

Persian Water Architecture and Its Impact on Medieval Indian Irrigation and Urban Planning

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Abstract: Water management has always been an essential component in the development of civilizations, especially in arid and semi-arid regions. Persia developed one of the world's most sophisticated traditional hydraulic systems known as the qanat, an underground water channel system designed to transport groundwater through gravity while minimizing evaporation. Through trade, migration, cultural interaction, and the establishment of Persianized dynasties in India, Persian hydraulic knowledge significantly influenced medieval Indian water management systems. This paper examines the impact of Persian water architecture on Indian irrigation systems, urban planning, and hydraulic engineering with special reference to the qanat systems of Burhanpur and Bijapur. The study analyses Persian literary sources, archaeological evidence, and comparative architectural features to understand the adaptation of Persian hydraulic technologies in Indian climatic conditions. The paper also discusses Mughal gardens, underground canals, reservoirs, and water distribution systems that reflect Persian influence. Furthermore, the study highlights the present condition of these historic water structures and emphasizes the importance of their conservation in the context of climate change and increasing water scarcity. Persian hydraulic traditions not only transformed medieval Indian urban planning but also contributed to sustainable water utilization practices that remain relevant today.

Keywords: Burhanpur, hydraulic engineering, irrigation systems, Persian influence, qanat, water management.

Received : 06 January 2026

Revised : 14 February 2026

Accepted : 25 February 2026

Published : 25 June 2026

TO CITE THIS ARTICLE:

Ansari Rukhsar Suhail Ahmed & Anita Rane Kothare (2026). Persian Water Architecture and its Impact on Medieval Indian Irrigation and Urban Planning. *Journal of History, Archaeology and Architecture*, 5: 1, pp. 1-6.

INTRODUCTION

Water is among the most valuable natural resources for human survival and the growth of civilization. Ancient societies developed different methods of water conservation and irrigation according to their environmental conditions. In arid and semi-arid regions, advanced water management systems became necessary for agriculture, settlement, and urbanization. Persia, present-day Iran, developed one of the most sophisticated traditional hydraulic technologies known as the qanat system. This underground water channel system enabled the transportation of groundwater from aquifers to settlements through gravity while protecting water from evaporation and contamination (Beaumont 1971: 39–50).

Iran has historically experienced water scarcity because of its dry climate and low rainfall. In response to these conditions, Persian engineers developed underground tunnels connected with vertical shafts to access groundwater. The qanat system became an important technological achievement and later spread to many parts of the world including Central Asia, North Africa, and South Asia through trade routes, migration, and Islamic expansion (English 1968: 170–181).

During the Delhi Sultanate and Mughal periods, India witnessed strong Persian cultural influence in administration, literature, architecture, garden planning, and hydraulic engineering. Persian engineers and architects introduced advanced water management techniques suitable for urban settlements and dry climatic regions. Medieval Indian cities such as Burhanpur and Bijapur preserve important examples of Persian-style underground water systems.

This paper examines Persian influence on medieval Indian irrigation systems and urban planning with special focus on the qanat systems of Burhanpur and Bijapur. The study also analyses Persian-inspired hydraulic architecture in Mughal gardens and urban centres while discussing the present condition and conservation of these traditional systems.

ORIGIN AND DEVELOPMENT OF THE QANAT SYSTEM IN PERSIA

The qanat system originated in ancient Iran and became one of the most significant hydraulic inventions of the ancient world. A qanat consists of underground channels that transport groundwater from elevated aquifers to settlements and agricultural lands through natural gravity. Vertical shafts are dug at regular intervals for ventilation, maintenance, and excavation purposes.

The primary objective of qanat construction was to provide fresh water in desert regions while minimizing evaporation losses. According to scholars, the goals of qanat systems included supplying water to arid regions, developing agricultural lands, cooling settlements, and supporting urban populations (Saberioon and Gholizadeh 2010).

Persian hydraulic engineering reflected advanced understanding of geology, hydrology, and environmental adaptation. Unlike surface canals, underground water channels protected water quality and maintained cooler temperatures. The technology became especially important in areas where rainfall was limited and groundwater resources needed careful management.

Apart from qanats, Persian hydraulic architecture included reservoirs, cisterns, fountains, canals, baths, and garden irrigation systems. Water played both practical and symbolic roles in Persian culture and architecture. Flowing water represented purity, prosperity, and paradise within Persian-Islamic traditions.

PERSIAN INFLUENCE ON MEDIEVAL INDIAN WATER MANAGEMENT

Persian influence in India expanded significantly during the Delhi Sultanate and Mughal periods. Persian language became an important administrative medium while Persian scholars, engineers, and architects migrated to India under royal patronage. These interactions facilitated the transfer of hydraulic knowledge and architectural techniques.

The Mughal rulers introduced Persian-inspired irrigation systems, gardens, canals, and reservoirs into India. Historical works such as the Baburnama and Ain-i-Akbari provide evidence regarding Mughal interest in gardens, water channels, and urban planning.

Persian hydraulic influence in India can be identified through:

- underground water channels,

- gravity-based irrigation systems,
- Persian wheels,
- reservoirs,
- Mughal garden water networks,
- and underground drainage systems.

The Deccan region particularly adopted Persian qanat technology because of similarities between the climatic conditions of Iran and parts of peninsular India.

THE QANAT SYSTEM OF BURHANPUR

Burhanpur preserves one of the most important examples of Persian-style underground hydraulic systems in India. Burhanpur became an important Mughal military and commercial centre during the medieval period. Because of the increasing population and limited water availability, an advanced water supply system was developed.

The Burhanpur water system utilized underground channels to transport groundwater from nearby hills into the city. The system functioned through gravitational force and included vertical shafts similar to Iranian qanats. These shafts allowed cleaning, repair, and circulation of air within the tunnels.

Scholars have identified clear similarities between the Burhanpur system and Persian qanat technology in terms of:

- tunnel construction,
- underground water flow,
- shaft alignment,
- and gravity-based engineering (Misra and Dewda 2018: 105–118).

The Burhanpur qanat system supplied water to residential areas, gardens, baths, and military establishments. It represented a sustainable and environmentally efficient form of urban water management.

Today many sections of the Burhanpur water network are damaged because of urbanization, garbage disposal, and lack of maintenance. However, conservation projects initiated under climate adaptation programs have revived interest in restoring these traditional systems. The restoration of these underground channels is increasingly viewed as an important strategy for sustainable water management in regions facing climate-related water scarcity.

THE QANAT SYSTEM OF BIJAPUR

Vijayapura, historically known as Bijapur, also demonstrates Persian influence on medieval water management systems. During the rule of the Adil Shahi dynasty, extensive hydraulic systems were developed to provide water to the city and surrounding settlements.

The Bijapur qanat system consisted of underground channels connected with vertical shafts. These channels transported groundwater to urban areas using gravity. The system provided clean and cool drinking water suitable for the dry climate of the Deccan plateau.

Kishore Raghubans (2015: 18–23) observed that the qanat system at Bidar and Bijapur reflects Persian hydraulic influence introduced through Deccan Sultanates. Persian engineers employed sophisticated methods of groundwater harvesting and urban water distribution.

The Bijapur system also supported gardens, mosques, palaces, and public water facilities. Several vertical shafts remain visible today although many tunnels have deteriorated due to neglect and urban development.

Research on groundwater quality in Bijapur further highlights the importance of traditional underground water systems in maintaining potable water supplies (Hiremath, Hiremath and Yadawe 2010: 1471–1476).

PERSIAN WATER ARCHITECTURE AND MUGHAL URBAN PLANNING

Persian influence on Indian hydraulic architecture extended beyond irrigation systems into urban planning and garden architecture. Mughal rulers adopted the Persian charbagh garden concept, in which gardens were divided into symmetrical sections by flowing water channels.

Important examples include:

- Shalimar Bagh
- Taj Mahal
- Fatehpur Sikri

These gardens incorporated fountains, canals, cascades, and reservoirs that reflected Persian aesthetic and symbolic traditions. Water represented paradise, purity, and royal power in Mughal architecture.

Persian hydraulic principles also influenced:

- palace cooling systems,
- urban drainage,
- water storage structures, and canal-based city planning.

The Mughal adaptation of Persian architectural ideas created a distinct Indo-Persian style that combined Indian environmental requirements with Persian artistic traditions.

COMPARATIVE STUDY OF PERSIAN AND INDIAN QANAT SYSTEMS

Although Indian qanat systems were influenced by Persian models, they were modified according to local climatic and geological conditions. Persian qanats generally functioned in desert environments with deep aquifers, whereas Indian systems adapted to monsoon climates and Deccan geology.

The similarities between Persian and Indian qanats include:

- underground water channels,
- use of gravity,
- vertical maintenance shafts, and protection from evaporation.

Differences include:

- variation in tunnel depth,
- construction materials,
- geological adaptation,

and integration with Indian tanks and reservoirs.

The Indian adaptation of Persian hydraulic engineering demonstrates how foreign technologies were localized within regional environmental conditions.

DECLINE AND CONSERVATION OF TRADITIONAL WATER SYSTEMS

The decline of traditional qanat systems in India occurred because of several factors including colonial modernization, mechanized water extraction, urban expansion, and neglect by local communities.

The British colonial administration introduced modern pipelines, pumps, and new hydraulic technologies that gradually replaced traditional systems. As a result, many underground channels became abandoned or blocked. In several places, shafts were filled with garbage or damaged by construction activities.

Despite this decline, traditional water systems continue to offer important lessons for sustainable water management. Contemporary climate change and increasing water scarcity have renewed scholarly and governmental interest in conserving historic hydraulic structures.

Recent restoration initiatives in Burhanpur demonstrate the relevance of traditional water harvesting systems for present-day environmental challenges. These systems operate through gravity and require minimal external energy, making them environmentally sustainable.

CONCLUSION

Persian influence on medieval Indian water management systems significantly contributed to the development of hydraulic engineering, irrigation techniques, and urban planning. The introduction of qanat technology and Persian architectural principles transformed water supply systems in several Indian regions, especially Burhanpur and Bijapur.

Persian-inspired underground channels, reservoirs, fountains, and Mughal gardens demonstrate the successful integration of Persian hydraulic knowledge with Indian environmental conditions. These systems not only supported medieval urbanization and agriculture but also represented sustainable methods of water utilization.

The surviving qanat systems of India are valuable examples of historical engineering and environmental adaptation. Their conservation is important not only for historical and archaeological study but also for addressing present-day concerns related to climate change and water scarcity. Persian hydraulic traditions therefore remain relevant in understanding sustainable approaches to water management in contemporary society.

ACKNOWLEDGEMENT

The author expresses sincere gratitude to the research supervisor, Dr. Anita Rane Kothare, Department of Ancient Indian Culture, St. Xavier's College, Mumbai, for valuable academic guidance and encouragement during the study. Gratitude is also extended to scholars and researchers whose works on Persian hydraulic systems and medieval Indian water management provided important insights for this research.

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