



## THE GRAND ANICUT ACROSS CAUVERY, TIRUCHIRAPALLI: PAST AND PRESENT MODERNIZATION – REVISITED

A.RANJITH

Associate Professor of History  
Pachaiyappa's College , Chennai.

### Abstract:

*How wise our ancestors were to identify  
Those all pervading elements five,  
Soil, Water, Fire, Air and Space  
Towards which now the rich nations race.  
Mother East, womb of all life, predominates  
Followed by Water sustain all that germinates.  
All through my care I handles Water  
Only to find I could not master.  
On the lap of mother you were air borne  
To rush Sanjeevi to save one renown,  
Now man has learnt to fly with ease  
Can he stand the Wind Power let loose!  
So it is with Water too,  
Controlled, harnessed showers benefits true;  
Water Shakti is too tough to harness  
So, we bow down to Thee for guidance.  
Desperate though confident Karikala was  
When Cauvery suddenly changed its course.  
Paying obeisance to Thee we are told  
He plunged into action too bold.  
You Blessed him build this Anicut Grand  
Across mighty Cauvery gushing water and sand,  
And stood here to protect it all the time  
Infusing confidence in us to maintain it for a while.*

### KEYWORDS:

Cauvery, Coleroon, Ullar, Anicut, Srirangam, Tiruchirappalli, Vennar, Reservoir

### INTRODUCTION:

The River Cauvery bifurcates into two branches 23 miles below the kattalai bed-regulator, and about 11 miles to the west of Tiruchirappalli. These two branches, the Northern of which is called the Coleroon enclosed the Srirangam Island, which is about 18 miles long and 4 miles broad as its widest point. Srirangam is in the middle of this island. The river is about 7 furlong wide at the Upper Anicut, and its width there is greater than anywhere else.

Though the constriction of the Grand Anicut prevented the wastage of the available water from the Coleroon, the bed of the Cauvery used to be gradually thinned from the point of bifurcation and that the bed of the Coleroon was being scoured, with the result that the supply of water to the Tanjore delta gradually diminished. The extent under irrigation had gradually diminished.<sup>1</sup>

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### Grand Anicut Across Cauvery

The Grand Anicut is on the west of the Cauvery at the lower tip of the Srirangam Island. The Cauvery and the Coleroon nearly unite at this point. A channel called, Ullar, running for about three furlongs from the Cauvery into the Coleroon, have united than much of the useful supplies in the cauvery were flowing down the Ullar into the Coleroon in a lower bed and getting wasted into the sea.<sup>2</sup>

The Chola Kings constructed the Grand Anicut across the Ullar to keep the two rivers part, long before any irrigation works of modern type were thought of or built in other parts of the Country. It is believed to be about 1600 years old. It is 1080ft in length 40-60ft in breadth, stretching across the outlet the Ullar in a serpentine form. A portion of it was built in ogee, form, while the rest of constructed in a series of stops, the fat of the soiled dam being protected by a rough stone apron. Only the apron wells of the old structure and old Hanuman Temple on the apron are now visible. Portions of the old work that still remain lie buried in the sands of the Cauvery underneath the visible structures. On examination, it was found to consist of a core of roughly-dressed granite, set in med, covered with outer facing of roughly-dressed blocks set lime water. It withstood the floods by due care inertia of its materials.<sup>3</sup>

Very little of the old work remains. It has been remodeled a number of times during the last 100 years and provided with sand securing and surplus sluice which dispose of the surplus water of the Cauvery and help to keep the bed of the river free from sand and modern contrivances, such as steel shutters to enable effective and timely regulator. It was raised by British Engineer in 1804 and provided with sand scouring sluice in 1830. In 1839, the existing work was used as the foundation of bridge piers and a bridge was built over them. In 1880, ten small scouring sluice, 3 ft. wide and 4ft high, were constructed. As the crest of the dam was a little over 9ft high, dam stones were constructed on the top of the dam project in 2 ½ ft. above the crest. As the effective length of the dam, with the construction of bridge piers and the dam stones, was reduces to 735ft. the stone were removed and automatic falling shutters 2ft 10 n. high, were fitted on the crest in 1886. The falling shutters were removed and replaced by 30 lifting shutters of 32 open Sft. high in 1899. Three arches were washed away in the scouring sluice portion during the 1909 floods. They were restored omitting the scouring sluices.<sup>4</sup>

Immediately below the Grand Anicut, the main river divides itself into two principal branches, the Vennar and the Cauvery, forming the head of the delta proper. The most important controlling works, the Cauvery -Vennar Regulator, are constructed there. They were originally built four miles above the present head in 1851. The regulators were reconstructed almost at right angles to the Grand Anicut in 1886 at a cost of about Rs.7 lakhs for distributing the available flow between the two rivers and for excluding the flood waters from both. The first few miles of the course of the old Vennar, which was to the right of the flood bank on the right of the Cauvery, was blocked up, and a new cut was made from the river to the new head. The regulators are fitted with ordinary screw gearing shutters. Some modifications have since been made in the shutter arrangements. The regulators were primarily constructed for distributing the water into the two rivers.<sup>5</sup>

The new head of the Grand Anicut Canal of the Cauvery Mettur Project is on the right bank of the Cauvery just above the Vennar regulator and there is about six furlongs of continues masonry works. The old Vennar drainage course, which formerly emptied into the Vennar below the site of the canal head site, was diverted for a considerable length and it now discharge into the Cauvery on the up-stream side of the new canal by an under-tunnel below the G.A. canal and the Vennar. Water is headed up on the upstream side of the regulator. A height of 5ft. of water above the sill is maintained, for discharge into the Cauvery about 7ft. for a discharge into the Vennar and about 10ft into the G .A. Canal as its head reach, is banded up heavily.<sup>6</sup> The lands to the right of the G.A. Canal are now cultivated under the Uyyakondur Channel which irrigates a part of the Cauvery above and below the Cauvery Regulator.

About a mile above the Grand Anicut, there used to be a bridge across the Cauvery near the Old Vennar head. It used to obstruct the flow in the river. It was demolished after it was damaged during the floods of 1924. A road dam of over 406ft. in length and 22ft. in breadth, has been put up on the left flood bank of the Cauvery to allow its excess water to spill into the Coleroon during the floods.<sup>7</sup>

The Granad Anicut is a marvelous piece of hydraulic structure built across a mighty river in its sandy bed when the science had not developed enough to build safe structures on permeable foundations and serving to this date excellently well with a few modifications made in the nature of improvements to the structure. Judged from the recorded data, floods to an extent of about 5260 cusees (1,86,000 cusees) have been discharged through this anicut with minimum or no damage. It is possible that much higher floods could have flown over in the past when there were no other structures in this river.<sup>8</sup>

No recorded information is available as to how they founded this structure nor on the manner of its construction. It is believed that large cyclopean stones would have been brought and dumped across the

stream and continuously replenished as these boulders sank in the sandy bed, until the structure rose above to raise the water-level. It has not been possible to explore and detail the foundations accurately. Such a course has not been advised either, considering the importance of this structure to the delta irrigation. The anicut consists of a core of rough stones in clay covered with a facing of rough stone in mortar. A portion of the crest was built with a curved top and the rest with a series of steps, the foot of the solid dam being protected by a rough stone apron. The anicut is 329 m (1080 ft) long, 12.20 to 18.30m (40 to 60 ft) in width and 4.57 to 5.49 m (15 to 18 ft) high. The main function of this anicut was to retain the supply in Cauvery and its branches and pass on the surplus into Coleroon through the Ullar River.<sup>9</sup>

The whole work should have been done employing native labour with a religious zeal utilizing whatever experience they had at that time in tackling river problems. It is on record that thousands of slave labour brought from Ceylon after the Cholas conquest of Ceylon were employed on this work. The sheer necessity to save the crops in the delta and provide waters for irrigation against all odds should have driven the ruler to embark on such a stupendous task with confidence and hope and they should have persisted until they succeeded. The plan of the anicut was seemed to keep the alignment in the flowing stream, finally ending up with a structure with a serpentine course to bridge between the two banks. The foundation base even on date is so stable and massive that successive generation have only thought of improvements and modifications to the superstructure without meddling with the foundation base, lest they may disturb the already settled mass.<sup>10</sup>

### IMPROVEMENT WORKS

Several modifications and improvements were made to the Grand Anicut at different stages over the past two centuries all the time keeping the base structure intact and adopting the then available technology to solve the problems that arose. In 1839, Sir Arthur Cotton built the under sluices 1.22 m x 0.91m (4ft x 3ft) in the body wall with their sills 3.05 m (10 ft) below the crest. The foundations of the under sluices consisted of about 2ft depth of brick works below cut stone floor of the vents and under this brick work about 2ft of dry rubble masonry on the sand. They were thus practically founded on the old dry rubble anicut which was itself founded on sand. Simultaneously, in 1839, a bridge consisting of 30 spans of 9.14 m (32ft) each was built over the anicut for ease in operation during floods. By the construction of the piers and due to the dam stones the effective length of the anicut got reduced to 224.0m (735ft). In 1886 the dam stones were removed, piers and abutments raised by 5 ft and automatic falling shutters 0.86 m (2ft 10 in) high were fitted on the crest to increase the water way for floods. Four shutters were fitted in each span of the bridge. 27 1/2 spans held these falling shutters while the rest 21/2 spans were occupied by the ten scour vents. Thirteen years later in 1899, the falling shutters were removed and replaced by wit shutters of 9.75 m X 1.32 m (32 ft x 5 ft) size designed by Col. Smarts and fabricated in the Public Works Workshops, Madras.<sup>11</sup>

There have been slight cracks in the right abutment wing for several years. In April 1909, the leaks observed increased considerably in the right wing of the anicut in the scour vents portion and in the summer floods on 23 August 1909, the apron blew up suddenly bringing down the right abutment and the arches in the three adjacent vents. They were rebuilt omitting the scour vents, before the irrigation season of the following year. The new work was founded on solid clay bed met with about 6.1m (20ft) below the anicut crest level. The foundations consist of concrete for a depth of 6 ft and of ground moulded brick in surkhi mortar for the next four feet. As an additional precaution a puddle clay apron of 0.91 m (3ft) thickness was provided upstream for such widths as to secure a hydraulic gradient of 1 in 10. The cost of the restoration was Rs.1,23,000.

In 1922 new scouring vents, 5 in number, of 6.10 m (20 ft) span fitted with radial gates were created and they were aligned to be on the downstream end of the anicut. To protect the Grand Anicut foundation from scour a bed regulator was constructed for a length of 305 m (1000 ft) from the nose between the anicut and the scouring sluices on the upstream side with the object of deflecting the low water course away from the anicut towards the Vennar Regulator and then to the scouring sluices.<sup>12</sup>

When a new diversion structure is proposed, the anicut structure is first designed and constructed across the river course and along with it, the head regulator for the irrigation channels taking off from the river and the necessary scour vents or alternative silt exclusion devices. The Grand Anicut structure is unique in this respect. This however was built on the left bank of the River Cauvery to maintain higher flow levels in Cauvery and spill the surplus in to Coleroon. The Cauvery continued to flow into the delta with no regulator to control the discharges. Vennar, the river to the right of Cauvery, had its open off-take about 5 km upstream of the Grand Anicut location.<sup>13</sup>

Owing to the existence of the layer of the sand referred to above, it has been considered that the regulator would not stand a difference of water level of more than 18.2m (6 ft) between front and rear. Later

the permissible difference has been increased to 2.743 m (9 ft) as the work has been found in actual practice to have stood the difference safely. This restriction was carefully observed during flood regulation. But to this extent the original object of the regulators which was carefully observed during flood regulation. But to this extent the original object of the regulators which was to exclude the flood waters from entering the delta in all but extraordinary floods was not realized.

The first storage reservoir across Cauvery in Tamil Nadu was built at Mettur between the years 1928-1934 with a capacity of 2645 Mm<sup>3</sup> (93,470 Mcft). This remains to be the largest storage in the state even to day. Besides stabilising the existing irrigation in the basin below the reservoir an extent of 1,22,00 ha (3,01,000 acres) of new irrigation was planned adjacent to the Cauvery delta which was to be served by a new canal called the 'Grand Anicut Canal'. The head sluice for the Grand Anicut Canal was also hence located next to the Cauvery Vennar Regulators. This has six vents (9.15 m x 1.68 m (30 ft x 5 Y2 ft) each and the vents are fitted with radial shutters. The Grand Anicut Complex thus contains the old anicut severally modified, the Head Regulators for the Rivers Cauvery and Vennar and for the newly excavated Grand Anicut Canal.<sup>14</sup>

While the Upper Anicut, the Cauvery dam and the Grand Anicut ensured adequate flows being carried by Cauvery and Vennar for the delta irrigation there was no means of avoiding flood waters rushing into the delta streams in unrestricted large quantities thus creating breaches in the rivers and channels and causing heavy flood damages. For a long time this helpless state of affairs continued. The first proposal for the regulation of flood entering into the delta unchecked were made by Captain Mead in 1870. He suggested regulators being built on Cauvery and also Vennar at the head of the delta close to the Grand Anicut. Major Montgomerie who was asked to examine the proposals gave his report in 1881. He made a recommendation which was relevant in the situations then existed and said that the outlet to be built across Cauvery and Vennar should have adequate ventway to pass all the local floods. He rightly felt that each section of the delta should pass its share of the floods minimizing concentration of damages in particular routes. At times of normal flows the regulators would control the distribution of flows between Cauvery and Vennar.<sup>15</sup>

Major Montgomerie's recommendations were revised by Colonel Mullins and a decision was taken to build the head regulators for both Cauvery and Vennar about 61 m (200 ft) downstream of the Grand Anicut and at right angles to the same. The Vennar head thus got shifted downstream with the course above being subsequently abandoned. The plans and estimates were sanctioned for Rs.6.88 lakhs in the proceedings of the Government of Madras.<sup>16</sup>

The Cauvery Regulator has 14 spans of 11.28 m (37 ft) each and the Vennar Regulator 11 spans of the same length. Each span is divided in front into three opening of 3.05m (10 ft) each with intermediate piers 1.05m (3 ft 6 in) each. The floor consisted of a concrete apron 1.52 m (5 ft) thick protected in front and rear by retaining walls taken down into the clayey sub-soil below. The foundation concrete was made up of one part surkhi mortar, two of clean river gravel and three of well burnt broken brick. The foundations of the front retaining wall were taken down 3.05 m (10 ft) below sill and those of the rear 3.35 m (11 ft). The concrete floor however rests on sand and there is a thickness of 0.3 to 1.2 m (1 to 4 ft) of sand below the bottom of the floor of the Cauvery Regulator while the depth below the floor of the Vennar Regulator was about 0.15 m (6 in).

There are rough stone aprons in front and rear of each regulator of 15 and 30 ft with width respectively - the aprons resting on sand. The shutters of the Cauvery Regulator are 9 ft high and the ventway above the top of the shutters has been left open. In the case of the Vennar Regulator the shutters are 3.45 m (11 ft 4 in) high, but the vent over the top of the shutters has been blocked with masonry resting in concrete beam.<sup>17</sup>

#### SAFETY OF THE ANICUT

The Grand Anicut would have weathered many a high flood in the times of unrecorded history. Known floods of high magnitude have occurred in November 1858, July 1896, November 1906, July 1911 and November 1920. In 1924, which is known as the year in which River Cauvery carried the largest flood in recorded history, the Grand Anicut Complex is said to have passed a flood of 4.50 lakh cusecs. Later in 1961 the flood that was passed was recorded as 3.0 lakhs cusecs. Cauvery normally carries high floods during the south-east monsoon but there have been periods when large floods have hit the delta right in the north-east monsoon, when along with the delta rains causing local floods, the flows from the uplands and also from the higher regions have also telescoped and caused heavy discharges.<sup>18</sup>

The periodical improvements to the Grand Anicut and the several outlets that have been constructed on the Cauvery arm above Grand Anicut have served to safeguard the structure limiting the flood discharges it had to lake. Breaches that occurred in August 1909 have however been due to leakages that have developed earlier which undermined the foundation of the structure. The failure was not so much



due to the incapacity of the anicut to discharge the flood volumes.<sup>19</sup>

Though at times of heavy floods reaching the anicut, part of the floods were discharged through the Cauvery and Vennar arms through the regulators, care was always taken to see that the difference between the water levels upstream and downstream of these regulators never exceeded 9 ft which, to a certain extent, restricted their usages for flood discharges. At such critical situations momentarily safety of the entire complex used to be feared but fortunately nothing untoward has so far happened.<sup>20</sup>

The latest large flood that has been passed through before the construction of Mettur Reservoir in 1924 was estimated to be of the order of 12,900 cumecs (4,56,000 cusecs). Even though large part of this has been carried by Coleroon from Upper Anicut itself, still the accumulation of flood above Grand Anicut was quite heavy. The need for an additional bye-wash above the anicut was immediately felt. On the left bank of Cauvery at about 2 km upstream of the Grand Anicut a bye wash of length 1219 m (4000 ft) was then created which would surplus 2792 cumecs (96,600 cusecs) into Coleroon reducing the load on the Grand Anicut to that extent. Floods of high magnitude received after 1924, in the years 1961 and 1977 have caused breaches of Cauvery bank. But the structure has been safe with very little or no disturbance even to its apron.<sup>21</sup>

### MODERNISATION

The safety stipulation that the difference in water level between front and rear of the Cauvery Vennar Regulators should not exceed 2.743m (9 ft) virtually resulted in the flooding of the delta when it is already suffering from heavy drainage congestion due to the monsoon rains. In the modernization programme for the delta, flood relief is also an important component and to this purpose all the structures in the Grand Anicut Complex have been examined for structural stability and safety and strengthened to the needs such that the flood flows into the delta through the Cauvery, Vennar and Grand Anicut Cannal Head Regulators could be completely cut off by full closure of all the Regulators irrespective of the differential head developing.<sup>22</sup>

These strengthening works were taken up in 1972 at a cost of Rs.121.00 lakhs. The maximum flood that may be realized at the Grand Anicut was estimated at 1.80 lakhs and this would raise the front water level to +61.567 m (202.00 ft). To withstand this water pressure, the aprons in front and rear were extended and provided with cement concrete cut off at the ends. The safety of the structures against creep and uplift was using Khola's theory. Energy dissipating devices checked like the baffle walls and stilling basins were created behind the Head Regulators wherever found necessary.

Another major improvement since made is to energise the shutter operation in all the Head Regulator in the complex and the Grand Anicut by providing electric motors. This has eased and quickened the shutter operation remarkably which incidentally ensure uniform opening of the shutters during all stages of water regulation. The old structure thus continuously updated through its existence of eighteen centuries is now conforming to latest hydraulic design and equipped with the modern operational facility.<sup>23</sup>

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