

# Research on the Function and of Water Conservancy Heritage of Karez

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## Abstract

**On the basis of in-depth investigation and research and extensive listening to the opinion of all aspects, this paper comprehensively analyzes and evaluates the development history, basic features, functions and values of the Kares water conservancy heritage, analyzes the current situation of preservation, protection , management and use, and puts forward the key protection and development prospects, prospects, providing the basis for the top-level design and poliey formulation of national. It lays a soid foundation for the high-quality development of water conservancy in Turpan.**

## Keywords

**Karez; Water Conservancy Heritage; Evaluation of Value; Protective Asures; Development Prospect.**

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## 1. Introduction

Located in an important town on the ancient Silk Road, Turpan has a continental warm temperate desert climate, with high temperature and little rain, little precipitation and large evaporation capacity, so it is known as China's "heat pole". For thousands of years, generations of Turpan people living on this land have worked hard and overcome difficulties. With diligence and wisdom, they have created a large-scale and magical underground water project.

It is the most important water source for production and life of Turpan people, and it is called the three major projects in ancient China together with the Great Wall and Grand Canal. Karez plays an important role in the formation and development of Turpan Oasis Civilization, leading the change and development of local history and culture, local customs, traditional customs, lifestyle, literature and art, code of conduct, way of thinking, values and so on. For local people of all ethnic groups, the Karez is not only a water conservancy project, but also a cultural heritage and spiritual sustains, and a model of harmonious coexistence and perfect combination between man and nature.

At present, more than 200 Karez all still in use in Turpan. In history, Lin Zexu went to Turpan four times to promote the karez to create oases that nourished generations of Turpan people. Without karez, there would be no people living in Turpan, and there would be no thousands of years of history, diverse cultures and splendid civilization in Turpan. Huang Qingwen[1] analyzed the history and current situation of karez in Turpan, analyzed the history and current situation of karez in Turpan, analyzed the reasons for the decay of karez in Turpan, and put forward some suggestions for the protection and utilization development of karez, such as strengthening the digging and reinforcement, improving the management system and increasing the investment of funds. From the perspective of cultural heritage management. Abuduwayiti maimaiti[2] put forward countermeasures such as the

establishment of law enforcement team, the demarcation of protection scope, and the publicity work from the perspective of cultural heritage protection. Hu Haitao[3] analyzed the stress and strain state of the karez after the reinforcement of the oval culvert lining by finite element method and proposed the soil course measures for the protection of the Karez. Zhao Li [4]analyzed the reasons for the decline of karez in Turpan Basin, and put forward suggestions on strengthening the management of karez and establishing protected areas. Cui Feng et al[5]. analyzed the cultural value of karez agricultural heritage in Xinjiang from three aspects: the adaptability of biodiversity and cultural diversity in coordination with natural and social environment, and promotion of regional sustainable development, based on the interpretation of the value standard of global important agricultural heritage projects by the Food and Agriculture Organization of the United Nations. However, there is no research on the protection and utilization of karez water conservancy heritage. Based on seven selected water conservancy heritage karez as examples, this paper makes an in-depth study of history, function and value of the karez in Turpan, and put forward suggestions and strategies for sustainable development of karez.

## 2. Basic Information

There are 517 karez in Gaochang District of Turpan, including 115 water karez and 402 dry karez[6]. Based on preservation history and use status and other factor, Miyimubayi, Bostak, Wudaolin, Gasili, Keqike, Ximen and Ying karez are selected for research. All of them have a history of more than 500 years, and their core items are basically intact. They still play an important role in the production and life of local people and are representative in Turpan Karez. There is great potential for the intergration of water culture and tourism industry.

**Table 1.** Basic situation of sample karez

Numble	Name	Location	Length (m)	sharfts	Water yield (L/s)	Irrigation area (hm <sup>2</sup> )
1	Mimubayi	Gaochang Distict	11000	440	90.2	812
2	Bositake	Gaochang Distict	3000	110	17.9	162
3	Ying	Gaochang Distict	3000	110	50.1	451
4	Wudaolin	Gaochang Distict	2600	104	34.3	310
5	Gasili	Gaochang Distict	2100	75	26.1	235
6	Keqike	Gaochang Distict	3500	116	23.1	210
7	Ximen	Gaochang Distict	4500	180	30.2	272

## 3. Heritage Development and Main Characteristics

### 3.1 Origin and Development of Karez

After the 12<sup>th</sup> year of Jiaqing, the development of the karez in Turpan was slow for a long time. It was not until the 25<sup>th</sup> year of Daoguang when Zexu Lin was banished to Turpan that the local karez was developed on a large scale and in planned way for the first time.

Guangxu 3<sup>rd</sup> year after the Qing army recaptured Turpan, the office to supervise the rehabilitation of the Taoist Shengyan Lei, stationed defense battalion commander Ruiqiu Luo and other people to build the Turpan Hall palace canal karez. Plus, the governor advised people to dig karez, the development of agricultural production.

On June 1915, in the fourth years of the Republic of China, Zengxin Yang instructed Wenbing Hu, the governor of Turpan Country, to raise funds. Two years later, Turpan country overhauled karez excavation project, during which 23 karez were repaired and revised. In the early years of the Republic of China the Xinjiang Water Conservancy Association surveyed water conservancy in the whole Xinjiang, mainly planned karez in Gaochang District and Shanshan country, and put forward plans to dig new karez and renovate old ones. There are more than 800 roads of old karez in Turpan, and there are more than 600 roads of water.

From 1949 to 1957, the local party committees and governments at all levels led the masses to build water conservancy and repair and build a number of karez. Each township has a professional team of karez builders. By 1957, the number of karez in Turpan had reached 1,237, with an area of 21,333hm<sup>2</sup>.

Since 1957, with the increase of population and rapid expansion of irrigation area, the technology of long-distance river surface water transport has been developed rapidly, and the surface water supply capacity has gradually increased, but karez water is still the main local water source. After 1965, electromechanical wells began to be introduced and used, and the proportion of water used in karez began to decline. In 2014, Turpan Water Conservancy Research Institute conducted a census of the city's karez, the karez reduced to 997 in Turpan, including 214 water karez, irrigation control area of 6,253.33 hm<sup>2</sup>, 783 dry karez.

### 3.2 Major Characteristic

Like many other karez in Turpan, the 7 karez selected in this study have always been important material resources for local people's production, life, recreation and entertainment. They have distinct features of water control, extensive benefit to the people, obvious regionalism and outstanding ethnic integration, which are highly matched with economic and social development.

#### (1) The characteristics of water control

Karez is an ancient project of artesian flow drawing shallow groundwater in Quaternary water-bearing strata. It is composed of artificially dug shaft, underground water collecting culvert and water transmission culvert with a certain longitudinal slope, water logging dam and surface water transmission open channel. Karez has the characteristics of relatively stable water volume, less evaporation loss, not easy to pollute good water quality, constant water temperature, suitable for agricultural irrigation and human drinking.

#### (2) The characteristics of people's livelihood

Water is the sources of life. In feudal society with backward technology, people settled down by water, and the construction of villages mostly centered on the water source of the karez. The karez has always been the main water source of people's living water, along with all aspects of people's living water, along with all aspects of people's diet and daily life. For a long time, engaging in oasis and horticultural cultivation. As well as animal husbandry, has become the main feature of the agricultural economy of local minority ethnic group dominated. The water quantity of the karez is relatively stable and the water quality is good, which makes it an ideal water source for agricultural irrigation and plays a crucial role in increasing the yield and income of agricultural crops. At the same time, the karez is also a model of systematic protection and of "mountains, rivers, forests, fields, lakes, grass, and sand".

#### (3) The characteristics of cultural

In the long historical development process, the karez has not only become the emotional dependence of local people, but also the embodiment of their spirit. The formation and development of the oasis and the formation of the oasis civilization have played a decisive role. People in Turpan usually use

a karez to describe their address. With the development of history, this method has become the way to name rural settlements in the local administrative region. Local people and karez are closely connected and co-existing, and have completely preserved the material and intangible cultural of irrigation, diet, singing, and dancing, painting, and poetry, technology, living. Which has distinct regional and unique cultural characteristics.

## **4. Function and Value Assessment**

### **4.1 Function and Value of Eliminating Harm and Promoting Benefit**

The karez is a comprehensive groundwater development and utilization project designed and implemented by ancient people in combination with the local hydrogeology and production technology condition, and a historical witness of the harmonious coexistence between man and nature. It is based on the characteristics of the change in groundwater depth of pied hill diluvial fan, the stable excavation structure of the culvert, the poor slope the culvert and no power transmission, and the regulation and storage of waterlogging dam.

### **4.2 Function and Value of Benefiting the People**

Turpan climate is arid, rainfall is rare, evaporation is strong, agricultural development almost all rely on artificial irrigation. The existence of karez makes people in the areas of extreme drought and water shortage have the tenacious and sustainable survival ability, and also promote the healthy development of oasis economy and society. The historical role of karez has not been eliminated with the development of society. On the contrary, history has given it new connotation of the integrated development of culture and tourism industry in karez, the local economic environment has been improved, and the employment and entrepreneurship of local residents and rapid development of tertiary industry have been promoted.

### **4.3 Function and Value of Governing the Country**

Gaochang district of Turpan, located at the heart of the ancient Silk Road, is a historic city with a long history of civilization. Since the Han Dynasty, it has long been the political, economic and cultural center of China's wester regions. The rulers of the past dynasties took the construction of water conservancy as a plan to govern the state. The rapid development of the karez in the second half of the 19th century reflects the important historical background of the development and utilization of northern and southern Xinjiang and large-scale development of water conservancy facilities after the establishment of Xinjiang province in Guangxu period of the late Qing Dynasty. From 1949 to 1957, Party Committees and governments at all levels in Turpan led the mass to repair and build the karez on a large scale. To meet the needs of the masses for production and living water, and make important contributions to the stability of border areas and ethnic integration.

### **4.4 Function and Value of Ecological Landscape**

The karez is a unique ecosystem. It is not only the main source of water for many plants in the oasis, but also plays a special role in the survival of local animals. There is little natural water surface in the rural areas of Turpan. Around and within the water supply range of karez, waterlogging dam and supporting water supply channel system, there are often babbling streams and shady trees. Forming many ecological spaces with local characteristics. It is the area with the most suitable climate in the village, and it is an important public place for the village.

### **4.5 Function and Value of Art Appreciation**

Numerous karez are distributed in the Turpan Basin, like a winding dragon standing in the desert beach next door, lining up along the terrain, forming a unique and strong visual impact. Its scale, coverage of the vast, numerous, magnificent momentum, it is rare.

### **4.6 Innovation Creates Function and Value**

The oval-shaped section structure formed by the excavation of karez, the distance arrangement of the shaft and the function of ventilation and soil transport, and the use of stick orientation and oil lamp

orientation technology in the excavation process fully reflect the innovation and creativity and creativity of the local people. At the same time, the unique technology of flood and drought disaster prevention, water resources development and utilization, ecological environment management technology of karez has a strong advanced and leading role.

## 5. Preservation Protection Status

### 5.1 Important Material Composition

The ancient open channel, culvert, shaft, waterlogging dam, etc., have preserved good integrity in the aspects of orientation, form, material, function, tradition and technology, etc. Except part of the interior landslide water erosion damage, still maintain the original dug state. Represented by the remaining operation traces, it can reflect the original appearance of the construction techniques, processes and other aspects as that time.

### 5.2 Surrounding Original Style

Most of the sealed mounds on the surface of the karez are well preserved, and the aerial photos are orderly and clearly visible. Water outlets, waterlogging dams and irrigation canal systems have been basically kept in their original canal systems have been basically kept in their original forms, and surrounding villages and trees have also been well preserved.

### 5.3 Clear Protection Measures

The relationship between karez and agricultural culture is still maintained, and it is still an important way of irrigation and life in the local environment. The interdependence between the karez and the settlements continues.

## 6. Key Protection Measures

The plan for the protection and utilization of the karez Heritage was formulated to systematically solve the problems of the protection and utilization of the karez heritage. Continue to implement the Plan for the Protection and Utilization of Groundwater Resources in Turpan and the Plan for the Treatment of the Over-Exploitation Area in Turpan, gradually realize the balance of groundwater recovery and replenishment, restore the groundwater level, and ensure the water output of karez. Actively strive for funds, increase the investment in the protection and utilization of karez scientific research, continue to research and development or introduce the use of new technology, to solve the long-term problems of gully collapse, blockage, and to increase the integration and expansion of “culture, tourism and water”, and show the function and value of the karez in all-round and multi-angle way.

The CPC Central Committee and The State Council attach great importance to cultural development. Water is the foundation of survival and the source of civilization. Karez has witnessed the origin, prosperity and integration of Turpan, accumulated, inherited and enriched the collective memory of the Chinese Nation. It is a very valuable material heritage of water conservancy, which has a broad prospect in sustainable development, diversified and integrated development, and high-quality development of water conservancy.

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