Design Pipe Distribution Network for Irrigation Purpose Replacing Canal Distribution Network

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Abstract - The objective of this research paper is to highlighting the use of Pipe Distribution Network (PDN) instead of Canal Distribution Network (CDN) to increase the overall project efficiency of irrigation project and thereby reducing the stresses due to water scarcity. In order to achieve more benefits from PDN, planning, designing, and construction of it should be carefully done. This paper provide the guideline for planning, designing and construction of PDN system for irrigation. It is recommended that PDN system could be saving and feasible over conventional CDN and this system is so flexible that it can be implemented as a new. Classical approach for the automatically solving the problems of network is by using specialized software such as EPANET.

Index Terms -*Pipe Distribution Network (PDN), Canal Distribution Network (CDN), Flow Velocity, Diameter of Pipe, Hydraulic Gradient Line (HGL).*

I. INTRODUCTION

A.General

Water distribution system is hydraulic structure consist of aspect such as are pipes, tanks reservoirs pumps and valves etc. Now a days it becomes necessary to supply; efficient water supply is of foremost importance in designing a new water distribution network or in spanning the existing one. It also becomes necessary to investigate as well as establish a good network ensuring sufficient head. Determination the flows and pressure head in network pipes has been of great amount and concern for those winding with designs, construction and conservation of public water distribution systems. Analysis and design of pipes networks create a relatively complex problem, especially if the network The water is then fed into the distribution systems. The analysis is done using the software EPANET. EPANET is software that models water distribution pipe line systems. EPANET is the public domain software that may be freely copied and distributed. It is a Windows 95/98/NT/XP program. EPANET performs extended period transcript of the water movement and quality behaviour within pressurized pipe networks. Pipe networks consist of pipes, nodes (junctions), pumps, valves, and storage tanks or reservoirs. EPANET tracks:

- The flow of water in each pipe,
- The pressure at each node,
- The height of the water in every tank,
- The type of chemical concentration throughout the
- network during a simulation period,
- Water age,
- Source, and
- Tracing.

B. Objective

- To analyse the existing water distribution system using EPANET and to advise some measures if present network does not fulfil the present and future demand.
- To supply water in sufficient quantity and at the desired pressure to an individual farm.
- To design well planned pipe distribution network to carry the water from reservoir to farm.
- To determine the pipe diameter and suitable material.

II. STUDY AREA

The study area lies in Velhe taluka near Gunjawani dam in Pune districtof Maharashtra The dam is situated on the river Kanand. The area comes under canal command of Kurud irrigation tank. The field lies at 18.3014285ºN latitude and 73.6194598º E longitude in Velhe taluka. The Length of the main canal is 1.730 km The height of dam is 52.82m.Total catchment area of the dam is 104480 sq.km The height of ogee spillway of Gunjavani dam s 22.76m and width of spillwayis 27m.The design discharge of spillway is 1280.03 metre cube/sec.Total existing area under cultivation (irrigable area) is 16500 ha. Total capacity of dam is25070cumi.

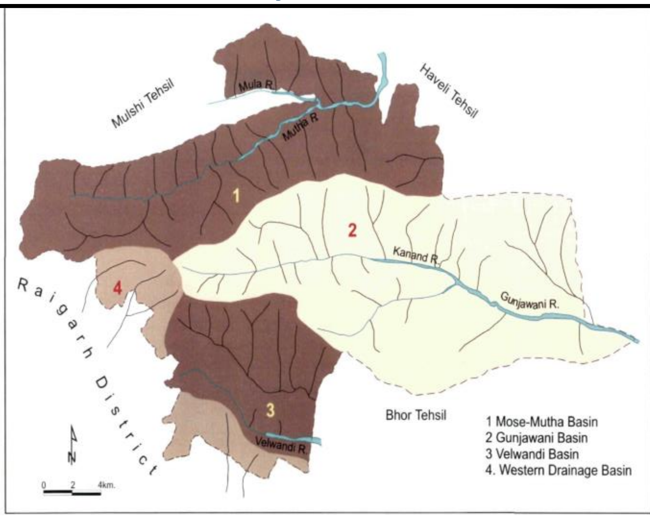
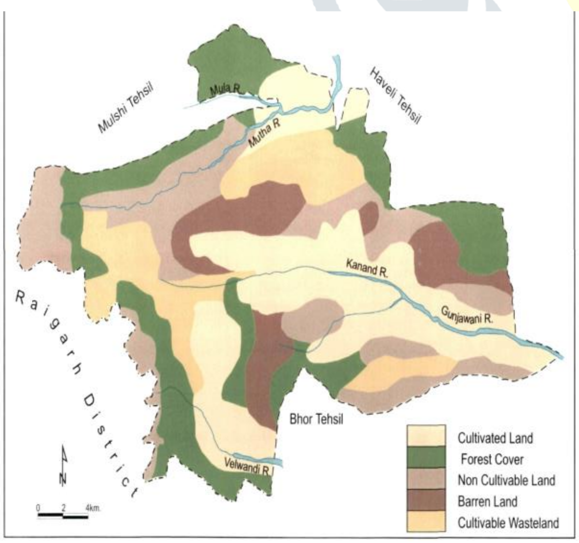


Fig. 1 Physiograph of VelheTehsil according drainage

Month of July, because of cloud cover. From July onwards daily range of temperature reaches maximum in December or January. As the Vehle Tehsil is situated in the rainshadow zone of the Western Ghat, it receives heavy rainfall from southwest monsoon during June to September. On an average Vehle receives more than 2600 mm. rainfall annually. July is the rainiest month (Fig.2.5). Greater contrast is observed in the distribution of rainfall over the whole tehsil. The western part of the Vehle Tehsil receives more than 1200 mm rainfall, and at the same time eastern part receives less than 600mm. of rainfall annually. The zone of heaviest rainfall coincides with the Western Ghat crest. Velhe is the rainiest place in the Pune district, occupying one of the southernmost locations in the Pune district and directly exposed to the South-West monsoon. The amount of rainfall declines towards east Ambavane, being the eastern most place in the tehsil, receives less than 500mm rainfall annually.



Fig, 2 Landuse In Velhe Tehsil

III. METHODOLOGY

This chapter describes the materials and methodologies adopted in the study for analyzing the existing irrigation system and design of underground pipe line irrigation system to reduce the losses. The chapter also presents the comprehensive management plan of the existing crop and water resources in order to obtain the sustainable output from the agriculture. For this study actual site visit to be propose and dada collected is as follows:

- Soil types :-
  The type of soil surrounding Gunjawani dam is brown-mixed fertile soil.
- Local topography:-
  Pipe distribution along the gravitational flow is always cheaper and requires less power for supplying than the lift irrigation.Selected site has suitable topography for gravitational flow
- Local weather pattern:-
  Ample amount of rainfall is more than enough for adopting pipe distribution network.It will be absurd for designing the pipe distribution over an area having scanty rainfall.
- Types of crop:-
  The common type of crop grown here is rice.

A. *Procedure:-*

- Decide the size of area, should be more than 5 ha.
- Prepare a contour map using Quantum Geological Information System software.
- Reconnaissance survey will have to be carried out to collect the data regarding existing crop types, crop water requirement
- Study the existing canal network.
- Collect the soil specimen and test the various soil properties.
- Calculate the theoretical discharge required for given area.
- Then decide the discharge required for a particular reach (sub-area) considering the water requirement of crop of that reach.
- Calculate the various losses in pipe distribution network
- Determine the diameter of main pipe and distributary pipe for the effective head using EPANET software.

IV TEST CALCULATIONS

Water Content by Oven Drying
Empty weight of container (W1) = 18 g
Weight of container plus soil (W2) = 78 g
Weight of container plus soil after oven drying (W3) = 65 g
Water content = (w2-w3)/ (w3-w1)
= (78-65)/(65-18)
= 0.2765

Specific Gravity by Pycnometer
Empty Pycnometer Weight (W1) = 654 g
Pyconometer + soil (W2) = 854 g
Pycnometer + soil + water (W3) = 1663 g
Pycnometer + water (W4) = 1536 g
Specific Gravity = (w2-w1) / (w2-w1)-(w3-w4)
= (854-654) / (854-654)-(1663-1536)
= 2.73
Duty=8.64xB(days)/$\triangle$ (m)

$= 8.64 \times 120/1.2$

$= 864$ Ha/cum

Q $= 91.8$ (Ha)/864 (Ha/cum)

$= 0.19625$ cum

V $= k.C\,(D/4)^{0.63}.S^{0.}54$ ....Hazen-Williams friction loss for water flow in pipes

Where, S= 0.02ft

K=0.85

C=120

V $= 0.85 \times 120 \times (D/4)^{0.63} X 0.02^{0.54}$

$= 5.01D$

Q $= V \times A$

$91.8 = 5.01D \times \pi/4 \times D^2$

D $= 4.20$ ft

IV. EPANET SOFTWARE

It is the computer program that performs extended period simulation of hydraulic and water quality behaviour within pressurized pipe networks. A network consists of the pipes, nodes (pipe junctions), pumps, valves and storage tanks or reservoirs. It is tracks the flow of water in each pipe, the pressure at each node, the height of water in each tank, and the concentration of a chemical category throughout the network during a simulation period comprised of complex time steps. In addition to chemical species, water age and sources tracing can also be simulated.

It was developed by the water supply and water resources division (formerly the drinking water research division) of the U.S Environmental protection agency's national risk management research laboratory. It is the public domain software that may be freely copied and distributed.

EPANET is the designed to be a research tool for improving our understanding of the movement and fate of drinking water constituents within distribution systems. It can be used for more different kinds of applications in distribution systems analysis. Sampling program design, hydraulic model calibration, chlorine residual analysis, and customer exposure assessment are some examples. EPANET can be help assess alternative management strategies for improving water quality throughout a system.

Running under windows, EPANET provides the integrated environment for editing network input data, running hydraulic and water quality simulations, and viewing the results in a variety of formats. These is include color-coded network maps, data tables, and time series

Graphs, and contour plots.

V. RESULT

For the comparative study of canal and pipeline system we come to know that overall efficiency of the project will increases discharge required case of canal system which reduce the losses.

Therefore the cost of the project is less as compare to the canal system.

VI. CONCLUSION

Considering the deficiency of water, PDN system is recommended for irrigation in command area. PDN system saves water onto conventional CDN system and should be preferred where land cost is comparatively high and farmers are unwilling to handover their valuable land. The pipeline distribution system would be more suitable for implementation of modern techniques like sprinkler and drip irrigation etc. The planning and designing of PDN should be carefully done so that maximum benefit of the system can be utilized.

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