

A STUDY OF APPLICATION OF QANAT SYSTEM USING MODERN TECHNIQUES FOR OASIS CREATION

Vishal B. Patil¹, Sujit B. Waghmare², Akash S. Lonkar³, Aniket A. Sarje⁴, Sunil Deshpande⁵

^{1,2,3,4,5}Department of Civil Engineering Dr. D. Y. Patil Institute of Technology, Pune, Maharashtra, India

Abstract—A Qanat is a gently sloping underground channel to transport water from an aquifer or water well to surface for irrigation and drinking. This project will make an attempt to discover the water scarce area adjacent to water-rich aquifer where this system can be adopted using new techniques. The purpose of this paper is to study Qanat system and transport water from water-rich area to water-scarce area.

Keywords— Arid area, Groundwater, Qanat, Water supply technology

I. INTRODUCTION

Arid and semi-arid zones of the earth are always dealing with deficit of available water. In such conditions, natural resources like underground water storage is precious but vulnerable stock. Therefore, proper manipulation of such resources is an important task. Construction of underground tunnels is one of the oldest method in management and control of underground water. These structures are used for controlling and supplying underground water resources since anient times. Now-a-days, these structures are used in promotion and development of agriculture. Water stock in reservoir of such dams is usually utilized by gravitational drainage system.

A Qanat is gently sloping underground channel to tansport water from an aquifer or water well to surface for irrigation and drinking. In this paper, it has been demonstrated that methods of water management, such as Qanat system, could provide a good example of human wisdom to battle with water scarcity in sustainable manner.

II. LITERATURE REVIEW

Several research papers were reviewed to study how the QANAT system can be used for its applications. Reviewing papers helped in determining the scope of the study. This study analyses the history of the Qanat and identifies the advantages of this groundwater water delivery system as well as the reasons why Qanats will be abandoned. The study also provides suggestions for technical methods to refine the Qanat by using new materials and modern geological techniques. The methods suggested in this study are expected to contribute to the restoration and reconstruction of the Qanat system.

Methodology

A. *Appropriate selection of site:*

After the review of certain research papers, we found the areas which are water scarce and requires the water for the purpose of drinking and irrigation. With the use of google earth software some areas which are applicable by Qanat system are found and finalization of appropriate site has been done.

B. *Selection of Study area:*

Amongst several sites available to be studied like Arjun Sagar Dam and Jayakwadi Dam finally Pimpalgaon Joga Dam site was selected to be studied since it was physically approachable and the inputs necessary for application of Qanat could be conveniently acquired for studying.

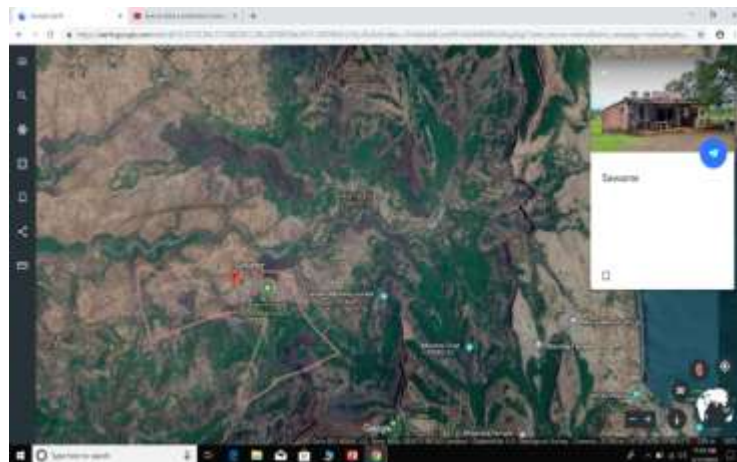


Fig. 1 Selected site (Pimpalgaon joga dam and Sawarne village)

C. Understanding necessary Requirements:

Identifying the crop conditions and different types of soil and requirement of water as per the present population.

D. Collection of data and computation procedure:

Several data needed to be collected and further the computation was carried out. Following is the procedure of carrying out computation:

- Finalization of the area which is arid and requires application of Qanat system.

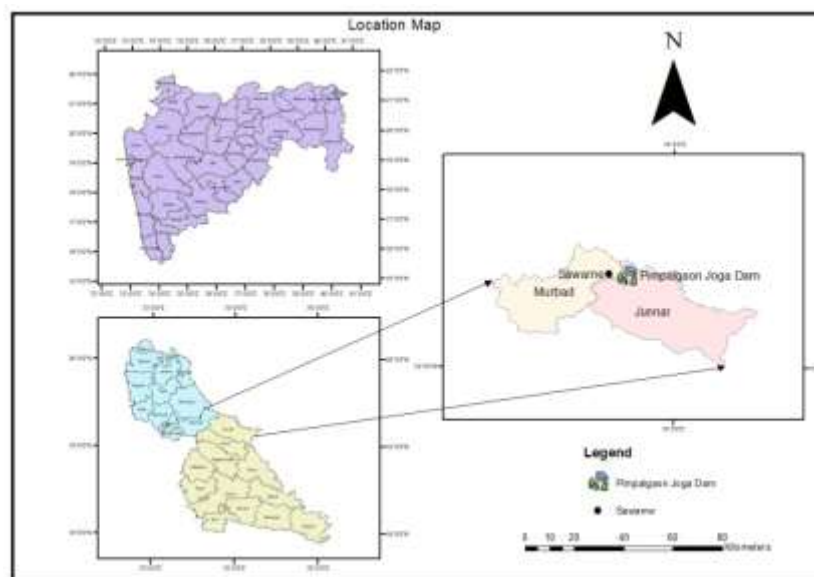


Fig. 2 Location Map

- Permeability of soil.

SHEAR PARAMETER

Sample	Liquid Limit %	Plastic Limit %	Plasticity Index %	Permeability (cm/s)
1	31	22.5	8.6	23.2x10 ⁻⁵

2	43	25.5	20.5	19.2×10^{-5}
3	46	37.3	10.67	2.02×10^{-5}

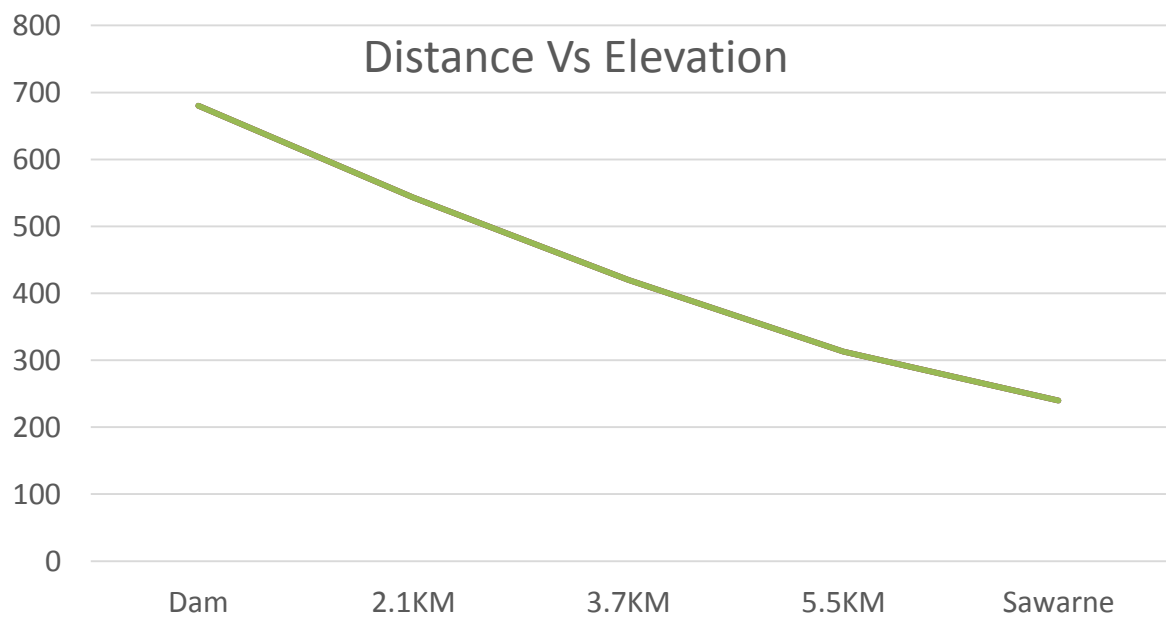
- Different types of crops are taken such as rice, wheat and their requirement of water is

Crops	Requirement of water
Wheat	67 cm

- Population of sawarne village is above 700 people and about 99 houses.

Required water for the village is = 700 people x135 /capita/day
 = 94,500 /capita/day

- Alignment of proposed qanat.



- Number of air vent shafts are 4 and depth of the shafts are

- 1) 520mm
- 2) 410mm
- 3) 310mm
- 4) 230mm

The size of the air vent shafts is of core size 0.10m and length is 0.127m-3.09m

Conclusion

The Qanat is an ancient water management system used to provide a reliable supply of water to human settlements and for irrigation in arid and semi-arid climates. As per the requirement of water for area with consideration of present aquifer we calculate and select the proper canal depth with suitable requirement of air shaft design for successful transport of water towards water scarce area for irrigation as well as for daily requirement of water also.

REFERENCES

- [1] "An ancient invention for water management in iran" by Seyshervan Gharari ed Hamed Alemohammad, Wulf, H.E., Qanats of Iran, scientific American.[1968]
- [2] "Qanat: a sustainable groundwater supply system" by Habashiani, Rasoul, Masters thesis. James Cook University.[2011]
- [3] "a technique appropriate for extracting water from hard rock terrains " by Dariush Mahmoudi, Mohsen Rezaei and Majid Dashti Barmaki, Int. J. Hydrology Science and Technology, Vol. 7, No.2,[2017]
- [4] "The role of Qanat and irrigation networks in the process of city formation and evolution in the central plateau Iran" by Hassan Estaji and Karin Raith, the case of sabzevar. University of applied arts Vienna, Vienna, Austria.[2016]
- [5] "Review of ancient wisdom of Qanat , and suggestions for future water management" by Mohsen Taghavi-Jeloudar1, Mooyoung Han Mohammad Davoudi Mikyeong Kim, Department of Civil and Environmental Engineering, Seoul National University, Seoul 151-742, Korea.[2013]
- [6] "An Appraisal of Qualifying role in Hydraulic Heritage System A case study of Qanat in the central Iran" by Mehdi F. Harandi Marc J. de Vries, Department of hydraulic engineering, Delft University of Technology, Delft, The Netherlands.[2007]
- [7] "The origin and spread of Qanats in the old world" by Paul Ward English, Proceeding of the American Philosophical Society, Vol. 112, No. 3(Jun. 21, 1968)pp. 170-181[1968]
- [8] "Underground Irrigation Canals in Arid Regions through the High-resolution Satellite Images and Field Works" by Hidehiro and Hisao WUSHIKI, Journal of Arid Land Studies[2011]
- [9] "Biodiversity in Qanats" by k. Rezaei Tavabea, H. Azarnivandb, a International Desert Research Center (IDRC), University of Tehran, Tehran, Iran.[2008]
- [10] "Quality assessment of qanat water for drinking and agricultural use in Tehran" by Naser Ebadati, Azadeh Haji Hosseini, Department of Geology, Islamic Azad University, Iran.[2018]