Early water systems in Mughal India

This paper explores the patterns of water use which developed during the early years of the Mughal Empire in India. Research on Mughal water systems invariably draws attention to the refinement of garden pools, fountains, wells, and baths. These water features provided sensory delight; they expressed important cultural and political ideas; and they served various practical needs. Although the importance of garden water features has often been acclaimed, there have been no detailed investigations of their structure or development.

Even less is known about how garden water features were related to broader patterns of urban or agricultural water use. Several scholars have written about canal networks, well technologies, and irrigation during the 16th century. For the most part, however, research on garden water features has proceeded independently of research on large-scale water development. As a result, it is not known whether innovations in garden hydraulics led to or followed from innovations in large-scale water systems. Nor is it known how local water systems responded to regional flood and drought events. Because the pre-Mughal water systems of northern India have received even less attention than those which followed, it is difficult to know what is distinctively “Mughal” about the water features of Babur and his successors.

This paper attempts to organize the issues mentioned above into a coherent framework for research. A regional emphasis is given to gardens along the Yamuna (Jumna) River at Agra. The following research problems are discussed:

1. Patterns of water development: What is an appropriate typology for describing “Mughal” water features? How were these features geographically distributed? How did Babur’s perceptions of hydrology and water use compare with actual patterns?

2. Origins and influences: How did Babur’s experience prior to occupying India direct the path of water development at Agra? What influences were derived from pre-Mughal or contemporary practices in India? How did the special qualities of the Agra landscape help shape the design of Mughal water systems?

3. Relationships between different scales of water development: How were local water features related to larger spatial patterns of water use? How were the aesthetic, symbolic, and functional qualities of water related to one another at different scales of development?

The first set of questions is largely descriptive. It calls for a reconstruction of the physical patterns of water...
development and the spatial distribution of various technologies. Answering the second and third sets of questions partly depends upon how well the patterns of water development can be described. This paper very briefly considers the lines of investigation that could eventually account for the origins and diffusion of various design innovations. The final set of questions probes the relationships among local water features and their broader landscape context(s). The proposed scales of investigation range from the individual garden to urban and regional patterns of water use.

Recent scholarship on Islamic gardens has tended to employ rather specific lines of esthetic interpretation focusing on paradisiac symbolism, kingship, and social function. Interestingly, contemporary garden descriptions do not fully conform with any single perspective; nor does Qur'anic paradise imagery. The argument of this paper is that inquiry into the three sets of geographical questions posed above will assist in interpreting the meanings of water in the Mughal landscape.

**NATURAL WATER FEATURES**

Upon invading India for the final time in 1526 A.D., Babur recorded detailed impressions of both natural and man-made water features that he observed. He noted, for example, three groups of rivers: the Indus and its tributaries; the Yamuna and Ganges Rivers; and lastly, the rivers of the «Hindustan Hills», upon which Babur noted that no snow falls. Figure one maps out the location of water uses and devices that are mentioned in the Baburnama. The map suggests that what Babur most often meant by «Hindustan» was the Yamuna River corridor and its lower tributaries, such as the Chambal and Betwa Rivers. The Yamuna served as an artery for military transportation and recreational travel. Babur and his nobles held numerous parties on boats, islands, and riverbanks. The military and recreational functions overlapped when the army would halt at spots selected for scenic views overlooking a river.

We read in the Baburnama that agriculture was largely rainfed, but that wells were often used for irrigation. The rains were described as damp but salubrious. The rains were refreshing; but the country was generally hot, dry, windy, and dusty. The rains eroded gullies and entrenched streams making travel difficult. Babur complained that the country was flat with no swift streams, but he commented favorably on springs, feshets, and waterfalls that he saw. Indeed, he made quite strong qualitative judgements about most of the landscape features he encountered. «Hindustan» was alternately praised and criticized. Advantages and disadvantages were catalogued with wonder and occasionally disgust. These varied perceptions cannot be examined in detail in this paper. The point here is to note that Babur’s observations on the natural water features and hydrology of Hindustan were complex and sometimes paradoxical. He presented images of the wet and the dry which were simultaneously practical and poetic, positive and negative.

Babur’s description of the natural landscape was reinforced by Shaikh Zayn al-Din Wafa’i Khwafi [Zain Khan]. Much of Zain Khan’s text parallels that of Babur closely, but there are several interesting elaborations. For example, Babur accounted for the absence of irrigation canals by saying, «For not doing it there may be several reasons, one being that water is not at all a necessity in cultivating crops and orchards.» Zain Khan’s remarks may reflect the other unspoken ideas underlying this early perception of water use in Hindustan.

The reason for not doing this [i.e., building irrigation works] is that the Almighty sacred God has stripped the people of Hindustan of the sense of necessity of running waters, and they do not welcome the same except for cultivating crops or quenching their thirst. This is so much so that when sometimes someone, possessed of power and authority, during the course of his travels, happens to set up a tent with enclosures on the bank of a river, they keep the surrounding sides covered or veiled, and the front is also not left open towards the side of the river. This shows that they have a sort of aversion for looking towards water...

The Shaikh’s comments are loaded with ambiguities and intriguing connotations. He seemed to say that the people of Hindustan did not build «running waters» because they had sufficient water, because they were unaware of the need for irrigation, because they were principally concerned with the functional qualities of water, and because they had an aversion or indifference to water — all at the same time. Each of these assertions is contradicted or qualified by other passages in contemporary texts. Immediately following his victory at Panipat, for example, Babur visited tombs and gardens of the Delhi sultans and other sites along the Yamuna River that presumably displayed functional if not also delightful uses of water. There is ample evidence in the Sultanate histories of a sensitivity to the vagaries of rainfall, as well as to the value of a good riverfront location.

As a final note on natural water features, there is an obvious neglect of Hindu sites along rivers and lakes in Babur’s memoirs. Ghats are briefly noted at Buxar (Baksara), but otherwise Babur displays no interest in the qualities of Hindu structures located along natural water bodies.

**CANALS, WELLS AND TANKS**

The absence of «running waters» (generally translated as «canals») is mentioned repeatedly. This is curious in light of the early and in some cases massive canal
construction which occurred during the Sultanate period. The Jumna canal, which was constructed during the reign of Firoz Shah, reportedly extended over 120 miles. Gardens, palaces, and sarais in the Delhi area were presumably served by smaller canals. These would be relatively slow-moving, however, and would have few of the qualities of a channel diverted from a mountain stream — qualities that may also be implied by the words "running waters."

Moreover, it is important to recognize that at Agra the deeply dissected terrain restricted canal development both upstream and downstream of the city, giving support to Babur's remarks and reinforcing the idea that his descriptions of Hindustan are centered on the Agra region.

There is an ongoing scholarly debate over the use of the Persian wheel and other well technologies in India. This literature was recently reviewed by Siddiqui and also by Askari. Well types ranged in complexity from the temporary lined wells that served military campaigns and local settlements, to the multi-storied step wells of the nobles. Babur described in detail the three-storied step well that supplied his first garden at Agra. Water lifting devices included leather buckets, Persian wheels, and water jars at shallow wells. Babur strongly criticized the sanitation of Hindustani wells involving buckets drawn by bullock power at Agra, Bayana, and Chandwar, but Zain Khan implies that such problems went unnoticed for some time after the Mughals arrived.

Tanks have perhaps the longest history of any water features in northern India. Among the first sites visited by Babur after the battle of Panipat were the Hauz Shamsi and Hauz-i-Khas, the latter dating to Khalji rulership in Delhi. Babur also mentions existing reservoirs and tanks at Dholpur, Sikri, Chanderi, and Gwalior. As figure one indicates, references to water impoundments in the Baburnama fall into two classes: large reservoirs serving water supply and sometimes recreational needs; and small tanks built for aesthetic and religious purposes.

Babur's own tanks were exclusively of the latter variety. His water gardens at Dholpur, for example, drew upon water impounded at a dam built by Sikandar Lodi. His lake pavilions at Sikri were built in a large tank of unknown origins. Upon discovering a small stream or spring, he would often create a small octagonal pool for ablutions and aesthetic enjoyment.

**GARDEN WATER FEATURES**

It is clear from the foregoing section, that the earliest
Mughal water features were not large-scale «civil works» but were instead the more exquisite wells, pools, and channels of the garden. Babur wrote several extended passages on the use of water in his gardens. The first of these describes the hot and cold baths built at Agra. Construction of these and of the associated tanks and wells is rendered in considerable detail during the first year of Babur’s rule, a fact that exemplifies the esthetic and functional importance of water for Mughal rulers\(^{24}\). A second major class of water features was the octagonal ponds and seats built along small streams and springheads [op. cit. note 23]. Finally, several passages deal with the construction of more extensive garden pools and channels, for example those at Dholpur\(^{25}\). Curiously, there are no references anywhere to chadars or fountains. The words «running waters» may imply such features, but at this early date they may also have meant any water moving through a channel which offered a combination of irrigation and visual delight.

It should be noted that sources on pre-Mughal water systems provide little information on garden water features\(^{26}\). This suggests that Babur’s complaint may not have been so much about the absence of any «running waters» in the landscape as an esthetic judgement about those he did observe.

**ORIGINS AND INFLUENCES**

The scope of this paper permits only a rough outline of the influences on Mughal water systems. Several hypotheses were mentioned above. These may be organized into seven categories which distinguish among the geographical origins of early Mughal design features:

1. Babur’s previous design experience in Fergana, Kabul, Samarkand, and Lahore.
2. Babur’s travels prior to invading Hindustan, e.g., in Herat, Lahore, and Samarkand — i.e., at places he visited but did not build.
3. Stories and descriptions of Hindustan which Babur would have heard prior to occupying it.
4. Places visited during the invasion and shortly afterwards, i.e., Sultanate influences.
5. More distinctly Hindu influences, e.g., from the palace complex at Gwalior\(^{27}\), and from the work of stonemasons and other craftsmen\(^{28}\).
6. On-site influences at Agra, i.e., the effects of landscape development prior to 1526 A.D. In part, Babur was reacting against existing landscape conditions, but there would also have been attempts to adapt Mughal design ideas to the circumstances of the local landscape.
"VIEW OF THE CITY OF AGRA FROM THE RIVER JUMNA" ENGRAVING DATED 1857
Conventionally, only the first and last of these hypotheses have been taken seriously. Babur is presented as an innovator at Agra or as a vehicle for the diffusion of central Asian garden traditions into India. Hypotheses 1 through 3 call for more precise distinctions among Babur’s early garden experiences and influences outside India. Hypotheses 4 through 6 require that similar distinctions be made among Babur’s experiences within India. This is admittedly a difficult task since many of the early sites have disappeared or changed radically.

Nevertheless, historical texts provide some help, and also some motivation, for taking these six hypotheses seriously. Babur records many cases of conscious site-seeing, some of which are accompanied by detailed descriptions.

The final hypothesis receives considerable attention in the literature on Mughal environmental design. Babur’s role as an innovator in India, however, must be determined from an analysis of the potential influences on his work there. The geographical scale of investigation is particularly important for understanding what was derivative and what was innovative in Babur’s designs. That Babur and his contemporaries introduced new technologies and design forms into the Agra area is unquestionable; that the Agra projects had no important precursors in northern India is doubtful. Moreover, the Persian and central Asian roots of early Mughal design are not yet well enough known to sort out the “original” and “traditional” attributes of Babur’s designs. These issues are crucial for studies of later Mughal water systems and gardens, for they define the foundations of Mughal environmental design and the roles of various people who prepared those foundations.

GEOGRAPHICAL RELATIONSHIPS AMONG WATER FEATURES

In the previous section it was noted that the scale of investigation may influence what is regarded as innovative or distinctive about a particular water system. The geographical patterning of water systems also helps to establish the relationships that existed among functional, aesthetic, and symbolic qualities of water. In the case of Agra, six geographical scales of analysis are pertinent for understanding the roles of water in the landscape: a) internal garden water systems; b) the landscape context of individual gardens; c) garden complexes along the Yamuna River corridor; d) the urban water system at Agra; e) urban centers along the Yamuna and its tributaries; and f) regional water systems.

Agra has only several gardens with extant water systems that have been attributed to Babur. These include the baths and pools at the Ram Bagh (also called Aram Bagh and Bagh-i-Gul Afshan by various sources) and the remnants of the Zehra Bagh (also called Dehra Bagh and Zahara Bagh). Because the identification and history of these gardens await detailed study, inferences about the use of water in gardens must remain conjectural. Two other Babur gardens were identified in Carleyle’s archaeological report of 1871-72, but they were in a ruined state at that date and have not been subsequently researched; these are the Chai-bagh and the Achanak Bagh. Nath has recently argued that the Chauburj (located near the tomb of Itimad-ud-Daula) was part of a larger garden complex containing Babur’s Bagh-i-Zar Afshan [op. cit. note 27]. There are reputed Lodi ruins in Sikandra; and numerous villas and pavilions which lined the riverfront, of which almost nothing is known. The latter included the riverfront residences of Zain Khan, Yunus-i-‘ali, Khalifa, and presumably other nobles during Babur’s reign39.

a. The smallest scale of analysis focuses on these garden water systems — that is, on the garden as a self-contained object. The problem is to show how garden water systems operated, how they were experienced, and how their layout was related to the overall structure of the garden.

b. The next larger scale of geographical analysis is that of the garden landscape — i.e., views to and from individual gardens. It is clear from Zain Khan’s comment quoted above that views of the riverfront from tented enclosures had great aesthetic appeal. This goes against the common notion that the inward orientation and paradise symbolism of Islamic gardens resulted in weak relationships with the outside landscape. In Agra many of the gardens were open to the Yamuna River.

c. The Yamuna River played a prominent role in spatially organizing the complex of gardens which in later years would come to line the river. We learn from de Laet and other early 17th century travellers that, “The city is much longer than it is broad; for all the inhabitants have desidered to be near the river, and hence have built their houses along its banks”30. If the historical patterning of riverfront development at Agra could be reconstructed, it would provide a fascinating view of Mughal urbanism as it unfolded over a period of nearly two hundred years. Riverfront development became popular quite early during Babur’s reign. During his first year in Agra, Babur stated that the residences and palaces along the river had acquired the name “Kabul” among the local residents31. Unfortunately, pre-Mughal riverfront structures have not been identified.

d. At the urban scale, there is a fundamental problem with locating where the Lodi fort and city lay before Akbar’s rule. Those who follow Carleyle speak of a city which lay on the east bank of the Yamuna near the village of Nunhail22. Others have surmised that the foundations of Akbar’s Red Fort have Lodi origins. The apparent reliance of Agra on shallow wells means that
large-scale canal features are not to be available to help reconstruct the early urban water system. It may be, however, that further review of Sultanate histories and descriptions of Agra would answer some of these questions.

e. It is crucial to think of Agra as spatially situated along a regional Yamuna River corridor. The Yamuna provided a spatial linkage upstream with Delhi and downstream with Benares, Allahabad, Etawah, and Ghazipur. These linkages placed Agra in a strategic position for territorial control in northern India. Agra history is intimately connected with river travel. The founding of Agra by Sikandar Lodí occurred on a river trip from Delhi. Babur toured the region by boat, as did Humayun, Akbar, and Jahangir. The river served a complex mix of functions including commerce, festivals, military transportation, and water supply for gardens and residences.

f. At the largest scale of analysis are the "hydraulic" connections among areas which are not connected by rivers. Babur noted, for example, the strategic significance of the water supply at Fatehpur Sikri in his battle with Rana Sanga. His memoirs give only a sketchy view of the regional pattern of water supplies—but again, it is a pattern that could be expanded through an analysis of pre-Mughal texts. In later years there would be trade in drinking water and ice. Also important at this scale of geographical analysis would be the provisioning of sarais and forts with water—either in tanks, wells, cisterns, or jars. Such way-stations constituted a crucial resource for long-distance military campaigns and general travel.

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7 Ibid., p. 486.

8 Ibid., p. 518.

9 Ibid., pp. 518, 532.

10 For example, at Bhosawar, Firozpur, and Chandern; ibid. pp. 580, 581, and 597.

11 Ibid., p. 487.


13 Baburnama pp. 475-6.

14 Note the water shortage in the Agra-Gwallor area during Sikandar Lodí's reign. Abdulláh, Tarikh-i Daud. In The History of India as Told by Its Own Historians, Vol. IV., p. 466. Ed. H.M. Elliot and John Dowson, Allahabad, Kitab Mahal Pvt. Ltd., 1964 [1st pub. 1867-77]; and the response to pervasive water shortage by Firoz Shah: 'Ali, Shams-i Siraj, Tarikh-i Firoz Shahi, in Elliot and Dowson, vol. III, p. 300; and Tarikh-i Firoz Shahr, of Barani, in Elliot and Dowson, vol. III, p. 146. The pre-Mughal interest in building along the Yamuna River is also evident in these two texts, Barani, p. 136 (Kila-ghar-i), and Shams-i Siraj, p. 302 (Firozabad).

15 Baburnama, pp. 591, 655. For a note on ghats: Pieper, J. Water in Hindu Urban Architecture. «Art and Arch. Research Papers», 15 (1973), 39-44. One is reminded here of the recurring stories about Muslim displeasure with Hindu behavior at rivers and tanks during religious festivals and eclipses. Although not mentioned by Babur, these stories are recounted in the histories of Firoz Shah before him and those of Akbar and Jahangir later on.
18 Baburnama, p. 532.
19 Ibid., p. 487.
20 Ibid., p. 475.
21 Ibid., pp. 585, 588, 592, 612.
22 Ibid., pp. 606-7.
23 Ibid., pp. 580, 581, 683.
25 The Dholpur garden water systems are described in the Baburnama, pp. 585, 606-7, 615, 634, and 639.
26 For exceptions, see Siddiqui, Waterworks, (passim), who cites early references to fountains, channels, and garden tanks in Gujarat, Delhi, and Jaipur. It is important to note, however, that Babur did not travel into Gujarat and that he stayed only briefly in Delhi and Jaipur.
28 Baburnama, p. 519.
31 Baburnama, p. 532.
34 River trips by Humayun, Akbar, and Jahângrî are reported in the following passages:
36 Baburnama, p. 548.
37 Baburnama, p. 548.
38 One is reminded here of the water shortages suffered by Sikandar Lodî’s troops near Agra (note 14 above), Firoz Shah’s army in the Rann of Kutch, and Humayun in western Rajasthan. While Humayun wandered in the desert, Sher Shah ordered a network of sarais to be constructed and provisioned with water: Sarwân, ‘Abbas Khan. Tânikh-i Sher Shah, in «The History of India as Told by Its Own Historians», Vol. IV, Ed. H.M. Elliot and John Dowson, Allahabad, Kitab Mahal Pvt. Ltd., 1964 [1st pub. 1867-77], pp. 417-8.