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Kankaria Coaching Depot — India's First Water-Neutral Railway Facility

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CURATED & WRITTEN BY

**Bharat Choudhary**

UPSC Educator & Content Creator

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Kankaria Coaching Depot — India's First Water-Neutral Railway Facility

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WHY IN NEWS

Ahmedabad's Kankaria Coaching Depot has become **India's first water-neutral railway facility**, meeting **100% of its water requirements** through a combination of **rainwater harvesting, treated wastewater recycling, and solar-powered water treatment**. The achievement aligns with **Indian Railways' Mission Green (Net Zero Carbon by 2030)** and contributes to the **National Water Mission** under India's National Action Plan on Climate Change (NAPCC). On Earth Day 2026, this milestone is being highlighted as a model for replicating sustainable infrastructure across India's vast railway network.

WHAT IS "WATER NEUTRALITY"?

A **water-neutral** facility is one where:

- **Total water extracted** from external sources (municipal supply, groundwater) = **Zero** (or net zero)
- All water needs are met from:
 - **Harvested rainwater** (captured on-site)
 - **Recycled/treated wastewater** (treated and reused)
 - **Process water recovery** (condensate, cooling water recirculation)

Water neutrality goes beyond **water efficiency** (using less) to **water self-sufficiency** (using none from external sources).

KANKARIA COACHING DEPOT — KEY FEATURES

What Is a Coaching Depot?

A **coaching depot** in railway terminology is a maintenance facility for **passenger coaches** (carriages).

Operations require large amounts of water for:

- **Coach washing** — exterior and interior cleaning of coaches
- **Toilet system flushing** — bio-toilets require water

- **Workshop washing** — cleaning of mechanical components
- **Drinking water** for staff
- **Firefighting reserves**

Water-Neutral Systems Installed

SYSTEM	FUNCTION
Rooftop rainwater harvesting	Collects monsoon rainfall from shed roofs; stored in underground tanks
Wastewater treatment plant (STP)	Treats used water from coach washing and sanitation to reusable quality
Recycled water loop	Treated water recirculated for coach washing — the largest water use
Solar-powered water pumps	Eliminates external energy dependency for water distribution
Zero-liquid discharge (ZLD)	No wastewater discharged externally

Capacity and Scale

PARAMETER	VALUE
Water saved annually	Estimated millions of litres
External water dependency	Zero (water-neutral)
Energy for water management	Solar-powered
Carbon reduction	Linked to Green Railways mission

INDIAN RAILWAYS — ENVIRONMENTAL INITIATIVES

Mission Green (Net Zero Carbon by 2030)

Indian Railways — **one of the world's largest railway networks** — has committed to:

- **Net Zero Carbon by 2030** — ahead of India's national 2070 target
- **100% renewable electricity** for traction by 2030
- **Zero liquid discharge** across major facilities
- **Massive afforestation** along railway land

Indian Railways consumes approximately **~20 billion units of electricity annually** — switching to 100% renewable would be one of the largest corporate clean energy transitions globally.

Key Green Initiatives

INITIATIVE	DETAIL
Solar panels on coaches	DEMU trains with rooftop solar; station solar installations
Bio-toilets	2.5 lakh+ bio-toilets in coaches; eliminates track-side discharge
LED lighting	Full station and coach LED transition; ~20% energy saving
Regenerative braking	Electric locomotives feed energy back to grid during braking
Station water harvesting	Rainwater collection at major stations
Water-neutral depots	Kankaria as pilot; plan to replicate across network

Water Use in Railways

Indian Railways is a **massive water user**:

- Coach washing requires ~500-800 litres per coach per wash
- A 24-coach train washed daily = 12,000-19,000 litres/day per train
- Kankaria Depot handles hundreds of coaches — annual water saving is in millions of litres

NATIONAL WATER MISSION — POLICY CONTEXT

The **National Water Mission (NWM)** is one of the 8 missions under India's **NAPCC (National Action Plan on Climate Change)**:

PARAMETER	DETAIL
Launched	2008 (NAPCC)
Nodal ministry	Ministry of Jal Shakti (formerly Water Resources)
Objective	Conserve water, minimise wastage, equitable distribution both across and between states
Key target	20% improvement in water use efficiency

Jal Shakti Abhiyan

Jal Shakti Abhiyan (JSA) — a time-bound campaign for water conservation:

- **Phase 1 (2019):** 256 water-stressed districts; intensive campaign for check dams, ponds, rainwater harvesting

- **Phase 2 (2021):** Catch the Rain campaign — “Catch the Rain, Where it Falls, When it Falls”
- **Jal Jeevan Mission** — separate but related: tap water connection to every rural household by 2024 (extended to 2028)

India’s Water Stress Reality

PARAMETER	VALUE
Annual per capita water availability	~1,486 cubic metres (below 1,700 — water-stressed threshold)
Groundwater dependency	~89% of rural drinking water; ~65% of irrigation
Annual groundwater extraction	India is world’s largest groundwater user
Water bodies lost (since 1970)	~38% reduction in surface water bodies

India is on the **water stress threshold** — making innovations like Kankaria’s water-neutral model strategically critical.

RAINWATER HARVESTING — TECHNOLOGY AND POLICY

Types of Rainwater Harvesting (RWH)

TYPE	METHOD
Rooftop RWH	Rainfall collected from rooftops via gutters; stored in tanks or recharged to groundwater
Surface runoff harvesting	Contour bunds, check dams, percolation ponds
Groundwater recharge	Injection wells, bore recharge pits
Watershed management	Catchment-level water retention

Policy Mandates

- **Model Building Bye-laws 2016:** Central government’s model rules requiring RWH in new buildings above a certain area
- Several states (Delhi, Maharashtra, Tamil Nadu, Karnataka) **mandate** RWH in new constructions
- **BIS standards** for RWH systems published; BIS IS 15797

REPLICATION POTENTIAL

Indian Railways operates:

- **~7,000 railway stations**
- **~300 coaching depots and workshops**
- **~67,000 route km of track**

If Kankaria’s model is replicated across even 10% of coaching depots, it could save **billions of litres** of water annually and eliminate external municipal water dependency for railway maintenance.

RITES Ltd. (Railway design and engineering consultancy) is tasked with preparing a **scalability blueprint** for water-neutral depot design.

UPSC RELEVANCE

PAPER	ANGLE
GS3 — Environment	Water conservation, NAPCC, National Water Mission, rainwater harvesting
GS3 — Infrastructure	Indian Railways, Mission Green, Net Zero 2030
GS3 — S&T	Zero-liquid discharge, water treatment technology, solar-powered infrastructure
GS2 — Governance	Jal Shakti Abhiyan, Jal Jeevan Mission
Mains Keywords	Water neutrality, Kankaria, rainwater harvesting, ZLD, Indian Railways Mission Green, NAPCC, National Water Mission, Jal Shakti Abhiyan

FACTS CORNER

- **Kankaria Coaching Depot:** Ahmedabad; India’s first water-neutral railway facility
- **Water neutrality:** 100% water needs met from harvested rain + recycled wastewater; zero external dependency
- **Indian Railways Net Zero target:** 2030 — ahead of India’s 2070 national target
- **Indian Railways electricity:** ~20 billion units/year; moving to 100% renewable by 2030
- **Bio-toilets:** 2.5 lakh+ installed in coaches; eliminates track-side discharge

- **National Water Mission:** One of 8 NAPCC missions; 20% water use efficiency improvement target; Ministry of Jal Shakti
- **Jal Shakti Abhiyan:** 256 water-stressed districts (Phase 1, 2019); Catch the Rain (Phase 2, 2021)
- **India per capita water:** ~1,486 cubic metres — below 1,700 water-stress threshold
- **India groundwater:** World's largest groundwater user; 65% irrigation; 89% rural drinking water
- **RITES Ltd.:** Railway design consultancy tasked with scalability blueprint for water-neutral depots

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