KEY WORDS:
Bawdis, Bijapur, Karez System, Qanat System, Traditional Water Systems, Water Management

Reviving Traditional Water System in Bijapur to Mitigate Current Water Shortage

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ABSTRACT

The Adilshahi city of Bijapur is well known for its excellent water management and conservation system created in 16th century to overcome the drought. The traditional water systems and their structures such as karez or qanats and bawdis which are still standing as the witness to the city's water conservation systems. This study focuses on the present water scenario and to overcome the shortage with the help of traditional water management and conservation techniques. It attempts to identify and map the medieval water systems to meet the present need and to know the socio-cultural background of the city with the context of the usage of the water. It also discusses all the options, the potential to revive these traditional water systems, and recommend the course of action to overcome the present water scarcity at its best levels.

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Introduction

As the global water crisis emerge, the revitalization of historic water system and updating of traditional practices can make helpful contribution to the challenge. Restoration of the traditional water conservation system can find a key implementation of the current water scarcity. This study focuses on the traditional water management system created in the 16th century in the city of Bijapur (recently renamed as Vijayapura), the Adilshahi capital, in the present-day Karnataka state of India.

The prominent water structures were Kharejari or Surang-Bhawi, Ganj Pipeline network and Public Bawdis, and also the talabs which served as water source for the public use and connected the people with social means. Kharejari, also known as Karez or Qanat all refer to underground tunnels used to transport water and have the same meaning. Qanats are underground tunnel system inspired by the ancient Persian technique which were bringing the infiltrated groundwater, surface water, or spring water to the earth's surface using gravitational force. The social cultural background study depicts the water as central commodity for the people. These amazing waterworks of 16th century fell under disuse after the prolonged negligence and modern pipe system occurred. As days passed, the draught condition has got worse, so the revitalization of these traditional water systems may play a key role towards water conservation and management.

Water is essential to life and survival; it is not only a functional addition to Islamic architecture but also an integral part of the Islamic religion and beliefs. The Holy Quran states that "Every living thing is made of water," and the importance of this thought is visible in Islam because it is used for Ablution five times daily; however, it is mentioned in the Sunnah that water conservation is embedded in Islam even if you live on a shore. Water has a symbolic (representing spiritual purity) and practical role in Islamic architecture (weather adjustment) (Shakhs, et al., n.d.). So as per religious perspective also, the water was considered as the divine matter for the man kind. This was considered as the part of architecture in the Islamic sense. This was carried forward by all Muslim rulers who ruled in and around the India who maintained water as their architectural and conservation element. When it comes to Bijapur, the same trend has been taken by the Adil shahi rulers in the 16th century.

The Adil shahi of Bijapur, were well known for their able administration and love for music were also recognized for excellent water management schemes that they implemented. Historical evidence show that they possessed deep knowledge about water harvesting. The water was collected in the hills outside Bijapur and supplied to the inner parts of the city through the tunnels to bawdis. (Siddhanti & Vishwanath, 2011) Historians confirm that the density of the population in the Bijapur was so high during the reign of Ibrahim Adil Shah- II and Mohammed Adil shah-II that the city probably consumed double the quantity of water it needed. The main sources of water conservation and supply in Bijapur during those days were Kharejari, Ganj Pipeline network, Public Bawdi's, and also the Talabs.

The aim of this Paper is to throw light on the traditional water systems of Bijapur city which is being depleted day by day. It attempts to map the medieval water systems to know if

they can be used to meet the present day needs and to highlight the socio-culture background of the city with the context of the usage of the water.

Basic Premise of the Study

Providing clean drinking water is one of the primary functions of a city administration. One such attempt was done about 530 years ago at Bijapur city by the Adil Shahi kings (1490-1686).

Through three means the Kharejari or Surang-Bhawi (tunnel-well in Kannada), Ganj Pipeline network (network of water towers and terracotta pipelines) and Public Bawdi's and also the talabs which were initial water source for these systems. Talabs were catchment areas of the city which were located in the outskirts of the city from were these tunnels were constructed according to the geography and the natural slopes of the city. The spatial arrangement was such that the rich and the poor had easy access to potable water. The defense perspective was probably overlooked considering the availability of water while selecting the site for Bijapur city, this was totally against the convention of medieval period dynasties in India. The city sits in sync with a highly dissected and undulating topography of the Deccan Plateau. (Valliyil & Govindankutty, 2022).

Rethinking to revive traditional water sources is the need of the hour, considering the present context of water crisis at both the global as well as local level. History and dynamics of water crisis may differ based on spatiality and temporality, but the stories of drying up of natural water sources are almost similar all over the world. (Koner & Samanta, 2021). According to the authors, reviving them is the best option to overcome the water crisis in the upcoming days.

Droughts and Water Shortage in Bijapur City

Bijapur in north Karnataka is affected by drought often. It lies between two major rivers namely the Krishna and the Bhima. The district is bounded on the north by Sholapur district of Maharashtra State, on the west by Belgaum district, on the east by Gulbarga district and on the south by Bagalkot district of Karnataka.

The district of Bijapur **(figure 1)** has a typically dry and wholesome climate. It is excessively hot in the summer, especially in April and May, when the temperature ranges from 40 to 42 degrees Celsius. The temperature ranges from 15 to 20 degrees Celsius during the winter months of November to January. Since the region typically experiences dry weather, the relative humidity in lower ranges. For the entire district, the average annual rainfall is 552.8 mm, with 37.2 rainy days. The monsoon typically begins in June and lasts until October in the district. Even though the district receives little amount of rainfall overall, it benefits from both the south-west and north-east monsoons. Within the district, the annual rainfall varies from place to place.

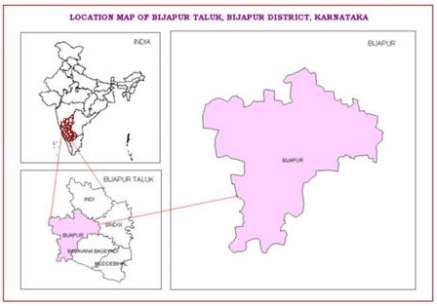

Figure 1: *Bijapur location map*

The population of Bijapur Taluka was 721075 as per the 2011 Census. 393648 of those people were in rural areas, and 327427 lived in urban areas, making up 55% of the total population in rural areas and 45% in urban areas. However, according to United nation world population prospect, Bijapur metro city's population has grown by 2.36% annually and we can consider it as total 434000 people. As per the population, the domestic water supply requirement for the Bijapur city may be calculated as the 135 litres for per person, making the total city requirement as 58,590,000 liters (58.59 MLD).

According to the data found, the above water need of the city is not met. There is overall 21.2% shortfall in the water supply as per the information collected from the water board of the city. The paper further discusses about the same with appropriate recommendation and the fulfilment of the water need by the tradition water system that are present in the city but are not in use.

The investigation continues by gathering information about the historic water systems, including how they were connected, how they provided water around-the-clock in the past, and what methods were employed for the storage system in the event of a shortage. These techniques would be used with a modern twist in the current fulfilment.

Historical Urban Water System of Bijapur

Sultan Ali Adil Shah is responsible for the beginning of Bijapur's water history. After the battle of Talikota, which resulted in the fall of the Vijayanagar Empire, Ali Adil Shah pioneered the establishment of Bijapur as a commercial hub.

The ambitious Deccan Sultan Ali Adil Shah started major initiatives for his city, including the construction of Jami Masjid. To the east of Bijapur Fort, he had also built a trading and commercial centre called Shahpur **(Figure 2)**. Given that the area was a severe, semi-arid plateau, it was crucial to manage water with great sophistication for humans and their domestic animals. Water infrastructure and the cultural identity of Bijapur are intricately interwoven. The monarch and the people's emotional, social, political, and cultural pride

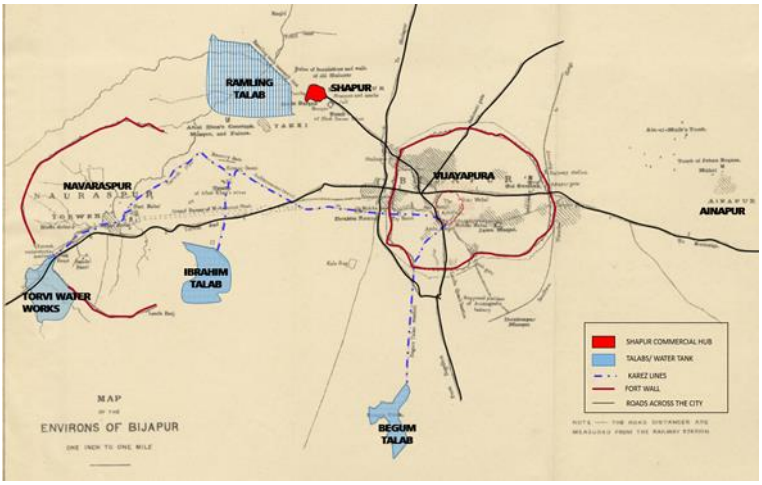

Figure 2: *Old map of Bijapur denoting Karez lines and water sources (By Author from the source image- British Library digitised image from page 165 of "Bijapur, the old Capital of the Adil Shahi Kings: a guide to its ruins with historical outline)*

are closely linked to this. The intricate hydro infrastructure projects required the use of Persian engineers, who were employed and managed by Amirs of the royal court. The water systems were designed and thought of both the supply and storage.

The Bijapur historic urban water system is a combination of the following:

1) Kharejari / Surang-Bhawi (tunnel-well in Kannada).

2) Terracotta / earthen pipeline network, Ganj (water towers)

3) Manmade reservoirs (using mud/stone embankments) and Bawdis (Cisterns)

The construction and completion of this multi-source water management system took place under the rule of the Adil Shahi rulers. Additionally, it demonstrates engineers' in-depth knowledge of local geology, slope, and aquifer qualities, as well as rainfall patterns and topography.

Urban water supply systems are arranged spatially as a result of thoughtful design and management of city services. The irrigation of agricultural lands and the watering of royal gardens were also made possible by these urban water systems.

Kharejari System: A king with origins in the West and Central Asia region brought the Karez or Kharejari, a distinctive water system, to India. Several Karez systems were built in India throughout the Middle Ages, primarily in the Deccan region. The majority of the Persian immigrants to India in the fourteenth century were the lords of the Deccan. Karez, Qanat,

or Kharejari – all refer to underground tunnels used to transport water and have the same meaning.

The qanat is a method for developing and supplying groundwater and consists of a gently upsloping tunnel, cut through alluvial material, which leads water by gravity flow from beneath the water table at its upper end to a ground surface outlet and irrigation canal at its lower end. The cross-section of the tunnel is usually elliptical with a height of c. 1.2 metres and width of c. 0.8 metres. Wherever possible the tunnels are unlined, but in areas of weakly consolidated material baked clay rings known as Kavalla are used to avoid roof and wall collapse. The vertical shafts are approximately 0.7 to 1.0 metre in diameter and are usually strengthened in their upper portion by mud brickworks (Beaumont, 2009).

The Bawdi or a step well can be considered to originate from the need to ensure water during the period of drought, and in the deep relationship of faith in the Water God as conspicuous even in the Vedas of around 1000 BC. They are most common in Western India, mainly in Gujarat and Rajasthan. Most of the still-existing step wells were initially used for recreation in addition to water storage. This was due to the fact that the well's base offered shade from the sun, and covering the well would increase this shade. Step wells were used as locations for both ceremonial and social events.

Both groundwater and surface water are utilised by the Bijapur Kharejari. The Blue lines in **figure 2** indicating the karez system. The Kharejari system consists of short aqueducts with lime mortar stone masonry construction, man-made reservoirs utilising mud/stone embankments, terracotta pipelines, and deeper gallery tunnels through compact basaltic bedrock. The importance of uniqueness is increased because this is the most sophisticated of all the Karez Systems in India. This is renowned for the water connectivity that was created by engineers and nobility.

Muhammed Nada – the unique pipeline urban water system: The 'Muhammed Nada' urban water system was special and had made sure that Bijapur's residents had access to potable water. From Jahan Begum Talab to Asar Mahal (constructed by Mohammed Adil Shah in c.1646 to serve as the Hall of Justice), the Muhammed Nada is a special network of pipelines, cisterns, and an above tank. We can observe this type of water system built by the monarchs in the sixteenth century here, which lies south of the city of Bijapur. Such an unusual water delivery system has never been identified in any other place. Muhammad Nada is the name of this iconic metropolitan water supply system.

Network of Bawdis: There were numerous Bawdi/ Baori (cisterns) built to store water in addition to these two urban water systems that supplied water to the city. As an alternative to the other two systems, these had been constructed by the Adilshah Sultans.

Both Karez and the pipeline network from Begam Talab are probably obstructed or contaminated by the enemy in the event of a battle or siege. As a result, the walled city is

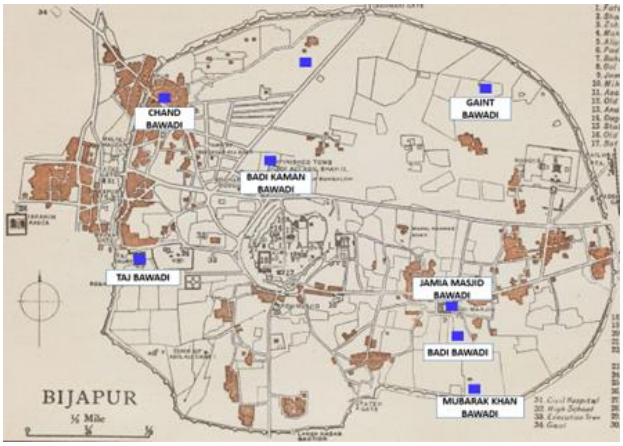

Figure 3: Indicating the Bawdis within the Bijapur city map (By Author from the base map source - https://sarmaya.in/objects/cartography/bijapur)

Figure 4: *Existing Gunjs at certain localities of Bijapur city (Photos by the author)*

populated in great numbers by Bawdi. The Taj Bawdi, the largest, Chand Bawdi near Shahpur Gate, Bari Bawdi and Mubarak Khan's Bawdi in the Southeast, Masa and Nim Bawdi in the North East, Hilal and Nagar Bawdi, and the Jami Masjid Bawdi in the South are some of the well-known bawdis in Bijapur **(Figure 3)**.

The fourth system, which could not be fully tracked, originates from the Ramling Talab (shown in **Figure 2**), reservoir from the Yadavas era. Although there is a network of Ganj-pipelines that lead from here to the city, there are now only a few. They have vanished completely as a result of land use change and landscape changes.

Identifying and Mapping Water Networks and Structures

Identifying the existing water systems of the Bijapur city and mapping the present bawdis in the city with the study of current conditions. This study also gives the clear picture about the traditional water system and their uses in the past. The water systems that are known

Figure 5: *BegumTalab*

Figure 6: *present condition of Ramlinga Talab*

Figures 7,8,9:
Underground tunnel, pressure tower and terracotta pipes at Ramlinga Talab

Figures 10,11: *The bund and the supply system from the bund to the supply point*

through the secondary data have been traced and documented with the respective water networks. And also gives the options to overcome the shortfall of the water through possible reviving recommendations for the existing water structures.

Further I began identifying the bawdis, or traditional water structures, in Bijapur based on secondary data. Established assumptions about the Karez roots that were linked in antiquity. Although I was able to start with a basic identification thanks to secondary data, fieldwork was still more important because it was impossible to know whether the study region that I had selected through secondary data would actually lead to the exact location or not.

The site physical tracing has been done from the participant observation. The initial tracing led was from the main sources of the water systems that are talabs/sarovar or water tanks. Then the secondary networks that are bawdis and the tunnels were identified from the mother source. Some tracings were found from the interviews with the surrounding localities which led to identify the bawdis that were also traced from the secondary data. Collected information about the past uses of the water structures, patterns of erosion of the water systems also has been documented, Photos of existing water systems has been taken to study the ancient traces. The overall field documentation is done with reference to the evolution of the Adil Shahi dynasty such as how they shifted from the different type of water systems from basic structures to advanced water networks which provided 24X7 water supply in the city as well as their increasing knowledge as rulers and the high demand for water among the populace.

The initial field survey was taken place at the talabs which where the catchments area for the further water supply. There were four main talabs in ancient city of Bijapur from where the water was taken into the city. The Torvi catchment area which was firstly connected to the Ramlinga talab (shown in **Figure 2**) which dates back to the Yadava period. Then, the manmade lakes were constructed for the advancement of the water network – those were Ibrahim Sarovar (shown in **Figure 2**) and the Begum Talab. However, there are no traces found of the present existence of the Ibrahim sarovar. Thought the Karez was also established along with the Begum Talab but there are no traces found at the place rather than the gunjs **(Figure 4)** the pressure towers which were located at certain interval. Presently there are only two ancient talabs that existing the Ramling Talab **(Figure 9)** which is in the depleting condition and the Begum Talab **(Figure 5)** which was revived recently as point of tourist attraction.

Ramlinga Talab was initially an earthen dam constructed by the Yadavas. The Adil Shahi engineers introduced innovative hydraulic engineering technologies, making it one of the most advanced dams in the Mediaeval Deccan. Ramalinga's water legacy, which included a network of jack wells spanning the bund.

These structures, which are made of masonry or concrete, **(Figures 10, 11, 12)** the tunnels, the pressure tower, and terracotta pipes produce generally pure water that is free of sand, debris, and undesirable floating material. The dam, which had a 40sq km surface area, supplied water to more than a million people living in Bijapur and its surrounding areas in the sixteenth century. The bund **(Figure 10)** is made up of a number of jack wells, which are intake structures used to collect water from reservoirs, lakes, and rivers on the surface before transferring it to a water treatment facility. These are the structures that, in the fourteenth century, were far more advanced than any other pipe system. These are the buildings that house the water source, treatment process, pump lines, and supplies **(Figure 11)**. This system was used till the Ramling Lake existed and served as the main resource of water to the city. And the water resource for the new city called shahapur. This was one of the oldest water works before the Torvi head works. The lake has dried up we can’t see any of the water which leads for the further connectivity.

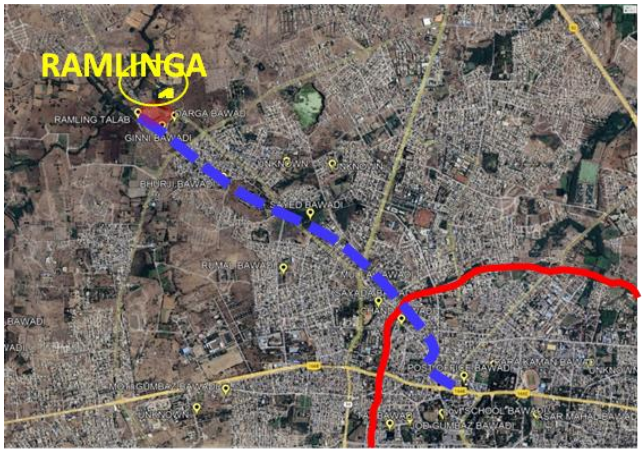

Figure 12: Mapping of Ramlinga water network

The **figures 12** shows the mapping details that has been observed on the field. The bawads that countinue from the Ramlinga Lake which connects to the Bijapur city. This the network has been observed from the field survey of the water bawdis that are still existing but not in use. Some of the bawdis have lost the trace because of the construction and the city development. Ramlinga talab, Durga Bawdi, Ginni Bawdi, Bhurji Bawdi, Sayed Bawdi, Mulla Bawdi, Sayada Bawdi, Chand Bawdi **(Figure 13)** and further connected to the water structures of the citadel. These all above mentioned bawdis are the connections that would have been taken the water from the Ramlinga Talab to the city centre.

After the Ramlinga connections of water were destroyed during the war. The karez was brought up to the city for the water require fulfilment. The Torvi water works are the trace of the Karez system that was introduced by the Adil shahis the connection of the Ramling Talab is much mechanized system of approach which is very convenient form of taking out the water from the catchment areas and then transferring them through the gunjs and the bawdis to the city and the citadel.

The Torvi water works led to construction of many bawdis in the city. This is the overall mapping of the documented bawdis that are still existing in the city. There are total 24 bawdis **(Figure 13)** that were documented by the author with the present condition and the water networks that were taken in the karez water system. There were just the bawdis which were nor connected neither considered in the water networks. Those are the storage bawdis that were constructed for the construction purpose and for the agricultural use of the city. There are some bawdis which are the dug water structures for taking out the rock for the construction. Later these were converted into bawdis. These are seen near to the monuments such as Gol Gumbaz which has its bawdi in the premises which was used for water the landscape area. Such examples can be seen surrounding the city which are now waste damp yards.

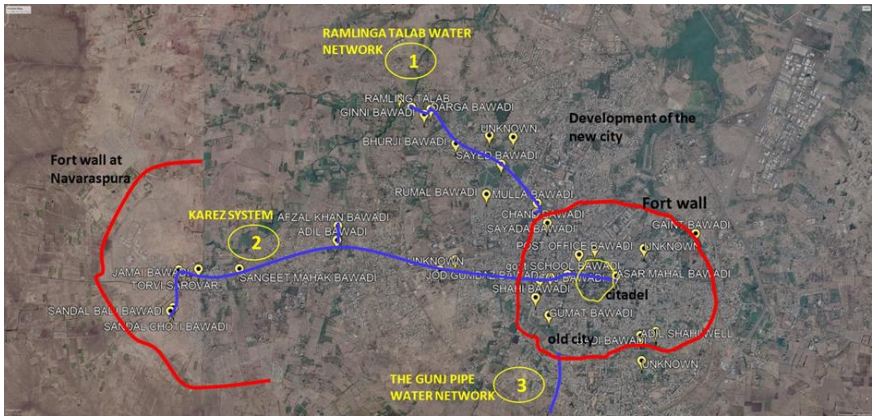

Figure 13: Mapping of water systems in Bijapur

The further documentation led to the karez water network **(Figure 4)** which was done just after the destruction of the Ramlinga water networks. The Torvi water works led to the huge change in the medieval age. These water networks were taken from the catchment areas which were located in the outskirts of the city. These were the prominent water structures that were used around 200 years after the establishment of the Adilshahi dynasty. These systems were documented according to the field observation and the secondary data found. There were some main water structures which don't have any remains in the present condition. Ibrahim sarovar is one of them. There were few traces that gives the existence of the Karez system. The underground tunnels are all depleted and presently run as drainage systems.

The Kharejari mother well Sandal Bawdi **(Figures 12,13)** is situated close to Torwi, 8 km west of Bijapur, along with other headwork's that were built using watershed management techniques, such as stream bunds, built reservoirs, tanks/cisterns, etc. Every stream has been tapped, and bunds have been built to recharge the underground water table, provide direct water to the Karez gallery, or do so via terracotta pipelines.

The analysis **(Figure 14)** is provided for the understanding of the geographic importance in designing the water networks. The geographic study has been done in 16th century before constructing the karez network. The Kharejari tunnel, which begins at sandal Bawdi and ends at Torwi Jami Masjid, is used to transfer more water using terracotta tubes. In order to avoid the upland area in between and transport water at the same contour levels, the pipeline was installed. At the route to Surang Bawdi, where the pipeline ends, there are valves and pressure tanks. Pipelines from Afzal Khan Talab also link to Surang Bawdi.

Water is transported from Ibrahim Sarovar to Sat Khabar Bawdi via a shallow tunnel before being transported to Surang Bawdi using terracotta tubes. Water is transported through a

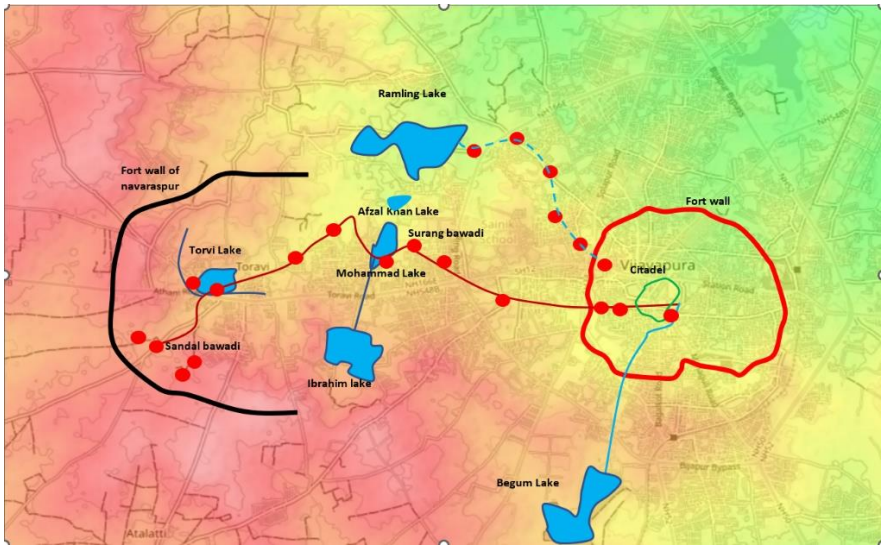

Figure 14: *Analysis of ancient water works of the Bijapur on the topographic map (By Author).*
Source of the topographic map:
https://en-gb.topographic-map.com/

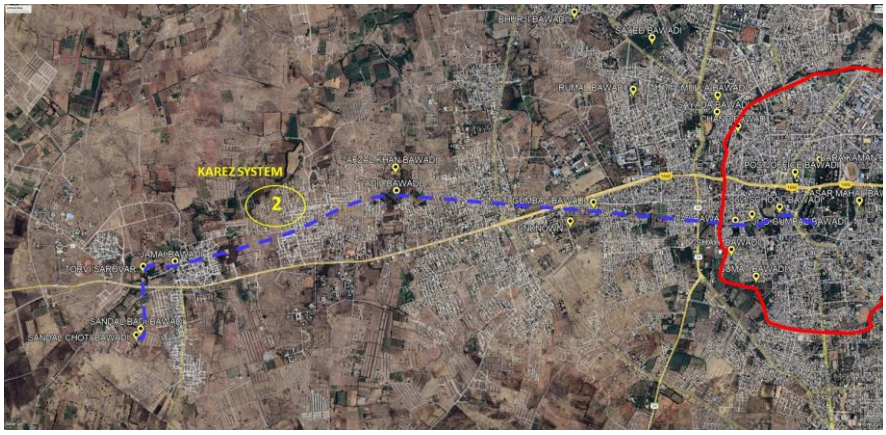

Figure 15: *Existing traces of the karez water network and the bawdis (mapping by author)*

wide, shallow tunnel from this location for roughly two kilometres before entering a deep tunnel carved out of tough basaltic rocks.

The analysis **(Figure 16)** has been done after the field study and documentation which denotes the all 24 mapped bawdis in systematic way that can be considered for the understanding of the different water systems with respective water structures or bawdis. The analysis is done on the basis of the three main categories that are the type of water system and the location where they are located and the ancient usage of the water structures.

sno	water system	bawadis	location	usage
1	Krez system	Taj Bawadi	Bijapur city	public use
		sangeet mahal bawadi	navaraspur	asthetical use
		Jamia bawadi	navaraspur	public use
		sandal Bawadi badi	navaraspur	mother well
		sandal bawadi chotti	navaraspur	public use
		Adil Bawadi	navaraspur	public and tourist use
		Shahi Bawadi	Bijapur city	public use
		Torvi sarovar	navaraspur	religional use
		Ibrahim rouza bawadi	Bijapur city	landscape and asthetics use
2	Muhammad Nada	Ginni Bawadi	Bijapur city	public use
		Bhurji Bawadi	Bijapur city	public use
		Sayed bawadi	Bijapur city	religional use
		Mulla Bawadi	Bijapur city	religional use
		Sayad Bawadi	Bijapur city	religional use
		rumal Bawadi	Bijapur city	public use
		Post office bawadi	citadel	public use and store
3	Net work of Bawadis	Badi bawadi	Bijapur city	storage
		Gumat bawadi	Bijapur city	public use and store
		illal khan Bwadi	Bijapur city	public use and store
		Masa Bawadi	citadel	storage
		chinni mahal Bawadi	citadel	storage
		Bibi Bawadi	Bijapur city	storage
4	Construction Quries conserted to Bawadis	Gol Gumabaz Bawadi	Bijapur city	landscape and asthetics use
		Barakaman Bwadi	Bijapur city	landscape and asthetics use
		Asae mahal bawadi	citadel	landscape and asthetics use
		Job gumbaz Bawadi	Bijapur city	landscape and asthetics use and religious purpose
		Jamia Masajid Bawadi	Bijapur city	landscape and asthetics use and religious purpose
		Gaint bawadi	Bijapur city	landscape and asthetics use

Figure 16: *Bawdis with type of water works (By Author)*

Findings and Recommendations

The field survey led to the clear understanding of the existing water networks and their conditions. This information gives the recommendations that can be used to overcome the main issue of the city. Not just the water shortage but the heritage concern can be raised as the point of saving these tradition unique water systems. There are many such stories behind every structure that are in city which are considered as ruins. The concern to fulfil the requirement for the city can be done through reviving these water systems. As per the observation done during the mapping and the field study the water bodies which are mapped are all contaminated and are in very bad condition. There are very few bawdis and talabs that are used for the domestic purpose. There is no water bawdi that can be used for potable water. The city drains are connected to these traditional water networks, and all of the networks are filled with drainage water. The structures have extremely large water storage capacities from the past that can be used during a drought. But all water networks need to be revived. As per the water board of the city, most of the water scarcity problems are raised by the rural area which are having agricultural land. As most of the bawdis are located in outskirts of the city where the rural area lies, it is easier to reach out for the water bodies to distribute the water from the bawdis.

As per the study, the recommendations were considered to meet the sustainable approach to the city in preserving and overcoming the present water shortage. The shortfall is considered as 12303900 litres (12.3MLD) (21.1% shortfall out of 58590000). In this case, the Chand Bawdi's capacity is taken into account while estimating the shortage. The Chand Bawdi served as a model for the city's other bwadis. This tank, which was built by Ali Adil Shah, has 20 million litre capacity. This particular tank served as a prototype for other tanks in the city at the time. The size and volume of the bawdis vary. The bawdi’s data cannot be measured or surveyed. The bawdis that are connected to the water network therefore have a minimum capacity of 5 million litres, according to secondary data. The second-largest bawdi in the city is called Chand Bawdi. So according to this data found from the historians and the secondary data the shortfall of the city can easily be reached to its point with the storage of water in the summers also. The percentage of the shortfall can be maintained if these tradition water systems survived. The usage of these may result in the excess saving of the water for the irrigation and rural purpose.

According to the findings, options for the reviving of the water systems are classified (shown in table no 1). There are three different categories by which they are observed and the suggestions are given. The recommendations are given as per the requirement of the revival for the city and the present condition of these water bodies. There are several parameters which should be taken under consideration for the revival of the traditional water bodies. These are the main considerations were are further sub divided into other parameters of the study.

- Ecological concern
- Water quality
- Heritage concern

These are the three parameters which have been considered for the potential of reviving the traditional water works of Bijapur. Ecological imbalance is the primary factor influencing the water system. Most categories of ecosystem services fall under the headings of provisioning and regulation.

- Provisioning service
- Regulating service

Provisioning services are products that are directly or indirectly derived from an ecosystem. Water bodies provide pure water. Water with a wide range of applications. On the other hand, benefits acquired from managing natural processes include regulating services. Fresh water can be used as an example of the linkages between supplying and regulating services because it is both a product and a regulatory element. Other than this the quality of water has been taken into consideration. For the domestic and potable use so these parameters also have the influence of the reviving of the water systems. Heritage value are considered for the preservation of the old and valuable monumental structure. But talking about the water systems, this water cause the development in the city through water usage and the water conservation program.

Summary and Conclusion

Since ancient times, a number of sustainable water supply and management techniques have been used. A foundation for thinking about the present and the future is provided by an understanding of past traditions and methods. Using ancient water management methods, to guarantee a year-round supply of drinking water and irrigation in desert and semi-arid areas. Bijapur used the best hydro mechanical way to supply the water throughout the city in 14^{TH} century. This led a historic change in the Deccan region after the system got its value around the country.

Bijapur also stands at its need to fulfil the water requirement by tradition methods that have been used for 200years. These water networks can still server the purpose to its peak. The shortfall that has been the issue for the past years can be overcome by the proper restoration of the water networks. This also brings back the glory of the tradition water system in and around the city. The heritage values are be uplifted through this program.as the present condition of the water systems is very bad at its point.

Poor urban planning practises and the commodification and retailing of land are other factors. Instead of eliminating options for sustainable growth, we need to examine possibilities and chances for a community-based participatory planning and development approach. As a testament to the Deccan region's urbanisation, which made it feasible to establish cities deep inside a semi-arid plateau region, Deccan Karez are the country's living water heritage. While conventional approaches to water management had been concentrated on maintaining enough water supply, they may not reflect sustainable responses to today's climate change concerns with increasing rates of urbanisation and

population increase worldwide. But these systems still stand at its points to serve the requirement. The shortfall in Bijapur city can be reached through the usage of these tradition water systems. More than 25% of the rural areas can be served with this water network. The proper maintenance and the operation are main aims to recreate these systems to work and server there best. ■

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