Research Journal of Chemical and Environmental Sciences
Res J. Chem. Environ. Sci. Vol 5 [1] February 2017: 01-05
Online ISSN 2321-1040
CODEN: RJCEA2 [USA]

Website: www.aelsindia.com/rjces.htm

RJCES

ORIGINAL ARTICLE

Water Conservation of Ancient Structures of India

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ABSTRACT
India has a rich heritage of water conservation. The techniques of ancient times which were used for irrigation and water supply. Many of them are in working today also, with full proficiency. These traditional systems are the gift of the knowledge, ambience and society of a particular location. These systems are not only supplying water but also holding perfect balance between environment and human beings. In India water harvesting has been practiced since time immemorial. References of this practice are found in ancient religions, texts and history. Archaeological evidence of elaborate water storage and supply systems are found for periods dating back to the Indus Valley Civilization (3000-1500 B.C.) to as recent as 19th century A.D. During the last about 100 years, the objectives and focus of water harvesting have undergone considerable change though the basic techniques of design and construction have remained almost the same. At present most water harvesting structures are built under the holistic program of watershed development which addresses the key issues of domestic water supply for individual households and small communities in remote areas, improving agricultural production in rain fed areas, reclamation of degraded lands, rejuvenating defunct local streams, soil conservation, improving biomass and providing more livelihood options for the poor especially women. The current study provides an historical overview of water management at Kanheri caves and Elephanta caves over time and also makes an attempt to understand the values that the ancient texts and scriptures laid on 'water' in specific, further detailing out challenges in water management in the current context and suggesting future options for improved water management. The focus is to see how 'water' was and is perceived and the influence it had and has on 'water management'. The present status of water availability in India raises an alarm to look into water conservation systems of prime importance. The ancient techniques of water conservation can thus provide an insight of applying these techniques for future water conservation technology.
Keywords*: Indus Valley Civilization, water harvesting, water conservation, traditional systems.*

Received 20.01.2017 Accepted 10.02.2017

INTRODUCTION

When you progress forward in a manner like the Indian economy is doing currently, there comes a time when stopping for a moment to understand the glorious systems of the past converts the uncertain probability of success of similar future plans into realistic possibilities. In the case of India, the fascinating past of water management and conservation reminds us how naturally abundant we are and what magnificent riches can be reaped through successful management of these resources.

The history of water management in India goes back a long way, before some civilizations had even begun settling down as organized societies. Mohenjo-Daro and Harappa were old yet developed cities in the ancient times. These cities were well-organized and built of brick and stone. The drainage systems, wells and water storage systems were ahead of its time. These organized systems set them apart from all other ancient civilizations. It is when we take a look at the ancient water harvesting systems that such an activity not only appears doable, but stands out as a phenomenon to be marveled at. There was enough evidence to show that left to them, people were not only able to conserve and manage their water resources equitably, but also meet the local needs through community-owned systems of management. Each of these unique systems based on the local environment ensured that individual needs were met through an equitable management of the collective resource. Documenting indigenous methods of water conservation is today a stark necessity [1].

One thing is certain; water crisis is impending in the future. In order to avert this, we must revisit and learn from the practices used in the past. Select water conservation methods can then be adapted to the present day situation.

METHODOLOGY

The various methods of water conservation and water supply systems in terms of the following are highlighted:-

- Drains and Water Sewage Systems.
- Wells in ancient structures.
- Water Harvesting systems.
- Public bathing areas
- Cisterns at Kanheri.
- Baolis.

Drains:-

The ancient Indus Valley Civilization of South Asia, including current day Pakistan and Northwest India was prominent in hydraulic engineering and had many water supply and sanitation devices that were the first of their kind. Among other things they contained the world's first earliest known system of 'flush toilets'.

With a number of courtyard houses having both a washing platform and a dedicated toilet/waste disposal hole. The toilet holes would be flushed by emptying a jar of water, drawn from the house's central well, through a clay brick pipe and into a shared brick drain, that would feed into an adjacent soak pit (cesspit). The soak pits would be periodically emptied of their solid matter, possibly to be used as a fertilizer. Most houses also had private wells. City walls functioned as barrier against floods. The urban areas of Indus valley civilization provided public and private baths, sewage was disposed through underground drains built precisely with laid bricks, and a sophisticated water management system with numerous reservoirs was established. In the drainage systems, drains from houses were connected to wider public drains. The elaborate drainage system of the Harappa people shows that they had developed a high sense of health and sanitation. The drainage system and drains were covered with bricks or stones and were provided with inspection traps and main holes at regular intervals for inspection. Every house had its own soakpits which collected all the sediments and allowed only the water to flow into the street drains.

Waste Water at Lothal :-

Lothal is supposed to have the earliest dock in world history. The dockyard at Lothal is a remarkable lined structure with evidence of channels for inlet and outlet of water. Small bunds were built by local people to store rainwater for irrigation and drinking. For their renowned draining system, lothal engineers provided corbelled roofs and an apron of kiln-fired brick face of the platform where the sewerage entered the cesspool. Wooden screens inserted in grooves in the side drain walls held back solid waste. The well is built of radial bricks, 2.4 meters (7.9 feet) in diameter and 6.7 meters (22 feet) deep. It had an immaculate network of underground drains, silting chambers and cesspools, and inspection chambers for solid waste.

The extent of drains provided archaeologists with many clues regarding the layout of streets, organization of housing and baths. On average, the main sewer is 20-46 cm (7.9 -18.1 inch) in depth, with outer dimensions of 86 x 68 x 33 cm (34 x 27 x 13 inches). Lothal brick makers used a logical approach in manufacture of bricks designed with care in regards to thickness of structures. They used as headers and stretchers in same and alternate layers.

Dholavira storm water drainage system in the castle (2):-

Fig. 1.1: Dholavira

The site was discovered in 1967 -1968 by J.P. Joshi ex. D.G. of A.S.I and is the fifth largest of eight major Harappan sites. It has been under excavation since 1990 by the Archaeological Survey of India, which opines that "Dholavira has indeed added new dimensions to personality of Indus Valley Civilization.

The kind of efficient system of Harappans of Dholavira, developed for conservation, harvesting and storage of water speaks eloquently about their advanced hydraulic engineering given the state of technology in the third millennium BCE.

Dholavira (Fig.1.1) is the sophisticated water conservation system of channels and reservoirs, the earliest found anywhere in the world, built completely of stone. The city has massive reservoirs, three of which are exposed. They were used for storing fresh water brought by the rains or to store water diverted from two nearby rivulets. This clearly came in response to the desert climate and conditions of Kutch where several years may pass by without rainfall. A seasonal stream which runs in a North-South direction near the site was dammed at several points to collect water.

The inhabitants of Dholavira created sixteen or more reservoirs of varying sizes. Some of these took advantage of the slope of the ground within the large settlement, a drop of 13 meters (43 feet) from northeast to northwest. Other reservoirs were excavated, some into living rock. Recent work has revealed two large reservoirs, one to the east of the castle and one to its south.

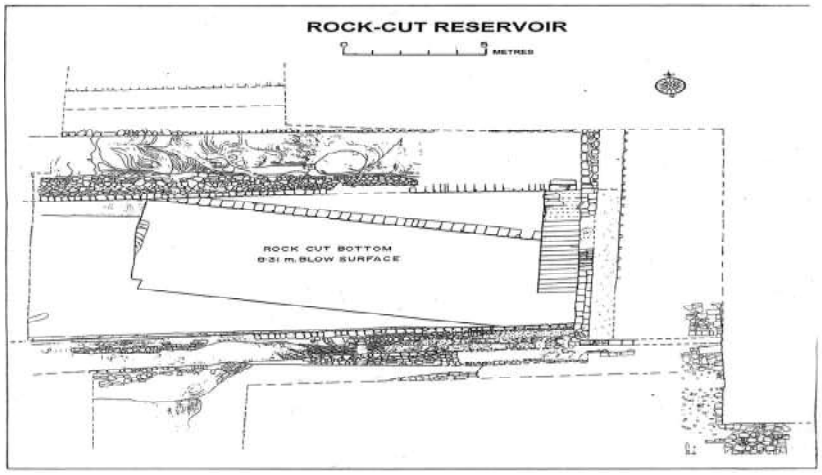

Fig 1.2: Rock Cut Reservoir

The reservoirs are cut through stone vertically, and are about 7 m (23 ft)deep and 79 m (250 ft) long. They skirt the city, while the citadel and bath are centrally located on raised ground. There is also a large well with a stone- cut (Fig 1.2) trough connecting it to a drain meant for conducting water to a storage tank. The bathing tank had steps descending inwards.

Wells in Harappa and Mohenjo-Daro:-

Public well, Harappa: A large public well and public bathing platforms were found in the southern part of Mound AB at Harappa. These public bathing areas may also have been used for washing clothes as is common in many traditional cities in Pakistan and India today.

Water Harvesting Systems (Water for Forts and Places of Worship):-

All forts, built in different terrains and climatic conditions, had elaborate arrangements for drinking water. Those built on hilltops or in rocky terrain depended mainly on rain water harvested from surrounding hills. The Amber Fort near Jaipur built about three centuries ago is a classic example of such a system. It has an automatic arrangement for desilting and aeration of harvested rain water before its entry into the large storage tank. The Jodhpur fort in western Rajasthan had water harvesting arrangements to tap both rain water and groundwater. The Panhala Fort of Maharaj Shivaji built on a hillock near Kolhapur in Maharashtra had Baolis and wells to tap underground springs originating in nearby higher hill slopes. The fort at Chittor on top of a hill has a large reservoir formed from the harvested waters of springs. At the Buddhist site of Sanchi (Madhya Pradesh) dating back to the 3rd Century B.C., there are three ancient tanks to store rain water from the hill slopes. Most of the old temples in south India built centuries ago have large tanks in their premises. These tanks are either fed by harvested rain water or by tapping underground springs. In Tamil Nadu alone there are 39 temple tanks with areas varying from 0.25 to 3 hectares. These are all fed by rain water. Though these were used mainly for bathing and religious purposes, these also recharged the drinking water wells.

In those days, centuries ago, the state built only large storages essentially for irrigation and water supply for the capital cities and important towns. These were obviously not enough and therefore the village communities and individuals were encouraged to build their own water harvesting devices to meet their basic domestic requirement of water. The communities being closely knit had a strong culture of providing voluntary labor and material contributions for building these facilities for the common good. The social norms for civilized behavior, interalia, enjoined on the community members to maintain these

facilities, conserve and protect water from pollution and ensure its equitable and fair distribution. Social scientists, historians and scholars have found that there was no problem of water scarcity where the community organizations were strong and the people relied upon their own efforts to build water harvesting structures. On the other hand, the situation was bad where the people depended entirely on the state for water.

Water is an absolute necessity in the Hindu mode of worship and almost all the rituals use offering of water to the deities, sipping of water, and personal anointments. All these require an extensive use of water. As a result, most, if not all major temples have built a tank or the next to the temple. Example: Pushkarni in Karnataka (3). In cases where there is a river or stream nearby, water is drawn from this source through canals.

Public Bath (Great Bath):-

The great bath is without doubt the earliest public tank in the ancient world. The tank itself measures approximately 12 meters deep north- south and 7 meters wide, with a maximum depth of 2.4 meters .two wide staircases lead down into the tank from the north and south and small sockets at the edges of the stairs are thought to have held wooden planks or treads. At the foot of the stairs is a small ledge with a brick edging that extends the entire width of the pool. People coming down the stairs could move along this ledge without actually stepping into the pool itself. Water for filling the Greatbath came from a large well situated in one of the rooms fronting the open courtyard of the building complex while corbelled baked brick drain in the south western portion of the bath served to carry away the waste water.

Cisterns at Kanheri :-

The Kanheri caves invariably contain evidences of 'Podhis' or water cisterns which were excavated ingeniously to trap the rain water and store them for use during summer periods.

Baolis :-

These are rightly referred to as India's forgotten water temples, many of which are almost redundant today. Many baolis are still popular and are sightings for various tourist and filmmakers. The most popular among these are 'Agrasen ki Baoli', 'Chand Baoli' etc. Baolis are basically the stepwells more commonly found on forts and ancient heritage structures.

One of the most crucial requirements of a fort was a regular supply of water to ensure self-sufficiency during a siege, which could last for months. The source of water was a closely guarded secret to prevent the unscrupulous enemy from poisoning it. Varahmir states in his Brihat Samhita that arteries of flowing water lie at various depths beneath the surface of the earth, and these can be located by an understanding of the topography and environment**.**

CONCLUSION

These water harvesting practices should be perceived by the common man as his sacred duty and by the communities as part of good local self-governance and social responsibility. This Water-Wisdom at all levels of society ensured adequate availability of water for all, which in turn, formed the basis for all round development and prosperity. We must revive and expand this old wisdom for the benefit of all our people especially in the rural areas. Localized water management is a cost-effective approach and more importantly local water management – harvesting and storing water where it falls – can only be done through community participation. The management of water is not simply about building more dams, or laying pipelines to take the water to our cities and then pipelines to flush the waste from our homes. The management of water is about building relationship of society with its water, so that we can understand the value of each raindrop and understand that unless we are prudent, indeed frugal with our use of this precious resource, there will never be enough water for all. Water management is then about society and its ability to build technologies to maximize the use of water and more importantly, technologies to share water with all. It is for these reasons that we must re- learn the water- wisdom of the past.

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Trupti Vaity and Sonal Tawde. Water Conservation of Ancient Structures of India. Res. J. Chem. Env. Sci. Vol 5 [1] February 2017. 01-05

