SUFFICIENCY OF WATER DISTRIBUTORY(HLBC)

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Abstract

It is known fact that India has a very large population and different studies show that it will continue to rise. The precipitation in India is extremely conflicting in mainstream varieties. The normal yearly precipitation for India has been assessed at 1,143 mm for the actual surviving of the nation, there is a good requirement for actualizing and arrangement of watering system procedures for the time being, and in the future. The present condition of canal and present cropping pattern, water is insufficient for the designed command area. In this method both discharge & crop requirement is considered. Hence for improving the irrigating capacity of canal, designed cropping pattern should be strictly followed. Increased pipe outlets should be reduced to its design size. Also uncontrolled pipe outlets should be controlled by suitable controlling methods for determining the sufficiency of water distributory. In order to determine the sufficiency of water, a distributory (D-65) in Hemavathi canal system is considered which runs for a length of 26.675 km having command area 4703.08 Ha. Crop water requirement by Duty method & Modified Penman's Equation of discharge through outlets is used for determining sufficiency of water. Climatic data for Modified Penman's method is collected for a period of 5 year from K.R Pete Hydrometer logical station in this connection.

Key Words: *Precipitation1, Cropping2, Distributory3 Controlling4 and Sufficiency5 .*

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1. INTRODUCTION

1.1 IMPORTANCE OF IRRIGATION IN INDIA

It is known fact that India has a very large population and different studies show that it will continue to rise. The precipitation in India is extremely conflicting in its including and also mainstream varieties. The normal yearly precipitation for India has been assessed at 1,143 mm for the actual surviving of the nation. India, with a topographical zone of 329 MHA,, with extensive stream bowls which have been isolated into 12 major and 48 medium waterway basin constitute 252.8 Mha and 24.9 MHA of TCA separately.

Watering system arrangement can be extensively gathered into two fundamental classes: (i) Surface watering system arrangements, and (ii) Ground watering system arranges. The choice of a watering system arrangement relies on upon numerous variables, for example, surface geology, precipitation attributes, sorts of source, subsoil profile.

1.3 ADVANTAGES OF IRRIGATION:

The introduction of watering system, has been numerous points of interest, when contrasted with the total dependence on precipitation. These may be specified as under:

- Increase in harvest yield.
- Protection from starvation.
- Cultivation of predominant products.
- Elimination of blended trimming.
- Economic advancement.
- Hydro power production.
- Domestic and mechanical water supply.

1.4 CROP WATER REQUIREMENT

FAO clarifies about yield water necessity and its count. The term water necessities of a yield implies the aggregate amount of all water and the path in which a product obliges water, from the time it is sown to the time it is gathered.

1.5.1 FACTORS AFFECTING CROP WATER REQUIREMENT

The total water requirements of crops depend on the following factors:

- Type of soil
- Temperature
- Wind and rainfall.
- Type of plant
- Method of growing
- Water controlling

1.5.2 NECESSITY OF CROP WATER REQUIREMENT STUDY:

Study of crop water requirement is necessary because of following reasons:

- Effective utilization of accessible water.
- Plan and layout of watering system project.
- Plan water asset advancement in a region.
- Assess watering system requirement.

1.6 DISTRIBUTION SYSTEMS FOR CANAL IRRIGATION:

If there should arise an occurrence of direct watering system plot, a weir or a barrage is developed over the stream, and water is going up on the upstream side. The course of action is known as head works or diversion head works.

Again, from a canal, outlet structures may take out water for delivery to the water courses belonging to cultivators

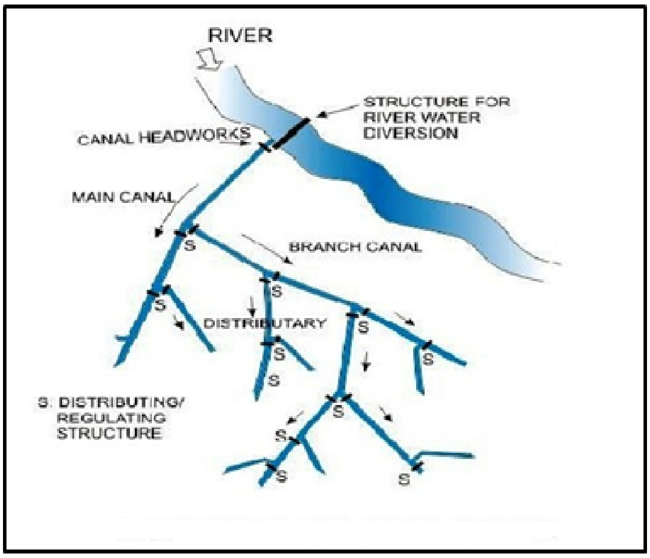


Figure 1.1: Typical layout of an irrigation canal system.

1.7 FLOW DISTRIBUTING STRUCTURES:

The flow of a canal can be distributed in to smaller branches using a variety of structures which have been developed to suit a wide variety of conditions. The flow being diverted in to each branch is usually defined as a proportion of the total flow. Flow distributors of fixed proportion type are generally used in India, whereas in some countries a flow splitter with a mechanical arrangement is used to change the flow distribution proportions.

1.8 CANAL OUTLET:

Canal outlets, also called farm turnouts in some countries, are structures at head of a water course or field channel. Since an outlet is a link connecting the government owned supply channel and the cultivator owned field channel, the requirements should satisfy the needs of both the groups. Discharge through an outlet is usually less than $0.085 m^3/sec$.

It is extremely hard to accomplish an immaculate configuration satisfying both the properties of 'flexibility' as well as 'sensitivity' because of various indeterminate conditions both in the supply channel and the watercourse of the following factors:

- Discharge and silt
- Capacity factor
- Rotation of channels
- Regime condition of distribution channels, etc.

These outlets are further classified as follows

(a) Non-modular outlets

These outlets operate in such a way that the flow passing through them is a function of the contrast in water levels of the conveying channel and the watercourse. Hence, a variation in either affects the discharge.

(b) Semi-modular outlets

The discharge through these outlets depends on the water level of the distributing channel but is free of the water level in the watercourse inasmuch as the base working head needed for their working is accessible.

(c) Module outlets

The discharge through modular outlets is free of the water levels in the dispersing channel and the watercourse, inside sensible working cut-off points. Though modular outlets, like the Gibb's module, have been designed and implemented earlier, they are not very common in the present Indian irrigation engineering scenario.

1.8.1 PIPE OUTLETS

This is a pipe with the exit end submerged in the watercourse (fig1.4). The pipes are placed horizontally and at right angles to the centre line of the distributing channel and acts as a non-modular outlet.

Discharge through the pipe outlet is given by the formula:

$$Q = CA(2gH)^{1/2} \qquad \text{(Eq 1.1)}$$

In the above mathematical statement, Q is the release; A is the cross sectional region; g is the increasing speed because of gravity; H is contrast in water levels of supply channel and watercourse and C is the coefficient of release, for the most part received as 0.65 for pipe outlets.

It is a typical practice to put the funnel at the bed of the disseminating channel to empower the outlets to draw corresponding measure of sediment from the supply channel.. Pipe outlets require minimum working head and have higher efficiency. It is also simple and economical to construct and is suitable for small discharges.

1.8.2 OPEN FLUME OUTLETS

This is a smooth weir with a throat choked adequately long to guarantee that the controlling segment stays inside of the parallel throat for all releases up to the most extreme (Fig 1.2). Since a hydraulic jump forms at the control section, the water level of the watercourse does not affect the discharge through this type of outlet. Hence this is a semi-modular outlet.

Generally, this type of outlet does not cause silting above the work, except when supplies are low for a considerable length of time..

The discharge formula for the open flume outlet is given as:

$$Q = CBtH\,{}^{3}/_{2}$$

(Eq 1.2)

Where,
Q (in cum/s) is identified with the coefficient of release, C and. Bt is the width of the throat in cm; and H is the stature of the full supply level of the supply channel over the peak level of the outlet in m.

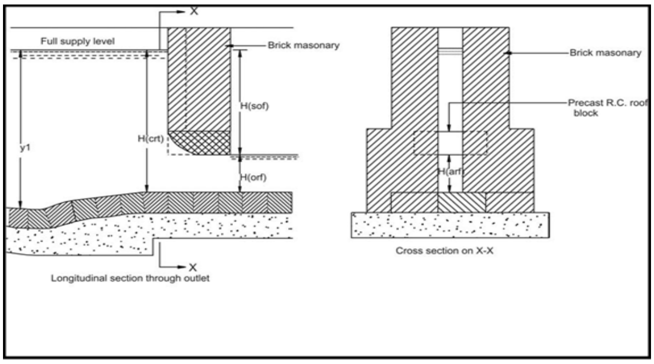


Figure 1.2: Open Flume Outlet

1.8.3 ADJUSTABLE PROPORTIONAL MODULE (APM)

There are different types of these outlets yet the soonest of them is the one presented by E.S. Crump in 1992. In this sort of outlet, a cast iron base, a cast iron rooftop square and check plates on either are side are utilized to alter the stream and is situated in a stone work structure (Fig 1.6). This outlet acts as a semi-module since it doesn't rely on the level of water in the watercourse.

The substance of the rooftop piece is situated 5 cm from the beginning stage of the parallel throat. It has a lemniscates bend at the base with a tilt of 1 in 7.5 so as to make the water join rather than a flat base which would make it wander. The cast iron rooftop piece is 30cm thick.

All things considered, the APM is the best kind of outlet if the obliged working head is accessible and is the most sparing in alteration either by raising or bringing down the rooftop square or peak. The discharge formula for this type of weir is given as:

$$Q = CB_t(H_2)\,{}^{1}/_{2}$$

Eq 1.3)

Where Q (in cum/s) is identified with the coefficient of release, C, which is taken equivalent to around 0.0403; Bt is the width of the throat in m; H1 is the profundity of head accessible, that is the contrast between the supply channel full supply level and the outlet bed (peak) level; and H2 is the distinction between the supply channel full supply level and the base level of the roof top block.

The base plates and the rooftop piece are fabricated in standard sizes, which with the obliged opening of the hole are utilized to get the coveted supply through the outlet..

1.9 FLOW MEASUREMENT IN CANALS:

The available water resources per person are growing scarcer with every passing day. Although a region may not face a net reduction in water resources, the increasing population of the area would demand increased food production and consequently, agricultural outputs.

The amount of water being delivered to a field of an irrigator should also be measured in order to make an assessment of water charges that may be levied on him. If the charge to the user of canal water is based on the rate flow, then rate-of-flow measurements and adequate records are necessary.

1.9.1 WEIRS:

Weirs have been being used as release measuring gadgets in open channels following just about two centuries and are likely the most widely utilized gadgets for estimation of the rate of stream of water in open channels. Weirs may be divided in to sharp and broad crested types. The types of sharp crested weirs commonly used for measuring irrigation water are the following.

(a) Sharp crested rectangular weir:

Amongst the many formulae developed for computing the discharge of rectangular, sharp crested weirs with complete contraction, the most accepted formula is that by

Francis and is given as:

$$Q = 1.84(L - 0.2H)H\,{}^{3}/_{2}$$

(Eq 1.4)

Where Q is the discharge in m^3/s; L is the length of the crest in meters; and H is the head in meters, that is, the vertical difference of the elevation of the weir crest and the elevation of the water surface in the weir pool.

(b) Sharp crested trapezoidal (Cipolletti) weir:

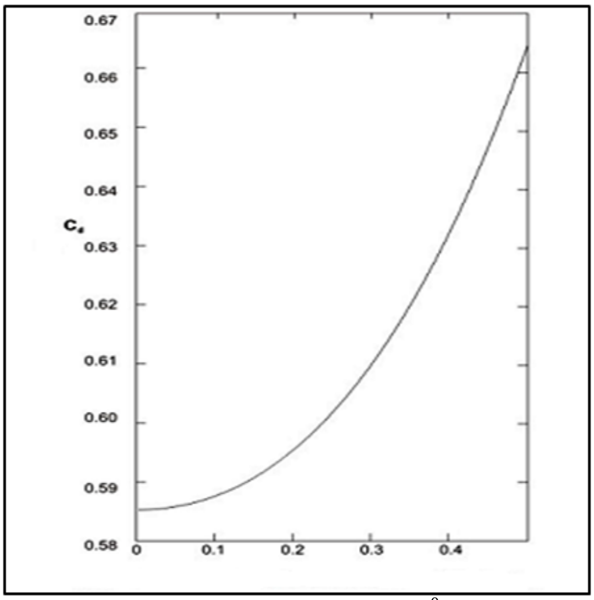


Figure 1.3 Value of Cd for 90^0 V-Notches

A general view of this type of weir is shown in Fig 1.8. The discharge formula for this type of weir was given by Cipoletti as:

$$Q = 1.86\ L\ H^{3}/_{2}$$

(Eq 1.5)

Where Q is the discharge in m^3/s; L is the length of the crest in meters; and H is the head in meters.

(c) Sharp sided 90^0 V-notch weir:

A general view of this type of weir is shown in Fig 1.9. Of the several well known formulae used to compute the discharge over 90^0 V-notch weirs the formula recommended generally is the following:

$$Q = {}^{8}/_{15}\,(2gC_d)^{1}/_{2}\,H^{5}/_{2}$$

(Eq 1.6)

Where Q is the discharge in m^3/s; g is the acceleration due to gravity ($9.8m/s^2$); C_d is a coefficient of discharge; and, H is the head in meters. The value of C_d varies according to the variation of H and **can be read out .**

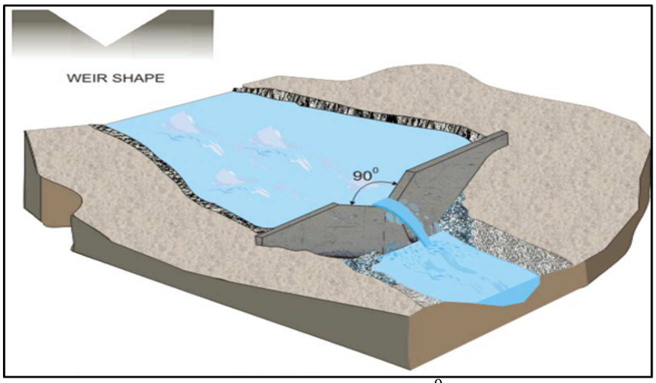


Figure 1.4: General view of 90^0 v-notch weir

1.9.2 FLUMES:

Flumes are flow measuring devices that works on the principle of forming a critical depth in the channel by either utilizing a drop or by constricting the channel. These two forms of flumes for flow measurement are described below.

***(a)* Flume with a Vertical drop:**

This type of structure is useful to negotiate a fall in the canal bed level. One of these, the standing wave flume fall developed at the Central water and Power Research Station (CWPRS), Pune, has been institutionalized and archived in Bureau of Indian Standard code IS: 6062-1971 "Technique for estimation of stream of water in open channels utilizing standing wave flume-fall" (Fig. 1.11)Because of the inherent free flow conditions the measurement of flow requires only one gauge observation on the upstream side.

The discharge equation for this structure is given by the following equation:

$$Q = 2/3(2g)^{1}/_{2}\ CBH1.5$$

(Eq 1.7)

Where Q is the release in m3/s; g is the speeding up because of gravity; C is the coefficient of release (=0.97 for 0.05 < Q <0.3 m3/s and = 0.98 for 0.31< Q <1.5m3/s); B is the width of the flumed segment, likewise called the throat and H is the aggregate head, that is, the profundity of water above peak in addition to the velocity head.

***(b)* Flume with a constricted section:**

This type of structures for measuring water discharge creates a free flow condition followed by a hydraulic jump by providing a very small width at some point within the flume. The flume comprises of a short parallel throat went before by a consistently merging area and took after by a consistently extending segment. The floor is level in the focalizing area, slants downwards in the throat, and is slanted upwards in the growing segment. The control segment, at which the profundity is discriminating, happens close to the downstream end of the constriction. Parshall flumes can be constructed in a wide range of sizes to measure discharges from about $0.001m^3/s$ to $100m^3/s$.

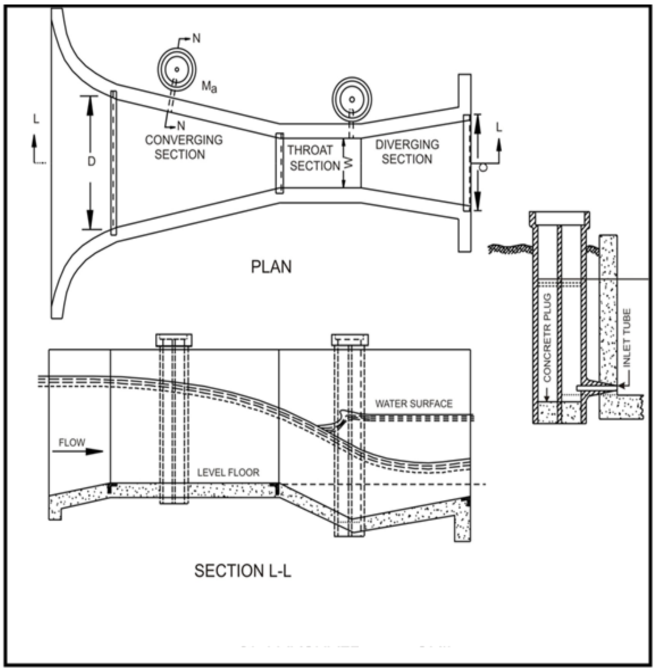


Figure 1.5: Parshall measuring flume

1.10 LOSSES OF WATER IN CANAL:

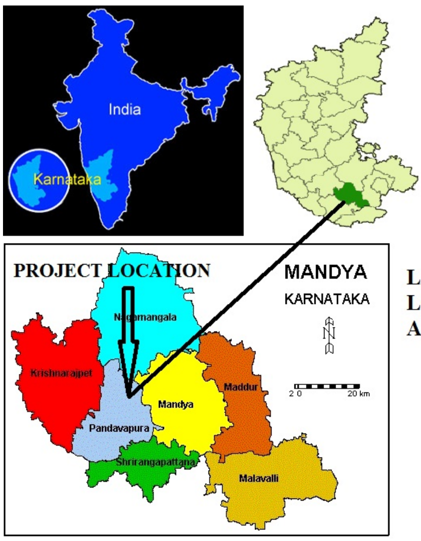
During the entry of water from the principle trench to the outlet at the leader of the watercourse, water may be lost either by dissipation from the surface or by drainage through the peripheries of the channels. These misfortunes are now and then high, of the request of 25 to 50 % of the water occupied into the primary trench. Dissipation and leakage misfortunes are talked about underneath:

- **Evaporation**: the water lost by dissipation is by and large little, when contrasted with the water lost by drainage in specific channels. Dissipation misfortunes are for the most part of the request of 2 to 3 percent of the aggregate misfortunes.
- **Seepage**: there may be two distinct states of drainage, i.e. (i) percolation, (ii) absorption
- **Percolation**: in permeation, there exists a zone of persistent immersion from the trench to the water-table and an immediate stream is set up.
- **Absorption**: in assimilation, a little soaked soil zone exists round the channel area, is encompassed by zone of diminishing immersion.

1.12 OBJECTIVE :

This work is intended to find the sufficiency of the discharge in an existing Distributory canal in satisfying the water requirement from head to tail end. The project involves the following works

(a) Collecting details of distributory more specifically discharge head of each outlet.
(b) Determining crop water requirement for the command area of distributory using different methods:
   (i) Crop water requirement by Duty method.
   (ii) Crop water requirement by Modified Penman's method.
(c) Determining the discharge thorough pipe outlets using Hydraulic formulas.
(d) The water requirement for command area of each pipe outlet.
(e) Determine outlet point up to which water is sufficient for present cropping pattern & present condition of outlets.



DETAILS
LATITUDE: 12°39'29"
LONGITUDE:76°29'07"
ALTITUDE :808.00

2. SYSTEM DESCRIPTION

2.1 INTRODUCTION:

This chapter highlights about the details distributory on which the study has been done. Also it includes the technical details like cross section details, command area, design discharge in canal, outlets provided, and observation made during field visit.

2.2 DETAILS OF DITRIBUTORY 65:

Hemavathi Left Bank canal (HLBC) off takes from Hemavathi dam constructed across Hemavathi River near Gorur. Dam construction work completed in the year 1979. The above said distributory canal work completed in the year 1984. Distributory No 65 takes off at Ch 153.025 of HLBC. It is designed to irrigate area 11616.61 Acres (4703.08 Ha) of semidry crops during khariff season. The reach comes under preview of Hemavathi Left bank canal division, Pandavapura Taluk, Mandya District, Karnataka. Table 2.1 presents the design details of distributor No 65 of HLBC. Figure 2.1 shows the cross section details of distributory 65. Table 2.2 shows the details of pipe outlet, its design discharge and command area.

Table 2.1: Design Details of Distributory No 65:

Bed Width	0.9m
Full Supply Depth	1.1 m
Free Board	0.15m
Side Slope	1:1
Mannings Coefficient	0.012
Bed Slope	1 in 2500
Length of Distributory	26.675 kM
Command Area	11616.61 Acres (4703.08 Ha)
Design Discharge	69.78 Cusecs (1.976 Cumecs)
Type of outlet	Pipe Outlet
Size of pipe outlet	0.1 m

Fig. 2.2

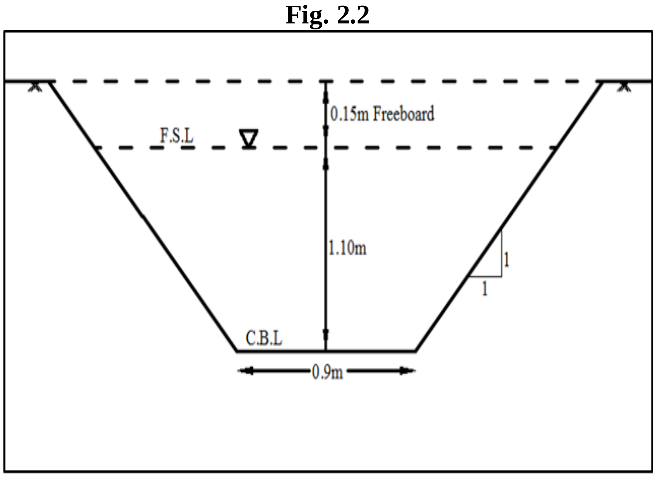


Figure 2.1: Cross-section of D-65

2.3 FIELD OBSERVATION:

Following are the observation made during the field visit:

- The Distributory is completely lined and lining is in good condition.

- Pipe outlets are provided in distributory to draw water from distributory.
- Size of pipe outlet was increased to draw more water. Actual size of pipe outlet was 10cm, and now it is increased to 20cm.
- Canal was designed for Semi Dry Crops But on field observation it is found that there is a Violation in cropping pattern.

2.4 DISCHARGE CALCULATION FOR FULL SUPPLY OF CANAL:

Discharge is calculated for Full supply depth of canal with the help of manning's formula an

$$V = 1/n(R^{2}/_{3}\, S^{1}/_{2}) \quad \text{(Eq 2.1)}$$

$$Q = AV \quad \text{(Eq 2.2)}$$

In the above comparison, Q is the release; An is the cross sectional range, V is speed of stream, n is Manning's Roughness coefficient, S is the bed slant of channel, R is the Hydraulic Mean Radius is given by A/P, where P is the wetted edge of trench for full supply depth.

Table 2.3: Discharge of D-65

Depth of Flow	1.10 m
Bed Width	0.9 m
Side Slope	1:1
Slope Length	1.56 m
Area	2.21 sqm
Wetted Perimeter	4.02 m
Hyd Mean Radius	0.550 m
Manning's Coefficient	0.015
Bed Slope	0.0004
Discharge	1.976 cumecs

3. METHODOLOGY

3.1 INTRODUCTION:

To determine the sufficiency of water in Distributory No 65, the methods of crop water requirement and discharge calculation is adopted. Methods adopted are as listed below.

(a) Crop Water requirement by Duty Method
(b) Crop Water requirement by Modified Penman's Method
(c) Calculation of discharge though pipe outlets using Hydraulic formula.
(d) Duty will be expressed in ha/cumecs or acre/cusecs or acres/MCft.

3.2 CROP WATER REQUIREMENT BY DUTY METHOD:

Duty represents the irrigating capacity of a unit of water. It is the connection between the area of crop irrigated and the quantity of watering system required during the whole base period of that crop.

3.2.1 CALCULATION PROCEDURE CROP WATER REQUIREMENT

- For each Crop Duty is known. (From Irrigation Handbook. For Paddy 50acres/cusecs, For ragi 150acre/cusecs, for sugarcane 60acres/cusec)
- Also the command area is known for each pipe outlet (From Tree plan of canal)
- For present cropping pattern (Paddy-80%, Ragi-15%, and Sugarcane-5%) calculate command area for each crop at for each outlet.
- From known duty & command area discharge can be calculated

  Discharge=Command Area/Duty
- Discharge through each pipe outlet for different crops is calculated in similar manner. (conveyance losses for lined canal – 20% is considered)
- This discharge is cumulated. At some chainage cumulated discharge becomes equal to the head discharge. Remaining Length of canal (and corresponding Command area) is Suffering Atchkut**.**

3.3 CROP WATER REQUIREMENT FROM MODIFIED PENMAN'S METHOD:

Prediction method for yield water prerequisite is utilized attributable to the trouble of getting precise field estimations. The technique frequently should be connected under climatic and agronomic condition altogether different from those under which they were initially created.

3.3.1 EVAPOTRANSPIRATION (ETo):

The effect of climate on yield water prerequisites is given by the reference crop evapotranspiration (ET_o) which is characterized as "the rate of evapotranspiration from a broad surface of 8 to 15cm tall, green grass front of uniform tallness, effectively developing, totally shading the ground and not shy of water"(fig 3.1). ET_o is communicated in mm every day and speaks to the mean esteem over that period.

Parameters Involved in calculation of Evapotranspiration:-

(a) **Realtive humidity**:- The relative moistness (RH) communicates the level of immersion of the air as a proportion of the real to the immersion vapour weight at the same temperature.
(b) **Vapour Pressure(ea)**:- Water vapor is a gas and its weight adds to the aggregate environmental weight. In standard S.I. units, weight is no more communicated in

centimeter of water, millimeter of mercury, bars, air, and so forth., however in pascals (Pa).

(c) **Saturation Vapour Presure(es)**:- When air is encased over a dissipating water surface, balance is come to between the water atoms getting away and coming back to the water repository.

(d)**Atmospheric pressure(P):-** The air weight, P, is the weight applied by the heaviness of the world's environment.

(e)**Daily extraterrestrial radiation (Ra):-** The sun powered radiation got at the top ofthe earth's environment on a flat surface is known as the extraterrestrial (sun oriented) radiation.

(f)**Solar or shortwave radiation (Rs):-** As the radiation infiltrates the environment, a percentage of the radiation is scattered, reflected or consumed by the air gasses, mists and dust. The measure of radiation coming to a level plane is known as the sun powered radiation,

(g)**Clear-sky sun oriented radiation (Rso):-** . Rso is the sunlight based radiation that would achieve the same surface amid the same period however under cloudless conditions.

(h)**Albedo (α):-** A lot of sunlight based radiation coming to the world's surface is reflected. The division, α, of the sunlight based radiation reflected by the surface is known as the albedo.

(i)**The net sun based radiation (Rns):-** The net sun powered radiation, Rns, is the division of the sun powered radiation Rs that is not reflected from the surface.

(j)**Net longwave radiation (Rnl):-** The sun based radiation consumed by the earth is changed over to warmth vitality. By a few procedures, including discharge of radiation, the earth loses this vitality. In this way, the physical radiation is alluded to as longwave radiation.

(k)**Net radiation (Rn):-** The net radiation, Rn, is the distinction in the middle of approaching and active radiation of both short and long wavelengths.

(l)**Soil warmth flux (G):-** The dirt warmth flux, G, is the vitality that is used in warming the dirt. G is certain when the dirt is warming and negative when the dirt is cooling.

3.3.2 CROP COEFFICIENT (Kc)

The impact of the yield attributes on harvest water prerequisites is given by the product co-proficient (Kc) which exhibits the relationship between reference (ET_o) and yield evapotranspiration (ETcrop) or ETcrop= Kc× ET_o. (Fig 3.2). Estimations of kc given are demonstrated to change with the product, its development stages, developing season and winning climate conditions. ETcrop can be resolved in mm/day.

3.3.3 CROP COEFFICIENT (Kc) CURVE FOR CROPS

Based on the determination of the length of crop development stages and the relating harvest coefficients, a product coefficient bend can be built. The state of the bend speaks to the adjustments in the vegetation and groundcover amid plant advancement and development that influence the proportion of ETc to ETo. From the bend, the Kc variable and henceforth ETc can be determined for any period inside of the developing season.

3.3.4 PLOTTING OF K_C CURVE:

- Collection of Climatic data from nearby Hydrometer logical Station. HM station near D65 is K.R Pete HM Station
- Using climatic data Calculating ETo for Ragi, Paddy, And Sugarcane
- Determining Crop coefficient for Ragi, Paddy, & sugarcane for different growth stage.
- Consumptive Use (Cu) is calculated for different month for all crop.
- Calculate monthly requirement of crops considering Rainfall and conveyance loss (20%).
- Determine Critical Month in which Cu is maximum is considered for calculating Discharge Though pipe outlet
- Calculating Discharge through each pipe outlet considering 15 days frequency of water supply
- Cumulating the discharge through each outlet. At some chainage cumulated discharge becomes equal to the head discharge. Remaining Length of canal (and corresponding Command area) is Suffering Atchkut.

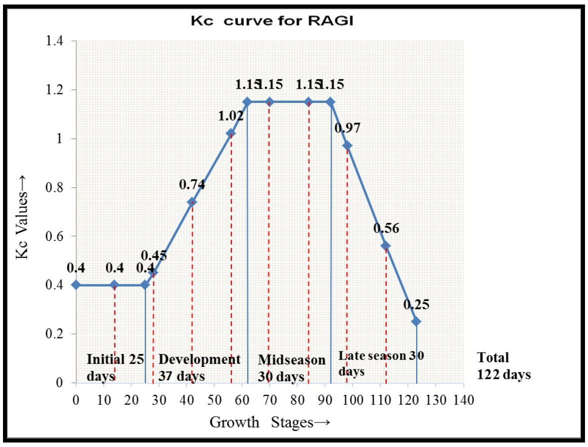


Figure 3.3: Kc curve for Ragi

3.4 DISCHARGE THOUGH PIPE OUTLETS:

Discharge through pipe outlet (Fig 3.5) is calculated with the help of hydraulic formula. Then discharge through pipe outlet is calculated using Eq 3.1. Also conveyance loss is considered 0.6 cumecs /$10^6 m^2$ wetted area.

$$Q = CdA(2gH)^{1/2} \qquad \text{(Eq 3.1)}$$

3.4.1 ESTIMATION OF CROP WATER REQUIREMENT:

- Design discharge at the head of canal is known, also the section of canal & bed slope is known.
- From these data head of water at each pipe outlet is calculated using Eq 2.1 and Eq 2.2
- Also conveyance loss is calculated (at 0.6 cumecs per 10^6 sqm of wetted area) and discharge through each pipe is calculated .
- This discharge is cumulated. At some chainage cumulated discharge becomes equal to the head discharge. Then command area is cumulated to find the sufficiency of water.

4. RESULT AND ANALYSIS

Table 4.36: Comparison of result

Sl. No	Method	Area can be irrigated (Acres)				Chainage (km)	Suffering Atchkut (Acres)
		Total	Paddy	Ragi	Sugarcane		
1	Crop Water Requirement by Duty Method	3257.6	2606.05	488.63	168.88	15.275	8359.01
2	Crop Water Requirement by Modified Penman Method	3640.4	2912.33	546.06	182.02	15.275	7976.21
3	Discharge calculation Through Outlets	2848.36	2278.69	427.25	142.42	20.5	8768.25

4.1 CROP WATER REQUIREMENT BY DUTY METHOD:

Table 4.1 shows the calculation of crop water requirement by Duty Method. Following are the result obtained by this method

Total command area can be irrigated for present crop pattern = 3257.6 acres (1318.85 ha) of which 2606.05 acre Paddy, 488.63 acre Ragi, 168.88 acre Sugarcane. This area covers up to chainage 15.275 km.

4.2 CROP WATER REQUIREMENT BY MODIFIED PENMAN'S METHOD:

Table 4.2 to table 4.34 shows the calculation procedure of Crop Water Requirement by Modified Penman's method.

Following are the result obtained by this method

Total command area can be irrigated for present crop pattern = 3640.4 acres (1473.85 ha) of which 2912.33 acre Paddy, 546.06 acre Ragi, 182.02 acre Sugarcane. This area covers upto chainage 15.275 km.

4.3 CALCULATION OF DISCHARGE THOUGH PIPE OUTLETS:

Table 4.35 shows the calculation procedure of discharge through pipe outlet using hydraulic formulas.

Head discharge (1.976 cumecs) reaches up to chainage 20.5 km. Total command area under this chainage can be irrigated for present crop pattern = 2848.36 acres (1153.18 ha) of which 2278.69 acre Paddy, 427.25 acre Ragi, 142.42 acre Sugarcane.

4.4 ANALYSIS

It can be noticed that the Water sufficiency estimated by crop water requirement method is almost same. The Result obtained by Discharge calculation is more than that of other two methods. The first two methods adopt only requirement of water but does not consider discharges through pipe outlet. However water drawn from the pipe outlet may not be sufficient to fulfill its Command area.

CONCLUSIONS

After analysing all three methods, it can be concluded that for the present condition of canal and present cropping pattern, water is insufficient for the designed command area. All three methods give almost similar result in terms of command area. From "Calculation of Discharge Through pipe Outlets" method though the water reaches up to chainage 20.5km, irrigating area is less (2848.36 acres). In this method both discharge & crop requirement is considered. To improve the irrigating capacity of canal, designed cropping pattern should be strictly followed. Increased pipe outlets should be reduced to its design size.

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