Journal of Advances and Scholarly Researches in Allied Education
Vol. 18, Issue No. 5, August-2021, ISSN 2230-7540

A Review of Kukadi Canal Irrigation Project

Krishna Rao Ther[1]*, Dr. A. Rajshekhar[2]

[1] PhD Student, Kalinga University, Raipur (CG).

[2] PhD Guide, Dept. of Geography, Kalinga University, Raipur (CG)

Abstract - One major hydraulic project that exemplifies the importance of water management in agricultural growth is the Kukadi Canal Irrigation Project. Located in an area rich in agricultural history, this initiative seeks to improve water distribution, increase crop yields, and strengthen local economies. Our investigation into this evaluation takes us through the beginnings of the project, its complex engineering, its effects on nearby communities, & its overall value to sustainable agriculture. By delving into the Kukadi Canal Irrigation Project, one may learn a great deal about the interdependent nature of water resource management and agricultural success, as well as about the complex web of engineering, ecology, and socioeconomic factors at play. The Kukadi Canal Irrigation Project is reviewed in this paper..

Keywords - Kukadi Canal Irrigation Project, Sustainable, Agriculture, Hydraulic, Crop.

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INTRODUCTION

The districts of Pune, Ahmednagar, and Solapur in western Maharashtra are afflicted by water shortage, and the rivers Ghod and Kukadi are the primary sources of irrigation water accessible to these regions. The confluence of Mina and Ghod, a river in the Ambegaon district of Pune, India, occurs close to Nirgudsar. Upstream of Yedgaon in the Tal. Junner district of Pune, the rivers Kukadi and Pushpawati converge. The Western Ghats, namely the Junner and Ambegaon Tahsils in the Pune district, are the precipitation catchment areas for all five of these rivers, which get an annual rainfall of 3810–5080 mm.[1]

In about 32–40 km, the precipitation decreases to around 1000 millimetres. After there, it drops to 635 mm in the 50 km that follow. Crop failures, poor yields, and the seeming poverty of the agriculturists are typical in the traditional rainfall shadow region, which extends eastward beyond the Pune Nasik road and steadily decreases rainfall from 635 mm to 460 mm.

This project was designated to use 1416M.Cum in the original Bhima Project. 1206M.Cum. (42.606TMC.) is the total 75% reliable yield up to the planned dam locations. The government-appointed research team has suggested allocating 1101.50M.Cum. (38.90TMC.) to this project after the announcement of the Krishna Water Dispute Tribunal judgement, and the project is now being designed appropriately. For a long period, the state was concerned about the challenges of delivering irrigation benefits to the drought-stricken areas of the Ahmednagar, Solapur, and Pune districts. Year after year, shortage affects Parner, Karjat, Shrigonda, and Shirur Tahsils of the Pune District, Karmala Tahsils of the Solapur District, and Ahmednagar District, respectively. If irrigation facilities were made accessible, the lush valleylands could support a variety of crops. Irrigation of many wells in the region has shown this to be true. The rainfall, which ranges from 460 mm to 635 mm and is irregularly distributed, is not enough to support crops.

This occurs for about every other year. Population decline in these tahsils relative to neighbouring Kopargaon and Shrirampur reveals the tract's poverty and the land's unsustainable nature. If the currently planned and underway project does not come to fruition, the whole land will stay undeveloped.

From 1903 to 1910, Mr. Beak, the superintending engineer, focused on researching ways to use the water resources of the three rivers—the Ghod, the Mina, and the Kukadi to irrigate fields in their respective valleys and to help alleviate water scarcity in the areas of the state affected by drought, specifically in the Shrigonda and Karjat tahsils of the Ahmednagar District and the Karmala tahsil of the Solapur District. Several plans to use the water from the aforementioned rivers have been discussed since then.

The state's 1966 project report provides a thorough explanation of the several options considered by Mr. Beak. Building has already begun on the final proposal, which is detailed below. In accordance with letter number PIM/3465/12050-I.P. from the irrigation department dated 30/04/1965, the Kukadi project report was delivered to C.W. &P.C. Under IP No. PIM/3465/12231-IP (4), dated 08/11/1966, via

Appendix no. I (1), the Government of Maharashtra officially authorised this.

Upstream of the Pimpalwandi settlement and the Pune-Nasik road is where you'll find the Yedgaon site. Due to this, the road and the township will be unaffected. However, in comparison to Kandali Village, the foundation conditions here are less than ideal. On the river's right side, you may see exposed rock. It is accessible in the riverbed at a decent depth, nevertheless, and is deeply situated on the left side. Despite factoring in the expense of an extra 7 kilometres of canal in favour of Kandali, preliminary cost calculations show that, even taking submergence into account, the costs at Kandali are still greater than those at Yedgaon, the more expensive foundation.

The location is 2.5 km downstream of the Yedgaon settlement, at 190-10'-30" North and 740-1'-30" East. A cart track departs off the Pune-Nasik road near mile 49/6 and leads to the site, which is about 5 km from the National Highway.18

Following careful consideration of all available options, the following design was selected for construction of the Yedgaon Dam in June 1977, marking its last stage of completion. The dam had already reached its maximum storage capacity. The main control is located on the left side, and the Kukadi Left Bank Canal begins at the Yedgaon weir. Nevertheless, the outflow structure is situated on the right side of the river at Ch. 2804m due to the thick overburden and deeply seated rock on the left bank. Since it was determined to be both cost-effective and practical, the earth dam has been divided at this point such that the left side of the outflow has a non-overflow portion.

During the 1977 monsoon, when the lake was filled for the first time, a region downstream of the dam became waterlogged. For this reason, a plethora of relief walls were built in 1979 to address the issue. The formerly flooded land has been extensively restored.

Both the Ar and the Kukadi rivers flow eastward from the separating ranges formed by the two mountain ranges that are offshoots of the Western Ghats; the Kukadi and the Meena rivers flow westward from the same spot. Some of these branches, between the villages of Thakarwadi and Padli, have spurs that come near to the river Kukadi's banks. Therefore, in this reach, we looked at a few other potential dam locations, which are detailed in the previous project report. The project study from 1966, which was authorised by the administration, suggested a location close to the settlement Manikdoh and called for a composite arch with masonry sections in the main gorge and earth embankments on both sides.[2]

The precise coordinates of the dam location are 730° 49′ east longitude and 190° 14′ north latitude. Located around 3 km from Junner, the location may be reached via the Junner-Ghatghar road. A gross storage capacity of 308Mcum (10.88 TMC) is planned for the Kukadi River dam near Manikdoh (also known as Thakarwadi). The initial plan is to release the water into the river via six 1.2M river sluices, with an additional 1.8 M available in the spillway section. The plan was to divert this water into the main Kukadi Left Bank Canal by collecting it at the Yedgaon dam, which was already in place downstream.

The residents of Junner Tahsil used this Manikdoh reservoir for irrigation purposes while the project was underway. In light of their needs, a 23.5-kilometer-long Left Bank Canal with a head capacity of 1.52 cumecs is suggested. The project has resulted in the relocation of two of the six river sluices originally planned for the gorge, which are now located near the exit at Ch. 270 mtr, together with the one for the Manikdoh Left Bank Canal. The four piers in the spillway segment now include four river sluices, and at Ch. 270M, at the beginning of the Manikdoh Left Bank Canal, there are three exits of the same size. As of June 1984, the main dam's construction was about finished.

Approximately sixteen kilometres east of Manchar on the Pune–Nasik road lies the hamlet of Shingve, where the Meena River, a left-bank tributary of the Ghod, meets it. At an elevation of about 1067 metres, the river originates on the eastern slopes of the Western Ghat. The river begins its journey above mean sea level (MSL), descending steeply before winding its way through a valley bounded on each side by two parallel shoots of the Sahyadris. Near Nirgudsar village, the river valley widens; nevertheless, the valley grows so much wider downstream of Wadaj village that it becomes economically and practically impossible to choose a storage site. A large amount of arable and valuable land will be submerged at any location downstream of Wadaj settlement.

In the Junner Tahsil of the Pune district, close to the hamlet of Wadaj, is the Wadaj dam on the River Meena. Latitude 190° 8′ North and longitude 730° 54′ East are the geodetic coordinates of the dam site. The amended project report for the Kukadi Project states that the original plan was to release water from Wadaj dam into the Meena River, collect it further downstream at the Basti pick-up weir, and then link it to the Dimbhe Left Bank Canal. It was determined in 1977 that a straight canal from Wadaj storage, rather than the Ex-Basti pick-up weir, would be the most cost-effective option after examining the aforementioned plan and relevant alternatives. In addition, the peasants' desire to irrigate higher-level farms with a straight canal from Wadaj was comparable. As of June 1983, the main dam's construction was almost finished. Tis storage has a total capacity of 35.94Mcum, which is equivalent to 1.27 TMC.

One of the main northern tributaries of the Bhima River is the Ghod River. At an elevation of about 1067.07 m. above M.S.L., it emerges on the eastern

side of the Sahyadri range. As the valley begins to widen, it flows downstream past Ambegaon town. The valley is typically narrow upstream of Ambegaon, and there is seldom a decent basin for storage.

The submersion of Ghodegaon, a Tahsil head quarter, is a potential outcome of any storage below the Ghodegaon weir that would allow water to be diverted into the Kukadi Left Bank Canal. Thus, between the cities of Ambegaon and Ghodegaon, on the river's reach, is an appropriate location for a dam.[3]

Approximately 1.5 km upstream of the supedhar is where the dam will be built. An abrupt protrusion almost meets the river's left bank. On the right bank, north of the Dimbhe (Bk.) settlement, there is a large hilltop that connects the tip of this spur; excellent rock can be seen in the river bed and along the left bank. Construction of the dam has already begun along this path, since the government has approved it after considering the findings of the trial bores.

This dam is located at 730-44'-30" East Longitude and 190-5'-45" North Latitude. From Manchar town on the Pune-Nasik route (National Highway No. 50), which is located on the right side of the river, it is readily accessible via asphalt road. The town of Manchar is located around 25 kilometres from the dam site. On the left bank, there are no reliable communication channels since the area is mostly steep.

The reservoirs on the left and right sides of the Dimbhe River are the starting point for the Dimbhe Left Bank Canal. Dimbhe Left Bank Canal is the starting point for the canal. On Kilometre 3. With all three gates open, the outlets may discharge up to 39 cumecs of water. With a total capacity of 382.06 million cubic metres, or 13.50 trillion cubic feet, the dam is impressive. In 1995, the dam's construction was finally finished.

The primary goal of the Ar River storage at Pimpalgaonjoge was to provide water to the Yedgaon dam, and a secondary objective was to strengthen irrigation on the existing Bandhara at netwad on the Pushpawati River as much as possible. The need to expand existing canals and construct new ones in order to irrigate more land has been on the rise since 1976.

In order to put an extra 36,300 hectares under irrigation, a letter was filed to the government based on the water need for eight monthly cropping patterns, calculated using the pan evaporation technique. Pimpalgaon joge was advised to use a 55-kilometer left-bank canal to irrigate about 11,500 hectares inside this region.[4]

An unmetalled road going to Junner, a significant Tahsil town, is around 19 kilometres distant from the location site, which is situated approximately 1.6 km upstream of the hamlet Pimpalgaonjoge. The Ane-Malsej state highway also provides access; the dam line is about 25 km. from Alephata, heading towards Bombay, and is quite close to this route. Based on geodetic coordinates, the dam is situated at 190°18′-45″ North latitude and 730°52′-30″ East longitude. A catchment area of 97 square miles and an Ingles discharge of 1,145 cumecs (40.470 cusecs) are provided by the Earthen Dam of Pimpalgaon joge. Dam storage capacity is 217.915 M.cum (7.695 TMC). The year 2000 marked the completion of the dam's construction.

CANALS OF KUKADI PROJECT

In 1971 and 1972, amid a time of severe shortage, work began on the canal. Since then, the work has been ongoing and is being finished in phases. Water has been realised via canals and the work up to 114 km. is complete. It is projected that the remaining tasks associated with the Kukadi Left Bank Canal will be finished by the year 2000. The appropriate phasing of the canal system's development has been planned and is detailed below.[5]

As 1975–1976 came to a close, the Yedgaon weir was finished. The first 25 km of the Kukadi Left Bank Canal were irrigated in 1976 during the Rabi season using the potential that was produced during the monsoon. Thus, about 2,106 hectares of land may be irrigated within the first 25 km of the Kukadi Left Bank Canal. The entire water capacity of the Yedgaon weir was achieved by the end of 1978–79, as the taintor-gates had been installed by the end of June 1977.

As a result, almost 10,000 hectares of water potential would be used up by finishing the first 55 km of the Kukadi left bank canal. Work has progressed up to 114 kilometres, and 28,569 hectares of potential have been produced.

In 1983–1984, the Manikdoh dam was finished, releasing all of the water that could be stored there. A plan has been put up to tap into the water potential of Yedgaon reservoir for the Kukadi Left Bank Canal. Irrigation beneath the Manikdoh left bank canal will make use of the storage capacity of about 0.7 TMC.

Between Visapur Tank and the Saraswati River, there is an area of about 20,719.50 hectares, with an additional irrigation area of 10,416 hectares. This whole region is already under the authority of Visapur Tank. Due to the limited water resources of the Visapur tank, only a portion of the aforementioned 2,428 ha. gets subirrigated annually on average. The remaining region is watered by the tank once every five to six years, depending on the availability of monsoon runoff in the Visapur tank's catchment area. Since the farmers are already planning to use irrigation and are only waiting for water, connecting the Kukadi and Visapur canals will allow for complete irrigation to begin under the direction of the Visapur tank right away. We have anticipated the need to redesign the current Visapur system in both the estimate and the work plan.[6]

The agriculture department may provide the farmers with advice on crop pattern, agricultural techniques, and proper manners throughout the project's building time, as well as any assistance they may need. By the time the project's full irrigation potential has been realised, all of the communities will have seen the farm's improved productivity and usefulness, and they will have been persuaded of the merits of irrigation for cultivating new crops.[7]

After considering that the five dams gather around 75% of the water, the decision was made to utilise the water for the Kukadi project. Approximately 42.09 million cubic feet. As a result, 0.2 mcft of water for the Ghod canal and 0.5 mcft for the Pushpawati dam were made accessible. The inhabitants of the Kukadi region saw a surge in their water needs between 1970 and 1971. Thus, the right bank canals of Visapur and Ghod also contributed to an increase in the available water.

Keeping the canal as high as possible at a level not less than R.L. 627.88 at Pimpalwandi, where the Pune – Nasik road crosses the canal, was determined to be the key to aligning the Kukadi left bank canal with storages for the integrated Kukadi project. Mr. Beale conducted extensive surveys from 1903 to 1908 to reach this conclusion. This level was mandatory, thus it will remain so throughout the building process. The Yedgaon weir is located about 6 km upstream of this bridge, and its height at Yedgaon is 629.715 metres.

The canal begins at a height of 629.715 metres, just below the Yedgaon weir. With the primary command being on the left bank of the Kukadi River, it follows that the main canal is also on the left bank. The heavy overburden on the left flank prevents the canal from being lifted off from its usual placement on the left side of the weir. There is a surplusing setup and a head regular set up on the right bank, close to the river gorge. The three 1.8¸2.7m apertures on the head regulator allow for a discharge of 59.60cumecs.[8]

Based on the country's geography, the canals were essentially separated into three divisions, as seen below:

Miles 0–64 from Yedgaon to Dudh Nala constitute Section I. Part II: From the tank at Visapur to Dudh Nala, km 64 to 114.

Section III: From the Visapur tank to the Temburni road, includes Sina LBC, Chilwadi, and the Pondewadi branch, from km 114 to 249...

The first part is ideal for watering because of its location. Up until you reach Alkuti Nala, the land is rich and prolific. Up till Dudhnala, the ground might be suitable for irrigation. With an average of around 265 hectares per km of canal length, the total command area is 16896 hectares in length.

Up to Dudhnala, the whole canal alignment, including the lining, has been completed. A bed fall of 1 in 6,700 goes along the falling contour that the canal alignment follows. Down here you can see a few key aspects of the alignment.

Cutting just beyond complete cutting to avoid bagayat lands is used to take the alignment in Km. number 3. Since most of the excavation is in dirt, deep cutting does not cost much. In km 4 and 5, the course has been taken on higher terrain by deep cutting to avoid travelling through the settlement of Pimpalwadi and across undulating chopped up territory. At km no. 6, the canal crosses National Highway No. 50, which runs between Nasik and Pune. The alignment mostly follows conventional cutting and bank till kilometre 30 from km 8 to km 50. The dirt is murky up to the earth mantle, which is rather thick.

There are a handful of deep cuttings between km 51 and 64. Continuing along a declining slope, the canal passes through many ordinary locations.

Part II: Kilometres 64–114, from Dudhnala to Visapur Tank:

A multitude of spurs obstruct this stretch of the canal. The vast majority of the land is elevated, on very rich soils that are ideal for watering crops. There is an average of 445 hectares of command area per km of canal length on this stretch, making the total command area 22309 hectares. The whole canal alignment has been mapped out, and the excavation for this section is complete. The lining up and earthwork up to km 114 is about finished. The following are the most salient aspects of the alignment discussed here: not include the aforementioned parts From km 115 to 117, the route mostly follows a declining contour. The canal, which flows downstream of the Visapur Tank and crosses the Hanga Valley via an aqueduct, has enough funding allocated to it. There are a variety of spurs and hill ranges that interrupt the county from 64 to 96 km. Deep cuttings are supplied to decrease the length of the canal so that it does not have to take a lengthy diversion to pass this county.[9]

Part III: (Numbers 114–249 from Visapur Tank to Karmala Temburni)

Irrigation is planned for the whole command area of this project, which is located in the scarcity zone, where rainfall is scarce. It is presently planned to irrigate this fertile and obviously appropriate land using the Kukadi Left Bank Canal.[10]

With an average of 820 hectares per km of canal length, the total command area in this stretch is 11,4006 hectares. From km. 117 to 249, the Kukadi Left Bank Canal follows a gently sloping terrain with no trouble staying in alignment. Approximately 120 or 260 km from the centre of the Dhond-Manmad section of the railway is the Kukadi Left Bank Canal.

Offcutting at Km. 194 in the Sina Valley was to be the site of branch canals, according to the previous project report. Recent research has shown that there are several deep cuts; to circumvent these obstacles, the decision was made to run the main canal via Sina Valley, with a cut made at Km. 192.

This new canal joins the existing alignment at Km. 223 and takes the place of the old Sina Right Bank Canal. The area that was originally planned for irrigation remains unchanged as a result of this modification. Starting at Km. 192, the first of the proposed branch canals, the Chilwadi Branch, would serve the region lying between Km. 192 and 212, where the former canal route was. Starting at km 223 and serving the area between km 212 and 223 along the former canal line is the second branch, the Pondewadi Branch.[11]

The basic outline of the command to be covered has been prepared with the goal of providing services to diverse places. Junner, Ambegaon & Sirur Tahsils in Pune District, Parner, Shrigonda, and Karjat Tahsils in Ahmednagar District, and Karmala Tahsil in Solapur District are all set to reap the irrigation advantages of this project. Multiple canals will be used to irrigate these lands.The Maharashtra Krishi Jeevan and data from the villages form the basis of the C.C.A. Eighty percent is the typical ratio of G.C.A. to C.C.A. The tract is prone to drought, thus in order to distribute irrigation facilities over a greater region, a proportion of 65% for cultivable land to irrigable area was selected.

The districts of Pune, Ahmednagar, and Solapur are the ones that get the most from the Kukadi Left Bank Canal, according to table no. 3.6. Because most of Shrigonda Tahsil's acreage (30,616 hectares) is irrigated, it reaps the maximum advantages from this in the Ahmednagar district. About 15,6278 hectares is the entire area that the Kukadi Project is expected to be able to irrigate. The districts of Ahmednagar, Solapur, and Pune are all part of this. The majority of the land, around 75,346 hectares, is irrigated in the Ahmednagar district, but the primary project is situated in the Pune district, as shown in table no.3.7 above.

The World Bank took into account the eight-month cropping cycle for the Kukadi project in their letter dated 20/11/1980 and increased the irrigation capacity to 107%. During the Kharip season, 52% of the irrigable land area is used for crops, and that number rises to 80330 hectares during the Rabi season, 55%.[12]

Current methods dictate the following irrigation times for the two seasons: 1) Kharif, which begins on June 15th and ends on October 14th. 1) Rabi - October 15th to February 14th. Current farming methods, agro-meteorological factors, soil type, etc. were considered in order to develop an appropriate design cropping pattern for the project.

Subtracting the effective rainfall from the crop water need yields the net water requirement for consumptive use of crops. During this process, appropriate adjustments are made to account for drying up before harvesting. A computer software created by the World Bank's South Asia Department was employed in these research. Assuming a field efficiency of 65% and a conveyance efficiency of 75%, the net water need is then transformed into demand at the canal head.

Shrigonda Dist. Ahmednagar is home to the Kukadi Canal Irrigation Department no. 2. In which fall under Ghod and Kukadi left bank canal command area from 114km. to 178km. and visapur medium project. Under this supervision, there is one small project with five K.T. goods on Ghod in the Pune district, one small project with one K.T. ware at Kapse wasti, and eight smaller canal projects.[13]

Ghod Dam, on the Ghod River, is located between the villages of Chinchani and Shirur in the district of Pune, as well as Vadgaon and Shrigonda in the district of A. Nagar. Ghod project's total water storage is about 216.31 million cubic feet. Plus, 154.80 square feet is a good amount. Twenty thousand five hundred acres are going to be irrigated as a result of this project, which covers the 14310-hectare Ahmednagar district as well as the 6190-hectare Pune district.

Irrigation covers an area of about 528,3 hectares in the Ahmednagar district and 24,562 hectares in the Solapur district along the 114 km of the Kukadi Left Bank Canal. The PWD has already transferred the land below 178 kilometres to the irrigation department for use in irrigation. The region In accordance with the directives of the senior office, canal committee, and collector office, the water used to fill dams for drinking water only came from 178 km.

At this time, the Kukadi canal encompasses the Visapur medium project. With a storage capacity of roughly 922 million cubic feet, it can irrigate an area of around 5,388 hectares.

The Kukadi Canal oversees five small projects in the Shrigonda Tahsil and three smaller projects in the Karjat Tahsil. It can hold about 16,45 mm3 of water, and it is used to irrigate an area of 3,288 ha. The same holds true for the K.T. Wares facility in Kapase wasti, which supplies water for the irrigation of an area of about 267 hectares. This dam has a total capacity to store roughly 1.38 mm3 of water.[14]

All small and medium projects, including Ghod and Visapur, were to be filled to capacity before the Rabi season in 2009–10. This decision was reached on 15/10/2011 by the committee of canal irrigation.

Here is a breakdown of the irrigated area in Shrigonda Tahsil by project during the Rabi season: The overall irrigated area is 39714 hectares, with the following projects: Ghod (1106 hectares), Kukadi (24722 hectares), Visapur (medium) (3956 hectares), minor (1028 hectares), and K.T. Wares (1014 hectares). Using the existing water storage,

the canal irrigation committee decided that the Ghod and Kukadi left bank canals should be used in two cycles throughout the summer. As a result of such choice, two cycles are provided.

Here is a breakdown of the irrigated area in Shrigonda Tahsil by project throughout the summer: Total irrigated area: 15060 hectares; projects: Ghod 4797.45 hectares, Kukadi 5768.30 hectares, Visapur 2850 hectares, Minor projects 651 hectares, and K.T. Wares 1000 hectares.33On 08/09/2010, the following report was prepared for Shrigonda Tahsil on the stored water of Kukadi, Ghod, Visapur, and other smaller projects: The Kukadi watershed saw severe rains in 2009 and 2010. Because of this, additional reservoirs and dams were filled to capacity with water from spills.[15]

CONCLUSION

The evaluation of the Kukadi Canal Irrigation Project highlights the critical role it plays in the agricultural sector of the area. Beginning with its conception and continuing through its technical complexities and effects on agricultural yields and rural economies, the project provides a thorough picture of its relevance. A symbol of sustainable farming methods, the Kukadi Canal guides us through the complexities of water resource management. In addition to demonstrating impressive technical skills, the project brings spotlight on the need of balancing social and economic progress with environmental concerns. This analysis sheds light on the ways in which strategic water management may promote agricultural profitability while simultaneously maintaining ecological sustainability and meeting human needs in a balanced way.

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Corresponding Author

Krishna Rao Ther*

PhD Student, Kalinga University, Raipur (CG)