TRADITIONAL WISDOM IN WATER MANAGEMENT-A CASE STUDY OF DAULATABAD FORT (INDIA)

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ABSTRACT

In the arid zone the spell between the two Rain showers is too large. These dry spells reduce the crop yield drastically. Once the rain disappears, the lands become as dry as like desert, life difficult and water scare to find. In India, the monsoon rainfall occurs only for a short duration. It is not evenly distributed all over the country. It is erratic in nature. Some times it fall with high intensity or some times with very low. Thus the water was a very ephemeral resource for them. To maintain the sustainability in food production and to give protective irrigation they slowly grew the extraordinary traditions of water harvesting in innumerable forms in different parts of India. Depending on the resources available to them, they developed a range of techniques to harvest every possible form of water - form rainwater to ground water, stream water to river water, and floodwater. Various examples spread over the country shows that the water harvesting systems were last for a long period of time, may be 300 to 600 years. The systems were maintenance free, or can run with meager expenses. Indians have given importance not only for the collection of rainwater but equally importance to the purity of the water. Indian civilization is one of the oldest civilizations in the world. It has contributed a large number of aspects such as religion, culture, philosophy, technology, water harvesting, and water management. Several periods of prosperity are quite discernible in the history of India. Numerous documentary and field evidences which attest to the existing water systems which in turn were based on well conceived planning and regulation, are extant in different part of India. The method of water development of respective periods have long been closely linked to the Indian climate, social fabric, and living style. The recently carried out exercise by Maharashtra Water & Irrigation Commission has brought to the fore the possibility of unearthing countless guiding principals through the data that may prove useful in the contest of structures being conceived in the new environment of India. History shows that, though under the dynastic ruler of those days, people lived happily. However owing to the neglect, innumerable structures and an invaluable stock of literary and documentary information pertain thereto are gradually being pushed on the verge of extinction. It is necessary to get all this preserved as a valuable historical heritage. The Medieval rainwater harvesting techniques and management of water resources used at Daulatabad fort

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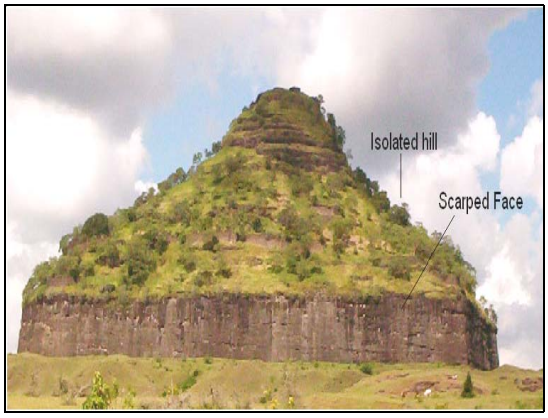
[India], is an inspiring example for the water harvesting experts. It gives the guidelines for How to manage the available water resources effectively? The water harvesting techniques at Daulatabad can be said as one of the best examples in the world. The details of the scheme are discussed in this paper.

INTRODUCTION

In monsoon countries like India, rainfall is seasonal and its variation from place to place is appreciable large. Daulatabad is situated in central-southern part of India. In this region the monsoon rainfall is quite scanty and highly erratic. There were no permanent water supply sources, like river or big tank in the vicinity of Daulatabad fort. Hence rainwater was the main source for the contemporary people. All this area is covered with Amygdaloidal basalt; in which rainwater do not get percolate inside the ground. Therefore only ground water source was not sufficient to fulfill the needs of the people. But History revels that though the water was scanty, the agriculture based economy flourished in this area and the period was known as golden era. This means that the people were well managing the available water resources and making good yield from their farms.



It is believed that Bhillama the fifth king of Yadava had constructed the Daulatabad fort in the year 1187A.D[1]. For the purpose of defense he selected an isolated cone shaped hill, suddenly rising from the plains to the height of 700 feet and surrounded by spurs of the Balaghat ranges. The hill is separated from the rest of the area by naturally scarped cliff. Due this feature minimum artificial defense would necessary. Bhillama made it more impregnable by scarping it further. An official chronicler Mr. Lahori wrote that, the scarping was so smooth that neither an ant nor a snake could scale it[2]. From the defense point of view the above arrangement was very good. But water supply to the high level fort was a big problem. Pertaining to the water supply schemes at Daulatabad, the contemporary historians and travelers even known for their details are silent. Therefore in this paper we have thrown a light on the issue, how? The dynasties had solved the water problems.

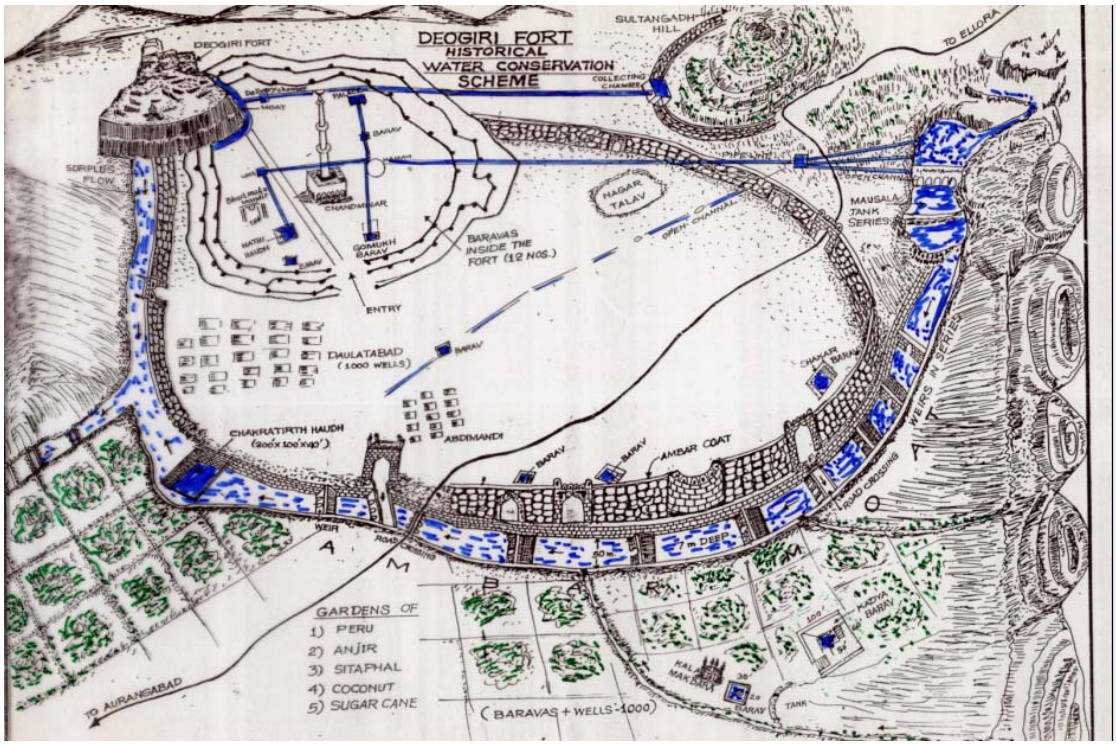
It was a capital of Maharashtra state for a long period and imperial capital for a short duration. From contemporary record it is evident that the Daulatabad of Yadava's

period was a twin city comprised of the suburbs of Kataka and Devagiri. It was the wealthiest trading center of south-central part and the seat of intense political activities, and the army head quarter. It was under the Islamic rule for more than 600 years. Hence it has assimilated the Islamic way of life in its true sense.

Daulatabad is known for its medieval hill–cum land fort. It is most significant of all forts in India. It is associated with number of dynasties. Their names are listed below.

1. The Yadava [1187-1294 A.D.]
2. The Khalaji [1295-1320 A.D.]
3. The Tughlaq [1320-1343 A.D.]
4. The Bahamanis [1350-1484 A.D.]
5. The Nizam [1490-1635 A.D.]
6. The Mughal [1635-1724 A.D.]
7. The Asafzahi [1724-1948 A.D.]
8. The Maratha [1750-1780A.D.]

Being capital of the region, the population in this region was high. Thus demand of water was also high. The dynasties had solved these water problems. They adopted various rainwater harvesting methods and efficient water management techniques. Rainwater harvesting methods adopted at the world famous Daulatabad fort in the olden days are inspiring examples to the present water crises problems[3].



WATER SUPPLY DURING YADAVA'S PERIOD

Yadavas were the founder of the fort and the city. It was their capital. The township of Daulatabad included the citadel with few palace complexes at the central hill and suburbs of the towns of Daulatabad and Kataka. Daulatabad was reserved for civil population and kataka for the army.

Baring rain was the only source of water source. They constructed two cisterns cut in rock for storing the rainwater. Storage capacities of these cisterns are very small. With adequate monsoon, the stored water would suffice for approximately two hundred persons per year. There were about 100 wells including step wells in the vicinity of the suburbs. Further the extensive exploration also revealed that there are four big tanks at different altitudes. These tanks were constructed in the Yadava's reign. After Muslim occupation they were renamed as Parion-Ka-Talab, Hauz-A-Qutlaq and Ab-Pash-Darra. The rock – cut cisterns, open dig wells and tanks were the sources of water supply during the Yadava's period. The estimated population was about 50000.

WATER SUPPLY DURING KHALAJI'S PERIOD

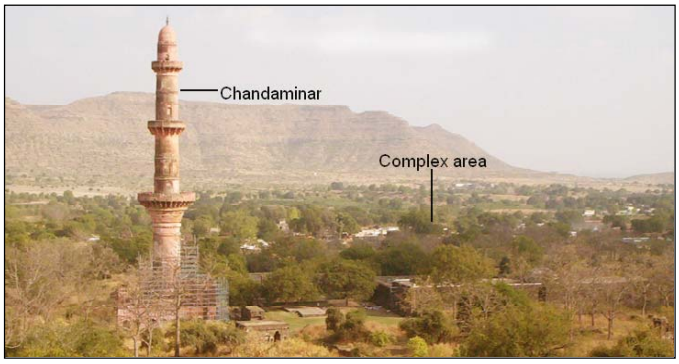
Khalaji's reign was very short. They did not add in to the existing water supply schemes.

WATER SUPPLY DURING TUGHLAQS'S PERIOD

Tughlaq followed Khalaji. He resolved to shift his capital from Delhi to Daulatabad. New fortification walls were constructed and the fort was made strong to withstand the attacks of enemies. According to Yaha sirhindi, the city was erected within a span of six years [1321-27 A.D.] and peoples were forced to migrate from Delhi to Daulatabad. Because of the forcible migration its population was reached to zenith. This abnormal increase in population warranted a guaranteed water supply. For that purpose he diverted the water from Mausala tank to the forte.

WATER SUPPLY DURING BAHAMANI'S PERIOD

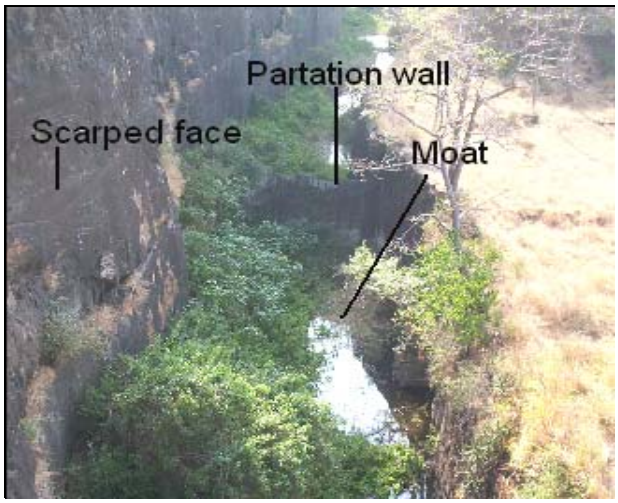
For about one and half century, Daulatabad was under the possession of the Bahamani dynasty. During these occupations some fortification walls namely the double wall of Mahakota and Kalakota were added, The Chandminar complex was erected. Some palaces, mosques, gardens, and residential quarters were also erected.



There were wells within and out side the forts. For the purpose of water supply, some of the wells were sunken deep. The earlier water supply system was renovated.

WATER SUPPLY DURING NIZAM'S PERIOD

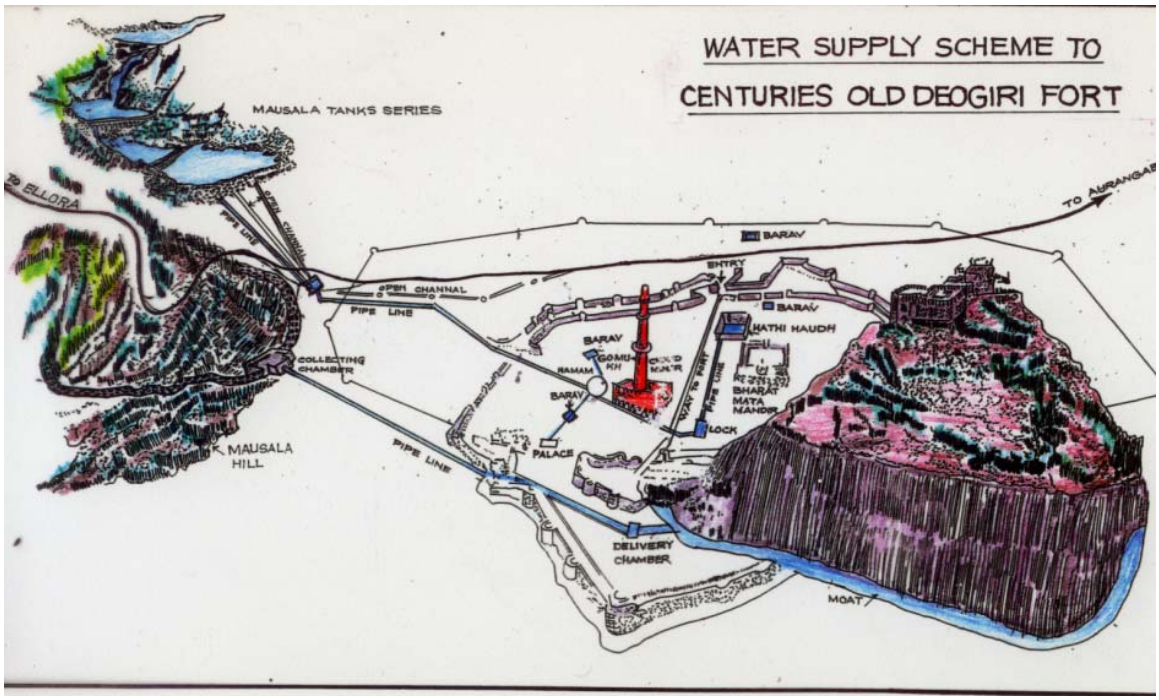
Nizam was the successor of Bahamani. Malik-Amber was the prim minister of Nizam. Malik was a born hydraulic genius. His knowledge of hydraulics was matchless., Daulatabad was made the state capital in his working period. This resulted into abnormal increase in population. Under the guidance of Malik, the forte was again reinforced. He constructed a magnificent palace at the top of the hill as an emergency resort. He provided all types of royal amenities at the high altitude. He excavated a ditch around the circuit of the hill and isolated the hill from the rest of the area. He continued the excavation deep in to the ground and provided an artificial moat of thirty feet wide and sixty feet deep all around the hill[4]. A withdraw-able bridge over the mote was provided to have link between the central isolated hill and rest of the area.



The area limited by the escarpment on one side and fortification wall [kalakota] on the other side was reserved for the royal Darbar. Large numbers of palaces including Divan-E-Khas were constructed along the escarpment.

The area between Kalakota and Mahakota was reserved for residence. This area was divided in to two sectors. The north sector was earmarked for VIPs and south sector was distributed among the bureaucrats and ministerial staff. A great fortification wall known as Amberkota with number of strong gates, battlements, bastions, was constructed in this period.

As far as the source of water supply is concerned there were two reservoirs in the northern valley but were at low level. Therefore it was not possible to carry water from these reservoirs in to the fort. For making arrangement of water supply to the high level based fort, Malik had constructed a number of new water supply schemes. The details are given below.



RAINWATER HARVESTING[5]:

FIRST LINE OF WATER SUPPLY

This scheme was designed only for the water supply to the royal-complexes. On the opposite and northern side of the fort, there is a hill known as Mausala hill. For collecting the rainwater coming from the top, he constructed a ditch and a small masonry bund at the foot, parallel to the length of the hill. The width of the bund was 450mm, height 750mm, and length was measured as 2000m. A gentle slope was given to the ditch. At the end of the ditch a collection-filtration chamber was constructed. This chamber incorporated two filtering units one below the other. The upper unite is in brick and lime mortar while the lower one is in dressed stones. The lower unit has two openings. One opening has diameter 200mm and other having 400mm diameter. From these openings two conduits were takes off. Stone grills were fixed at the mouth of the two opening for filtering the water.

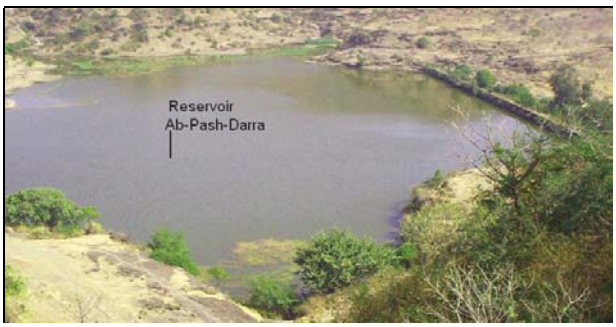
A second chamber was constructed near the moat and at the top of a tower, inside the fort. The level difference between the two chambers was kept as 10m. The conduits taking off from the first chamber ends in to the second. The 200mm-diameter conduit was made up of terracotta. And the 400mm-diameter conduit was made up of stone. Both these conduits were laid in lime concrete with casing of lime mortar, bricks bats and pebbles. The lengths of the conduits were measured as 1000m.

The water flowing down the hill thus gets collected in to the collection-filtration chamber. The bottom R.L. of this chamber is measured as 514.820 meter. After filtration the filtered water enters in to the conduits and conveyed to the second chamber. The second chamber was constructed at the top of a tower, near the escarpment. It was also functioning as a distribution chamber. The bottom R.L. of this

second chamber is found to be 503.570 meter. The level difference between the two chambers was sufficient to carry the water by gravity. A moat section of 200 meter long, 10 meter deep and 20 meter wide were separated from the rest. For that purpose of two diaphragms at 200m distances were kept while cutting the moat below the surface level. The water -storing capacity of this moat section is 40000 cubic meters. A hole at a specific height was provided in each diaphragm for letting out the excess water and stored in the remaining part of the moat. At two convenient places provision of lifting water were made. With the help of the Bullocks water was lifted in to an elevated tank. From this tank terracotta pipelines were provide to supply water to the desired palace complex.

SECOND LINE OF WATER SUPPLY

To meet increasing need of water supply he implemented number of other schemes. To provide water between the fortification walls Kalakota and Mahakota, a new scheme of water supply was provided. On the north side of the fort there is one valley. In this valley there were three reservoirs. A controlled outlet, to let out the water was provided in the topmost dam. The water released from the out let gets collected in to a rock cut cistern, which was constructed, on the down stream side of the dam-wall. This reservoir was named as Hauz-E-Qutlaq. A conduit of 200 mm diameter was taking off form the above rock cut cistern. This conduit line carries water and let in to a water distribution chamber, in side the fort. From this chamber several terracotta pipelines takes off, leading water to various sectors. One of these pipelines conveys water to Hati-hauz [a huge water tank]. The tank is of size 38m x 38m x 6.6m size. It has storing capacity of 10000 cubic meters. It is below ground level. And walls are smoothly plastered from inside. Steps were provided on the three sides to reach to the bottom of the tank. The water stored in this tank was then utilized as and when needed. This water could be fulfilling the annual need of 20000 people.



THIRD LINE OF WATER SUPPLY

A chamber was constructed, on the down streamside of the second reservoir [middle level reservoir] and at the foot of the left side hill of the valley. A ditch was excavated and a bund was constructed parallel to the length of this hill, in such a way that, the rainwater, fowling down the hill gets collected in the above chamber. A conduit takes water from this chamber, crosses the valley and releases water in to an open channel. This open channel runs along the northwestern boundary of the lower most third weir

[Ab-Pash-Darra]. A control out let was fixed in the dam wall of the third reservoir. From which water can be released in to the above channel as and when required. This channel ends in to a filtration chamber. This chamber was constructed near the Ellora-gate. After filtration, the clear water was conveyed inside the fort with the help of 200mm diameter terracotta conduits. Numbers of pressure relief towers were fixed on this conduit line. This conduit again ends in to a distribution chamber. From this chamber water was distributed to desired locations.

FORTH LINE OF WATER SUPPLY

For providing water to general habitation, a separate scheme was executed. Water from the third reservoir was released in to a separate open channel. This channel was constructed in stone and lime mortars. This channel was conveying water to a filtration chamber. After filtration, with the help of conduits, the water was supplied to the area of general habitation.

FOUNTAIN

Generally the conduits end in a tank [small or big], and mostly it is connected to a fountain fixed at the center of the tank. Arrangements were made to collect the excess water after filling the tank. The excess water was then conveyed to the garden with the help of small channels.

For beautification of the garden the tanks were made in various shape such as hexagonal, octagonal, lotus shape etc. The use of water for entertainment is the outstanding contribution of this phase.

LOCKING SYSTEM

The water so brought to the distribution system was controlled by means of locking of pipes. The system was very simple. A conical piece of over burnt brick was used to fix in side the pipe. Using this piece the flow could be controlled.

CONCLUSION

The habitation inside the fort can be divided in to following region.

1] To meet the scarcity of water various schemes of water supply are implemented during different phase of occupation. The schemes can be groped as permanent and seasonal. The seasonal devices were based on rainwater harvesting. Reservoirs constructed in the northern valley were used as permanent water source.

2] Stone and earthen conduits, filtration chambers, pressure relief towers and distribution pipelines were the characteristic features of the supply schemes.

3] Water is conveyed by means of gravity.

4] Without any engineering contrivance, they calculated the relative levels and designed and executed the schemes.

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