INTRODUCTION TO STHAPATYA VASTU AND NIRMAN VIDYA AND ARTHASHASTRA (KS60001)

Term Project

Complementarities of Hydrology and Water Resources Management

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Introduction

Hydrology

Hydrology is the study of the distribution and movement of water (āpa) both on and below the Earth's surface, as well as the impact of human activity on water availability and conditions.

It is the scientific study of the movement, distribution, and management of water on Earth and other planets, including the water cycle, water resources, and environmental watershed sustainability.

Water Resource Management(WRM)

Water Resources Management (WRM) is the process of planning, developing, and managing water resources, in terms of both water quantity and quality, across all water uses.

It includes the institutions, infrastructure, incentives, and information systems that support and guide water management.

Literature Review

Hydrology

Ancient religious text known as the Rigveda has several allusions to the hydrologic cycle and related phenomena (Sarasvati, 2009). According to the Rigveda, "the God has created the Sun and positioned it in such a position that it lights the entire world and continually takes water (in the form of vapour), changes it to cloud, and finally discharges it as rain" (verse I, 7.3).

The Sun's rays are the primary source of rain and evaporation, according to the Atharvaveda (about 1200-1000 BCE) (verse I, 5.2 in Sanskrit):

amurya up surye yabhirg suryah sah|ta no hinvantvadhavaram ||

Knowledge of Hydraulic Engineering in Ancient India:

Yajurveda:

The Yajurveda (about 1200-1000 BCE) describes how water travels from clouds to Earth, flows down channels, is stored in seas, and then evaporates further (verse X, 19). The Atharvavedic period saw a similar level of understanding of topics like water evaporation, condensation, rainfall, river flow and storage, and cycle recurrence. Therefore, it may be assumed that contemporaneous Indian intellectuals were aware of the hydrologic,cycle's,components—infiltration,water,transport,storage,and evaporation—during the Vedic and earlier times in India.

Mahabharata:

The Indian summer monsoon, or Indian Summer Monsoon, lasts for 4 months, according to the epic Mahabharata (verse XII, 184.15-16), and during the next 8 months (non-monsoon months), the same water is drained by the Sun's rays through the process of evaporation.

Matsya Purana and Vayu Purana:

Mentions the evaporation process which burns water by Sun rays and which is converted to vapor (i.e., the process of evaporation). These vapors ascend to the atmosphere with the help of air and fall as rain in the next rainy season for the goodness of the living beings (NIH, 2018).

Linga Purana:

Explains the various processes of the hydrologic cycle such as evaporation, and condensation and mentions that water cannot be destroyed; it gets changed from one form to another as the following:

jalasya nasho vridwirva natatyevasya vichartah|ghravenashrishthto vayuvrishti sanhrte punah||

Water management technology in ancient India:

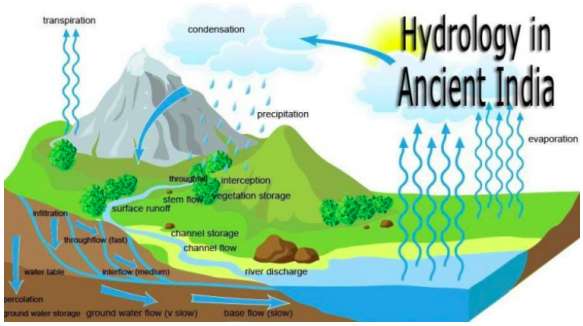
Dholavira, an important city in the Indus Valley civilization, contained sophisticated water management systems comprising series of reservoirs, step wells, and channels. The city is ringed with a series of 16 large reservoirs (7 m deep and 79 m long), with some of them interconnected together; these storage structures account for about 10 % of the area of the city. The ability to conserve every drop of water in the parched landscape speaks volumes about the engineering skills of the people of Dholavira.

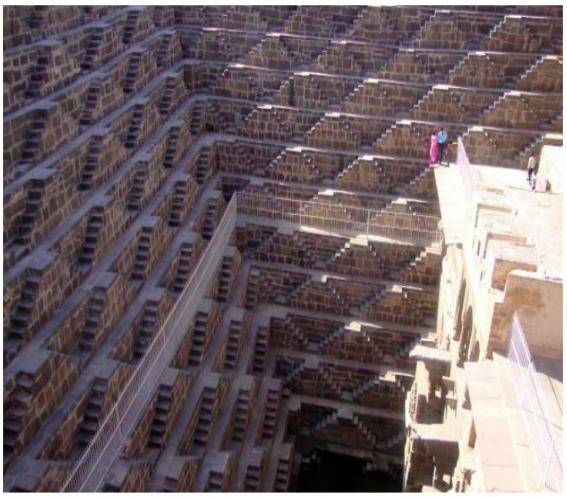
Rigveda:

Many verses indicate that agriculture can be progressed by use of water from wells and ponds (verse I, 23.18, and verse V, 32.2). Verse VIII, 3.10, mentions construction of artificial canals by (Ribhus or engineer) to irrigate desert areas. Verses VIII, 49.6, and X, 64.9, emphasize efficient use of water; i.e., the water obtained from different sources such as wells, rivers, rain, and from any other sources on the earth should be used efficiently, as it is a gift of nature, for the wellbeing of all.

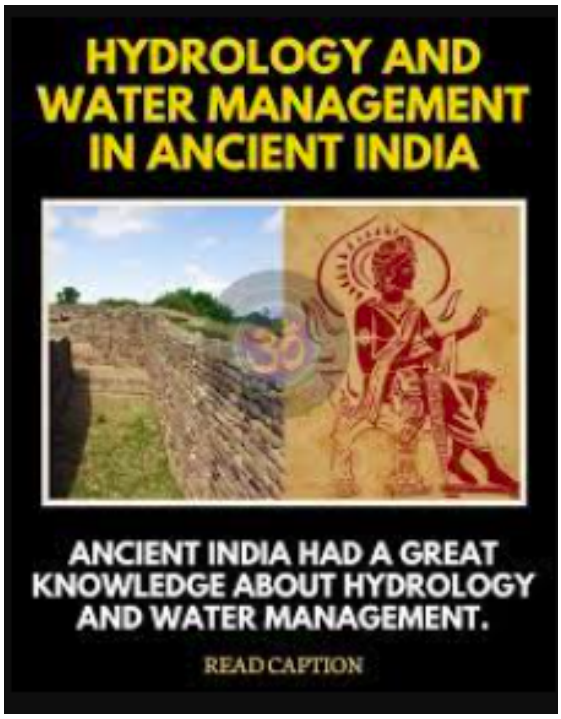
Yajurveda:

Contains references to water management. Verses VI, 100.2, and VII, 11.1, of Yajurveda mention “that the learned men bring water to desert areas by means of well, pond, canals, etc., and the man should think about the drought and flood like natural calamities in advance and take preventive measures accordingly”

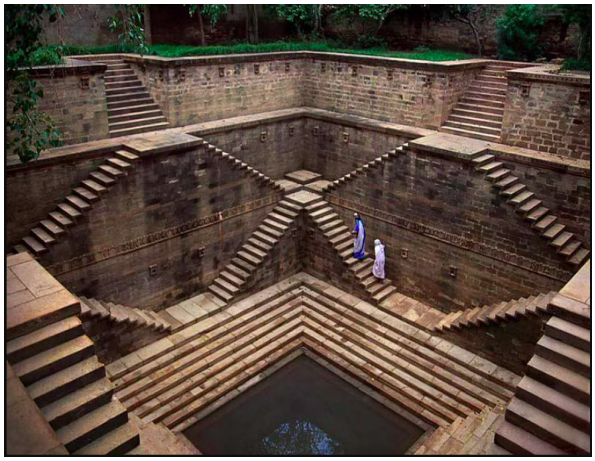




Rainwater Harversting in ancient times



Reservoir to conserve water



Traditional Water Conservation

Concordances and Discordances

Ancient Times

A very good example is the well-planned city of Dholavira, on Khadir Bet, a low plateau in the Rann in Gujarat. One of the oldest water harvesting systems is found about 130 km from Pune along Naneghat in the Western Ghats. A large number of tanks were cut in the rocks to provide drinking water to tradesmen who used to travel along this ancient trade route. Each fort in the area had its own water harvesting and storage system in the form of rock-cut cisterns, ponds, tanks and wells that are still in use today. A large number of forts like Raigad had tanks that supplied water.

In ancient times, houses in parts of western Rajasthan were built so that each had a rooftop water harvesting system. Rainwater from these rooftops was directed into underground tanks. This system can be seen even today in all the forts, palaces and houses of the region.

The old city of Jodhpur has over 200 stepwells and they were built from around the 6th century onward as part of an incredibly sophisticated water architecture," he explains. During the little rain that the region receives between June and September water is diverted from canals built on the hilly outskirts of the city to man-made tanks or talabs.

Modern Times

The development of modern methods of sewage treatment can be traced back to the mid nineteenth century in England and Germany. The large population in London and the limited area available for treatment in sewage farms, broad irrigation, or intermittent filtration led to renewed interest in more intensive methods of treatment before discharging the treated effluent to land and hence to freshwater bodies. Methods of treatment that were used included large septic tanks, contact beds, and trickling filters. Where sufficient land was available intermittent sand filters were also used.

Some important technological developments that have brought about the renewed interest in wastewater reclamation include: the availability of reliable microfiltration, ultra filtration, and reverse osmosis membranes; the use of ozone coupled with biological filtration, low, medium, and high energy UV disinfection; high energy UV advanced oxidation. These treatment processes, can now be used to remove

acute toxicity (e.g., microorganisms) and chronic toxicity (e.g., chemical constituents). Further, because multiple treatment processes are now available for any given constituent, the multiple barrier concept, which involves the use of redundant treatment processes or other activities, in parallel or series, is applied to reduce the risk from a given constituent (e.g., pathogenic microorganisms). In addition, instrumentation and monitoring equipment have also contributed to the reliability of advanced water treatment facilities.

Conclusion

Hydrologic knowledge in ancient India was contained in the shlokas of scriptures and very few people are conversant with the languages of the scriptures. Hence, knowledge and wisdom remained largely unknown to the later generations. Further, the script of the Harappans has not yet been deciphered. If further research is carried out on ancient literature and when the script of the Harappans is deciphered, many more facts will emerge which may be much more fascinating than what we know so far.

There are pieces of evidence to show that the Harappans had developed one of the smartest urban centers in those ancient times with an exemplary fusion of civil, architectural, and material sciences. The Indus Valley civilization is known to have developed the earliest-known system of flush toilets in the world. They had also developed sophisticated water management systems comprising a series of reservoirs, step wells, and channels.

References:

- https://hess.copernicus.org/articles/24/4691/2020/
- https://www.constrofacilitator.com/water-preservation-methods-during-ancient-times/
- https://www.frontiersin.org/articles/10.3389/fenvs.2018.00026/full
- https://sandrp.in/2017/02/09/ground-water-2016-indias-water-lifeline-continues-to-bleed/