International Organization of Research & Development (IORD)
ISSN: 2348-0831
Vol. 08 Issue 02 | 2020

Study and Replacement of Open Canal Irrigation Network by Closed Concrete Buried Pipe Distirbution System in Mula Irrigation Command Area, Rahuri Ahmednagar District

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DOI: 10.5281/zenodo.4916210

ABSTRACT

Present study is focused on Mula Irrigation project and impact of open channel Irrigation element and looked towards replacement of the open canal with closed concrete pipe . The Mula irrigation project is Large Scale Public Sector Irrigation Projects (LSPSIP) .Mula dam is located at 19020" to 19035" N latitude and 740 25" to 74036" E longitude. The dam is constructed (1971) on river Mula a tributary of river Godavari at Rahuri, district Ahmednagar. The water storage capacity of the dam is 26 TMC. Catchments area is about 2275 sq km and it experiences an average rainfall 58 cm. Maximum depth is 67.97 m. The dam water has been used for drinking and irrigation by the people of Ahmednagar cities and district. Actually Ahmednagar district is located in rain shadow region in Maharashtra.. The data regarding the water availability of Mula Dam has been collected from Mula irrigation Department. The water of Mula Dam is being used for the purpose of agriculture, drinking, industry and livestock. The agricultural development took place in the study region due to Mula Dam.

Keywords:Catchment Area, Command Area, MLBC, MRBC, Conduit, Geomorphology, Water Utilization, Reservoir Irrigated area, Mula irrigation project, water storage, canal and well irrigation.

1. INTRODUCTION

Pump irrigation covers the majority of the irrigated lands in the developing countries of the arid and semi-arid regions. The irrigation water taken from the aquifer or the surface run off ponds, lakes, rivers and dams, is pumped to the fields through conventional (earth) ditches or lined canals, resulting into tremendous losses from seepage and evaporation, deep percolation and canal leakage. Studies from many countries show an average of 33 percent water losses during conveyance through a 100 m conventional channel. The field irrigation methods are the traditional surface gravity - furrow, basin, border etc., with field application efficiencies of 60–70 percent, i.e. additional water losses of about 20–27 percent of the total. Then the overall irrigation efficiency ranges from 40 pecent to 47 percent approximately. It is observed that the available supply inmany of the canal; systems is one forth to one third of the amount of water needed for intensive agriculture; nor it is supplied satisfactory in time. Moreover, neglect or ignorance of surface water component in irrigation planning is one of the main causes for water logging and the attendant problems of salinity in the commands.

1.1 Significance of the Study

Water has an economic value in all its competing uses and should be recognized as an economic good. In future Agriculture will not get water free and easily as it did in the past. Farmers will have to heavy pay for the water, and cost will be increasing steadily over the years to come.

During the recent decade, growth in crop productivity in irrigated areas has slowed and competition for water for non- agricultural use has increased and hence there is lots of water shortage for irrigation purpose, to overcome this problem up to certain level closed pipe flow is the good option.

1.2 Objectives

To analyze the reservoir water utilization of Mula irrigation project in catchment as well as command area, Ahmednagar district.

- To Study the impact of Mula irrigation project on irrigation area by surface (canal) and well irrigation .
- To Study the water availability and utilization of Mula irrigation project and design the closed conduit pipe system.

1.3 Data Collection

For this research work various secondary data sources are used. The collected data is collected from Mula irrigation Department, Ahmednagar and processed such as Canal alignment index map, soil data, Rainfall Data in Catchment area of various rain gauge stations.

1.4 Study Region

Mula dam is located at 19020‟ to 19035‟ N latitude and 740 25‟ to 74036‟ E longitude. The dam is constructed(1971) on river Mula a tributary of river Godavari at Rahuri, district Ahmednagar It is bounded on the north by Nasik district; on the north-east by Aurangabad district of Marathwada division, on the east by Beed district; Osmanabad district; on the south by Solapur district; and on the south-west by of Thana district. Total geographical area of the district is 17,035 square km.

Fig 1:Location Map of Ahmednagar District.

Figure 2:Showing satellite image of Mula dam catchment area and command area (19.3293065°N,74.5295548°E) (Source- Google earth)

2. LITERATURE REVIEW

Prior to start the project work I have gone through various literature and journals. The following literature review is concentrating on the relevant topics in terms of Various irrigation Practices and Future need of Closed conduit pipe system and its design .

Pradeep Bhalage et.al 2017 :Carried out case study work and published paper entitled as” Case Studies of Innovative Irrigation Management Techniques” and he identified he major reasons for low Water Use Efficiency of Irrigation projects Mahato and he studied the various Case Studies of Innovative Irrigation Management and they concluded that specially designed closed pipe water distribution network improves the crop yield significantly. It saves considerable amount of water with trouble-free irrigation management.

American Pressure Concrete Pipe Association, July 2011 :Published the Manual “External Protection of Concrete Cylinder Pipe” This manual has been developed by the American Concrete Pressure Pipe Association to provide the specified or owner with helpful guidelines for the supplemental protection of concrete cylinder pipe if it is to be installed in adverse environments.

Updated Structure Design Manual, April 1982 :Published the “Reinforced Concrete Pipe Methodology”. In this work the methods to be used for design of reinforced concrete pipe are the Indirect Design and Direct Design methods Direct design method follows the principles of strength of material and reinforced concrete design.

Priyani .V.B,1957 : Studied and Published A book entitled as "The Fundamental Principles of Irrigation Engineering" furnishes in concise, clearly illustrated by appropriate drawings or sketches, descriptions on the numerous structures connected with irrigation and of the various practices followed in the distribution of water to crops.

3. METHODOLOGY

3.1 Mula irrigation division Existing canal details (MLBC and MRBC)

The dam has a gross storage capacity of 767 Mcum and a live storage of 609 Mcum and has a planned capacity to irrigate 80,800 ha in 149 drought prone villages in Ahmednagar district. The project serves the command area through two main canals, the MLBC (Mula Left Bank Canal) and the MRBC (Mula Right Bank Canal) and their branch canals serving an area of 10,100 ha and 70,700 ha respectively. The MLBC was mainly intended to strengthen and stabilise the command of Pravara right bank canal and so the study concentrates on the MRBC. The minors and direct outlets taking off from the MRBC itself serve an area of 28,075 ha.

Table 1:Mula Irrigation Project canal Details

Sr. No	Sub Division	Canal	Total Length (km)	Discharge Capacity at Head (cusec.)	Total Command Area (hec.)	Cultivable Command Area (hec.)	Irrigation capacity (hec.)	Water User Organization
1	Rahuri	MRBC	0-26	1650	14253	12899	8846+1155 2 MPKV.	36
2	Ghodegaon	MRBC	26-52	1335	14437	14040	92633	36
3	Newasa	Br.No 1	0-30	315	23539	21806	15291	64
4	Kukana	Br.No 1	0-30	375	29154	27320	17920	73
5	Amarapur	Lat Distributary	0-18	157	9970	9452	68177	
		Pathardi Br.Canal	0-43	157	19028	17583	11397	70
Total MRBC					110381	103370	70689	279
6	MLBC		0-18	250	17004	15182	10121	24
7	Mula High level Right canal		0-58	95			3015	
8	Mula High level Left canal		0-12	18	34001	20240	250	
9	Total Mula Project				161386	138792	82920	303

The first two branch canals taking off from the MRBC serve an area of 33,215 ha. The thirdbranch, known as the Pathardi branch, takes off at the tail end of the MRBC and runs for 53 km serving an area of 11,400 ha, but only for eight months (July to February). The command area of the MRBC is divided into 5 sub-divisions known as Rahuri, Newasa, Ghodegaon, Kukana and Amarapur sub-divisions and we may take Rahuri sub-division as comprising the head reach, Newasa and Ghodegaon as comprising the middle reach and Kukana and Amarapur as comprising the tail reach of the project.

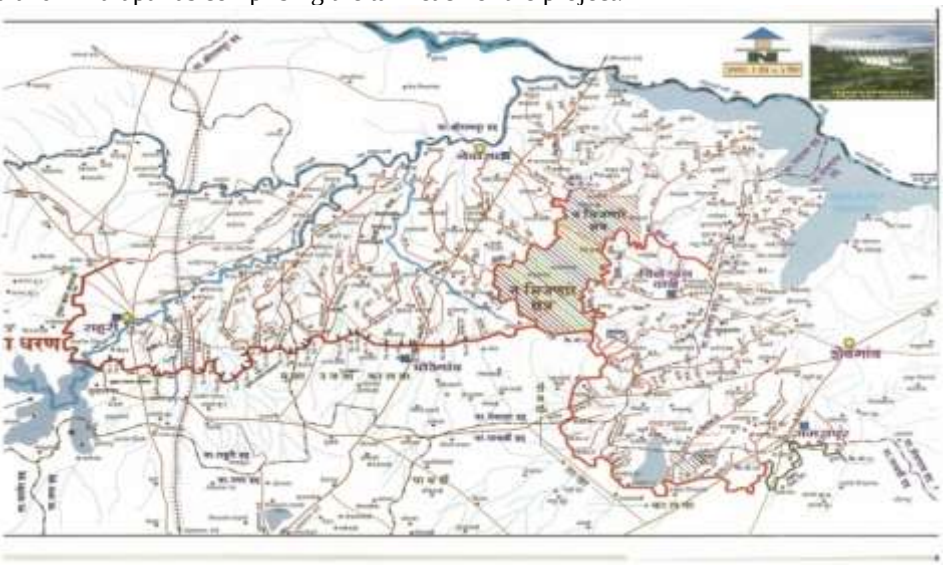

Fig 3:Mula irrigation division Existing canal alignment MLBC and MRBC

4. PROCESS FLOW CHART

Fig.4 : components of underground pipelines

There are several types of stock water pipeline systems that we need to know how to design .More than one of these system types may be incorporated in a single system.

4.1Gravity System

A gravity pipeline system is one in which the water supply surface is higher than all points in the pipeline and no pump is required. This type of system can generally be subdivided into two subtypes:

- The low pressure gravity system
- The high pressure gravity system.

4.1.1 Low Pressure Gravity System

Low pressure is loosely defined as below 15 psi at all points in the line. An example of a typical low head gravity pipeline is shown in Figure 3.1. In this type of system the flow rate is usually whatever the spring or other water supply will provide. It is important to make sure there can be no air locks in the system, and since the pipe is usually shallow, design the pipeline so that it freely drains when not in use. A low pressure gravity of flow for its entire length. There is not enough pressure in the system to properly operate air valves, although stand pipe vents may be used.

4.1.2 High Pressure Gravity System

This type of system is often located at the end of a pumped pipeline, starting at a storage tank at the top of a hill. Float valves are used on all tanks to control flow. Air locks at significant high points in the pipeline are prevented by installing air valves or vents. Air valves will not work if pressure is too low.

4.2 Components of Underground Pipelines

All the low head underground pipe line system requires pump stand as inlet or gravity inlet, gate stands, pressure relief valves, outlets and end plug. Typical components of underground pipeline are illustrated in Fig.

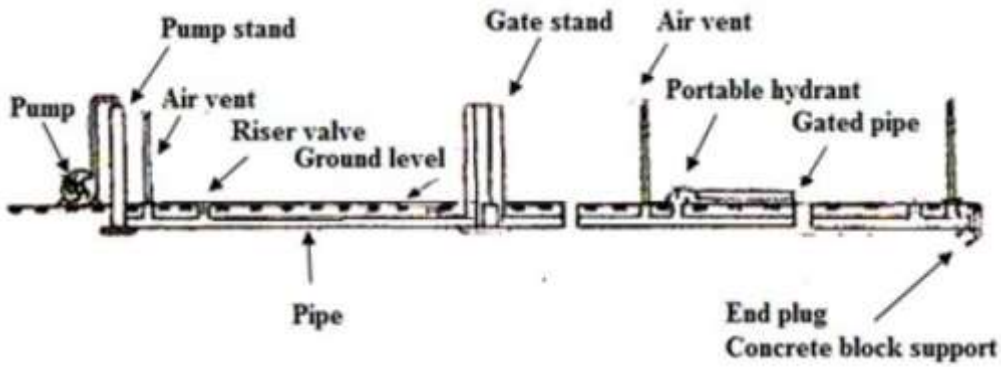

Fig.5 : components of underground pipelines

5. DISCUSSION AND CONCLUSION

The world commission on Dams states that "Dams have made an important and significant contribution to human development, and the benefits derived from them have been considerable."
Canal Irrigation in Maharashtra is mostly provided by Large Scale Public Sector Irrigation Projects and in Maharashtra which provides water not only for irrigation but even for non- irrigation purposes. These systems are highly complex Public Distribution Systems comprising of several Techno- Socio-Economic-Legal processes expected (but not designed) to simultaneously achieve multiple & at times, even competitive / conflicting objectives ,but 21 st century is the right time to design and implement the complex systems to achieve significant contribution to human development.

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