentation provided an overview of JJM implementation in Rajasthan and focused on operation and maintenance (O&M) challenges and opportunities for system strengthening. It highlighted that JJM has expanded functional tap connection coverage across millions of rural households in 48 districts and shifted the emphasis from construction to sustained operation through decentralized, participatory models.

Key contextual data included the share of single village and multi village schemes, the growing shift towards surface water–based systems, and extensive investments in recharge structures through convergent programmes. The presentation outlined major sectoral trends: water scarcity and heavy groundwater dependence, high extraction rates, widespread water quality issues, climatic vulnerability, the need to revive traditional harvesting systems, and limited community participation in planning and management.

Field insights on VWSCs showed low awareness of roles and responsibilities, weak ownership (schemes seen as belonging to PHED), reluctance to take over O&M, inadequate capacity-building, and poor documentation and asset management. UNICEF stressed that O&M is central to functionality, equity, and sustainability, and recommended:

- Clear communication of scheme ownership, roles, and responsibilities.
- Continuous capacity-building of government functionaries, PRIs, and communities.
- Transparent financial management and appropriate tariff systems linked to assured, adequate water supply.
- Joint monitoring of schemes and source sustainability interventions, and legal empowerment of VWSCs/PRIs to own and manage rural water systems under the Panchayati Raj framework.

### **Conclusion and way forward**

The workshop was concluded by Sushmita Sengupta, CSE by highlighting the key takeaways from the presentations and discussions. Some of the key highlights include:

- Groundwater in Rajasthan, especially in desert districts, is under intense quantitative and qualitative stress, making source sustainability an existential priority rather than an option.
- Watershed development, aquifer-based planning, and scientific recharge site selection using GIS and remote sensing can significantly enhance the effectiveness of investments.
- Local water sources—wells, handpumps, ponds, and tanks—remain critical for resilience, especially where piped schemes are irregular or insufficient, and must be mapped, protected, and rejuvenated.
- Greywater management is integral to water security and environmental health, and needs scalable, context-specific interventions from household to village scale.
- Community institutions such as VWSCs require sustained capacity-building, clear mandates, and financial and technical support to move from symbolic existence to effective management of rural water systems.

Table: Details of participants attended the workshop

SN	Participating department/ Organization	No. of participants
	<b>Government departments</b>	
1	Public Health Engineering Department, Rajasthan	25
2	Watershed Development and Soil Conservation Department, Rajasthan	29
3	Rural Development and Panchayati Raj Department	3
4	Swachh Bharat Mission (Grameen)	4
5	Groundwater Department Rajasthan	11
6	Central Groundwater Board	1
	<b>Academic Institutions</b>	
7	Malaviya National Institute of Technology, Jaipur	24
	<b>Private Partners</b>	
8	Tata Trusts	2
9	Centre for Microfinance	2
10	Pradan	1
11	Foundation for Ecological Security	2
12	Arpan Seva Sansthan	1
13	UNICEF	2
14	Ambuja Foundation	2
15	Centre for Environment and Development Studies	1
16	Arpan Samaj Seva Sansthan	2
17	Centre for Science and Environment	5
	<b>Total</b>	<b>117</b>