

ANCIENT IRRIGATION SYSTEMS OF KARNATAKA

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ABSTRACT

Irrigation systems were very well developed in the ancient India and particularly in Karnataka, as is evidenced from various modes of irrigation still in practice from the ancient irrigation systems that were constructed centuries ago and from the innumerable inscriptions available for the historians. Irrigation was practiced traditionally through wells, anicuts, canal systems, tanks, ponds and various sources of water like rivers, streams etc. Irrigation became necessary in those times because the rainfall was scanty and non-uniform in many regions of Karnataka with exception of western ghats where the rainfall was copious. Many rivers rise in western ghats, one among them is Tungabhadra river, and flow towards east, passing through the plains of Karnataka. In many parts of Karnataka, in the erstwhile Vijayanagara empire in the regions of Bellary and Raichur districts and in Cauvery basin, many irrigation systems were constructed by the erstwhile rulers of the region which are even now being used with appropriate modifications to suit the modern needs of agriculture.

This paper is an attempt in putting together the ancient wisdom in establishing irrigation systems, particularly in the Vijayanagara period from 1335 A.D. - 1565 A.D. i.e. for a period of 230 years and the amount of effort and ingenuity of the people involved in those times, the forethought of the rulers and individuals which was responsible primarily in having a flourishing economy, stable food production and overall prosperity of the people of those times. The Vijayanagara empire was spread from the areas of the present Bellary and Raichur districts to the whole of South India with the capital at Hampi near present day Hospet in Bellary district. It had many irrigation systems constructed utilizing the waters of Tungabhadra river by way of a number of anicuts across the river thereby channelizing the flows from the impounded reservoirs along the banks of the river to irrigate the fields and innumerable tanks and ponds constructed in the region, lift works on a small scale on the banks of river and wells tapping the groundwater for irrigation purposes. The best practices in management and maintenance of the water resources so that the irrigation systems were kept in good condition to continue to serve the farmers for generations to come are commendable. Though irrigation is highly advanced in the present times with its own pitfalls such as siltation of reservoirs, land becoming water logged and saline, many aspects of hydraulics, construction and management that were adopted in the ancient times of Vijayanagara period are noteworthy and the techniques adopted and lessons learnt by our predecessors in successful construction and management of irrigation systems will continue to inspire the generations to come in better management of rich water resources of the Karnataka State.

Key words: *Ancient, anicuts, irrigation systems, water resources, Vijayanagara empire, hydraulics, techniques*

Introduction

Agriculture was a major occupation of the people of ancient India for livelihood which continues to be so in the present times. Irrigation had been practiced in ancient India for stable and improved food production. In southern India, irrigation was very well developed during the Vijayanagara empire which has been evidenced from various archeological investigations, inscriptions and as seen from the ancient irrigation systems in operation even now, though with improvements. Irrigation was practiced traditionally through wells, anicuts, canal systems, tanks, ponds and various sources of water like rivers, streams and groundwater. Irrigation became necessary in those times because the rainfall was scanty and non-uniform in many regions of Karnataka with exception of western ghats where the rainfall was copious. Many rivers in Karnataka rise in western ghats. One among them is Tungabhadra river that flows towards east, passing through the plains of Karnataka. In many parts of Karnataka, in the erstwhile Vijayanagara empire in the regions of Bellary and Raichur districts and in Cauvery basin, many irrigation systems were constructed by the erstwhile rulers of the region which are even now being used with appropriate modifications to suit the modern needs of agriculture.

An attempt is made in this paper to put together the ancient wisdom in establishing irrigation systems, particularly in the Vijayanagara period from 1335 A.D. - 1565 A.D. i.e. for a period of 230 years and the amount of effort and ingenuity of the people involved in those times, the forethought of the rulers and individuals which was responsible primarily in having a flourishing economy, stable food production and overall prosperity of the people of those times.

The Vijayanagara empire was spread from the areas of the present Bellary and Raichur districts to the whole of South India with the capital at Hampi near present day Hospet in Bellary district. It had many irrigation systems constructed utilizing the waters of Tungabhadra river by way of a number of anicuts across the river, thereby channelizing the flows from the impounded small reservoirs to the banks of the river to irrigate the fields. Innumerable tanks and ponds were constructed in the region, lift works on a small scale on the banks of river and wells tapping the groundwater were constructed for irrigation purposes. The best practices in management and maintenance of the water resources so that the irrigation systems were kept in good condition to continue to serve the farmers for generations to come are commendable. Though irrigation is highly advanced and is on very large scale in the present times with its own pitfalls such as siltation of reservoirs, land becoming water logged and saline, many aspects of hydraulics, construction and management that were adopted in the ancient times of Vijayanagara period are noteworthy and the techniques adopted and lessons learnt by our predecessors in successful construction and management of irrigation systems will continue to inspire the generations to come in better management of rich water resources of the Karnataka State.

The various type of irrigation systems built during the Vijayanagara empire are mainly classified as;

1. River anicuts
2. Tanks
3. Wells &
4. Lifts

The above irrigation systems developed and practiced widely are presented here in brief along with the knowledge of hydraulics, the foresightedness and the professionalism shown by the builders and rulers of those times in developing such a vast irrigation systems spread over the entire Vijayanagara empire.

River anicuts

Vijayanagara empire with its capital at the modern day Hampe on the right bank of Tungabhadra river near Hospet flourished with prosperity and well being of its people mainly because of the prime importance given to the harnessing of waters of Tungabhadra river for irrigation purposes, construction of innumerable tanks across streams and wells which together contributed to the increase in agricultural productivity which was essential in those times for food security and all-round prosperity of its people. The irrigation structures constructed stand testimony to the ingenuity and skill of the people who relentlessly pursued in building and operating numerous irrigation systems extensively spread over the entire empire. Construction of irrigation structures was regarded as a meritorious and religious service of the mankind next to temple building.

The people of those times in the Vijayanagara area had the knowledge of harnessing the river waters for irrigation and drinking purposes. The new capital founded at Hampe required increased amount of water for its population for drinking purposes and for meeting the food production required by the increasing population. The existing tanks and wells were not sufficient to meet the requirements of the increasing population and this necessitated them to tap the river water for agricultural and other needs. Some of the important anicuts constructed across the river Tungabhadra thereby diverting the flows to the agriculture fields by a system of canals together with their planning aspects and other important features are presented here.

More than 12 anicuts were constructed across Tungabhadra river in Bellary district (Fig 1). These were necessary for the settlements in Vijayanagara and surrounding areas and similar endeavors were made to construct river anicuts in the Vijayanagara empire. Turtha anicut (Fig 2) is one such small dam or anicut as it is called, built in 1399 A.D. across Tungabhadra river close to the present Virupaksha temple in Hampe towards north side. The right bank canal from this anicut is called as Tunrtha canal, which is in service even now, with appropriate modifications carried out to suit the present day needs. The unique feature of the anicut is that it makes use of the existing rocky islands in the river which are connected by the anicut. The right bank canal

taking off from the anicut is called as Turta canal, meaning the current of water flowing through the canal is swift because of the rocky terrain and steep gradient. This canal is still in use for agricultural purposes.

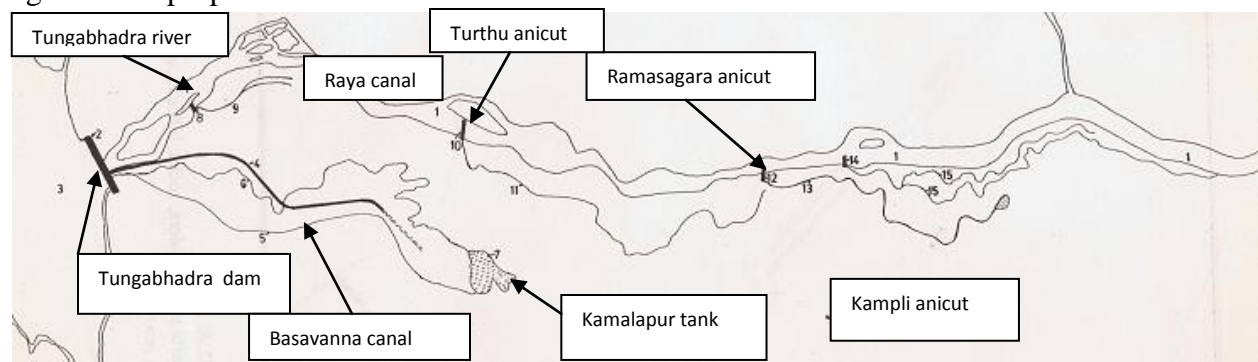


Fig1: layout of anicuts along Tungabhadra river and the canal system

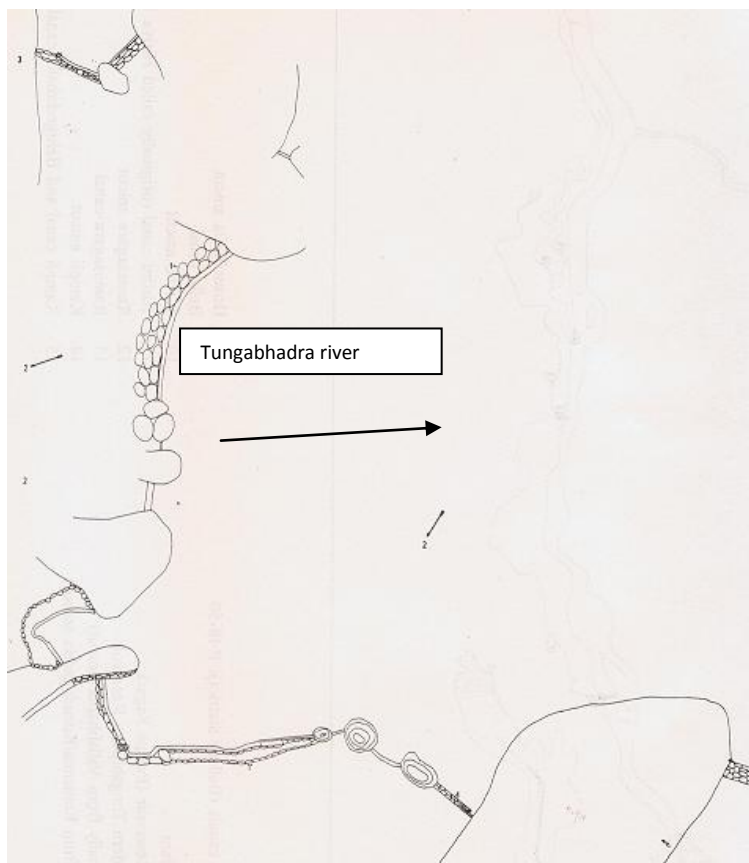


Fig 2: Turtu anicut layout

Another anicut constructed is at a distance of about thirty kilometres west of Hampe, constructed in the year 1521 AD. The anicut has two parts, one on either side of the island in the middle of river. The right bank canal is called as Basavanna canal and the left bank canal is called as Korragal canal. However, these two canals are supplied with water from the present day Tungabhadra reservoir as the ancient anicut got submerged in the Tungabhadra dam constructed in the 1960s. Next along the river is Hosakote anicut. This anicut also makes use of the island in

the middle of the river. The site selection made by the planners is admirable as the naturally existing rocky island in the middle of the river was made use of for economy as well as for safety of the structure which was in two parts. The canals on both sides are now fed by the Tungabhadra dam as the anicut was submerged in the Tungabhadra dam. The right bank canal is called as Raya canal which at its tail end feeds the Kamalapur tank. There were habitations in the Kamalapura village which was part of the capital Vijayanagara and the water fed to Kamalapura tank was used by the habitations. Thus the Vijayanagara city area was served with water for domestic needs from the Tungabhadra river tapped at a higher elevation of the river and conveyed to the capital by gravity to meet both agriculture and domestic needs of the population. This arrangement is an example of intelligent planning involved in those times in mitigating the hardships of the population for agriculture and drinking needs.

Bella anicut near Hosur village is another example of ingenuity and skill of the builders. This anicut was constructed from right bank of the river, but it ended at the middle of the river meeting an island and the left side anicut was not constructed. This was not necessary considering the site conditions, as on the left side, the natural boulders enabled rise of water level and flow of water on the right side into the Bella canal. This shows the ingenuity of the planners in site selection.

Another anicut; the Ramasagara anicut across Tungabhadra river was built making use of the river islands near village Bukkasagara. It is another example of skill in site selection from the point of economy and safety of the structure. The right bank canal from this anicut crosses other canals taking off from other anicuts and a noteworthy feature is the use of stone aqueducts for crossing the canals, which goes to show that the builders were keen not to lose the potential head of water which would result in loss of command area. Their concern to maximise agriculture productivity can be seen from such endeavors.

The anicut downstream of Ramasagara anicut is Kampli anicut, which is similar in construction features wherein the river islands are made use of by connecting them with anicut structures. This anicut is also in use now. The tail ends of the Ramasagara and Kampli anicuts feed a small tank which has a canal called as Bellagodihalli canal. The other anicuts across Tungabhadra river are Siraguppa anicut, Desanuru anicut, Vallabhapur anicut, Hulagi anicut, Sivapur anicut, Sanapur anicut etc which were built making use of rocky river islands advantageously.

The anicuts also served the tanks which were not filled up regularly as they were rain dependent which was erratic. Wherever tanks could be advantageously fed from the river anicuts, the plans were implemented. Among numerous tanks fed by anicut canals some of them are; Kamalapur tank near Hampe fed by Raya canal taking off from Hosakote anicut and Bhimasamudra tank in Chitradurga district fed from anicut across a stream called Jannigehalla.

The idea of construction of anicuts, later spread to other parts of South India and can be seen functioning even now in Cauvery river and its major streams in Karnataka and Tamilnadu, Tungabhadra river and major streams in Andhra Pradesh.

The construction features of river anicuts

The anicuts were constructed in Tungabhadra river making use of the natural rocky islands in the river and selecting sites where width of river was narrow. Rocky river beds were selected enabling natural features to be made use of in the alignment of the anicut. The anicuts were constructed of large sized stones. The stones were laid one above the other with heavier ones at the bottom and no lime mortar was used. This was done intentionally so as to allow the silt to pass through the joints. Also, care was taken to minimize the width of the joints as much as possible. There was no deep foundation for these anicuts as rocky bed was available. The stones were fixed in to the grooves cut in the river bed. Anchoring of the stones to the bed was done by iron or by stones. The height of the anicuts was usually not more than four to eight feet. In some case, only half the anicut was constructed leaving the other half free. This was enough to raise the water level in the river. In some cases, the top level of the weir was kept different for different reaches of the anicut. This ensured passage of flood waters over the weir with different velocities and ensured safety of the structure. Thus, the arrangement of the anicut planned specific to each anicut ensured raising of water level thus allowing water to the canals leading to the fields. Safety of the anicut was given prime importance which they learnt by many failures of anicuts.

Tanks

Building tanks was an activity encouraged and extensively practiced by the Vijayanagara rulers for agricultural benefits as well as to meet drinking water needs of the people and cattle. This was also necessary as harnessing the rivers by river anicuts was limited to areas in the vicinity of the rivers. The river anicuts obviously could not supply water to far flung areas of the empire and many aspects of tank construction like embankment, sluice, waste weir and canals were of exemplary nature depicting both skill and sound knowledge of hydraulics and hydrology. The tanks were constructed in series, wherever geographically feasible with surplus of one tank feeding the lower tank on the same stream. This was a common practice of tank construction, which ensured safety of the tanks and optimum utilization of available rain water for agriculture use.

The tank construction methodology was well mastered by the builders of those days. Every care was taken in construction of embankment with upstream stone revetment for protection, sluice/sluices for irrigating the fields through canals and a waste weir for safety of the tank during floods. Considering the sheer number of tanks constructed during those days in locations widespread throughout the empire, one wonders at the way all the catchments were exploited to

advantage in terms of storage and agriculture productivity. these tanks demonstrate that the builders had a sound knowledge of contours, canal hydraulics and site selection.

Wells

The river anicuts and tanks were primary sources of water for irrigation and other uses. These alone were not sufficient to meet the irrigation needs of the area. Therefore, the open wells and spring wells were constructed, mostly by individuals, in rest of the areas not covered by anicut canals and tanks. The groundwater was used for irrigation and other needs by lifting the water by mechanical means.

The conveyance system adopted by the builders needs attention. From the wells, elaborate conveyance canals with stone aqueducts resting on vertical stone columns were used for conveying the water from the wells. The builders had the knowledge of gravity and gradient for the flow to occur in a channel. Burnt earth pipes were used to convey water through them and sometimes more than one row was used for assured supply of water, safety and durability of pipes. Also, regulation of flow was done with the use of shutter type sluices. All these skills demonstrate the high level of expertise that was available in those times. The natural springs that were available were made use of for irrigation to the fields directly or for feeding of tanks. Prime importance was given for maintenance of these structures by regular desilting and maintenance by the beneficiaries by contributions proportionate to their area benefitted.

Lifts

Where the water level was lower than the lands to be irrigated like in wells, rivers and streams, lifting of water was resorted to by the farmers. The lifting was carried out mainly by engaging labour or bullocks. Instances of employing water wheels have been mentioned in the inscriptions. These kinds of lifts were widely in use in the Vijayanagara empire and they served small area for irrigation.

Water management

Importance was also given during the Vijayanagara era for maintenance of the irrigation works. They realised that if sufficient attention was not given to maintenance aspects, the systems would deteriorate when subjected to vagaries of nature over time. The maintenance works included removal of silt and vegetation from canals and tanks; preventing leakages, repairs of breaches, repairs of sluices and waster weir in case of tanks, watch and ward of structures etc. There were many practices for proper upkeep of the irrigation systems. Some of the measures were providing land grant, investing money and to use the interest earned on maintenance, authorise local persons to collect water taxes and retain a part of the amount for maintenance, making use of the money collected from fisherman towards fishing rights in tanks, maintaining from the taxes collected etc. To carry out maintenance, local committees were formed who would oversee the maintenance of the irrigation works. Because of these measures in practice, most of the

irrigation works were kept in good condition and served their purpose during the Vijayanagara era.

Conclusion

The ancient wisdom in establishing irrigation systems in India, particularly in the Vijayanagara period from 1335 A.D. - 1565 A.D. i.e. for a period of 230 years is well chronicled by the researchers through extensive study of archeological excavations, inscriptions and documents available pertaining to the period and it reveals that the rulers and individuals who were involved in developing and utilizing the water resources from rivers, streams, tanks and groundwater had a thorough knowledge of the hydraulics of storage and water conductor systems. The efforts made by the rulers, planners and builders in taming nature, particularly the rivers, the ingenuity demonstrated in building a vast network of irrigation systems in the entire Vijayanagara empire to meet their agriculture and drinking water needs is noteworthy and commendable. The fact that many such systems are still in use speaks volumes about the care the rulers had taken in proper and continuous maintenance of the systems, their farsightedness to make them useful for centuries. An extensive network of river anicuts, tanks, wells and individual lifts built in the entire Vijayanagara empire and the lessons learnt by them will continue to inspire the generations to come.

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