



REVIVING HISTORIC AQUEDUCTS TO MEET PUNE'S MODERN WATER NEEDS

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Abstract: Pune is currently experiencing acute water scarcity, primarily due to the over-extraction of groundwater, which has resulted in significant aquifer depletion and borewell depths extending to nearly 450 feet in several areas. The construction industry, being one of the largest consumers of potable water, further exacerbates this challenge. Although treated wastewater from Sewage Treatment Plants (STPs) is available, its application remains limited and underutilized. This study investigates the feasibility of restoring the historic Peshwa-era aqueducts—an 18th-century water supply system that once extended over 20 kilometers and served more than 200 locations across the city—as a sustainable supplement to current water resources. Through a multidisciplinary approach involving technical assessment, historical analysis, and stakeholder engagement, the research also includes monthly water sampling from key sites such as Bagul Udyan and Tapowan Society in Parvati Paytha to evaluate water quality for potential use in drinking (with minimal treatment), gardening, and construction. The objective is to propose a sustainable water management framework that reduces dependence on groundwater while integrating heritage infrastructure into modern urban planning.

Index Terms - Groundwater Depletion, STP Water, Peshwa-era Aqueducts etc.

I. INTRODUCTION

Pune, often celebrated as the cultural heart of Maharashtra, has seen a remarkable evolution—from a quiet, tradition-rich town during the Maratha rule to a dynamic urban center brimming with industry and innovation. While its origins date back to the 8th century, it was during the 18th-century Peshwa era that Pune experienced significant growth in civic infrastructure. Among the most notable advancements of that time were water management systems, including the Katraj reservoir and an intricate network of aqueducts and stone-lined channels that supplied water to key locations like Shaniwar Wada. These systems showcased not only technical sophistication for their era but also a clear vision for sustainable urban planning.

Today, as one of India's fastest-growing cities, Pune is witnessing rapid industrial expansion, booming IT parks, and an ever-growing real estate sector. This urban growth has led to a sharp rise in water demand, pushing the limits of existing water sources. Municipal supply, mainly drawn from reservoirs like Khadakwasla, Panshet, and Temghar, often falls short, prompting increased reliance on borewells and private water tankers, particularly in new urban settlements. A key driver of this demand is the construction industry, which consumes massive volumes of water each day—not just for building processes like concrete mixing and curing, but also for basic needs of on-site labor. Estimates suggest that for every 1,000 sq. ft. of built-up area, construction activities require between 6,000 to 10,000 liters of water, which, when scaled to city-wide development, translates into an immense strain on resources. Even though Pune's Sewage Treatment Plants (STPs) produce a substantial volume of treated wastewater, its use in construction remains limited. Instead, the industry continues to rely heavily on potable and groundwater sources, further depleting aquifers and often clashing with domestic water needs. In several neighbourhoods, the dependence on water tankers—many of which

source water from unregulated bore wells—has become the norm, raising concerns about long-term sustainability.

This research addresses this pressing issue by exploring how Pune's traditional water systems, especially the Peshwa-era aqueducts, can be revived and adapted for modern use. By drawing lessons from historical water practices and aligning them with current technologies like wastewater reuse, the study proposes a more sustainable approach to managing urban water demands—particularly those driven by the construction sector—while also preserving the city's rich heritage.

1.1 Description

This study takes a closer look at Pune's growing water challenges, focusing on how the revival of historic infrastructure—specifically the Peshwa-era aqueducts—could offer a sustainable solution to the city's rising dependence on groundwater and treated potable water. The research is grounded in the backdrop of Pune's rapid urban expansion, where the construction industry has become one of the most water-hungry sectors. Construction projects, big and small, often require water in the range of thousands to even millions of liters, with most sites depending heavily on borewells, municipal supply, or groundwater delivered by tankers. This pattern of usage has significantly strained local aquifers and added stress to the city's already burdened water supply network. Interestingly, while Pune operates multiple Sewage Treatment Plants (STPs) that produce large volumes of treated wastewater daily, only a fraction of this resource is actually put to use—particularly in non-potable areas like construction, where it could easily substitute fresh water. Meanwhile, a forgotten piece of Pune's water heritage still exists: the 18th-century Peshwa aqueducts. Once capable of carrying approximately 2.5 million liters of water per day across various parts of the city, these aqueducts stand as a testament to the ingenuity and sustainability of past urban planning. This research explores the potential of reactivating and integrating these historical systems with modern-day needs, offering an innovative way to reduce pressure on current water resources.

II. PROBLEM STATEMENT

Pune faces severe water stress due to overdependence on groundwater, especially in the construction sector. Despite available alternatives like treated wastewater and historic Peshwa-era aqueducts, their utilization remains minimal.

III. AIM

To evaluate the potential of reviving the Peshwa-era aqueducts and integrating treated wastewater as sustainable alternatives to reduce groundwater dependency in Pune's construction and urban water sectors.

This study aims to address Pune's growing water crisis by evaluating the potential of reviving the historic Peshwa-era aqueducts and promoting the use of this in the construction and urban water supply sectors. With groundwater levels depleting rapidly and construction activities consuming massive amounts of potable water, there is an urgent need to adopt alternative, sustainable solutions. The study focuses on understanding the capacity, condition, and feasibility of reactivating the Peshwa-era aqueducts, which once transported nearly 2.5 million liters of water daily across the city. Through historical analysis, technical assessment, and PMC engagement, the research proposes an integrated approach that combines heritage infrastructure with modern water reuse strategies to ensure long-term water sustainability in Pune.

IV. STUDY AREA

The study is centered on Pune city, located in western Maharashtra, covering an area of approximately 516 square kilometers. Known for its historical water systems and rapid urban growth, Pune now faces increasing pressure on its water resources. Major water supply sources include the Khadakwasla, Panshet, and Varasgaon dams. However, with the city's expanding real estate and construction sectors — especially in regions like Baner, Hinjewadi, Kharadi, and Wagholi — groundwater extraction has drastically increased. Many of these areas are heavily dependent on borewells and tanker water due to limited municipal supply. The presence of the underutilized Peshwa-era aqueduct system, which historically supplied millions of liters of water daily, offers a promising opportunity for sustainable water management in the city.

V. METHODOLOGY

This study takes a multidisciplinary approach to explore the feasibility of bringing Pune's historic Peshwa-era aqueducts back into practical use. It starts with a detailed review of the original aqueduct system and recent revival efforts, with particular attention to the Pune Municipal Corporation's (PMC) work on restoring the water supply line to Taljai Hill. On-ground field surveys will help assess the current physical state of these old structures and whether they can be adapted for today's urban needs. To understand how this water could be used, samples will be tested for quality to see if it's suitable for various purposes like drinking (with minimal treatment), gardening, and construction activities.

The study will also look at how water is currently used in the city, especially in high-consumption sectors like construction, to identify where aqueduct-supplied water could ease the pressure on groundwater sources. Technical feasibility will be examined by analyzing flow capacity, potential upgrades, and practical delivery systems. Importantly, input from PMC officials, engineers, and heritage conservation experts will be gathered to ensure that the findings are grounded in both technical and cultural realities. The ultimate goal is to develop a sustainable water management plan that blends the city's rich water heritage with the practical demands of modern urban life.

VI. WATER TEST

Water samples were collected from Bagul Udyan, Tapowan Society, Parvati Paytha, Pune during the first week of each month. The samples were then tested at a certified laboratory to evaluate their quality for multipurpose use.

Table -1: Monthly Water sample Analytical Results (Jan to April 2025)

Parameter	Jan 2025	Feb 2025	Mar 2025	Apr 2025	Permissible Limit (IS 10500:2012)	Remarks
pH at 25°C	7.28	7.35	7.31	7.33	6.5–8.5	Within permissible range
Total Dissolved Solids	598 mg/L	620 mg/L	605 mg/L	610 mg/L	500 (desirable), 2000 (max)	Slightly above desirable, within max
Total Hardness (as CaCO ₃)	318 mg/L	328 mg/L	321 mg/L	323.46 mg/L	200 (desirable), 600 (max)	Above desirable, within max
Calcium (as Ca)	74.8 mg/L	78.5 mg/L	76.2 mg/L	76.91 mg/L	75 (desirable), 200 (max)	Slightly above desirable
Magnesium (as Mg)	30.8 mg/L	32.3 mg/L	31.6 mg/L	31.92 mg/L	30 (desirable), 100 (max)	Slightly above desirable
Total Alkalinity (as CaCO ₃)	229 mg/L	233 mg/L	230 mg/L	231.15 mg/L	200 (desirable), 600 (max)	Slightly above desirable
Chloride (as Cl)	33.9 mg/L	35.2 mg/L	34.1 mg/L	34.74 mg/L	250 (desirable), 1000 (max)	Within permissible limits

Turbidity (NTU)	< 1	< 1	< 1	< 1	1 (desirable), 5 (max)	Excellent clarity
Sulphate (as SO₄²⁻)	11.6 mg/L	12.3 mg/L	11.8 mg/L	12 mg/L	200 (desirable), 400 (max)	Within permissible limits
Fluoride (as F⁻)	< 0.1	< 0.1	< 0.1	< 0.1	1.0 (desirable), 1.5 (max)	Safe
Nitrate (as NO₃⁻)	1.18 mg/L	1.26 mg/L	1.20 mg/L	1.22 mg/L	45 (max)	Very low – good quality
Sodium as Na	21.7 mg/L	22.8 mg/L	22.0 mg/L	22.14 mg/L	No IS limit, < 200 preferred	Safe
Potassium as K	< 1	< 1	< 1	< 1	No IS limit	Safe
Carbonate	19.8 mg/L	20.5 mg/L	20.0 mg/L	20.1 mg/L	No IS limit	Acceptable
Bicarbonate	188.4 mg/L	193.6 mg/L	190.0 mg/L	190.95 mg/L	No IS limit	Acceptable

VII. RESULT AND DISCUSSION

Water samples collected and tested between January and April 2025 show generally good quality and are suitable for a variety of uses. The pH levels consistently fall within the recommended range of 6.5 to 8.5, and turbidity remains low, suggesting that the water is clear and contains minimal suspended particles. While parameters like total dissolved solids (TDS), hardness, calcium, and magnesium are slightly above the ideal levels, they still stay within the acceptable limits defined by IS 10500:2012. Key indicators such as fluoride, nitrate, sulphate, chloride, and heavy metals are all well below the safety thresholds, meaning the water poses no significant health or environmental concerns. In addition, the water's characteristics—particularly its low turbidity, moderate hardness, and low chloride content—make it suitable for use in construction, as it helps minimize the risk of corrosion in reinforced concrete structures.

VIII. CONCLUSION

Water samples tested from January to April 2025 were found to be safe and versatile for a range of applications. The results suggest that the water is suitable for drinking after basic treatment methods like UV or RO filtration, as no signs of significant contamination were detected. It also meets the requirements for gardening, landscaping, and agricultural irrigation, with nutrient levels well within safe limits for plant growth. Additionally, the water's clarity and low corrosive nature make it well-suited for construction purposes, including concrete mixing, curing, and masonry work. While the samples were generally fit for all assessed uses, slightly elevated levels of hardness and total dissolved solids (TDS) indicate that periodic quality checks should continue. For drinking purposes, light purification is recommended. Most importantly, there were no traces of chemical, biological, or industrial pollutants, affirming the water's overall safety and reliability for both domestic and construction-related use.

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