

Vasai's Bavkhals

Reviving a 200-year-old water legacy through knowledge and care



Aga Khan Agency for Habitat
India





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Foreword



At the Aga Khan Agency for Habitat India, our work is grounded in the understanding that resilience is built not only through infrastructure, but through the people and practices that sustain it over time. Across diverse geographies, communities have long managed resources through systems that are adaptive, inclusive, and deeply embedded in everyday life. The bavkhals (traditional water ponds of Vasai) are a preeminent example.

Today, as Vasai–Virar grows into one of Maharashtra’s most dynamic urban corridors, these water bodies face increasing pressures. Encroachment, neglect, pollution, and siltation have diminished what was once a thriving network of community-managed systems.

In the face of growing climate variability—particularly water stress and flood risks—the bavkhal offers important lessons in preservation and restoration. It underscores both the value of local knowledge and the need to integrate cultural dimensions into approaches often dominated by technical solutions.

This handbook moves beyond a technical analysis of water access to foreground the social systems that shape preservation efforts. It brings together narratives and observations that situate the bavkhal within its broader socio-cultural and ecological context, presenting it as a living system where traditional knowledge and local governance intersect. In doing so, it seeks to integrate traditional resource wisdom into the broader discourse on urban resilience and habitat development, ensuring that future interventions remain grounded in local contexts.

We are grateful to the Wipro Foundation for its support, and to the community members whose voices and stewardship have made these restorations possible. We hope this handbook serves not only as a record of what has been achieved, but also as a practical guide for future action.

Prerana Langa

Chief Executive Officer, Aga Khan Agency for Habitat India

Acknowledgements

This handbook reflects a shared vision of strengthening urban water systems in Vasai through community participation, local stewardship, and inclusive planning.

We are deeply thankful to Dr. Himanshu Kulkarni (ACWADAM) for his guidance on groundwater systems and sustainable water management, and to Mr. Vishwanath Srikantaiah (Biome Environmental Trust) for his valuable insights on ecological approaches to water conservation

This work would not have been possible without the support of WIPRO Foundation, and the sustained engagement of Ashwini Bhat and Nakul Mohan Heble. We are grateful for their trust and partnership. Their commitment to community-led water resilience has been instrumental in enabling the scale and impact of this work

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Heartfelt thanks go to the residents of Vasai, whose knowledge and lived experiences form the foundation of this work. Their contributions — in the form of insights, archival photographs, and personal stories — have been invaluable, not only in shaping this handbook but also in bringing the exhibitions curated as part of this initiative to life in an authentic and meaningful way.

Developed by

Aga Khan Agency for Habitat India

Co-Creating Change

Working with the Aga Khan Agency for Habitat (AKAH) India on the bavkhal revival project offered us a window into the unique landscape of Vasai and Palghar district — just under an hour from the heart of Mumbai yet still holding on to its blue-green cover, perhaps due to its limited road connectivity.

Scattered across backyards, street corners, and agricultural lands, bavkhals — traditional community ponds — are now increasingly under threat. Many are being used as dumping grounds, filled in for speculative “development,” or simply neglected and polluted, eroding the ecological value they have sustained for centuries.

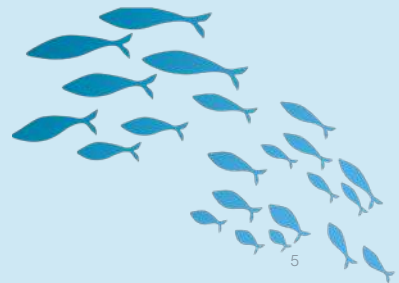
At this critical juncture, AKAH's initiative has played an important role in building awareness about the significance of these water bodies and working towards restoring their relevance. What stood out most was the genuine community engagement the team fostered. Residents frequently stopped interacting, eager to understand what was happening in their neighborhoods. Over time, this grew into a collective movement, bringing together neighbours in a shared effort to revive these endangered ponds.

Communities contributed their time, resources, and energy, taking pride as these bavkhals gradually began to come back to life. It is encouraging to see how this initiative has sparked a sense of ownership and collective responsibility, setting the stage for a ripple effect of restoration efforts.

Hearty congratulations to the AKAH team for initiating a movement that holds strong potential to grow and multiply its impact.

Ashwini Bhat

Operations, Wipro Foundation



What is a Bavkhal?

Bavkhals are historic, man-made water structures found in parts of western India. They are estimated to be 200–400 years old. Local communities built them to manage water security in semi-arid regions.

Bavkhals are usually 15–25 feet deep. Their main purpose was to store groundwater for irrigation. They helped farmers water crops when rainfall was low or irregular.

These structures were built using local materials and traditional knowledge of land and water systems. Their design allowed water to slowly seep into the ground, helping recharge nearby aquifers.

Over time, Bavkhals functioned as small ecological hubs, where stored water created cooler micro-climates that supported vegetation, biodiversity, and local ecosystems. They also served as shared community spaces centered around water for cultural celebrations.



Painting by Ernest Rodrigues, Bolinj village, Virar

This painting captures everyday life around a bavkhal, featuring the traditional Persian wheel (Rahatt), a water-lifting system for irrigation, and a vernacular pavilion that served as a place for rest, work, and community gathering.

Bavkhal as a Living Water System

A bavkhal is a traditional, community-built pond that functions far beyond water storage. It represents a nuanced local water management system shaped by a deep understanding of land and hydrology.

It is part of a living water system beneath the ground. As rainwater collects, it slowly seeps into the soil, replenishing the shallow aquifer below. In turn, this underground reserve helps sustain the wells through drier months.

Above the surface, the bavkhal quietly shapes its surroundings. As water rests in the open, it gradually releases moisture into the air, softening the heat and cooling the space around it. The trees and vegetation along its edges deepen this effect, casting shade and creating a pocket of relief from the surrounding warmth.

The result is a system that simultaneously replenishes groundwater, moderates local temperatures, and supports biodiversity—a centuries-old solution that remains highly relevant today.



Fig 1: Cross-Section Sketch of Bavkhal as critical "shallow aquifers" contributing to the Groundwater flow in Vasai

Life Around Bavkhals



The Bavkhal as a Shared Community
Space Centered on Water Access



The Persian wheel and bavkhal functioned as linked
systems of water resource management



The bavkhal and shrine as coexisting
sites of social life



Bavkhal used as a space for leisure,
interaction, and rest



Residents gather at a bavkhal for the traditional swimming
competition, a cherished part of St. John's Day
celebrations in Vasai

Why Bavkhals Matter



Water Security

Bavkhals ensure availability of water in wells and other local sources by increasing the groundwater table.



Flood Mitigation

Through storing and slowing down rainwater, bavkhals ease pressure on drainage systems and minimize flooding.



Groundwater Recharge

Bavkhals capture rainwater and allow it to slowly seep into the ground, recharging shallow aquifers.



Biodiversity Support

Each bavkhal supports a small but thriving ecosystem. Herons and kingfishers gather at the edges, while fish inhabit its waters, sheltered by native trees and vegetation.



Urban Heat Island Mitigation

As city landscapes grow denser, these open water spaces cool the surrounding air and offer pockets of relief in warming environments.



Community Life and Culture

Bavkhals host local festivals and provide space for community gathering and recreational activities. They hold memory, identity, and a shared sense of belonging across generations.

Threats to Bavkhals

Bavkhals are steadily disappearing due to urban growth, encroachment, and neglect. Many bavkhals that once supported local water systems and community life have turned into dumping sites. Pollution and silt are degrading the water, and with limited civic attention and fading community involvement, protection of these traditional ponds has become crucial. If this continues, these water bodies may be lost, along with the environmental and ecological benefits they quietly provide.

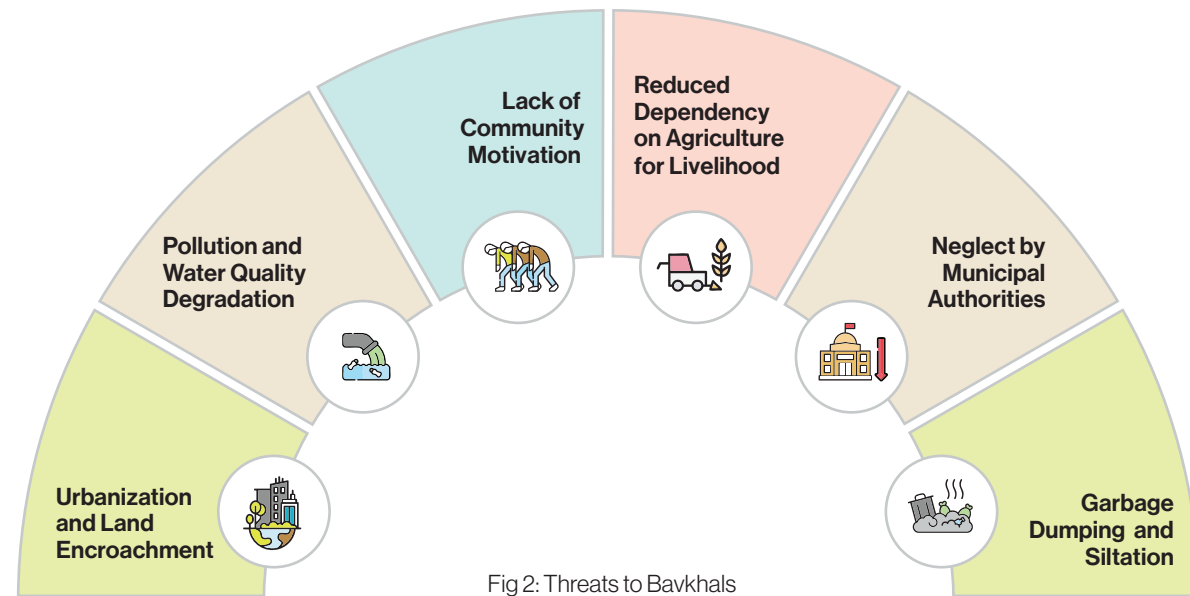


Fig 2: Threats to Bavkhals

Fig 3: Distribution of Bavkhals in Vasai-Virar in 2023
Source: AKAH India

- 560 bavkhals mapped by Aga Khan Agency for Habitat India till December 2025
- Bavkhals restored through community action and technical support from Aga Khan Agency for Habitat India



Hydrogeology of Vasai

Geological Foundation

The 380 sq. km landscape of Vasai–Virar in Palghar district is shaped by weathered basalt, a porous layer that acts as the primary aquifer, enabling natural groundwater recharge.

Primary Aquifer

Weathered
Basalt

Soil Type:

Coastal:

Calcareous soils

Plains:

Black soils

Hilly Regions:

Clayey/loamy

Rock Type:

Coastal:

Alluvium soils

Deccan Traps

Predominantly
Basalt

Eastern Hilly Regions:

Bauxite

Hydrogeological Profile

Shallow Aquifer (6–35 ft):

Bavkhal-connected
weathered basalt



Confined Aquifer (45–120 ft):

Non-porous material,
deeper extraction



Underground Streams:

Flow towards Vasai and
Vaitarna creeks

Rainfall & Drainage

Average annual rainfall:

2,396 mm

(rising trend 1998–2022)

Drainage:

Meandering streams flow into
Vasai and Vaitarna creeks

Annual risk:

Seawater intrusion and salt
pan seepage during monsoon
flooding, potentially elevating
salinity in coastal drinking water
sources

From Agrarian to Urban

In Vasai-Virar, bavkhals have shaped the city's landscape for over two centuries, with some bavkhals believed to be nearly 400 years old. Built as community ponds, they were designed to store rainwater and recharge the shallow aquifer. They are not relics of the past but systems that continue to support water security and ecological balance in the region today.

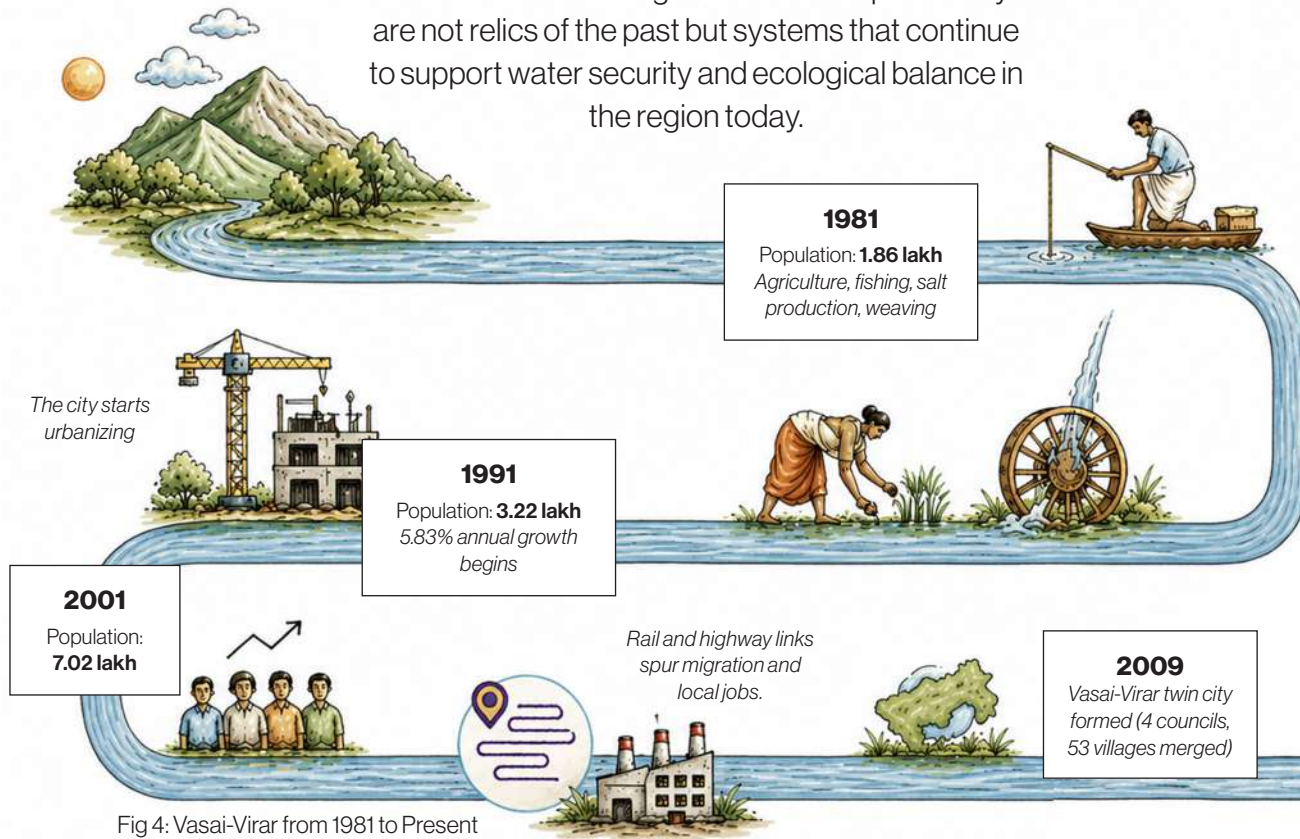


Fig 4: Vasai-Virar from 1981 to Present

Built-up Area Transformation: 90.63% overall expansion

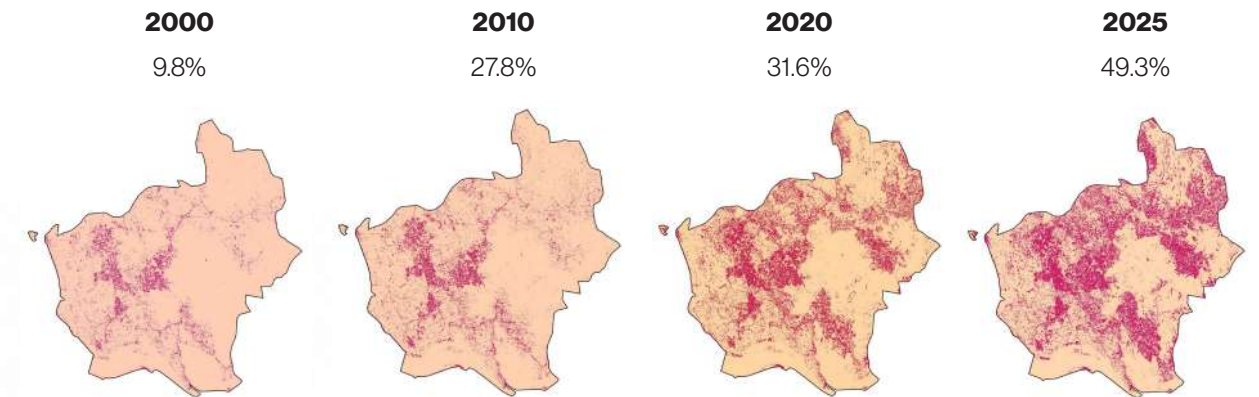
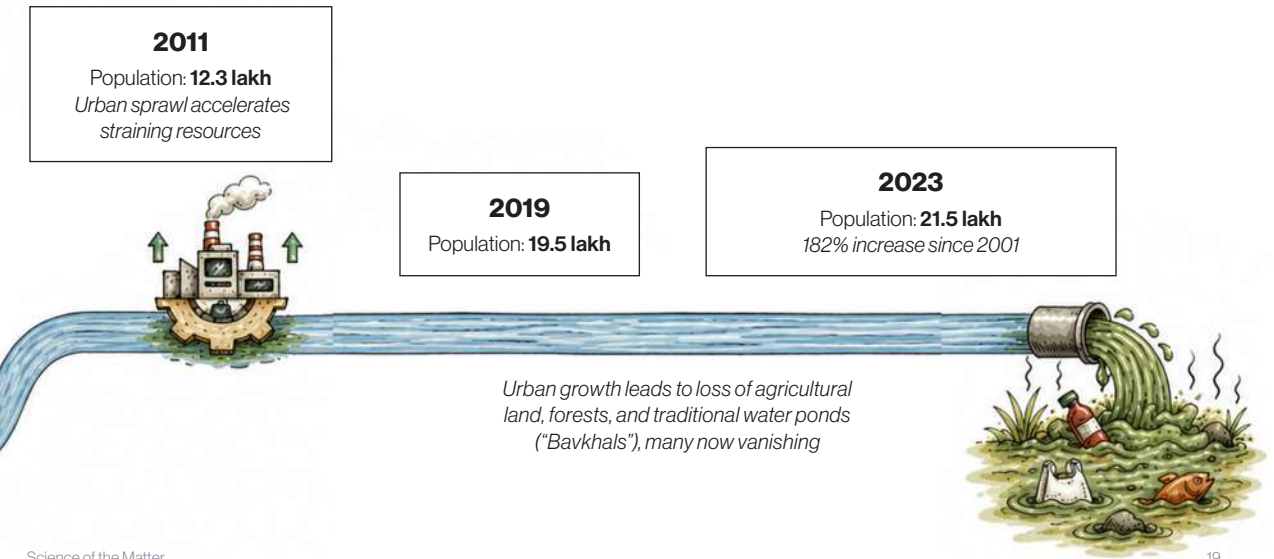


Fig 5: Vasai-Virar City Municipal Corporation Built-up area from 2000 to 2025

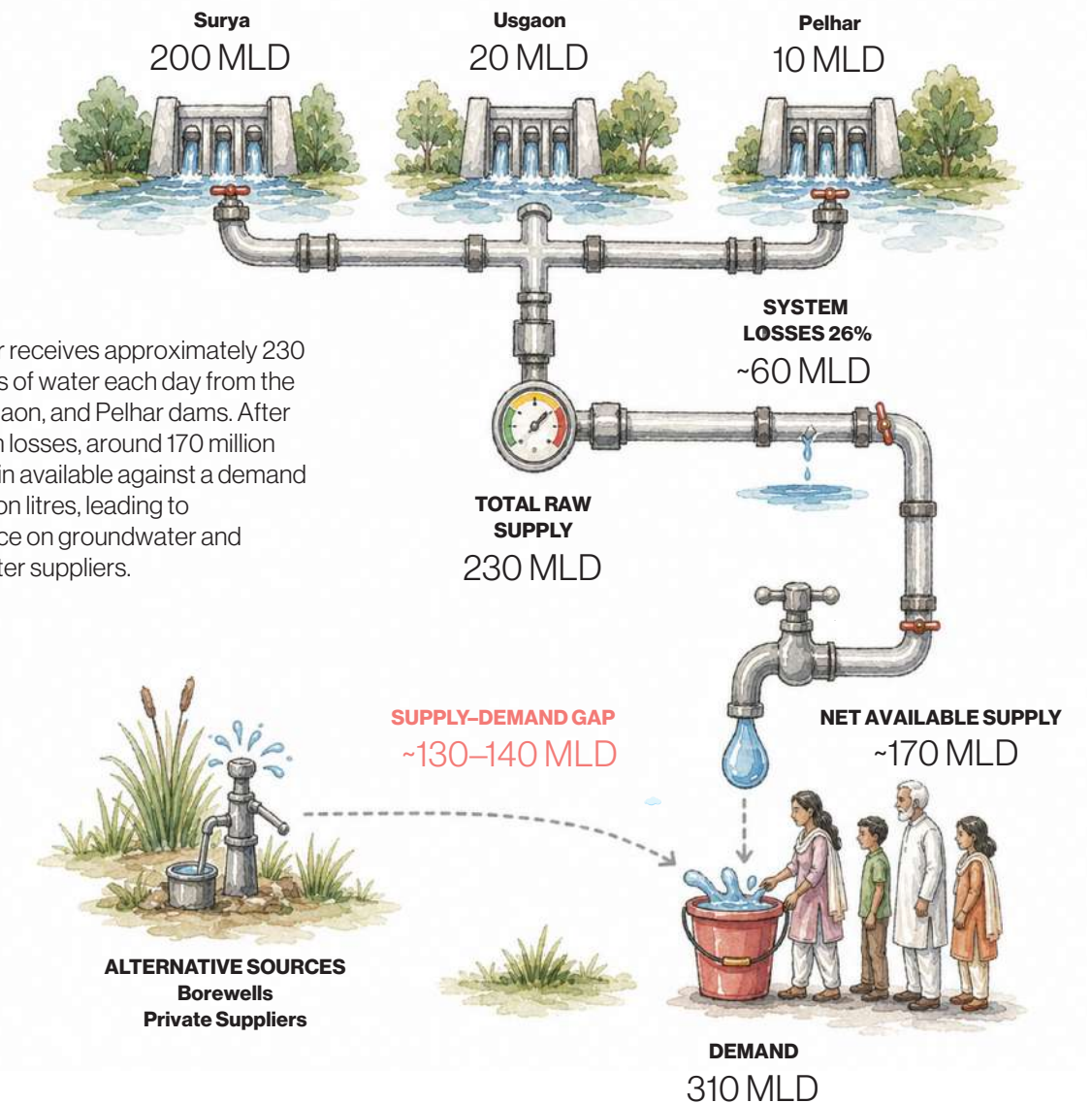
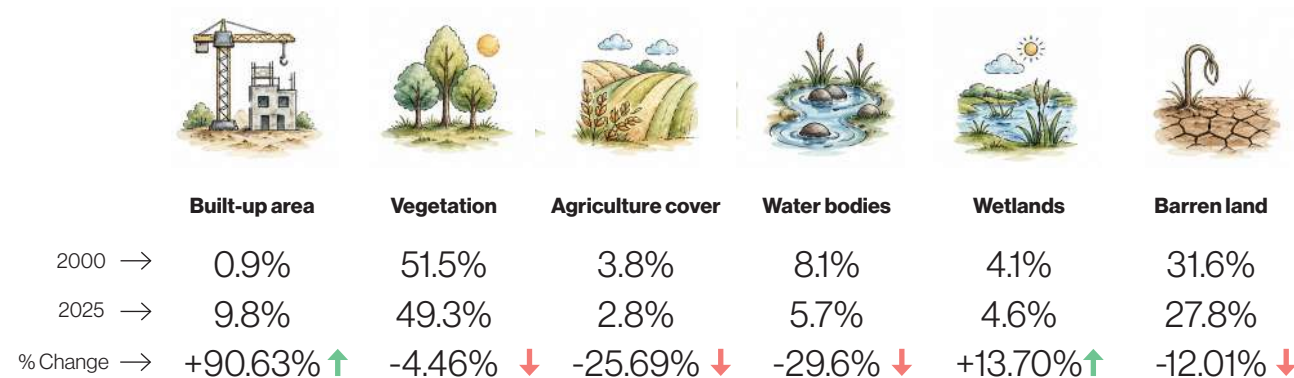
Source: AKAH India



Land Use & Land Cover Change

Over the past two decades, Vasai-Virar's landscape has changed rapidly. Built-up area has grown by 90.63 percent, while vegetation has reduced by 4.46 percent. As open land has given way to construction, natural drainage has weakened and rainwater has fewer places to go.

Water bodies have also shrunk by 29.6 percent. This decline reflects the steady encroachment and neglect of bavkhals, reducing their ability to recharge groundwater and reduce seasonal flooding.



WHY BAVKHALS ARE CRUCIAL FOR VASAI-VIRAR'S WATER SECURITY?

In many parts of Vasai-Virar city, wells and borewells run dry during summer as groundwater levels decline. But where bavkhals are maintained, groundwater remains available for longer, recharging the shallow and confined aquifers that sustain households dependent on wells and borewells.

Bavkhals help regulate salinity in coastal areas by promoting freshwater infiltration that limits saline intrusion into shallow aquifers. Consequently, TDS levels observed in bavkhals and dug wells (shallow aquifers) are generally lower than those in borewells (deeper/confined aquifers), resulting in improved groundwater quality.

When municipal supply is irregular, these ponds become a fallback source. For a city of nearly 1.8 million people, the bavkhal serves as a buffer that helps communities cope with irregular water supply.



Vasai's Bavkhal



Community Efforts to Conserve Bavkhals

Restoration through Care & Community

📍 Papdy, Khalbhat, Vasai

Dependents: 20 families (over 100 members)

The bavkhal in Papdy village supports small-scale fishing, local festivals, groundwater recharge, and helps maintain salinity balance in nearby wells.

The Challenges

Plastic waste and routine dumping began to contaminate the water. Algae spread across the surface, and silt gradually reduced the pond's depth and holding capacity. Fallen leaves and branches clogged the edges, while limited technical guidance and inconsistent community participation made sustained maintenance difficult.

What Changed

Residents formed a ten-member action committee to oversee upkeep and resource mobilization. Public notice boards were installed to discourage littering and introduce penalties. Tree planting drives added Neem, Fishtail Palm, and Tamarind to stabilise the banks. Native fish such as Selone, Katla, and Rohu were introduced to support water quality. Clean-up drives are now conducted twice a year, before the monsoon and in winter, ensuring the bavkhal remains functional and cared for.

“Cleaning our bavkhals is an investment for our village's future. Through desilting, we have expanded the ponds' capacity to hold water, and have overcome our seasonal water shortages. Bavkhals do more than just store water; it recharges groundwater and ensures our community has access to clean drinking water year-round.”

Janet Dias, resident of Papdy village





Harnessing Traditional Wisdom for Flood Resilience

📍 Nandwan, Giriz, Vasai

Dependents: 47-48 families (125 members)

In this part of the village, the bavkhal has long helped manage monsoon flooding while supporting groundwater recharge. It also functions as a shared space for gatherings and everyday leisure.

The Challenges

Each monsoon brings flooding to nearby homes, costing families four to five working days and leaving ground floor of their homes waterlogged. A proposed 14-foot-wide road over the site threatens to reduce its holding capacity further. Community funding for maintenance has been uneven, harmful fish species have disrupted the ecosystem, and rising salinity in borewells has affected drinking water quality.

What Changed

Residents strengthened traditional upkeep practices. An annual pre-monsoon desilting program maintains storage capacity, supported by bi-annual clean-up drives that include weeding and structural repairs. A metal safety barricade installed has helped prevent dumping of waste in the bavkhal. The bavkhal once again has become a space for social and religious gatherings, reinforcing collective responsibility. Technical guidance from AKAH India has supported more sustainable restoration efforts.

“We realized that if we did not protect our bavkhal, we would not just lose a pond but a buffer zone that controls flood. As encroachment around the bavkhal increased, we came together to mediate with the concerned authorities and protect it. We then pooled our own funds to desilt the pond. Today, it captures water runoff and helps protect our neighborhood from monsoon flooding.”

Gilinita, school teacher and resident of Nandwan

Community-managed Solar Powered Water Purification

📍 Waghmare Cross, Vasai

Dependents: 3 families

This bavkhal supports local water security, helps regulate drinking water salinity, and remains a shared space for gatherings and leisure.

The Challenges

By 2017, years of silt accumulation had reduced the pond to a dry pit by April. Nearby wells emptied within minutes, and recharge could take days. Water quality deteriorated, with TDS levels reaching 800 ppm, leading to fish deaths and poor light penetration. Routine upkeep and traditional methods were no longer enough to restore it.

What Changed

The community response shifted from maintenance to restoration. In year 2020, deep desilting using a JCB significantly increased storage capacity, allowing water levels to hold at 6 to 10 feet even during summer. A solar-powered filtration system improved oxygen levels and controlled algae growth. CCTV was installed to deter dumping, while natural fencing and stabilising grasses strengthened the edges. Annual family contributions now support ongoing maintenance and accountability.

“By 2017, our bavkhal would dry up by April, and so would the nearby wells. Waste dumping only made things worse. With technical guidance, we desilted the pond using JCB, installed a solar-powered water purification system, and added CCTV surveillance to prevent dumping. Today, our bavkhal is clean, protected, and continues to sustain us throughout the year.”

Alwyn Hanso, caretaker of the private bavkhal and resident of Waghmare Cross





Youth-led Approches to Conservation

📍 Nambatwadi, Remedy Area, Vasai

Dependents: 31 families (90 members)

For years, the space around this bavkhal hosted water festivals, gatherings, and youth activities while supporting groundwater recharge. Gradually, however, its condition made it unusable.

The Challenges

Wastewater discharge from a nearby eye hospital contaminated the pond. Persistent waterlogging limited access for events and recreation. Funding for restoration was limited, and some landowners resisted full-scale cleaning. Water quality across the area declined, and nearby well water became unfit for consumption.

What Changed

Momentum came from the younger generation. Under the leadership of Rachel Miranda, a youth-led effort mobilised the community. Cleaning and desilting were carried out thoroughly, and contamination from the hospital discharge was addressed through collective action. Native trees were planted along the perimeter in May 2025, and regular monitoring systems were introduced. Water quality improved significantly, with TDS levels reduced to 152 ppm. Annual family contributions now support continued maintenance.

“When we discovered that wastewater from a nearby hospital was flowing into our bavkhal, my friends from the neighborhood and I worked with the Municipal Corporation to stop it. We then mobilized the community to invest in conserving the bavkhal through desilting, and formed a committee to monitor and maintain it. Now our bavkhal is cleaner, healthier, and protected through community action.

Rachel Miranda, Youth leader and resident of Nambatwadi village

Powering Change through Grassroots Activism

📍 Sandor Village, Devtalav, Vasai

Dependents: 1 Family (40 members)

This bavkhal continues to support basic water needs and local livelihoods, even as pressures from flooding and neglect have intensified over time.

The Challenges

Seasonal flooding brings seawater intrusion and seepage from nearby salt pans, affecting water quality. Legal disputes within the owning family, along with gaps in official understanding, have slowed action. Plankton growth has turned the water dark, making cleaning slow and labour-intensive. Community involvement has weakened, with limited support from local governance and little engagement through existing social or religious platforms. In official records, misclassification has allowed construction activity

that further threatens the Bavkhal.

What Changed

Restoration here has relied on persistence and advocacy. Regular maintenance, including removal of plankton and waste, is carried out through sustained individual effort. Partnerships with traditional fishing communities have helped ensure recurring upkeep. Alongside this, efforts continue to push for formal recognition of these water bodies in development plans and for dedicated conservation funding. Community engagement is being rebuilt through local networks, with a growing group of committed individuals working towards wider collective action.

“Many bavkhals are still recorded as '*potkharaba*' (degraded land), despite their vital role in recharging community wells. I continue to raise this issue with the concerned authorities because unless these water bodies are officially recognized for their ecological function, they will remain at risk of being lost to construction projects.

Ranjeet, local activist, and resident of Sandor village



HOW MUCH WATER CAN VASAI-VIRAR'S BAVKHALS HOLD?

A total of 560 bavkhals have been mapped across the Vasai-Virar coastal belt and categorized as small, medium, and large based on their surface area. Assuming the minimum bavkhal size of 20 × 20 ft, each bavkhals can store an estimated 2–3 lakh litres of water.

Restoring all 560 bavkhals has the potential to create an additional 112–168 MLD (million litres per day) of water storage capacity, equivalent to the city's current water supply deficit. This illustrates the important role bavkhals can play in enhancing local water security, particularly in coastal communities where access to public water infrastructure remains limited.



Aga Khan Agency for Habitat India provided technical support to restore six bavkhals through desilting, edge stabilization, and native plantation. The restoration resulted in improved water-holding capacity and enhanced biodiversity. This section highlights the transformation of six bavkhals using Nature-Based Solutions (NbS).

Restoration & Water Resilience

Sandor

During: Jute netting installed along the bavkhal edges to stabilize soil.

Photographed in June 2025



After: A restored bavkhal retains more water and contributes to local groundwater recharge.

Photographed in July 2025



Bhuigaon

During: Desiltation to remove accumulated sediment and restore the bavkhals water-holding capacity.

Photographed in April 2025



After: Removal of silt enhances water retention leading to groundwater recharge.

Photographed in June 2025



Gomes Ali

During: Community members led the manual desilting of the bavkhal to remove accumulated sediment,

Photographed in April 2025



After: Enhanced vegetation growth around a clean bavkhal regulates the microclimate and builds community water resilience.

Photographed in June 2025



Nandakal

During: Manual desilting of the Bavkhal by community members to remove accumulated sediment.

Photographed in April 2025



After: A restored bavkhal with revived water storage and surrounding vegetation, contributing to local groundwater recharge.

Photographed in June 2025



Golpa

During: Local and tribal communities desilt the bavkhal, in a collective effort to revive it.

Photographed in April 2025



After: Restored bavkhal, ensures year-round water availability contributing to improved water resilience.

Photographed in June 2025



Satpala

During: Desiltation of a large bavkhal and the well within it to restore their water-holding capacity and recharge potential.

Photographed in April 2025



After: Bavkhal filled to full capacity after restoration with the well now fully submerged, improving groundwater table.

Photographed in June 2025



Restoration process at a glance

A Five-Step Flow

1. **Water Extraction:** Pumps are used to fully remove standing water, allowing proper access to accumulated silt.
2. **Desilting:** Trained labour teams manually remove built-up silt. The extracted material is set aside for reuse rather than disposal.
3. **Silt Redistribution:** Nutrient-rich silt is shared with nearby households and farmers for use in home gardens and agricultural plots.
4. **Edge Stabilisation:** Biodegradable jute netting is laid along the banks to reduce erosion and prevent soil collapse while vegetation takes root.
5. **Native Planting:** Indigenous species such as Neem, Black Jamun, and Fresh Mangrove are planted to strengthen the banks and support long-term ecological balance.



A restoration guide
for wider adoption

From Concern



Mobilise the Community

- Hold open meetings to assess water conditions and needs
- Identify key stakeholders and form an Action Committee
- Build shared agreement on why restoration matters



Assess and Plan

- Test water quality and check salinity levels
- Study aquifer connections and recharge potential
- Review encroachments, pollution sources, and ownership clarity
- Prepare a site-specific restoration plan
- Seek technical guidance where needed

to Collective Action



Secure Resources

- Set up transparent fund management
- Collect family contributions
- Explore grants and CSR support
- Estimate machinery, material, and planting costs
- Record all cost inflows and expenses



Restore the Site

- Remove standing water for access
- Carry out manual desilting
- Redistribute nutrient-rich silt locally
- Stabilise banks with biodegradable protection
- Plant native trees, grasses, and flowering species



Monitor and Maintain

- Test water quality twice a year
- Conduct seasonal clean-ups and pre-monsoon desilting
- Prevent dumping through surveillance where feasible
- Hold regular committee meetings
- Track improvements in water availability and flooding



Support Systems that Enable Success

Technical Support

Restoration works best when local effort is backed by the right expertise and tools.

- Access to water quality testing and basic monitoring protocols, including TDS and contamination checks
- Hydrogeological assessments to understand aquifer connections and recharge patterns
- Guidance on selecting native species suited to local soil and climate conditions
- Training in the safe use of machinery such as pumps and JCBs for desilting
- Design support for solar filtration systems and simple surveillance measures where needed

Funding Support

Sustained restoration depends on transparent and diversified funding.

- Government grants and conservation-linked schemes, including CSR initiatives
- NGO partnerships offering technical input and implementation support
- Annual family contributions, where benefits are visible and shared
- Coordinated equipment rental arrangements to reduce seasonal restoration costs



The exhibition celebrates community's relationship with bavkhals, showcasing the socio-cultural practices around these traditional ponds, while highlighting their importance in ensuring water security for the Vasai-Virar city.

Celebrating Stewardship on the Ground





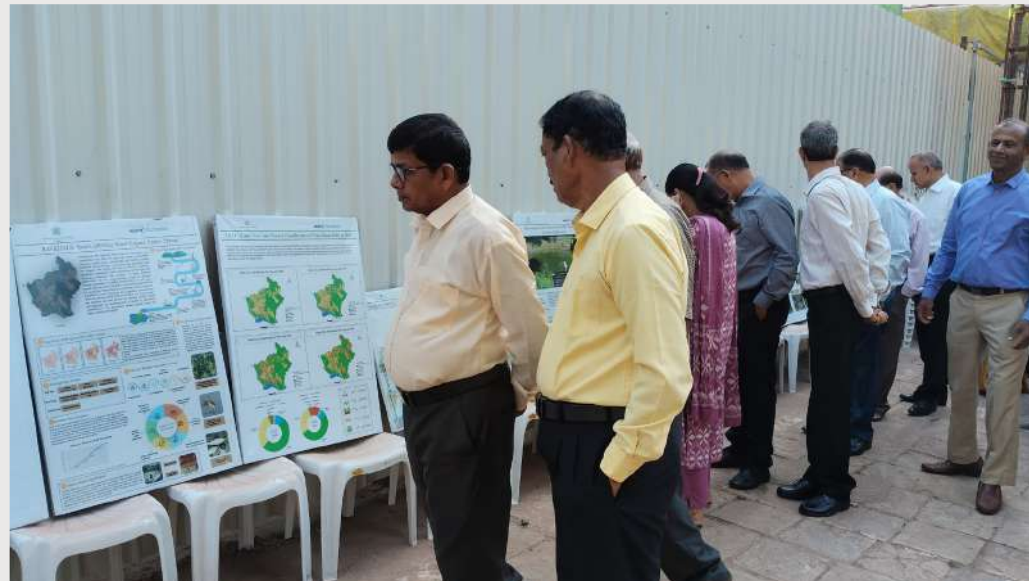
Giriz Village



Remedy
Village



Gass
Village



Papdy Village





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