PIPE DISTRIBUTION NETWORK FOR IRRIGATION SYSTEM

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INTRODUCTION

Historically Irrigation development in the country has been undertaken as Canal Distribution Network emanating from rivers, dams and reservoirs for the purpose of carrying water mostly through gravity up to outlets and from outlets to agricultural field through water courses or field channels. In earlier times canals were unlined; later on these unlined canals have been improved by lining to increase their water carrying efficiency which led to extend water deliveries to additional fields which had not been irrigated previously. Canals are designed hydraulically to provide the most efficient cross section for the transportation of irrigation water. There is no further scope in improving the efficiency of the hydraulically most efficient canals section with most efficient lining. Therefore the overall efficiency that can be achieved by canal conveyance and distribution has reached the upper limit which is about 35-60%.

With the increasingly greater demand on limited water supplies in many parts of country, there is an urgent need for its efficient utilization by reducing losses at various reaches in the irrigation system. Replacement of existing canals with pipe lines or new schemes with pipe lines wherever feasible in order to improve irrigation efficiency or to further extend the area of irrigated agriculture is the need of the hour. Field application of water through micro irrigation methods improves overall efficiency of the project to a great extent. Piped irrigation can be accomplished many a times through gravity and/or use of pumps to lift the water into the distribution network.

With rising population, demand for commodities and change in life style, more and more demand for water resources from other sectors is projected, leaving less water for irrigation as the availability is finite in nature. With rising population, per capita water availability has reduced drastically from 5177 cum in the year 1951 to 1567 cum in the year 2011. As per international standards, now India is already in water stress zone (if water availability is between 1000 to 1700 cum per year) with threats of climate change may further aggravate the problem. By the year 2050, with projected population of the order of 1.6 Billion, the water availability will further reduce to 1140 cum nearing to water scarce situation. India as a country has to adopt itself to this changed scenario. Efficiency has to be brought in each water use activity including irrigation for sustaining the food, water, shelter and employment requirement of the human and animal population.

Piped Irrigation System provides one of such options which if implemented properly can curtail irrigation water demand without compromising with net irrigation requirement (NIR) but by improving the water use efficiency. The estimated overall efficiency with piped irrigation network is of the order of 70-80%. Experience gained from several States and many Countries in arid and semi-arid zones has shown that Piped Irrigation Network (PIN) techniques are replacing successfully the traditional open canal methods. However, some of the projects already constructed with PIN are not showing expected performance due to various reasons including improper planning and lack of maintenance.

For proper planning, design and implementation of Piped Irrigation Network in the country, the need for suitable guidelines is felt necessary by the Ministry of Water Resources, River Development and Ganga Rejuvenation (MoWR, RD&GR) and Central Water Commission (CWC). Accordingly, this guideline on PIN has been prepared.

Piped Irrigation Network (PIN)

A Piped Irrigation Network (PIN) is a network of installation consisting of pipes, fittings such as valves, pumps (if necessary) and other devices properly designed and installed to supply water under pressure from the source of the water to the irrigable area.

For surface irrigation method, where large heads are not required, the underground pipe line system is used which is essentially a low pressure system, also known as ‗open or semi closed' system. This system is open to atmosphere and where the operating pressure seldom exceeds 5m to 6m. The available level differences of falling topography provide the operating head for the system under gravity for the low pressure flows. Where large heads are required, underground pipe line system is used which is essentially a high pressure system, also known as ‗closed' system. This system is not open to atmosphere and where the operating pressure exceeds 10m for drip and 20m for sprinklers. Usually gravity head is not sufficient to create such a high pressure; therefore, pumps are used for this kind of system.

Advantages of Piped Irrigation Network over Canal Distribution Network (CDN)

The following are the advantages of PIN over Canal Distribution Network (CDN):

i. As most of a piped distribution system underground, right of way problems are significantly reduced, allowing more direct and rational layouts to be chosen. Because outlet location is not limited by topography, pipe systems are better able to accommodate existing patterns of land ownership with the minimum of disruption compared with new irrigation development using CDN.
ii. Cross Drainage and Cross Masonry (Communication) structures can be omitted or minimized.
iii. Irrigation works become obstacles in the way of free drainage of water during rainy season and thus results in submerging standing crops and even villages.
iv. No damage due to heavy rainfall or flood during monsoon.
v. More Suitable option for flood prone area.
vi. No hindrance in movement to the farmers and farm equipments.
vii. Increase in CCA as compared to canals, as the water losses are negligible and acquired land for canal network can also be used for cultivation as Piped Irrigation Network is under ground.
viii. Better option for undulating fields.
ix. Because of shorter transit times for water from source to field, lower conveyance losses and the smaller volumes of water in the conveyance system, pipe systems can deliver a supply which is more flexible in both duration and timing, in a way not possible CDN, so enabling intensification and diversification into higher value crops.
x. Less execution time for PIN as compared to CDN.
xi. The important targets of the modernization of irrigation schemes and digital management will be achieved when water is delivered through Piped Irrigation Network.
xii. In case of canals, the marshes and the ponds caused by excessive seepage, in course of time become the colonies of the mosquito, which gives rise to vector borne diseases and this can be minimized by adopting Piped Irrigation Network. Further salinity and water logging can be reduced.
xiii. Increase in project efficiency of the Piped Irrigation Network is about 20% as compared to CDN.
xiv. Fertilizers/chemical can also be mixed with the water.
xv. Quantity of water supplied by Piped Irrigation Network is easily measureable; hence water auditing can be accurately measured.

Disadvantages of Piped Irrigation Network

i. Initial cost is generally higher as compared to CDN.
ii. Piped Irrigation Network may not be suitable if the irrigation water contains

large amount of sediments. Desilting arrangement would be necessary in such cases.

Application of Piped Irrigation Network

The Pipe Irrigation Network systems especially are to be preferred over CDN alternatives in the following situations:

i. Where water is valuable both, in terms of the crops which can be grown and limited availability as evidenced by low reservoir capacity or restrictive controls on water abstraction from river or groundwater sources,

ii. Where poorly cohesive soils would result in high seepage losses from open canals,

iii. Where irrigable land cannot be reached by an open canal system due to high ground levels.

A Piped irrigation network is a network installation consisting of pipes, fittings and other devices properly designed and installed to supply water under pressure from the source of the water to the irrigable area.

Pipelines also permit the conveyance of water uphill against the normal slope of the land and, unlike open channels, can be installed on nonuniform grades. The use of buried pipe allows the most direct routes from the water source to fields, and minimizes the loss of productive land (since crops can be planted on the fields above the pipelines)

The planning and layout of Piped Irrigation Network unlike CDN is not controlled by the command area to be irrigated and the source of supply. The layout of main lines and branches is generally fixed on the consideration of economy. For the layout of minors and distributaries, points of off take may be suitably selected but their layout is more or less governed by the blocks of areas to be irrigated taking into consideration watersheds and drainages. The main lines and branches are feeder lines for distributaries and generally no irrigation is done directly from them. Irrigation outlets are provided on distributaries or minors off taking from distributaries.

The stage for general planning and layout of Piped Irrigation Network arises after the general feasibility of the project has been established. The area to be irrigated by pipe line system shall be planned by preparing land use maps, preferably on a scale of 1:50,000, showing on them the area already under cultivation, soil types, habitation roads, drainage and contours of the area. The intensity of irrigation to be provided in the project shall be decided after taking into account the factors like socio economic factor, area and intensity of the irrigation being achieved on the other projects in the neighborhood etc.

The important crops of the area and their water requirements shall be determined in consultation with the department of agriculture and the agriculturist of the area proposed to be served allowing for the anticipated change in crop pattern due to introduction of wet farming in the area. Knowing thus the duty for various crops, the area under cultivation under different crops, the intensity of irrigation, the culturable area to be commanded shall be worked out and marked on the map. Areas that are higher and may not be supplied with the flow/gravity irrigation should be marked on the map with separate colour and the pumping requirements for that area need to be worked out separately.

Data Required for Piped Irrigation Network Planning

The following data is required for planning and layout of a Pipe system:

i. Topographical map of the area
ii. Subsurface data
iii. Texture and salt component of the soil
iv. Soil characteristics including mechanical properties and shear parameters
v. Permeability of the soil in relation to seepage losses
vi. Rainfall data
vii. Water availability Subsoil water level in the area and quality of the underground water
viii. Possibility of water logging and salination
ix. Availability of suitable construction material
x. Existing drainage and drainage facilities
xi. Existing crop pattern
xii. Existing communication and transportation facilities
xiii. Socio economic study and agro economic survey of the project area

xiv. Adequate investigation should be carried out to collect the data given by digging trial pits and bore holes, where necessary, to ascertain the nature of soil encountered along different alternative alignments.

Route Selection of Pipe Network

i. Length of pipelines in the network is minimal, as much as possible.
ii. Pumping is avoided if possible or least pumping effort is needed.
iii. High water pressure is avoided.
iv. Numbers of appurtenances (gate valve, check valve, drain, air release valve, pressure break valve) are minimized.
v. Very low or high velocities are avoided because low velocities cause sedimentation in pipes and high velocities cause corrosion of pipe.
vi. This results into most economical system.
vii. If horizontal pipe sections are used, release of air and drain the dirt will not be possible. So, in case of horizontal ground surface, artificial slopes are given to pipes to be laid.

Guiding Principle for deciding Carrying Capacity of Pipe/Canal

The carrying capacity of the Piped Irrigation Network/CDN shall be maximum of;

a) The carrying capacity calculated on the basis of the fortnightly crop water requirement as per the design cropping pattern and planned Irrigated Cropped Area (ICA) of the project as per Administratively Approved project report but considering 12 days flow period in a Fortnight.
b) The carrying capacity calculated on basis of due water entitlement of the Culturable Command Area (CCA) of the Pipe line or distributary as per the provisions Acts of State Level Authorities.
c) The carrying capacity calculated on basis of the operation schedule of the pipe/canal or distributary. The operation on the basis of 12 days on and 2 days off in a fortnight is preferable or as per the requirement.

The procedure to work out carrying capacity of canal for above alternatives is as given below:

Carrying capacity of Pipe on the basis of crop water requirement:

The fortnightly crop water requirement of the planned ICA of the canal/pipe shall be calculated by Modified Penman Method. For this, the cropping pattern approved by concerned Authority shall be considered. The ICA of the Pipe line shall be decided after completion of detailed command area survey of project. Once the design cropping pattern and ICA of the Pipe is finalized the fortnightly crop water requirements / Net Irrigation requirement (NIR) is worked out by Modified Penman Method. The gross Irrigation requirement (GIR) of canal/pipe shall be calculated by adding the conveyance losses up to crop root zone

For estimating Crop Water Requirement ―A Guide for Estimating Irrigation Water Requirements‖ (Published by MoWR RD & GR, Yr-1984) may be referred. It can also be estimated by using software like CROPWAT by FAO.

Design discharge of Pipe on the basis of due water entitlement as per provisions Acts of State Authorities:

As per the provisions in Acts of Water Resources Regulating Authority of States, the irrigation water is to be supplied to the WUAs on volumetric basis as per their due water entitlement. The outlet capacity in m3/s or l/s authorized per hundred hectares of Culturable Commanded Area (CCA) is called Basic Discharge Coefficient (BDC). The BDC not only defines the size of outlet for each outlet area but also form the basis for the design of the distribution pipes/canals in successive stages. The BDC depends on the agro climatic zones and defined at chak head.

It is essential to decide the master plan of WUA & their water entitlement at design stage. The canal/pipe carrying capacity shall be decided such that due water entitlement will be supplied to all the WUAs in command area of all lines of project.

To calculate the canal/pipe carrying capacity on basis of water entitlement, following guidelines shall be followed;

a) The master plan of all the probable WUAs in command area of project is to be prepared, once command area survey and tentative alignment of all the canals/Pipe line is finalized.

b) The locations where water is to be supplied to the WUA is to be identified.(entry point in jurisdiction of WUA) The water entitlement of the individual WUA and all the WUA on individual canal/Pipe line shall be worked out.

c) The water entitlement of WUA and entire canal/pipe line shall be decided on basis of the CCA of WUA and CCA of canal/pipe line. The total due water entitlement thus worked out shall be considered as Net water requirement (NIR) of canal/pipe line. By adding canal/pipe line loses (efficiencies) the gross water requirement (GIR) is calculated. The season wise and fortnightly gross water entitlement and net water entitlement for canal/pipe shall be worked out. On the basis of fortnightly water requirement, the canal/pipe design carrying capacity shall be decided.

2. Water Losses and Irrigation Efficiencies

To account for losses of water incurred during conveyance and application to the field, and efficiency factor should be included while calculating the project irrigation requirements.

The project efficiency is normally divided into three stages each of which is affected by a different set of conditions.

a) **Conveyance Efficiency**, Ec : Ratio between water received at inlet to a block of fields and that released at project head.

b) **Field Canal/Pipe line efficiency**, Eb : Ratio between water received at the field inlet and that received at the inlet of the block of fields.

c) **Field application Efficiency**, Ea : Ratio between water directly available to the crop and that received at the field inlet.

d) **Project Efficiency**, Ep : Ratio between water made directly available to the crop and that released at the head works, or Ep = Ea Eb Ec

e) **Distribution Efficiency**, Ed : Eb Ec

f) **Farm Efficiency**, Ef : Ea Eb

Conveyance losses in canals consist of two components

Evaporation losseand Seepage losses. The evaporation losses depend on the climatic zone and temperature variation whereas the seepage losses depend on the type of sub-soil, Ground water levels and type of lining and wetted area of the canal**. With most effective lining and most efficient canal section the adopted efficiency for canals** are 0.90 for Main/Branch Canal, 0.90 for distributary, 0.87 for minor/subminor and 0.90 for field channels. With the above the canal conveyance efficiency from source to minor works out to be 0.90X0.9X0.87 X100 = 70.5% and Source to Field Channel (Distribution Efficiency) is about 63% (70.5% X 0.9). As the piped net works are a closed system, there will be neither evaporation losses nor absorption/seepage losses except some leakages at fittings. Therefore, Design conveyance efficiency from Source to Minor should not be lower than 0.95 and with Field Canal/Line Efficiency of 0.95, the project efficiency works out to be about 90% (.95X95%).

Field Application Efficiency

For the purpose of working out the water requirement at the head of the pipe line the field application efficiency for micro irrigation as specified in part-II of the guidelines shall be adopted as not less than 90% in case of drip and not less than 75% in case of sprinkler irrigation. In case of surface irrigation methods, the field application efficiency of not less than 60 % for non- ponded/ponded crops.

Project efficiency

Over all irrigation efficiency for micro irrigation with sprinkler shall not be less than 68% (95%X.95%X0.75) against the present canal based conveyance system of 47.25% (70%X90%X0.75). Similarly for drip irrigation, it shall not be less than 81.23% (95% X 95% X 0.9) against the present canal based conveyance system of 56.7% (70%X90%X0.90).

Capacity Factor:

It is experienced that after construction of the conveyance system, the various unanticipated water demands as mentioned below arises due to various reasons which affects the carrying capacity of system assumed at the time of design.

i. The drinking and industrial water requirement demands.

ii. The letting out of water in rivers, nala during scarcity period.

iii. The demands for lift irrigation schemes on uncommand side of the Canals/Lines.

iv. The increased water demand due to the rich cropping pattern (Water intensive) adopted by farmers in comparison with the cropping pattern provided in Administrative Approved Project Report.

v. The demand for letting the water in storage tanks in command area and recharging of the command area during monsoon period.

vi. Increase in ICA of project with aging (ICA of project becomes equal to CCA due to conjunctive water use)

The above are the unanticipated water demands which could not be avoided. However it becomes very difficult to full fill the above demands simultaneously with regular irrigation water demands. Ultimately the rotation period of canal/pipe line gets prolonged which badly affects the irrigation management and resulting in reduction in yield of the crops. In order to take care of the unanticipated demands in future, some provision is to be made in the carrying capacity of main and branch lines by adding capacity factor. For the design purpose, a capacity factor of 1.10 shall be considered for Main line and Branch lines while deciding carrying capacity. No allowance is made for distributaries and minors as the capacity of these can be increased by increasing velocity without much loss in head.

COMPARISION OF IRRIGATION EFFICIENCY OF CDN & PIN

METHOD OF CONVEYANCE/IRRIGATION		**MICRO IRRIGATION**		**SURFACE IRRIGATION**
		SPRINKLER	DRIP	
CANAL BASED CONVEYANCE	Conveyance Efficiency %	70	70	70
	Field canal efficiency	90	90	90
	Field application efficiency	75	90	60
	Overall efficiency	47.25	56.7	37.8
PIPE BASED CONVEYANCE	Conveyance efficiency	95	95	95
	Field Pipe efficiency	95	95	95
	Field Application efficiency	75	90	60
	Overall efficiency	67.68	81.23	54.15
INCREASE OF OVERALL EFFICIENCY % (PIPE AGAINST CANAL)		20.43	24.53	16.35

HYDRAULICS OF PIPE FLOWS

Free Surface Flow

The flow in an open channel or in a closed conduit having a free surface is referred to as free-surface flow or open-channel flow. Free surface is usually subjected to atmospheric pressure.

Pipe Flow or Pressurized Flow.

A conduit flowing full will have no free surface, then the flow is called pipe flow, or pressurized flow.

Steady Flow

3.3.1 Law of conservation of Mass If it is assumed that water is incompressible, from the law of conservation of mass the Continuity equation of flow can be established as follows.

Q = = Constant

Where, Q = Discharge

Ai = Cross-sectional area

Vi = Velocity of flow

Law of Conservation of Energy

The total energy of pipe flow consists of elevationhead, pressure bead and velocity head. BetweenPoint (1) and (2), total energy may be conserved inprefect fluid . However, if the waterbegins to move, head loss generated by frictionwill occur. So, theenergy equation willbe as follows.

Where,∆E is energy addition to the system by pump,

∆H is the total head loss between points (1) and(2)It is very important to estimate the head losses forhydraulic engineering in steady condition.

3.4 Friction Loss (Major Loss)

There are a various formulae available forcalculating the head loss in pipes. However,Hazen-Williams formula for pressure conduits andManning‘s formula for free flow conduits havebeen popularly used.

a) Hazen William Formula

$V =$

$Q =$

$V =$

Where,

Q = discharge in cubic metre per hour

D = diameter of pipe in mm

V = velocity in m/s

r = hydraulic radius in m

S = slope of hydraulic grade-line

(Head loss/ Length of conduit) and

C = Hazen Williams coefficient

b) Manning's formula

$V =$

where

V = velocity in m/s

r = hydraulic radius in m

S = slope of hydraulic grade-line

N = Manning‘s coefficient of roughness

may be adopted generally for design purposes unless local experimental results or other considerations warrant the adoption of any other lower value for the coefficient. For general design purposes, however, the value for all sizes may be taken as 0.013 for plastic pipes and 0.0015 for other pipes.

c) Darcy-Weisbach's Formula

$S =$

where,

H = head loss due to friction over length L (m)

f = dimensionless friction factor

g = acceleration due to gravity in m/s2

V = velocity in mps

L = length in meters

D = diameter in meters

d) Colebrook-white formula

where

f = Darcy‘s friction coefficient

Re = Reynold‘s number = velocity x Diameter/viscosity

d = diameter of pipe

k = roughness projection

e) Modified Hazen William's formula

The Modified Hazen William‘s formula has been derived from Darcy-Weisbach and ColebrookWhite equations and obviates the limitations of Hazen-Williams formula.

$V =$

where

CR = coefficient of roughness (Table 5.5)

D = pipe diameter in m

g = acceleration due to gravity (m/s2)

S = friction slope

v = viscosity of liquid (m2/s)

For circular conduits, $\nu 20$ ℃ for water =

The Modified Hazen William‘s formula derived as

$V =$

where

V = velocity of flow in m/s

CR = pipe roughness coefficient

(1 for smooth; <1 for rough pipes;)

r = hydraulic radius in m

s = friction slope

D = internal diameter of pipe in m

h = friction head loss in m

L = length of pipe in m

Q = flow in pipe in m3/s

Minor Losses

Contraction Losses

Loss of head, hc, due to contraction of cross-section.The loss is caused by a reduction in the crosssectional area of the stream and resulting increasein velocity. The loss of head at the entrance to apipe from a reservoir is a special case of loss dueto contraction

It is noted that the contraction loss coefficient isalways smaller than the corresponding expansion loss coefficient. Also, ξv increases substantially with the contraction angle δ; and the above equation yields moderate losses for contraction angles below δ < 30◦. For δ = 90◦, ξv = (1−φ)/2, i.e., the loss increases linearly with the decrease in the contraction ratio.

3.5.2 Loss of head due to enlargement ofsection

Loss of head, he, due enlargement of cross section is caused by increase cross-sectional area of the stream with resulting decrease in velocity. The enlargement may be either sudden or gradual. The loss of head at the outlet end of a pipe into a reservoir is a special case of loss due to sudden expansion.

i) Exit or Outlet Loss

Loss of head caused by obstruction ofValves

Loss of head, hg, caused by obstructions such as gates or valves which produce a change in cross sectional area in the pipe or in the direction of flow. The result is usually a sudden increase or decrease in velocity followed by a more gradual return to the original velocity.

3.7 Total Loss of Head

The total loss of head, ∆H designates all losses of head in a pipeline which there is steady and continuous flow

PROBLEM STATEMENT

Reducing loss of water through Canal Distribution Network (CDN) by providing Pipe Distribution Network (PDN) for Irrigation.

Presently the overall efficiency of irrigation projects is around 41 – 48 %, it means that the average 50 % of water get lost. It implies that benefit of capital cost incurred on the traditional open channel system for irrigation purpose is less than 50 per cent. Also at many places, extra water is supplied to agriculture field due to bad practice of irrigation, it create the problem of water logging and thereby reducing the fertility of land. To save the precious water storage, and to utilize the maximum efficiency of irrigation project we need to overcome with Pipe Distribution Network.

OBJECTIVES

i. To collect the required parameters, condition and data for Pipe Irrigation Network.
ii. Gunjawani Dam visit regarding collection of information about Pipe Irrigation Network.
iii. To utilize 100% of water in pipe irrigation, and achieve highest percent of decided command area.
iv. Sub-divisions of Main Pipeline to increase cultivation area.

BENEFITS OF CLOSED PIPE DISTRIBUTION NETWORK

- It reduces the loss of water due to seepage and hence the duty is enhanced
- It controls the water logging and hence the bad effects of water logging are eliminated
- It provides smooth surface and hence velocity of flow can be increased
- Due to the increased velocity the discharged capacity of a canal is also increased
- Due to the increased velocity the evaporation loss also reduced
- It eliminates the effect of scouring in the canal bed
- The increased velocity eliminates the possibility of silting in the canal bed
- It controls the growth of weeds along the canal sides and bed
- It provides the stable section of the canal
- It reduces the requirements of lands width for the canal, because smaller section of the canal can be used to produce greater discharge.

SCHEDULE OF PROJECT WORK

- Domain Finalization....................1 WEEK
- Research Papers..........................1 WEEK
- Selection of Dam..........................1 WEEK
- Collection Data (Rainfall, Geographical & historical Data)...............2 WEEK
- Calculation of Reduced Level.......................................3 WEEK
- Calculation of Losses...2 WEEK

BUDGET OF THE PROJECT

Transportation Cost......................... 2000 Rs.
3D Design of Model..........................4000 Rs.
Stationary for Model Making.............. 8000 Rs.

LITERATURE REIVIEW 1

TITLE :- Guidelines for Construction of Pipe Distribution Network (PDN) for Irrigation

AUTHOR :- Mr. Sandesh B. Kulavmode, Dr.S.S.Valunjkar

Government of India aims to increase the water use efficiency by 20 percent till the end of year 2017. Also as per Maharashtra Water Resources Regulatory Authority (MWRRA) from the year 2019 onwards adoption of microirrigation for perennial crops is made compulsory. Maharashtra Water and Irrigation Department reports, current CCA of Maharashtra state is approximately 225 lacs Hector (Ha). By considering the availability of surface water and ground water, the total area irrigated by surface water is 85 lacs Ha and that of ground water is 41 lacs Ha. Hence it is possible to irrigate total 126 lacs Ha, which contributing just 56 percent of total CCA. Demand of water for civilization and industrialization is increasing at an alarming rate. This increase in demand reduces the water availability for irrigation. To overcome this water scarcity, optimum utilization of irrigation water is necessary which will help in irrigating maximum area and for this purpose there is need to modernization of existing conventional CDN system.

The objective of this 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 maximum benefits from PDN, planning, designing, and construction of it should be carefully done. This paper provides a guideline for planning, designing and construction of PDN system for irrigation. It is recommended that PDN system could be economical and feasible over conventional CDN and this system is so flexible that it can be implemented as a new scheme or used to convert the existing CDN.

LITERATURE REVIEW 2

TITLE :- Calculating Friction Loss Darcy-Weisbach Formula vs. Hazen-Williams: Why Darcy is the Appropriate Selection in Large Volume Sprinkler Systems That Use Propylene Glycol

AUTHOR:- Scott Martorano, CFPS, Senior Manager Technical Service

Propylene glycol has been widely accepted and utilized in fire sprinkler systems for many years. Until recently it has been restricted to antifreeze loops on wet pipe sprinkler systems. Innovative advances in the design of sprinklers systems and full-scale fire testing of class 2 commodities in rack storage configurations have demonstrated that sprinkler systems pre-primed with a water and propylene glycol solution utilizing K 25.2 sprinklers are a viable option for the protection of cold storage occupancies under certain conditions.

Full-scale burn testing has been conducted utilizing specific types of sprinkler systems; propylene glycol solutions and K 25.2 ESFR sprinklers that have been specifically tested for the application. The listings and manufacturer's installation instructions for these propylene glycol systems are very specific with regards to the type of system, the system volume and the piping configuration. If a system is selected to protect a cold storage occupancy using a propylene glycol solution, the fire protection designer must verify the appropriate product listings. In addition, the manufacturer's technical literature must be reviewed to ensure that the system design is in compliance with the listings and that all of the required components have been installed.

LITERATURE REVIEW 3

TITLE :- GSM based Automated Irrigation Control using Raingun Irrigation System

AUTHOR:- R.suresh, S.Gopinath, K.Govindaraju, T.Devika, N.SuthanthiraVanitha

The modern raingun irrigation systems, water is supplied half of the land zone of the plants by raingun due to which a large quantity of water is saved. At the present era, the farmers have been using irrigation technique in India through the manual control in which the farmers irrigate the land at the regular intervals. The global irrigation scenario, however, is characterized by poor performance, increased demand for higher agricultural productivity, decreased availability of water for agriculture, increasing soil salinity and possible effects of global warming and climate changeThis process sometimes consumes more water or sometimes the water reaches late due to which the crops get dried. Water deficiency can be detrimental to plants before visible wilting occurs. Slowed growth rate, lighter weight fruit follows slight water deficiency. This problem can be perfectly rectified if we use automatic microcontroller based raingun irrigation system in which the irrigation will take place only when there will be intense requirement of water.

LITERATURE REVIEW 4

TITLE :- Toward precision irrigation for intensive strawberry cultivation

AUTHOR :- J. García Morillo, M. Martín, E. Camacho, J.A. Rodríguez Díaz, P.Montesinos

The Donana ˜ area in Southwestern Spain has the largest concentration of strawberry producers in Europe. The annual yield, close to

300,000 t, is mainly devoted to the international markets (more than 90%). Due to the high water demand of strawberries and to the environmental concerns ofthe destination countries, the maximization of water use efficiency is critical for the strawberry sector. Aiming at the efficient water use in the strawberry production, a comprehensive drip irrigation system has been designed, according to precision irrigation principles. The system has been developed based on a three stages methodology. First, the irrigation process carried out by farmers has been assessed to identify inefficiencies in the irrigation system and management. Their performances have been evaluated using indicators such as the Relative Irrigation Supply (RIS), Strawberry Irrigation Water Applied (SWA) and Strawberry Water Footprint Applied (SWFA). The second phase is focused in an accurate irrigation scheduling based in precise crop water requirements estimation and the optimum irrigation pulse design. Finally, the irrigation system has been designed with the prevailing wisdom of meets the needs of the crop in a timely manner and as efficiently and as spatially uniformly as possible. The most appropriate drip irrigation emitters for the particular conditions of the strawberry production in the study area have been selected. The rest of the on-farm irrigation technologies required to control the system have been integrated, including soil water sensors, smart water meters, programmers, electrovalves and weather station. This precision irrigation system has been installed in a commercial strawberry farm during the irrigation season 2013–2014. Also, an application for PC, mobiles and tablets has been developed to provide farmers practical information (e.g. irrigation times) for optimal irrigation scheduling.

LITERATURE REVIEW 5

TITLE :- Pipe Distribution Network for Irrigation – an Alternative to Flow Irrigation

AUTHOR :- M. M. Satpute, P. V. Khandve, M. L. Gulhane

The population of mankind is increasing at distressing rate and human is tapping the natural resources to cater his need. The available resources including water and food are falling shorter to cope up with the need of mankind. To overcome this problem, it is very essential to conserve the water in many ways and utilize it so that food production should be sufficient to serve for mankind need at reasonably low cost. To increase the food production from agriculture land, irrigation is one of the tools to conserve the water and utilize it for agriculture production. Irrigation of agriculture land is done using various methods such as flow through open channel, lift irrigation, and drip irrigation etc.

Conventionally on almost all command area of irrigation projects in India, the water for irrigation is supplied through the network of turnout, sub minor, distributory, branch canal and main canal. Here, almost 50 % of water is lost during the storage and distribution. There are many disadvantages of the conventional system of irrigation. Their design overall project efficiency (OPE) of the conventional system is obliviously low and ranges between 41 to 48 % only. Actual OPE, it is needless to say, is only 20-35 % in most of the irrigation projects due to many difficulties and constraints. To improve the overall project efficiency of a project, it is essential to overcome various reasons and constraints which are responsible for the low efficiency.

The Pipe Distribution Network (PDN) for irrigation purpose is one of the best solution for substantially improving the design and actual OPE. The Pipe Distribution Network (PDN) is the technique of irrigating the command area through the network of HDPE pipes under gravity flow in place of open channels. This paper describes about the need of PDN system, advantage and scope of PDN, essential requirement for PDN implementation, general installation guide lines for PDN, planning and design principles of PDN. The paper also discusses about the magical improvement in the OPE of an irrigation project by adopting PDN. The paper compares the percentage increase in efficiency of the project and other parameters for an illustrated project of Nagthana-2 in Amravati District of Maharashtra.

Project Details

TALUKA	AS PER THE PROPOSED SUPRAMA REPORT		IRRIGATION AREA & WATER USE AS PER THE PROPOSED SUPRAMA REPORT (in consideration of closed tap & improved crop system)		
	IRRIGATION AREA (ha.)	WATER USE (TMC)	IRRIGATION AREA (ha.)		WATER USE (TMC)
			FLOW	LIFT	
VELHE	685	0.12	850	-	0.12
BHOR	7285	1.40	9435	-	1.40
PURANDAR	8530	2.02	5707	5400	2.02
			15992	5400	
	16500	3.54	21392		3.54

Total irrigation of the project through the traditional open canal is 16500 ha. As per the first revised administrative approval there were 22 km of right canal and 144 km of left canal was planned.

As per the recurring programme through these canal 685 ha. in Velhe, 7285 ha. in Bhor and 8530 ha. In Purandar Taluka.

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- Gunjawane dam is located on kanandi river, MoujeDhaneptal. Velhe Dist. Pune
- Total reservoir capacity of dam is 3.69 tmc and water use is 4.17 tmc

METHODOLOGY

This chapter describes the materials and methodologies adopted in the study for analysing the existing irrigation system and design of underground pipe line irrigation system to minimize the losses. This study depends mainly on primary data from the study area, beside secondary data from relevant official sources. The method selected for primary data collection included selection of site, actual site visit to the proposed site, rainfall data, crop type and variety, yield, soil type, method of irrigation. Secondary data consisted of testing of soil sample, preparing of contour maps by using QGIS software. The details of the study area and the sequential methodologies adopted in the present study are described below.

SITE SELECTION

As per IS: 11570-1985, the following factors shall be considered while determining the appropriate location of Intake:

1. The location where the best quality of water(at least suitable for irrigation purposes) is available.

2. Absence of currents that will threaten the safety of the intake.
3. Absence of ice floats etc.
4. Formation of shoal and bars should be avoided.
5. Navigation channels should be avoided as far as possible.
6. Fetch of wind and other conditions affecting the waves.
7. Ice Storms.
8. Floods.
9. Availability of power and its reliability.
10. Accessibility.
11. Distance from pumping station.
12. Possibilities of damage by moving objects and hazards.

DESIGN CRITERIA FOR PIPE IRRIGAION NETWORK

1. Limited water availability and extensive command.
2. Steep, uneven and undulated topography where canal system is uneconomical.
3. High losses due to evaporation, seepage and water theft.
4. Adoption of advance techniques for future development.
5. Farmer's responses and acceptability.
6. Availability of adequate fund.

DATA COLLECTION

1. Visit to Gunjavani Dam.
2. Collection of required Data.
3. Analysis of collected.

ROUTE SELECTION

1. Selection of route of Pipeline.
2. Maximum use of area for cultivation.

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