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A MODEL FOR EFFICIENT DISTRIBUTION OF IRRIGATION SUPPLIES AMONG DISTRIBUTARIES

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ABSTRACT

This paper focussed on different aspects of canal water which plays a pivotal role in overall water management in the country. A canal operation modael was developed to operate the canals and distribute water among distributaries on equitable and reliable basis as close to varying pattern of crop water needs as passible. To varify the model, data of Pakpattan Canal (U) releases was used. Irrigation water requirements in the command area was also estimated. Patterns of canal releases and operation of distributaries w.r.t. reliability and equitability of supplies were analysed.

Irrigation water requirements were found considerably greater than sanctioned water allowances and existing canal supplies. Canal releases were observed to be neither equitable nor reliable. The operation of canal delivery system as proposed, will bring the following improvements :

1. Assured schedule of distributaries running throughout the season in advance will enable the farmers to decide about the availability of canal water, minimum acrage to be sown and other agriculture activities to be performed.
2. Equity of supply among distributaries and among outlets along a distributary.
3. Efficient use of available canal water by improved management of canal operation.

1. INTRODUCTION

Economy of Pakistan is basically agrarian. Agriculture occupies a pivotal role in

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the nation's economy which is the largest goods producing sector. Over 50 percent of the population is engaged in agricultural activities. It provides the basic food and fiber requirements to rapidly increasing population of the country.

Total area of the country is 196.64 million acres. About 40 percent of area i.e. 78.0 million acres is suitable for agricultural and forestry uses. 20 percent of total land (40.0 million acres) is presently commanded by Irrigation System which comprises 34.6 million acres culturable command area (CCA). Remaining area is irrigated by tubewells or depends on rainfall and other means. About 90 percent of Pakistan's agricultural production comes from the irrigated lands of the Indus Plain (World Bank, 1988).

Total annual river flow in the Indus Plain is about 152.0 million acres feet (Khaliq, 1980). The quality of this surface water is good for irrigation with Total Dissolved Solids (TDS) between 100 to 350 ppm. At present about 102.0 MAF surface water is diverted into 43 canal commands annually. Water from the river channels is diverted by barrages and headworks into the main canals. Generally, the hierarchical canal system runs from main canal to branch canals/distributaries and minors, which is schematically shown in Fig. 1.

The Indus Basin Canal System is the largest continguous irrigation system in the World. It comprises the Indus River and its major tributaries, three major storage reservoirs, 19 barrages/head-works, 12 link canals and 43 canal commands. The total length of the canal system is about 39,000 miles. Water-courses, farm channels and field ditches add another about 1.0 million miles.

1.1. Constraints of Canal Irrigation

The general constraints of canal irrigation to maximize the agriculture production are summarized as below : -

i. High irrigation losses : High seepage losses from irrigation channels and fields has caused waterlogging in most of the irrigated areas. Only 30 percent of diverted river water to canals ultimately become available for the crops (PARC, 1982).

ii. Short water supply: Aggregate irrigation water supply does not meet for optimal yield of crops.

iii. Time pattern of the water supplies is not matched with time pattern of crop water needs.

iv. Uncertainty of water supply causes excessive water depletion in crops root zone between irrigations.

v. Improper distribution of supply results in water defficiencies in tail reaches of canals while upper reaches take excess supply and large areas remain without water for 6 months (non-perennial areas).

vi. Due to unplanned distributaries supply, farmers receive no advance information about canal closure when these are operated in rotations.

vii. Before start of season farmers have no choice to decide the cropping pattern and cropped area w.r.t. expected supply in the season.

viii. Inequitable distribution of supply among all farmers in the canal system and in individual canal command.

ix. Inefficient irrigation and out dated agricultural practices.

x. Low water use efficiency due to inadequate water management.

1.2. Objectives

To maximize the agricultural production, it is important to tackle with the problems of inadequate management of irrigation water. Operation and regulation aspects of canal distribution system plays a pivotal role in irrigation water management. Canal operation directly control the farm activities and effects the quality of crops.

Presently, irrigation canals generally run keeping in view hydraulic aspects only. No material effort has been taken to improve the operation of canals/distribution of supplies among distributaries w.r.t. crop-soil-climate conditions within existing set of constraints.

Thus the purpose of this study was to access the irrigation requirements in a canal command, evaluate the existing supply conditions and suggest solution to improve the canal operation/distribution system. The specific objectives were :

i. Comparative study of irrigation requirements and canal releases pattern in a selected canal command.

ii. To develop and varify a model for better operation of canals and the distributaries as close to crop needs as possible. Further to ensure the canal release be reliable and equitable.

2. PRESENT OPERATION OF CANAL SYSTEM

In Pakistan a network of irrigation canals had been spread to cultivate vast tracts of barren land. About three hundred years ago inundation canals were constructed by making cuts in the river banks at suitable locations to spread flood water for cultivating lands adjacent to the rivers. In mid of ninteenth century weirs and barrages were built across the rivers to divert water into the canals. All such diversion structures enable the canals to take the varying quantity of water on run of river pattern, whenever water was available in the rivers. In these circumstances, appropriate cropping patterns and cultural practices were evolved based on run of river supplies.

The sources of river water are snow melt, springs and rains. The Indus plain rivers are usually in spate during July and August due to monsoon rains. The peak flows in the rivers in summer are 50 to 200 times the normal winter flows. Thus the summer or Kharif season is the controlling factor in determining capacity of canals. Under these conditions a specific procedure was initiated for planning and designing the irrigation canals in the country. All the canals were designed on the basis of cropping pattern of the area, local practice of number of waterings and the volume of water required for about 3.0 inches of irrigation (Dench, 1943). As the winter flow in the river was limited, only 21 million acres of area had been provided with perennial (full year) irrigation facilities and 14 million acres with non-perennial (Kharif season only) irrigation supplies.

Water allowances for perennial and non-perennial canals were treated separately. Non-perennial ares were provided more water allowances, so as to provide some compensation for the deprivation of water during Rabi season.

Water Allowances varies approximately from 3.0 to 5.5 cusecs for perennial and non-perennial canals with total irrigation intensity hardly more than 70 percent. Afzal (1969) calculated that Water Allowance of 3 cusecs was equivalent to an application of 1.35 and 1.8 feet depth of water per acre at the farm and outlet head respectively. These Water Allowances were not taken on the basis of any consumptive use studies. But the idea was to bring down more and more area under cultivation with the minimum quantity of water.

2.1. System Type

Terminal end of an irrigation water delivery system is a farm or field. The manner in which supply is delivered to field determines the type of system. The operation of the streams supplying irrigation water to individual field or farm is expressed in supply duration, irrigation frequency and delivery rate of flow which are termed as "System Constraints" (ASCE, 1984). The operation of the delivery system is subsequently worked out for the Minor (tertiary), Distributary (secondary) and Main/Branch (primary) canal.

The irrigation water delivery system of Pakistan is open channel gravity flow system. With available supply, it operates on continuous flow upto outlet and below outlet supply rotates among farmers having fixed share according to their acrage on 7 or 10 days rotation. The system is rigid since rate of flow (capacity of outlet), frequency and duration (fixed share of each farmer) are fixed. The system can be categorised under rotation delivery method as continuous flow method.

2.2. System Constraints

The Indus Basin Irrigation System has numerous restrictions as a result of historical development of each canal command project and has little or no relevance with current needs of agriculture. Structural designs and water rights of canals are main causes of existing problems of canal irrigation in the country.

The salient characteristics and limitations of the canal system are briefly summarized below :

I. The unique feature of Pakistan's irrigation system is that it commands 35.8 million acres area with contiguous system. Availability of water is not according to crop water needs. Thus in Pakistan water, not the land, is a key contraint.

II. It was an implicit irrigtion development strategy to design canal with low Water Allowances, make non-optimistic assumptions on water availability, design the system for low irrigation intensities and to meet the objectives of bringing crops to maturity on the largest possible area with the minimum consumption of water.

III. Every canal system drawing irrigation supplies from rivers has acquired legal rights to continue to receive those supplies in quantities and at time corresponding to the pattern of its historic withdrawals over the years. This is an accepted principle of water law in the Indus Basin.

The "historic water right" of a canal command developed, as it shifted from inundation canals to weir/barrage control canals or built first were established on a first come first served basis. Thus the canals built first got the supplies and right on priority, those built latter were limited to what was left in the river. Existing water rights of the canal system are the product of historical accident. Thus shares of canals are not based on crop water requirements nor do they aim at optimizing agricultural productions. The water rights of canals are so rigid that if a canal system or a part of it does not need water, its water cannot be transferred to other canal system within the same province or the other.

IV. Before construction of reservoirs (Tarbela, Mangal and Chashma), the structural capacity to control water supply in the Indus Basin System was very limited. However, presently with reservoirs and inter river links, effective river integration is feasible but not practised due to other priorites (such as power).

V. The irrigation system is so constructed that there are no head gates at the turn out (outlet) and other regulation structures. Thus if a particular canal has full supply discharge there should be water in every watercourse on that canal. The watercourse system does not always flow full, but depends on supplies in the canals.

VI. The hydraulic design of a stable alluvial channels (distributary) requires constant flow at full supply as much as possible (consequently the outlet normally delivers constant quantum of supply in the watercourses automatically without any manual regualation). Otherwise, regime of the channel gets seriously upset resulting in silting (for lower discharges) or scouring (for higher discharges). On the other hand, the main canals and branches can operate with any available discharge as these are provided with adequate number of control structures.

VII. Most of the canal irrigation systems of Pakistan cover large areas and there are a few escape structures on them which are operated in emergency when closure/reduction is required quickly downstream.

2.3. Regulation of Irrigation Deliveries

There are two major aspects of irrigation water deliveries. One is the effective operation of the system above the point of delivery and the other is the effective delivery and application at the farm. Thus the farm irrigation depends on the operation of the system. The delivery point to fields is the turnout (outlet) from the distributary/minor. Upto this point (outlet), the regulation of the irrrigation water is governed by the Irrigation Department under administrative policies for a particular canal.

The functional responsibility of the Provincial Irriagation Departments is to deliver reliable and equitable supplies to canal outlets. System management decisions are made by the officials of the Department within Government policies, water rights, technical limitations and availability of supplies.

All the barrages/headworks of Indus Basin have historical water rights as explained previously and thus are sanctioned to draw a certain percentage of the river water. All the canals are designed for a fixed discharge. However, they are authorized to draw water upto a maximum limit referred to as the authorized full supply (AFS).

The quantity of water released to any canal is according to the programme framed by the Director Regulations (one each for Punjab and Sind Provincs for the Irrigation Departments, located at Lahore and Karachi respectively) to distribute the water supplies to canals of these provinces.

Each Director estimates the availability of water at each barrage located in his Province, in 10 daily periods for the whole of the Rabi and early Kharif seasons in advance. He then distributes water according to water rights and requirements in consultation with the engineers in charge of respective canal. Canal regulation is watched daily during the whole season.

Further canals are closed for inspections of their beds, sides, structures and for minor repairs annually. It is generally done, each year during the months of January/Feburary for two to three weeks, depending upon the nature of repairs to be made in each canal command.

2.4 Regulation of a Particular Canal System

The main canals off-take from controlled weirs/barrages on the river. The branch canals that off-take from the main canals, always have controlled regulations at their heads. The distriutaries off shooting from main canals or from branches are also fitted with steel gates at their heads or masonary works for regulation with "Karies". Cross regulations in the main canals or branch canals are frequently provided at D/S of distributary headworks for regulation in the distributaries. Minors and sub-minors originating from distributaies generally do not have gates at their heads and supplies are diverted through open masonary structures which work automatically on proportionate basis with rise and fall in water level of the distributary.

Finally, the water is diverted to the water courses through uncontrolled turnouts (outlets) which have fixed capacity and take full discharge only when channel is running at full supply level. Rarely main canals/branches have outlets and these are strictly discouraged.

In one irrigtion canal generally, one or more Executive Engineers are incharge of operation and maintenance while their jurisdication is called a Division. There are three to four Sub Divisions under the charge of an Executive Engineer in a Division. There is one regulation officer of the canal which is either Executive Engineer or Sub-Divisional Offeicer of head reach of the canal who is responsible for regulation.

The Executive Engineer makes their own schedules for running of the canal, branches, distributaries and minors in their areas based on the availability of water. Distributaries are formed in serveral groups and water is supplied to these groups in weekly rotations when supply in parent canal is less than capacity. The first few groups get full water supply during the first week while the shortages are transferred to the last group. During the next week, the group which has sufferred water shortage during the previous week, gets full supply and shortages are transferred to the other groups which have received full water supply during the previous week. These schedules come into operation when there is shortage of supply in rivers/reservoirs.

2.5 Short Comings

The canal operation and regulation system being practised is generally lacking the followings:

I. No advance complete plan of distriutaries running for whole season is known to the farmers. So they are not in a position to plan the cropping pattern, irrigation and agriculture activities.

II. Often at sowing period of crops the canal runs at full supply discharge but as supply dwindles channels start to run in rotation.

III. The agricultural activities suffer badly when channels suddenly start to run on rotation. Thus the process of agricultural inputs other than water suffers badly which effects the crops yield and agricultural production.

IV. When channels run in rotation then the channels in last group takes uncertain and varied supply during the week. Most of the delivered supply becomes wastage as seepage in distributary and water courses or execessive percolation in fields, due to less flow rate in the water course.

V. Releases in channels fluctuate most of the time and supply condition in non-perennial distributaries in Rabi season do not distribute the supply equitably among outlets. Sharp fluctuations and running of distributary less than at least 7 days are observed mostly in lower off-takes of parent canal and necessarily in Rabi season. This seriously effects irrigators whose consecutive turns fall in closure periods.

VI. Inequitable distribution of availabe supply among distributaries and among outlets along a distributary when it runs either less than the designed capacity or in rotation less than 7 days while some channels runs at full capacity for longer peroids.

3. MODEL FORMULATION FOR OPERATION OF CANAL

Lack of planning and isolation of releases from varying demand paterrn of crops, forced the farmers either over irrigation or under irrrigation resulting wastage of precious water or stress in the crops. The operation of the canal distribution system purely 'on demand" basis under the existing set of constraints and unique features of the irrigation system, is not practicable. However, improvement in management of canal operation within prevailing limitaions and conditions is possible. Since the operation of Mangla, Chashma and Tarbela reservoirs in 1967-77, Indus Basin Canal System is receiving dependable supplies in whole year specially in Rabi season against the run of river basis supplies in the past. Further utilization of ground water in most canal commands either by public tubewells or by private tubewells is being practised. Thus both water resources should be managed as an integrated system. Canal supplies should be delivered on the pattern of varying needs of crop requirements, taking into account the availability of ground water supplies in a particular canal command. It is incumbent upon the irrigation management to let each farmer know the availability of water (canal running) throughout the crop season in the beginning of each season. With this information, the farmer is then able to plan his cropping pattern and irrigation for the season on the basis of what he can draw from canal or from other sources (tubewells water). Further reliable and equitable distribution of available supply with optimum water use and conservation must be ensured by the management. To achieve these objectives, annual planning of irrigation water supplies is paramount. With these ideas, a Computer Model for Canal Operation was developed on LOTUS 123.

The Model calculates the total irrigation requirements in a specific area and based on canal capacity, available canal supply and ground water pumpage, prepares canal operation schedule for whole year. Further to distribute the supply available at main canal head among distributaries equitably, another computer programme was developed in BASIC named "Regulation Model" which prepares the complete schedule of distributaries running for whole year. Development and formulation of the canal operation model are discussed now.

3.1. Assumptions

1. Planned supply is available in the river/reservoir throughout the year as per schedule of idents.

2. Indented supply is available at canal head before the start of a particular period.

3. Supply in the main canal is available to run a particular distributary at its head regulator at full capacity as per schedule.

3.2. Steps to Formulate the Model

1. Estimation of the irrigation water requirements on ten daily period based on the prevailing cropping pattern and intensities in a canal command.

2. Estimation of probable availability of water at canal head and determination of assured available supply (from the probable one in both cropping seasons i.e. Kharif and Rabi).

3. Estimation of availability of ground water (public tubewells or private tubewells) supplies (if present).

4. When both types of canals i.e. perennial and non-perennial canals in a canal system exist then on availability of tubewells supply in both the areas, for assured availability of water, operate the canal for distribution of supply among distributaries of both types for entire year based on culturable command area (CCA) not as per Water Allowances (designed). It means equitable distribution of supply in all the distributaries . Hereafter such supply will be termed as "assured supply".

5. The canal for assured supply will be operated as under : -

(i) Determination of canal releases which can meet some percentage of irrigation requirements within the canal capacity and assured available supply in season (contraints), in such a way that during maximum demand periods, canal should run at full capacity. Further availability of tubewells supplies to meet the remaining irrigation requirements after utilizing the canal supplies must be kept in view. It may require different options.

(ii) Observe total canal closure for those periods when the crop requirements are less and can be easily met by tubewells supplies.

(ii) Prepare the "schedule of canal operation" for whole year based on ten daily periods or otherwise keeping in view the water distribution system (wara-bandi system) in the outlet command.

(iv) Prepare the "schedule of distributaries operation" for the whole year in such a way that at the end of the year total number of running periods of different distributaries are almost equal. So that equitable distribution of supply among farmers located in different distributaries is ensured.

(v) Prepare the "schedule of indents" on period basis by summing the designed discharge of distributaries running in a prticular period and main canal losses. These indents will represent the minimum requirement of supply at canal head to run the distributaries for "assured supply" condition.

3.4. Proposed guide lines for canal operation

1. The canal should be operated as per schedule prepared by the "Canal Operation Model" till weather conditions or any emergency warrants to modify the schedule. In such case, in coming periods the regulation officer should compensate the effected distributaries by arranging more supply from available excess supply (more than assured supply) during a particular period.

2. Any supply excess of "assured supply" should be distributed among the distributaries which were kept closed during a particular period in such a way that all distributaries at end of the year shared equally of this excess supply.

3. Schedule of operation of distributaries should be notified and distributed among the farmers well advance of the season. Further minimum area for which canal supply is scheduled, should also be notified so that farmers can decide to cultivate the appropriate area keeping in view the expected canal supply and any available tubewell supply.

4. Based on the schedule of indents in a particular period of each canal in a zone, regulation of reservoir, barrages/headworks and link canals should be done in such a way that before start of a particular period, the indented supply of canal is available at the headworks of canals.

4. DATA INUT AND RESULTS

Canal Operation Model was tested using the data of Pakpattan Canal (U) as case study. Schematic diagrame of Pakpattan Canal (U) system is shown in Fig. 2. First page of the model having major data input is attached as annexure-A.

Pakpattan Canal (U) offtkes at right bank of Sulmanki Headworks from river Sutlej. It commands 1.03 million acres gross command area (GCA), out of which 0.93 million acres is cultureable command area (CCA). This canal commands both type areas i.e. 0.60 million acres perennial and 0.33 million acres non-perennial. Water allowance for perennial area is 3.6 cusecs and for non-perennial area it is 5.5 cusecs. Capacity of canal at head is 6594 cusecs, out of which 5508 cusecs is for command area. There are, one non-perennial branch, 29 perennial and 23 non-perennial distrubutaries in Pakpattan Canal

(U) system and average (1981-84) irrigation intensity was 134.78 percent. In 1986, the no. of private tubewells in command area were 9342, having average 1.0 cusecs capacity.

Data required and input for various components of the model in connection with operation of Pakpattan Canal (U) are discussed below :

4.1. Proposed Canal Operation

1. The average (1981-84) cropping pattern, irrigation intensity and other data were taken for estimation irrigation water requirements in the command area.

2. The average releases (1981-84) were assumed as "available assured supply".

3. Minimum 50 percent supply of capacity of main canal was assumed to be maintained for regulation purpose.

4. Canal losses were taken as the difference of design discharge of main canal and sum of design discharge of offtaking distributaries.

5. The different efficiencies of irrigation water delivery system taken are as below :

   Conveyance efficiency = 75 %

   Delivery efficiency = 55 %

   Field application efficiency = 75 %

6. Tubewell supply available at field considering maximum tubewell running as 16 hours per day and conveyance efficiency 75 percent was used. Tubewells utility was assumed 25 percent.

7. As the Pakpattan Canal (U) consists both types of distributaries i.e. perennial (3.6 cusecs water allowance) and non-perennial (5.5 cusecs water allowance), so canal system was operated on basis of culturable commmand area (CCA).

8. Two times canal closurs in months of April and January for the duration of 2 periods (20 days) are proposed. In April, the irrigation requirements were less and meetable by about 50 percent utility of

tubewells thus for conservation of water this closure was proposed. In January the canal closure is done for maintenance purpose. Although during these periods requirements are relatively more than in month of December but to allow more sowing of wheat with canal supply, closures are observed in January. During these periods tubewells can meet the requirements wit 57 percent utility.

9. By manipulation certain percentage of irrigation requirements to meet with canal releases, when canal running at full capacity during maximum demand periods (June to August) with tubewells supply to meet the remaining requirements was determined. Thus the following percentage of irrigation requirements were found to meet with available assured supply of canal :

Canal releases for Kharif season	=	51.0 percent of irrigation requirements.
Canal releases for Rabi season	=	39.0 percent of irrigation requirements.

Results of all the steps i.e. from 1 to 9 above, are given in Table - 1 which prepares a proposed canal operation on ten daily basis for the whole year.

4.2. Schedule of Canal Operation

The "Schedule of Canal Operation" on seven and half (7.5) days periods was prepared as given in Table - 2. Seven (7) day rotation of water turn (wara bandi) in water course command is practised in the Pakpattan Canal (U) command and 12 hours (1/2 day) were taken for regulation purposes and as lag time of water to reach at tail outlets of the distributaries so that these can get full supply at 7 days turn when the distributaries are run in rotation. Schedule includes the following steps :

1. From the proposed assured canal releases, as determined in Table - 1, share of perennial and non-perennial distributaries based on culturable command area (CCA) was determined.

2. Practicable releases were determined so as to minimum 50 percent

supply of capacity in the main canal (Pakpattan Canal) (U) and branch canal (Khadir) is maintained for regulation purposes and to avoid excessive seepage. So when the shared supply in main canal and branch canal was less than 50 percent of capacity, then for that period complete closure of canal was proposed. The shared supply of closed periods was distributed in next 2 to 3 periods.

3. Available supply for distribution among distributaries was determined by deducting the canal losses from the practicable releases for both perennial and non-perennial canals. Rabi losses were taken about 8 percent less from the Kharif losses as evaporation losses are less in Rabi than Kharif.

4.3. Schedule of Distributaries Operation

There are 29 perennial and 23 non-perennial distributaries in Pakpattan Canal (U) system to distribute the available supply (Table - 2) equitably among the distributaries with the conditins that (1) until and unless any previously closed channel in a period was run, no other channel took supply (2) at the end of a year, number of total running periods of all the distributaries were as close to each other as possible. To achieve these objectives, a computer programme named "Regulation Model" as mentioned earlier was used. The model prepares the complete schedule of distributaries operation.

The schedule of distributaries operation was prepared for both perennial and non-perennial distributaries separately by running the "Regulation Model." The results are given in Tables - 3 and 4. The assumptions and explanations are given below :

1. Except total canal closure periods, it was assumed that all the offtakes running in a particular period will get their authorized discharge at their heads from the main canal/branch canal which were assumed running continuously.

2. By grouping of adjoining small distributaries with big one, perennial distributaries became 24 against 29 and non-perennial distributaries became 22 against 23 Nos.

3. Distributaries would run either to capacity or close and any available supply excess of total running of distributaries in a particular period as per criteria of "Regulation Model" was adjusted in next period. If

adjustd supply was equal or less than total distribution capacity of distributaries then adjusted supply would become available supply for that period but when it was more than capacity then excess of capacity would become surplus.

4. Indents were worked out by summing up the actually delivered supply and losses in a particular period.

5. Tables - 3 and 4 gives the "schedule of distributaries operation" for perennial and non-perennial distributaries respectively. These give complete annual scheduling of distributaries running in different periods, indents and total running periods of distributaries in the year. Summary of INPUT Data, gives the names of distributaries and their capacity at head in offtaking order from the parent canal.

4.4. Schedule of Indents

"Schedule of Indents" (Table - 5) was prepared by summing up the scheduled relases of perennial and non-perennial distributaries (Tables 3 and 4) and total losses in main canal and branch canal. These indents were minimum requirements of supply which should be available at canal head at the start of a particular period to operate the canal and distribute the supply on "assured supply" basis.

5. DISCUSSIONS AND CONCLUSIONS

The annual irrigation water requirements (7.09 MAF) are considerably greater than the sanctioned water allowances of canals. While availability of canal water (2.48 MAF annually) and canal capacities are limited. Canal operatin is being practised without planning to correlate it with varying needs of crops and releases are neither equitable nor reliable as for as stand point of farmers is concerned.

From the study of the propsed canal operation (Tables 1 to 5) of Pakpattan Canal (U), based on the proposed procedure, it is observed that delivery of available supply was more reliable and equitable throughout the year than existing practice.

The total proposed assured supply of 2.49 MAF (Table - 1) was almost equal to final indented supply 2.48 MAF (Table - 5) following the proposed canal operation procedure. The available supply for Kharif (1.48 MAF) and Rabi (1.0 MAF) was almost equal to final indented supply for Kharif (1.46 MAF) and Rabi (1.02 MAF). The proposed canal operation provided 51 percent cropped area in Kharif and 39 percent cropped area in Rabi with assured canal water supply throughout the season according to varying need of crops.

The schedule of distributaries operation for perennial (Table - 3) and non-perennial (Table - 4) canals represent that supply was distributed almost equitable among the distributaries in the year. Out of 24 perennial distributaries, the total running periods for 21 disties. were 34 and 2 disties. run for 35 periods while one disty ran for 33 periods. Thus 21 distributaries of different capacities ranging from 20 to 531 cusecs, had 34 total running periods in the year. While smaller disties. had 35 total running periods. 17 non-perennial distributaries out of total 22 had total running periods 22 or 23 while other 3 major distributaries which have capacities more than 200 cusecs, had 21 total running periods and 2 disties, of smaller discharges had 27 and 28 total running periods. The lesser number of total running periods of non-perennial distributaries were due to their more capacities as being designed for higher Water Allowances. As the "schedule of distributaries operation" took care of that no distributary would open until previously closed distributary had run and almost equal number of total running of periods of distributaries in the year was achieved, so it is apprehended that available supply would be distributed among distributaries almost equitably. Figs. 3 and 4 represents the running of distributaries as discussed above.

Due to the condition of distributaries running either to capacity or close for complete period (7.5 days) will ensure either running or close of all outlets along a distributary at least continuously for 7 days. It will supply the water to all outlets equitably along a distributary. Thus the proposed canal operation with the same quantity of supply as for exiting pattern of operation will provide the following benefits :

1. Advance planning of canal operation will enable the famers to plan their farming activities, cropping pattern and other activities to be performed during the whole season.

2. Reliable and equitable distribution of available supply among distributaries and outlets along a distributary.

3. Supply as close as varying needs of crops requirements.

From the stand point of engineering and administration, the advance planning and scheduling of supply is more sound than present practice. The comparison of irrigation water requirements at canal head, average releases (1981 - 84) and proposed assured releases of Pakpattan Canal (U) are presented in Figs. 5 to 7. A comparison of proposed annual running of 6 Nos. distributaries with releases in year 1982 - 83 is presented in Fig. 8 which shows an improvement in distributaries running with proposed operation over the existing releases pattern. No additional facility, financial or administrative set up is needed but efficient management is important to follow the canal operation procedure as discussed.

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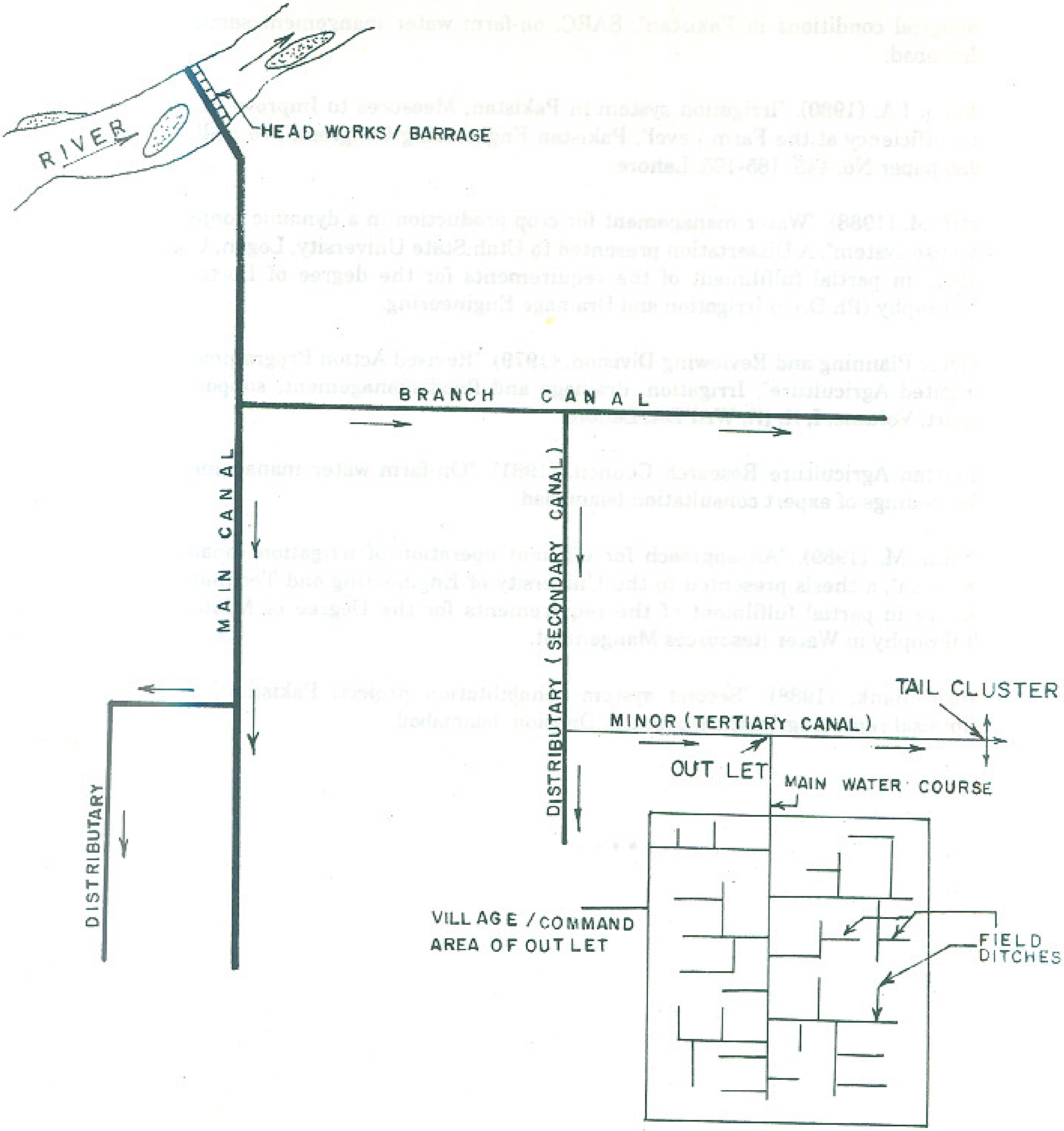


FIG. I. — Line Diagram of Canal Irrigation System in Pakistan.

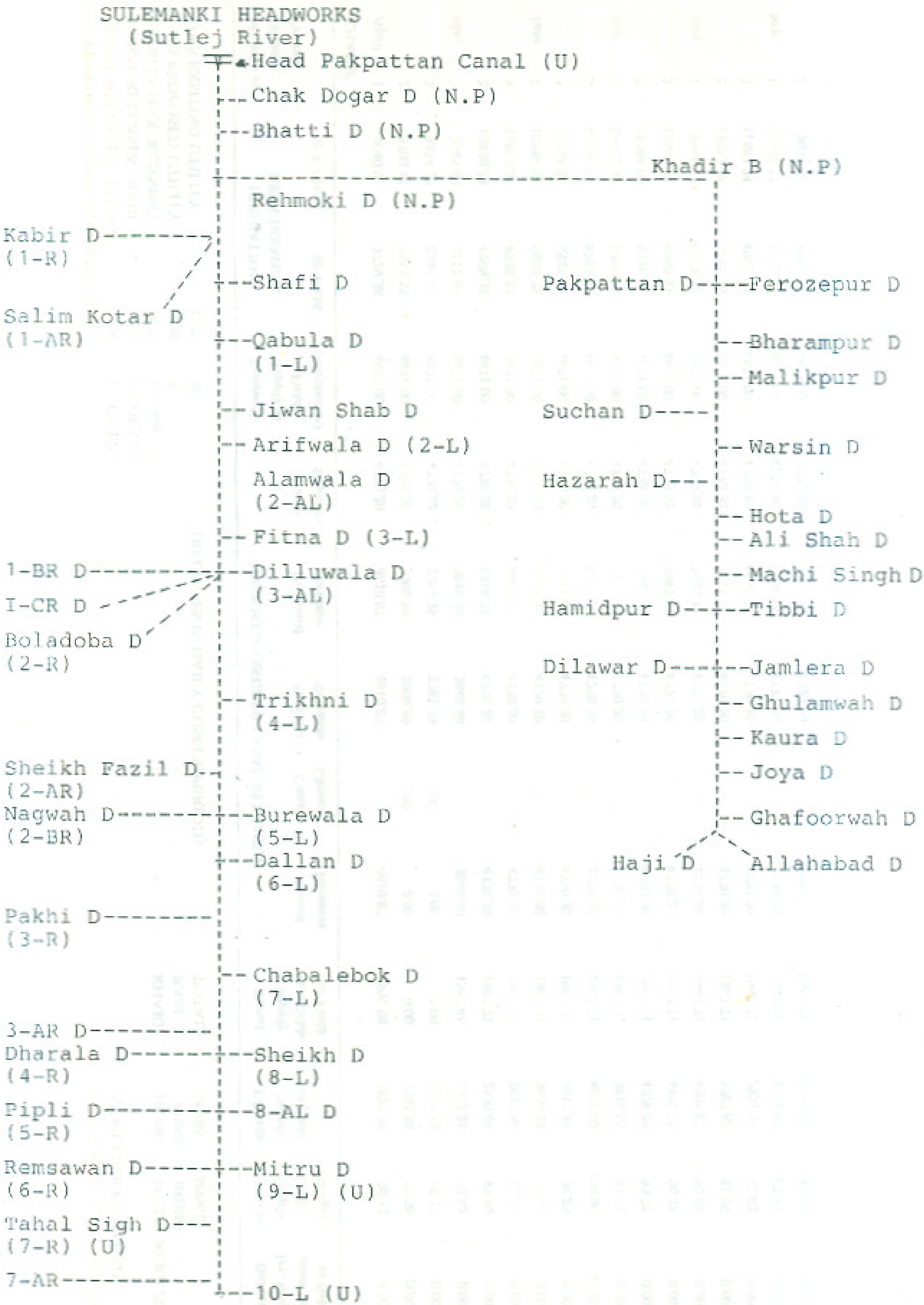


FIG. 2—— Schematic Diagrame of Pakpattan Canal (U) System.

Table - I

Proposed Canal Operation.

PROPOSED IRRIGATION SUPPLY

CANAL RELEASES - KHARIF:	51.00	(% OF I.R.)
CANAL RELEASES - RABI :	39.00	(% OF I.R.)
I/WELLS MAX. RUNNING:	16.00	hrs/day
I/WS PROPOSED UTILITY :	28.00	%
I/WS EXSITING UTILITY :	25.00	%

CHECK FOR CANAL SUPPLY AVAILABLE PROPOSED

KHARIF :	1482883	1492529	ACRE FEET
RABI :	993949	1003089	
TOTAL:	247683	2495618	

(RELEASES IN DAILY CUSECS/PERIOD)

Months in 10 Daily Periods		IRRIGATION REQUIREMENT @ C/head	@ Field	Tubewells Supply at Field (maximum)	Canal Capacity	PROPOSED ASSURED CANAL RELEASES Proposed Releases	Possible Releases	Canal Closure	Assurd Releases	Canal Supply Available at Field	T/Wells Supply at Field	T/Wells Supply Utility (% age)	Balance Irr. Req.to meet with at field
KHARIF													
April	1	9040.91	3729.38	4671.00	4770.20	4610.87	4610.87		4610.87	1901.98	1827.39	39.12	0.00
	2	5703.11	2352.53	4671.00	4770.20	2908.59	2908.59	1.00	0.00	0.00	2352.53	50.36	0.00
	3	5454.37	2249.93	4671.00	4770.20	2781.73	2781.73	1.00	0.00	0.00	2249.93	48.17	0.00
May	1	7545.88	3112.67	4671.00	4770.20	3848.40	3848.40		3848.40	1587.46	1525.21	32.65	0.00
	2	10420.23	4298.35	4671.00	4770.20	5314.32	4770.20		4770.20	1967.71	2330.64	49.90	0.00
	3	11892.29	4905.57	4671.00	4770.20	6065.07	4770.20		4770.20	1967.71	2937.86	62.90	0.00
June	1	13584.92	5603.78	4671.00	4770.20	6928.31	4770.20		4770.20	1967.71	3636.07	77.84	0.00
	2	15964.08	6585.18	4671.00	4770.20	8141.68	4770.20		4770.20	1967.71	4617.48	98.85	0.00
	3	16250.17	6703.19	4671.00	4770.20	8287.59	4770.20		4770.20	1967.71	4671.00	100.00	64.49
July	1	14022.69	5784.36	4671.00	4770.20	7151.57	4770.20		4770.20	1967.71	3816.65	81.71	0.00
	2	15384.60	6346.56	4671.00	4770.20	7846.66	4770.20		4770.20	1967.71	4378.85	93.75	0.00
	3	15661.70	6460.45	4671.00	4770.20	7987.47	4770.20		4770.20	1967.71	4492.75	96.18	0.00
Aug.	1	4966.12	6173.52	4671.00	4770.20	7632.72	4770.20		4770.20	1967.71	4205.82	90.04	0.00
	2	13952.38	5755.36	4671.00	4770.20	7115.71	4770.20		4770.20	1967.71	3787.65	81.09	0.00
	3	11883.74	4902.04	4671.00	4770.20	6060.71	4770.20		4770.20	1967.71	2934.34	62.82	0.00
Sep.	1	12369.77	5102.53	4671.00	4770.20	6308.58	4770.20		4770.20	1967.71	3134.82	67.11	0.00
	2	9658.68	3984.20	4671.00	4770.20	4925.93	4770.20		4770.20	1967.71	2016.50	43.17	0.00
	3	6559.65	2705.86	4671.00	4770.20	3345.42	3345.42		3345.42	1379.99	1325.87	28.39	0.00
S.Total(A.F):		4249786	1753037	1695457	17346	2167391	1605395		1492529.00	615668.00	1136090	67.0079	1279

Months in 10 Daily Periods		IRRIGATION REQUIREMENT		Tubewells Supply at Field (maximum)	Canal Capacity	PROPOSED ASSURED CANAL RELEASES				Canal Supply Available at Field	T/Wells Supply at Field	T/Wells Supply Utility (%-age)	Balance Irr. Req.to meet with at field
		@ C/head	@ Field			Proposed Releases	Possible Releases	Canal Closure	Assurd Releases				
RABI													
Oct.	1	5725.52	2361.78	4671.00	4770.20	2232.95	2232.95		2232.95	921.09	1440.68	30.84	0.00
	2	6566.17	2708.55	4671.00	4770.20	2560.81	2560.81		2560.81	1056.33	1652.21	35.37	0.00
	3	8734.96	3603.17	4671.00	4770.20	3406.64	3406.64		3406.64	1405.24	2197.94	47.05	0.00
Nov.	1	9057.89	3736.38	4671.00	4770.20	3532.58	3532.58		3532.58	1457.19	2279.19	48.79	0.00
	2	8275.29	3413.56	4671.00	4770.20	3227.36	3227.36		3227.36	1331.29	2082.27	44.58	0.00
	3	7990.33	3296.01	4671.00	4770.20	3116.23	3116.23		3116.23	1285.23	2010.57	43.04	0.00
Dec.	1	7612.76	3140.26	4671.00	4770.20	2968.98	2968.98		2968.98	1224.70	1915.56	41.01	0.00
	2	5508.53	2272.27	4671.00	4770.20	2148.33	2148.33		2148.33	886.18	1386.08	29.67	0.00
	3	5477.45	2259.45	4671.00	4770.20	2136.21	2136.21		2136.21	881.19	1378.26	29.51	0.00
Jan.	1	5669.32	2338.59	4671.00	4770.20	2211.03	2211.03		2211.03	912.05	1426.54	30.54	0.00
	2	6507.44	2684.32	4671.00	4770.20	2537.90	2537.90	1.00	0.00	0.00	2684.32	57.47	0.00
	3	6370.64	2627.89	4671.00	4770.20	2484.55	2484.55	1.00	0.00	0.00	7627.89	56.26	0.00
Feb.	1	7881.49	3251.12	4671.00	4770.20	3073.78	3073.78		3073.78	1267.94	1983.18	42.46	0.00
	2	8682.27	3581.44	4671.00	4770.20	3386.08	3386.08		3386.08	1396.76	2184.68	46.77	0.00
	3	9862.79	4068.40	4671.00	4770.20	3846.49	3846.49		3846.49	1586.68	2481.72	53.13	0.00
March.	1	11023.10	4547.03	4671.00	4770.20	4299.01	4299.01		4299.01	1773.34	2773.69	59.38	0.00
	2	12031.59	4963.03	4671.00	4770.20	4692.32	4692.32		4692.32	1935.58	3027.45	64.81	0.00
	3	9204.29	3796.77	4671.00	4770.20	3589.67	3589.67		3589.67	1480.74	2316.03	49.58	0.00
S.Total (A.F):		12840093	1171539	1686192	1722002	1107636	1107636		1003089	413774	757764	44.9394	0
Total (A.F):		7089880	2924575	3881650	3453466	3275027	2713031		2495618	1029443	1893854	56.0038	1279

TUBEWELLS OPERATION

T/WELLS PROPOSED PUMPAGE :	1893854	ACRE	FEET
TOTAL AVAILABLE PUMPAGE :	1690824	ACRE	FEET
BALANCE PUMPAGE REQUIRED:	203030	ACRE	FEET

Table - 2

Schedule of Canal Operation.

AVAILABLE SUPPLY
KHARIF: 1482883 ACRE FEET
RABI: 993949 (")
TOTAL : 2476832 (")

7.5 DAILY CANAL RELEASE
PRACTICABLE PROP. ASSUMED
KHARIF : 1468674 1486027 ACRE FEET
RABI : 1023149 1005794 (")

(RELEASE IN DAILY CUSECS/PERIOD)

Ten (10) Daily Periods Months		Proposed assured canal release	Seven & Half (7.5) Daily PERIODS Days	Time	Proposed assured canal release	Supplies Availble for Distribution among Distributries PERNIAL CANALS PRACTICABLE Share	Release	AVAILABLE Losses	Supply	NON-PERENIAL CANAL PRACTICABLE Share	Releases	AVAILABLE Losses	Supply	Practi-cabler elease at canal Head
KHARIF			KHARIF											
April	1	4610.87	3/4	6.0 PM	4611	3241	3241	887	2354	1369	1369	65	1304	4611
	2	0.00	11/4	6.0 AM	0	0	0	0	0	0	0	0	0	0
	3	0.00	16/4	6.0 AM	0	0	0	0	0	0	0	0	0	0
May	1	3848.40	23/4	6.0 PM	0	0	0	0	0	0	0	0	0	0
	2	4770.20	1/5	6.0 AM	3848	2751	2751	887	1864	1098	1098	65	1033	3848
	3	47720.20	8/5	6.0 PM	4540	3196	3196	887	2309	1344	1344	65	1279	4540
June	1	4770.20	16/5	6.0 AM	4720	3344	3344	887	2457	1426	1426	65	1361	4770
	2	4770.20	23/5	6.0 PM	4720	3344	3344	887	2457	1426	1426	65	1361	4770
	3	4770.20	31/5	6.0 AM	4720	3344	3344	887	2457	1426	1426	65	1361	4770
July	1	4770.20	7/6	6.0 PM	4720	3344	3344	887	2457	1426	1426	65	1361	4770
	2	4770.20	15/6	6.0 AM	4720	3344	3344	887	2457	1426	1426	65	1361	4770
	3	4770.20	22/6	6.0 PM	4720	3344	3344	887	2457	1426	1426	65	1361	4770
Aug	1	4770.20	30/6	6.0 AM	4720	3344	3344	887	2457	1426	1426	65	1361	4770
	2	4770.20	7/7	6.0 PM	4720	3344	3344	887	2457	1426	1426	65	1361	4770
	3	4770.20	15/7	6.0 AM	4720	3344	3344	887	2457	1426	1426	65	1361	4770
Sep.	1	4770.20	22/7	6.0 PM	4720	3344	3344	887	2457	1426	1426	65	1361	4770
	2	4770.20	30/7	6.0 AM	4720	3344	3344	887	2457	1426	1426	65	1361	4770
	3	4770.20	6/8	6.0 PM	4720	3344	3344	887	2457	1426	1426	65	1361	4770
			14/8	6.0 AM	4720	3344	3344	887	2457	1426	1426	65	1361	4770
S.Total:		1492529	21/8	6.0 PM	4720	3344	3344	887	2457	1426	1426	65	1361	4770
			29/8	6.0 AM	4720	3344	3344	887	2457	1426	1426	65	1361	4770
RABI			5/9	6.0 PM	4720	3344	3344	887	2457	1426	1426	65	1361	4770
Oct.	1	2232.95	13/9	6.0 AM	4720	3344	3344	887	2457	1426	1426	65	1361	4770
	2	2560.81	20/9	6.0 PM	3345	2427	2427	887	1540	918	0	0	0	2427
	3	3406.64	28/9	6.0 AM	2511	1890	1890	887	1003	621	0	0	0	1890

Ten (10) Daily Periods Months		Proposed assured canal release	Seven & Half (7.5) Daily PERIODS Days	Time	Proposed assured canal release	Supplies Availble for Distribution among Distributries PERNIAL PRACTICABLE Share	Release	CANALS AVAILABLE Losses	Supply	NON-PERENIAL PRACTICABLE Share	Releases	CANAL AVAILABLE Losses	Supply	Practi-cabler elease at canal Head
Nov.	1	3532.58												
	2	3237.36	RABI											
	3	3116.23	5/10	6.0 PM	2479	1870	1870	816	1054	609	1224	60	1164	3094
Dec.	1	2968.98	13/10	6.0 AM	2561	1922	1922	816	1106	639	1254	60	1194	3176
	2	2418.33	20/10	6.0 PM	3407	2467	2467	816	1651	940	1249	60	1189	3716
	3	2136.21	28/10	6.0 AM	3501	2527	2527	816	1711	974	0	0	0	2527
Jan.	1	2211.03	4/11	6.0 PM	3304	2400	2400	816	1584	903	1147	60	1087	3547
	2	0.00	12/11	6.0 AM	3227	2351	2351	816	1535	876	1120	60	1060	3471
	3	0.00	19/11	6.0 PM	3144	2298	2298	816	1482	846	1090	60	1030	3387
Feb.	1	3073.78	27/11	6.00 AM	3006	2209	2209	816	1393	797	1041	60	981	3249
	2	3386.08	4/12	6.0 PM	2353	1789	1789	816	973	565	0	0	0	1789
	3	3846.49	12/12	6.0 AM	2148	1657	0	0	0	491	0	0	0	0
March.	1	4299.01	19/12	6.0 PM	2139	1651	2203	816	1387	488	1016	60	956	3220
	2	4692.32	27/12	6.0 AM	2192	1685	2237	816	1421	507	1035	60	975	3273
	3	3589.67	3/1	6.0 PM	2211	1697	2249	816	1433	514	0	0	0	2249
			11/1	6.0 AM	0	0	0	0	0	0	0	0	0	0
S.Total		1003089	18/1	6.0 PM	0	0	0	0	0	0	0	0	0	0
			26/1	6.0 AM	0	0	0	0	0	0	0	0	0	0
Total(A.F) :		2495618	2/2	6.0 PM	3074	2252	2252	816	1436	821	1078	60	1018	3331
			10/2	6.0 AM	3386	2453	2453	816	1637	933	1190	60	1130	3643
			17/2	6.0 PM	3731	2676	2676	816	1860	1056	1056	60	996	3731
			25/2	6.0 AM	4186	2968	2968	816	2152	1218	1218	60	1158	4186
			4/3	6.0 PM	4594	3231	3231	816	2415	1363	1363	60	1303	4594
			12/3	6.0 AM	4692	3294	3294	816	2457	1398	1398	60	1338	4692
			19/3	6.0 PM	3865	2762	2762	816	1946	1104	1104	60	1044	3865
			27/3	6.0 AM	4356	3077	3077	816	2261	1278	1278	60	1218	4356

Table - 3

Schedule of Distributaries Operation (Perennial).

PAKPAITAN CANAL (U)

SCHEDULE OF DISTRIBUTARIE,S OPERATION

(PERENNIAL DISTRIBUTARIES)

PERIODS	7.5 DAILY (PERIODS) DATE & TIME	AVAILABLE SUPPLY	ADJUSTED SUPPLY	DY 1	DY 2	DY 3	DY 4	DY 5	DY 6	DY 7	DY 8	DY 9	DY 10	DY 11	DY 12	DY 13	DY 14	DY 15	DY 16	DY 17	DY 18	DY 19	DY 20	DY 21	DY 22	DY 23	DY 24	ACTUAL DELIVERED SUPPLY	EXCESS	SURPLUS	INDENTS
	DISCHARGE OF DISTIES.>			81	47	101	29	208	235	31	18	74	227	29	128	62	79	63	244	47	50	46	197	65	14	65	20				
KHARIF																															
1	3/4 6.0PM	2354	2354	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	C	0	C	0	2327	27	0	3214
2	11/4 6.0AM	0		MAIN CANAL CLOSOURE																											
3	16/4 6.0AM	0		MAIN CANAL CLOSOURE																											
4	23/4 6.0PM	0		MAIN CANAL CLOSOURE																											
5	1/5 6.0AM	1864	1891	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	C	0	C	C	C	0	C	0	C	1886	5	0	2773
6	8/5 6.0PM	2309	2314	0	0	0	0	0	0	0	0	0	0	0	0	0	C	C	0	C	0	0	0	0	0	0	0	2268	46	46	3155
7	16/5 6.0AM	2457	2457	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2457	0	0	3344
8	23/5 6.0PM	2457	2457	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2457	0	0	3344
9	31/5 6.0AM	2457	2457	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2457	0	0	3344
10	7/6 6.0PM	2457	2457	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2457	0	0	3344
11	15/6 6.0AM	2457	2457	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2457	0	0	3344
12	22/6 6.0PM	2457	2457	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2457	0	0	3344
13	30/6 6.0AM	2457	2457	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2457	0	0	3344
14	7/7 6.0PM	2457	2457	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2457	0	0	3344
15	15/7 6.0AM	2457	2457	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2457	0	0	3344
16	22/7 6.0PM	2457	2457	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2457	0	0	3344
17	30/7 6.0AM	2457	2457	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2457	0	0	3344
18	6/8 6.0PM	2457	2457	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2457	0	0	3344
19	14/8 6.0AM	2457	2457	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2457	0	0	3344
20	21/8 6.0PM	2457	2457	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2457	0	0	3344
21	29/8 6.0AM	2457	2457	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2457	0	0	3344
22	5/9 6.0PM	2457	2457	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2457	0	0	3344
23	13/9 6.0AM	2457	2457	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2457	0	0	3344
24	20/9 6.0PM	1540	1540	0	0	0	0	0	0	C	0	0	C	0	C	C	0	0	0	0	0	0	0	0	0	0	0	1509	31	0	2396
25	28/9 6.0AM	1003	1034	C	C	C	C	C	C	0	C	C	0	C	0	0	0	C	C	C	C	C	C	C	C	C	C	1027	7	0	1914
RABI																															
26	5/10 6.0PM	1054	1061	0	0	0	0	0	0	C	0	0	C	0	C	C	C	0	0	0	0	C	C	C	0	C	0	1057	4	0	1873
27	13/10 6.0AM	1106	1110	C	C	C	C	C	C	0	C	C	0	C	0	0	0	C	C	C	C	0	C	C	0	C	0	1107	3	0	1923
28	20/10 6.0PM	1651	1654	0	0	0	0	0	0	C	0	0	C	0	C	0	0	0	0	0	0	0	0	0	0	0	0	1571	83	0	2387
29	28/10 6.0AM	1711	1794	C	C	C	C	C	C	0	0	C	0	C	0	C	0	0	0	0	0	0	0	0	0	0	0	1794	0	0	2610
30	4/11 6.0PM	1584	1584	0	0	0	0	0	0	0	C	0	C	0	C	0	C	0	C	C	C	C	0	0	C	0	C	1584	0	0	2400
31	12/11 6.0AM	1535	1535	0	0	0	0	C	0	C	0	0	0	0	0	C	C	C	0	0	0	0	0	0	0	0	0	1514	21	0	2330
32	19/11 6.0PM	1482	1503	C	C	0	C	0	C	0	0	C	0	C	0	0	0	0	C	0	0	0	C	C	0	C	0	1503	0	0	2319
33	27/11 6.0AM	1393	1393	0	0	C	0	0	0	C	C	0	0	0	C	C	C	C	0	C	C	C	0	0	C	0	C	1389	4	0	2205
34	4/12 6.0PM	973	977	C	C	0	C	C	C	0	0	C	C	C	0	0	0	0	C	0	C	C	C	C	0	C	0	972	5	0	1788
35	12/12 6.0AM	0		MAIN CANAL CLOSOURE																											

(Table-3 Continued)

36	19/12	6.0PM	1387	1372	0	0	C	0	0	0	C	C	0	0	0	C	C	C	C	0	C	0	0	0	C	0	C	0	1389	3	0	2205
37	27/12	6.0AM	1421	1424	C	C	0	C	C	C	0	0	C	C	C	0	0	0	0	0	0	0	0	C	0	0	0	C	1422	2	0	2238
38	3/1	6.0PM	1433	1435	0	0	C	0	0	0	C	C	0	0	0	0	0	C	C	C	C	C	C	0	0	C	0	0	1434	1	0	2250
39	11/1	6.0AM	0		M A I N C A N A L C L O S O U R E																											
40	18/1	6.0PM	0		M A I N C A N A L C L O S O U R E																											
41	26/1	6.0AM	0		M A I N C A N A L C L O S O U R E																											
42	2/2	6.0PM	1436	1437	C	C	0	C	C	C	0	0	C	C	C	C	C	0	0	0	0	0	0	0	0	0	0	C	1429	8	0	2245
43	10/2	6.0AM	1637	1645	0	0	C	0	0	0	0	C	0	0	0	0	0	C	0	C	C	C	C	C	C	0	C	0	1636	9	0	2452
44	17/2	6.0PM	1860	1869	0	0	0	0	0	0	0	0	C	C	0	C	C	0	C	0	0	0	0	0	0	C	0	C	1869	0	0	2685
45	25/2	6.0AM	2152	2152	0	0	0	0	0	0	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1926	226	184	2742
46	4/3	6.0PM	2415	2457	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2457	0	0	3273
47	12/3	6.0AM	2457	2457	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2457	0	0	3273
48	19/3	6.0PM	1946	1946	0	0	0	C	C	C	0	C	0	0	C	0	0	C	0	0	0	0	0	0	0	C	0	C	1937	9	0	2753
49	27/3	6.0AM	2261	2270	C	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	C	0	2264	6	6	3080
TOTAL DISTRIBUTRIE,S OPENINGS:					34	34	35	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	35	33	34				

(SUPPLY/DISCHARGE IS IN CUSECS (CU.FT/SEC))

NOTE : 0 -------->When Distributry is Open
C -------->When Distributry is Close

S U M M A R Y O F I N P U T D A T A

TOTAL DELIVERY CAPACITY OF DISTRIBUTRIES: 2457
TOTAL KHARIF LOSSES IN MAIN CANAL : 887
TOTAL RABI LOSSES IN MAIN CANAL : 816

D E T A I L O F D I S T R I B U T A R I E S

NAME OF DISTIES.	DISCHARGE	NAME OF DISTIES.	DISCHARGE	NAME OF DISTIES.	DISCHARGE	NAME OF DISTIES.	DISCHARGE
DISTY. NO= 1: 1-R	81	DISTY. NO= 2: 1-AR	47	DISTY. NO= 3: SHAFI	10	DISTY. NO= 4: 1-L&J.SHAH	129
DISTY. NO= 5: 2-L	208	DISTY. NO= 6: 2-AL	23	DISTY. NO= 7: 3-L	531	DISTY. NO= 8: 3-AL	18
DISTY. NO= 9: 4-L	74	DISTY. NO=10: 5-L	227	DISTY. NO=11: 1-BR&1-CR	29	DISTY. NO=12: 6-L	128
DISTY. NO=13: 2-R	62	DISTY. NO=14: 2-AR	79	DISTY. NO=15: 2-BR	63	DISTY. NO=16: 3-R	244
DISTY. NO=17: 3-AR&4-R	47	DISTY. NO=18: 7-L	50	DISTY. NO=19: 5-R	46	DISTY. NO=20: 8-L	197
DISTY. NO=21: 6-R	65	DISTY. NO=22: 8-AL	14	DISTY. NO=23: 9L(U)	65	DISTY. NO=24: 7R,10L,D/L	20

Table - 4

Schedule of Distributaries Operation (Non-Perennial)

P A K P A T T A N C A N A L

S C H E D U L E O F D I S T R I B U T A R I E S O P E R A T I O N
(NON-PERENNIAL DISTRIBUTARIES)

PERIODS	7.5 DAILY (PERIODS) DATE & TIME		AVAIL-ABLE SUPPLY	ADJUS-TED SUPPLY	DY 1	DY 2	DY 3	DY 4	DY 5	DY 6	DY 7	DY 8	DY 9	DY 10	DY 11	DY 12	DY 13	DY 14	DY 15	DY 16	DY 17	DY 18	DY 19	DY 20	DY 21	DY 22	ACTUAL DELIV-ERED SUPPLY	EXCESS	SURPLUS	INDENTS
DISCHARGE OF DISTIES.					51	74	162	65	173	26	33	18	55	72	30	25	22	28	50	18	83	362	27	151	216	304				
KHARIF																														
1	3/4	6.0PM	1304	1304	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	C	0	0	C	C	1217	87	0	1282
2	11/4	6.0AM	0		M A I N C A N A L C L O S O U R E																									
3	16/4	6.0AM	0		M A I N C A N A L C L O S O U R E																									
4	23/4	6.0PM	0		M A I N C A N A L C L O S O U R E																									
5	1/5	6.0AM	1033	1120	0	0	0	C	C	0	0	0	C	C	C	C	C	C	C	0	C	0	C	C	0	0	1118	2	0	1183
6	8/5	6.0PM	1279	1281	C	C	C	0	0	C	0	0	0	0	0	0	0	0	0	0	0	C	0	0	0	C	1266	15	0	1331
7	16/5	6.0AM	1361	1376	0	0	0	0	0	0	C	C	0	C	0	C	C	C	C	0	C	0	C	C	C	0	1374	2	0	1439
8	23/5	6.0PM	1361	1363	0	0	0	C	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	C	1357	6	0	1422
9	31/5	6.0AM	1361	1367	C	C	C	0	0	C	0	0	0	0	0	0	0	0	0	0	0	C	0	0	C	0	1354	13	0	1419
10	7/6	6.0PM	1361	1374	0	0	0	0	C	0	C	C	C	C	C	0	0	C	C	C	C	0	C	C	0	0	1361	13	0	1426
11	15/6	6.0AM	1361	1374	C	C	C	C	0	C	0	0	0	0	0	C	0	0	0	0	0	0	0	0	0	C	1363	11	0	1428
12	22/6	6.0PM	1361	1372	0	0	0	0	0	0	C	C	C	0	C	C	0	0	0	0	0	C	0	0	C	0	1360	12	0	1425
13	30/6	6.0AM	1361	1373	0	0	0	C	0	C	0	0	0	C	0	0	C	C	C	C	C	0	C	C	0	0	1357	16	0	1422
14	7/7	6.0PM	1361	1377	C	C	C	0	C	0	C	C	C	0	0	0	0	0	0	0	0	0	0	0	0	C	1375	2	0	1440
15	15/7	6.0AM	1361	1363	0	0	0	0	0	0	0	0	0	0	C	0	0	0	0	0	0	C	0	C	C	0	1340	23	0	1405
16	22/7	6.0PM	1361	1384	0	0	0	C	0	C	C	C	C	C	0	C	C	C	C	C	C	0	C	0	0	0	1377	7	0	1442
17	30/7	6.0AM	1361	1368	C	0	0	0	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	C	C	1355	13	0	1420
18	6/8	6.0PM	1361	1374	0	C	C	0	0	0	0	0	0	0	C	C	C	0	0	C	0	C	C	C	0	0	1374	0	0	1439
19	14/8	6.0AM	1361	1361	0	0	0	C	C	0	0	0	0	C	C	0	C	C	C	C	C	0	0	0	0	0	1358	3	0	1423
20	21/8	6.0PM	1361	1364	C	C	C	0	0	C	C	C	0	0	0	0	0	0	0	0	0	0	0	0	C	C	1361	3	0	1426
21	29/8	6.0AM	1361	1364	0	0	0	0	0	0	0	0	C	0	0	C	0	0	C	C	C	C	0	C	0	0	1355	9	0	1420
22	5/9	6.0PM	1361	1370	0	C	0	C	C	0	C	C	0	C	C	0	C	C	0	0	0	0	C	0	0	0	1357	13	0	1422
23	13/9	6.0AM	1361	1374	C	0	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	C	C	C	1361	13	0	1426
24	20/9	6.0PM	0		M A I N C A N A L C L O S O U R E																									
25	28/9	6.0AM	0		M A I N C A N A L C L O S O U R E																									
RABI																														
26	5/10	6.0PM	1164	1177	0	0	0	0	C	C	0	0	C	C	0	C	C	C	C	C	C	C	C	0	0	0	1176	1	0	1236
27	13/10	6.0AM	1194	1195	C	C	0	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	C	C	1189	6	0	1249
28	20/10	6.0PM	1189	1195	0	0	C	0	0	C	C	C	C	0	C	C	0	C	C	0	C	C	C	C	0	0	1195	0	0	1255
29	28/10	6.0AM	0		M A I N C A N A L C L O S O U R E																									
30	4/11	6.0PM	1087	1087	C	C	C	C	C	C	C	C	C	0	0	0	0	0	0	0	0	0	0	0	0	C	1084	3	0	1144
31	12/11	6.0AM	1060	1063	0	0	0	0	0	0	0	0	0	C	C	C	C	0	C	0	C	C	C	C	C	0	1061	2	0	1121
32	19/11	6.0PM	1030	1032	C	C	0	C	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	C	C	1016	16	0	1076
33	27/11	6.0AM	981	997	0	0	C	0	0	C	C	C	C	C	C	C	0	C	C	0	C	C	0	0	0	C	997	0	0	1057
34	4/12	6.0PM	0		M A I N C A N A L C L O S O U R E																									
35	12/12	6.0AM	0		M A I N C A N A L C L O S O U R E																									

(Table -4 Continued)

36	19/12	6.0PM	956	956	C	C	C	C	C	C	C	C	C	C	0	0	0	0	0	0	0	0	0	C	C	0	949	7	0	1009
37	27/12	6.0AM	975	982	0	0	0	0	0	0	0	0	0	0	C	C	C	C	C	0	C	C	0	0	C	C	979	3	0	1039
38	3/1	6.0PM	0	M A I N C A N A L C L O S O U R E																										
39	11/1	6.0AM	0	M A I N C A N A L C L O S O U R E																										
40	18/1	6.0PM	0	M A I N C A N A L C L O S O U R E																										
41	26/1	6.0AM	0	M A I N C A N A L C L O S O U R E																										
42	2/2	6.0PM	1018	1021	C	C	C	C	C	C	C	C	C	C	0	0	0	0	0	0	0	0	0	0	0	C	1012	9	0	1072
43	10/2	6.0AM	1130	1139	0	0	0	0	0	0	0	0	0	0	C	C	C	C	C	0	C	C	0	C	C	0	1132	7	0	1192
44	17/12	6.0P	996	1003	C	C	C	C	C	C	C	C	C	C	0	0	0	0	0	C	0	0	0	0	0	C	994	9	0	1054
45	25/2	6.0AM	1158	1167	0	0	0	0	0	0	0	0	0	0	C	C	C	0	C	0	C	C	0	C	C	0	1160	7	0	1220
46	4/3	6.0PM	1303	1310	C	C	C	C	C	C	C	0	C	C	0	0	0	C	0	0	0	0	0	0	0	0	1306	4	0	1366
47	12/3	6.0AM	1338	1342	0	0	0	0	0	0	0	C	0	0	C	C	C	0	C	C	C	C	0	C	0	0	1340	2	0	1400
48	19/3	6.0PM	1044	1046	C	C	0	C	C	C	C	0	C	C	0	0	0	0	0	0	0	0	0	0	0	C	1046	0	0	1106
49	27/3	6.0AM	1218	1218	0	0	C	0	0	0	0	C	0	0	C	C	C	C	0	C	0	C	0	C	C	0	1213	5	5	1273
TOTAL DISTRIBUTRIE,S OPENINGS:					22	22	22	22	22	22	22	22	22	22	22	22	23	23	22	28	22	21	27	22	21	21				

(SUPPLY/DISCHARGE IS IN CUSECS (CU.FT/SEC))

NOTE : 0 -------)When Distributry is Open
C -------)When Distributry is Close

S U M M A R Y O F I N P U T D A T A

TOTAL DELIVERY CAPACITY OF DISTRIBUIRIES: 2099
TOTAL KHARIF LOSSES IN MAIN CANAL : 65
TOTAL RABI LOSSES IN MAIN CANAL : 60

D E T A I L O F D I S T R I B U T A R I E S

NAME OF DISTIES.	DISCHARGE	NAME OF DISTIES.	DISCHARGE	NAME OF DISTIES.	DISCHARGE	NAME OF DISTIES.	DISCHARGE
DISTY. NO= 1: CHAK DOGER	51	DISTY. NO= 2: BHATTI	74	DISTY. NO= 3: REHMOKI	16	DISTY. NO= 4: PAKPATTAN	265
DISTY. NO= 5: FEROZ PUR	173	DISTY. NO= 6: BEHRAM PUR	26	DISTY. NO= 7: MALIK PUR	33	DISTY. NO= 8: SUCHAN	18
DISTY. NO= 9: WARSIN	55	DISTY. NO=10: HAZARAH	72	DISTY. NO=11: HOTA&D.O/L	30	DISTY. NO=12: ALI SHAH	25
DISTY. NO=13: MACHI SING	22	DISTY. NO=14: HAMID PUR	28	DISTY. NO=15: TIBBI	50	DISTY. NO=16: DILAWAR	18
DISTY. NO=17: JAMLERA	83	DISTY. NO=18: GHULAM WAH	362	DISTY. NO=19: KAURA&JOYA	27	DISTY. NO=20: GHAFUR WAH	151
DISTY. NO=21: ALLAHABAD	216	DISTY. NO=22: HAJI(U)	304				

Table - 5

Annual Schedule of Indents at Head of Pakpattan Canal (U)

SCHEDULE OF INDENTS

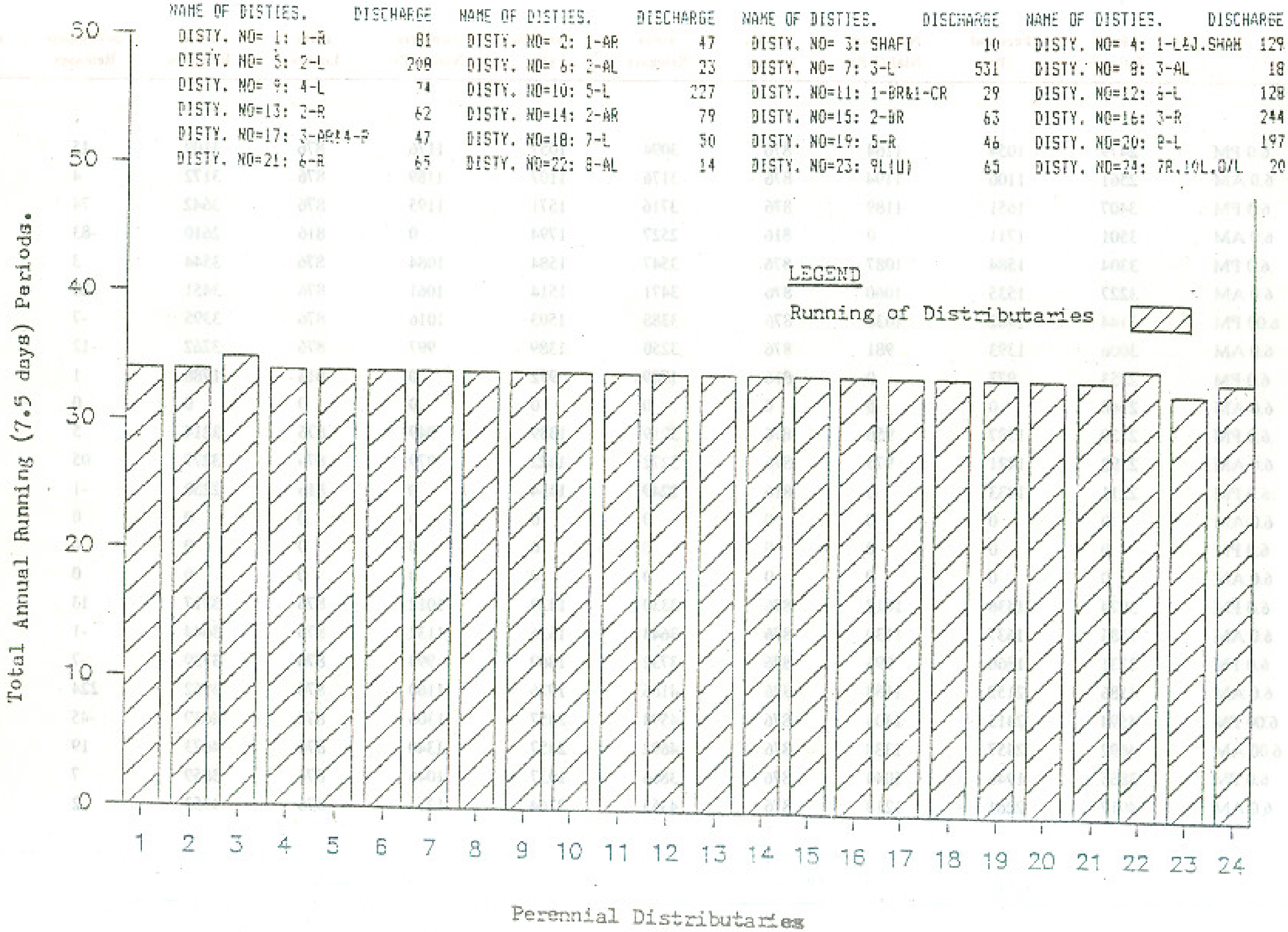
AVAILABLE SUPPLY @ CANAL HEAD
KHARIF : 1482883 ACRE FEET
RABI : 993949 "
TOTAL : 2476832 "

INDENTS @ CANAL HEAD
KHARIF : 1467410 ACRE FEET
RABI : 1020457
TOTAL : 2487866

(RELEASES IN DAILY CUSCES/PERIOD)

	Seven & Half (7.5) Daily		Supply for equitable distribution among distributries									Difference in Practic-able & Scheduled Releases	Indents /period at canal head (Cusecs/ period)
			Practicable Releases				Scheduled Releases						
Days	PERIODS Time	Proposed assured canal Release	Perenial (P)	Non-pere Nial (NP)	Total Losses	Total Releases	Perenial (P)	Non-pere Nial (NP)	Total Losses	Total Releases			
KHARIF													
3/4	6.0 AM	4611	2354	1304	952	4610	2327	1217	952	4496		114	4496
11/4	6.0 PM	0	0	0	0	0	0	0	0	0		0	0
16/4	6.0 AM	0	0	0	0	0	0	0	0	0		0	0
23/4	6.0 PM	0	0	0	0	0	0	0	0	0		0	0
1/5	6.0 AM	3848	1864	1033	952	3849	1886	1118	952	3956		-107	3956
8/5	6.0 PM	4540	2309	1279	952	4540	2268	1266	952	4486		54	4486
16/5	6.0 AM	4770	2457	1361	952	4770	2457	1374	952	4783		-13	4783
23/5	6.0 PM	4770	2457	1361	952	4770	2457	1357	952	4766		4	4766
31/5	6.0 AM	4770	2457	1361	952	4770	2457	1354	952	4763		7	4763
7/6	6.0 PM	4770	2457	1361	952	4770	2457	1361	952	4770		0	4770
15/6	6.0 AM	4770	2457	1361	952	4770	2457	1363	952	4772		-2	4772
22/6	6.0 PM	4770	2457	1361	952	4770	2457	1360	952	4769		1	4769
30/6	6.0 AM	4770	2457	1361	952	4770	2457	1357	952	4766		4	4766
6/7	6.0 PM	4770	2457	1361	952	4770	2457	1375	952	4781		-14	4784
15/7	6.0 AM	4770	2457	1361	952	4770	2457	1340	952	4749		21	4749
22/7	6.0 PM	4770	2457	1361	952	4770	2457	1377	952	4786		-16	4786
30/7	6.0 AM	4770	2457	1361	952	4770	2457	1355	952	4764		6	4764
6/8	6.0 PM	4770	2457	1361	952	4770	2457	1374	952	4783		-13	4783
14/8	6.0 AM	4770	2457	1361	952	4770	2457	1358	952	4767		3	4767
21/8	6.0 PM	4770	2457	1361	952	4770	2457	1361	952	4770		0	4770
29/8	6.0 AM	4770	2457	1361	952	4770	2457	1355	952	4764		6	4764
5/9	6.0 PM	4770	2457	1361	952	4770	2457	1357	952	4766		4	4766
13/9	6.0 AM	4770	2457	1361	952	4770	2457	1361	952	4770		0	4770
60/9	6.0 PM	3345	1540	0	887	2427	1509	0	887	2396		31	2396
28/9	6.0 AM	2511	1003	0	887	1890	1027	0	887	1914		-24	1914

Days	PERIODS Time	Proposed assured canal Release	Perenial (P)	Non-pere Nial (NP)	Total Losses	Total Releases	Perenial (P)	Non-pere Nial (NP)	Total Losses	Total Releases	Difference in Practic-able & Scheduled Releases	Indents /period at canal head (Cusecs/ period)
Seven & Half (7.5) Daily			Supply for equitable distribution among distributries									
			Practicable Releases				Scheduled Releases					
RABI												
5/10	6.0 PM	2479	1054	1164	876	3094	1057	1176	876	3109	-15	3109
13/10	6.0 AM	2561	1106	1194	876	3176	1107	1189	876	3172	4	3172
20/10	6.0 PM	3407	1651	1189	876	3716	1571	1195	876	3642	74	3642
28/10	6.0 AM	3501	1711	0	816	2527	1794	0	816	2610	-83	2610
4/11	6.0 PM	3304	1584	1087	876	3547	1584	1084	876	3544	3	3544
12/11	6.0 AM	3227	1535	1060	876	3471	1514	1061	876	3451	20	3451
19/11	6.00 PM	3144	1482	1030	876	3388	1503	1016	876	3395	-7	3395
27/11	6.0 AM	3006	1393	981	876	3250	1389	997	876	3262	-12	3263
4/12	6.0 PM	2353	973	0	816	1789	972	0	816	1788	1	1788
12/12	6.0 AM	2148	0	0	0	0	0	0	0	0	0	0
19/12	.6.0 PM	2139	1387	956	876	3219	1389	949	876	3214	5	3214
27/12	6.0 AM	2192	1421	975	876	3272	1422	979	876	3277	05	3277
3/1	6.0 PM	2211	1433	0	816	2249	1434	0	816	2250	-1	2250
11/1	6.0 AM	0	0	0	0	0	0	0	0	0	0	0
18/1	6.0 PM	0	0	0	0	0	0	0	0	0	0	0
26/1	6.0 AM	0	0	0	0	0	0	0	0	0	0	0
2/2	6.0 PM	3074	1436	1018	876	3330	1429	1012	876	3317	13	3317
10/2	6.0 AM	3386	1637	1130	876	3643	1636	1132	876	3644	-1	3644
17/2	6.0 PM	3731	1860	996	876	3732	1869	994	876	3739	-7	3739
25/2	6.0 AM	4186	2152	1158	876	4186	1926	1160	876	3962	224	3962
4/3	6.00 PM	4594	2415	1303	876	4594	2457	1306	876	4639	-45	4639
12/3	6.00 AM	4692	2457	1338	876	4692	2457	1340	876	4673	19	3673
19/3	6.0 PM	3865	1946	1044	876	3866	1937	1046	876	3859	7	3859
27/3	6.0 AM	4017	2261	1218	876	4355	2264	1213	876	4353	2	4353
Total (A.F)		2486720	1245614	567580	2492764	1242103	678183	567580	2487866	3898	2487866	



D E T A I L O F D I S T R I B U T A R I E S

NAME OF DISTIES.	DISCHARGE	NAME OF DISTIES.	DISCHARGE	NAME OF DISTIES.	DISCHARGE	NAME OF DISTIES.	DISCHARGE
DISTY. NO= 1: 1-R	81	DISTY. NO= 2: 1-AR	47	DISTY. NO= 3: SHAFI	10	DISTY. NO= 4: 1-L&J.SHAH	129
DISTY. NO= 5: 2-L	209	DISTY. NO= 6: 2-AL	23	DISTY. NO= 7: 3-L	531	DISTY. NO= 8: 3-AL	18
DISTY. NO= 9: 4-L	74	DISTY. NO=10: 5-L	227	DISTY. NO=11: 1-BR&1-CR	29	DISTY. NO=12: 6-L	128
DISTY. NO=13: 2-R	62	DISTY. NO=14: 2-AR	79	DISTY. NO=15: 2-BR	63	DISTY. NO=16: 3-R	244
DISTY. NO=17: 3-AR&4-P	47	DISTY. NO=18: 7-L	50	DISTY. NO=19: 5-R	46	DISTY. NO=20: 8-L	197
DISTY. NO=21: 6-R	65	DISTY. NO=22: 8-AL	14	DISTY. NO=23: 9L(U)	65	DISTY. NO=24: 7R,10L,O/L	20

FIG. 3 ——— Comparison of Proposed Annual Running Periods of Perennial Distributaries of Pakpattan Canal (U).

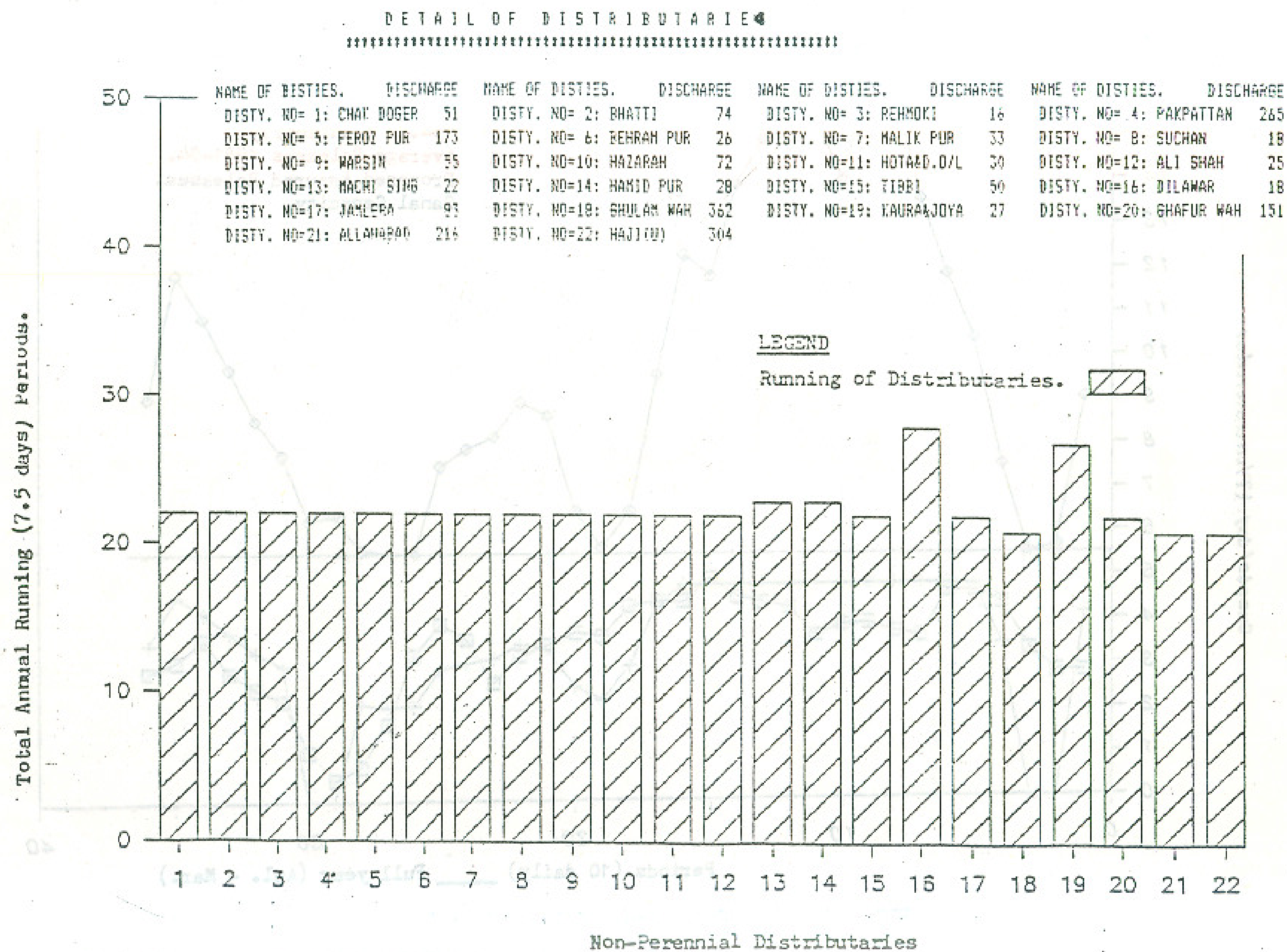


FIG. 4 —— Comparison of Proposed Annual Running Periods of Non-Perennial Distributaries of Pakpattan Canal (U).

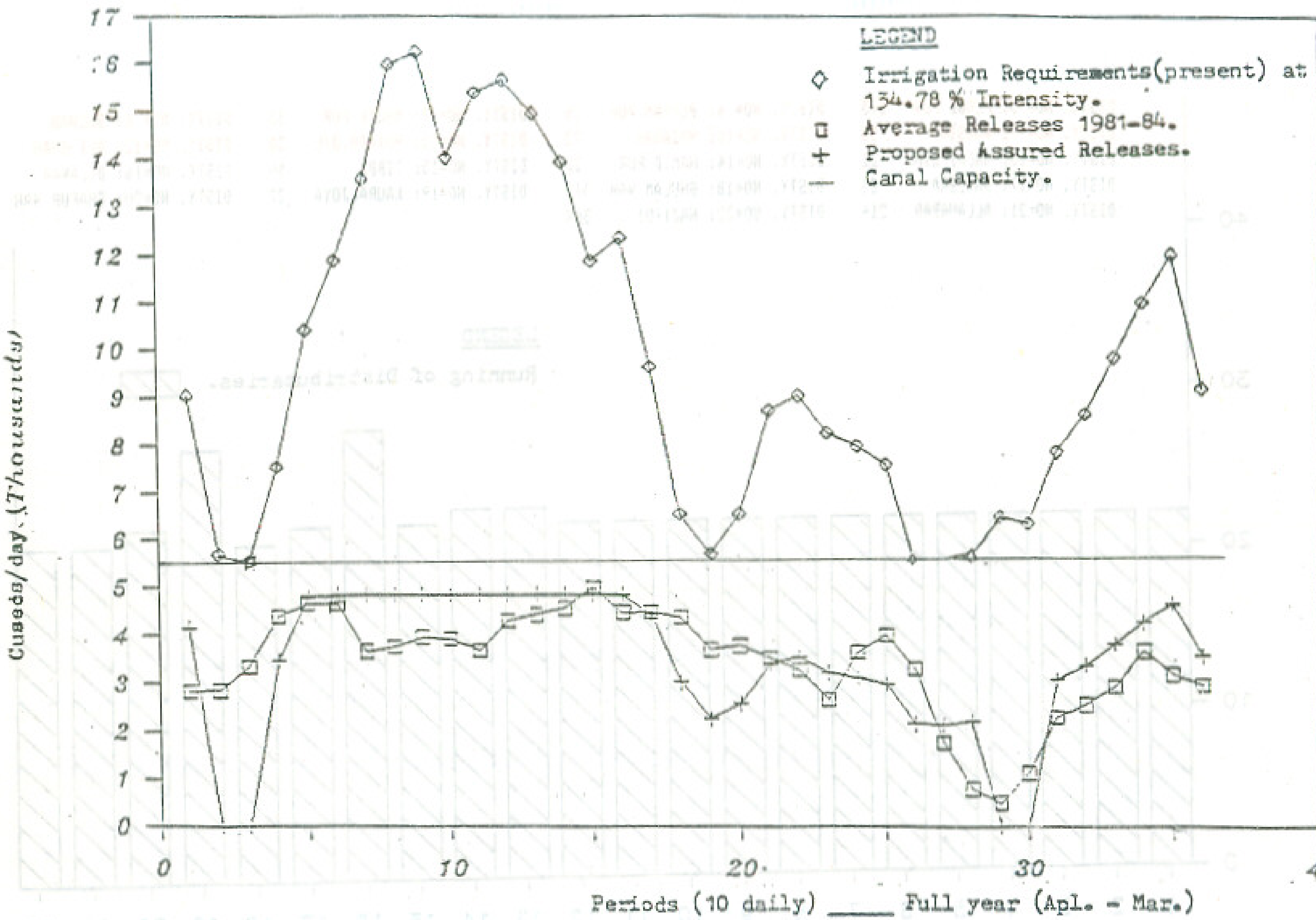


FIG. 5 ____ Comparison of Irrigation Requirements, Average Releases (1981-84) and Proposed Assured Releases in Pakpattan Canal (U).

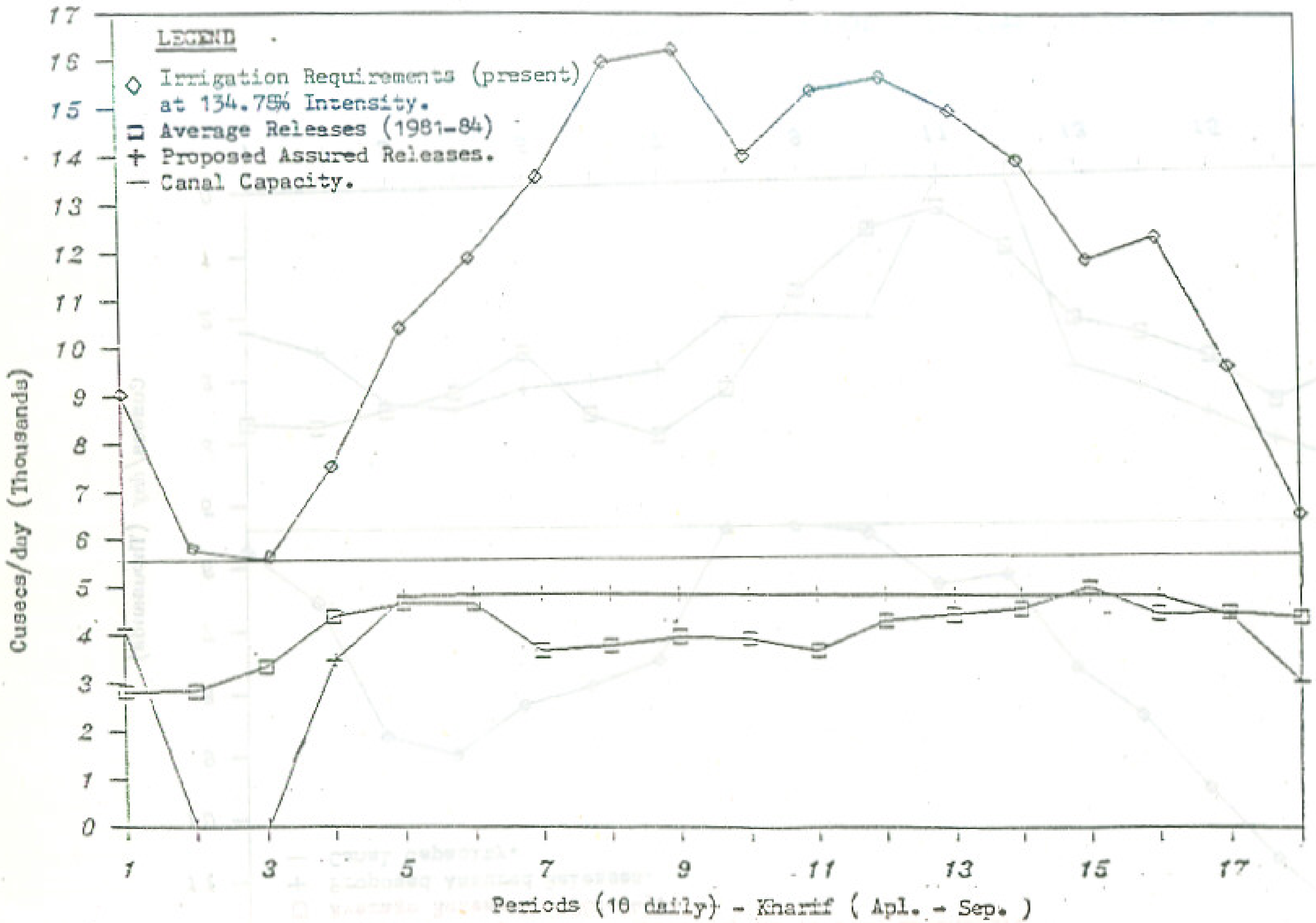


FIG. 6 ____ Comparison of Irrigation Requirements, Average Releases (1981-84) and Proposed Assured Releases for Kharif season in Pakpattan Canal (U).

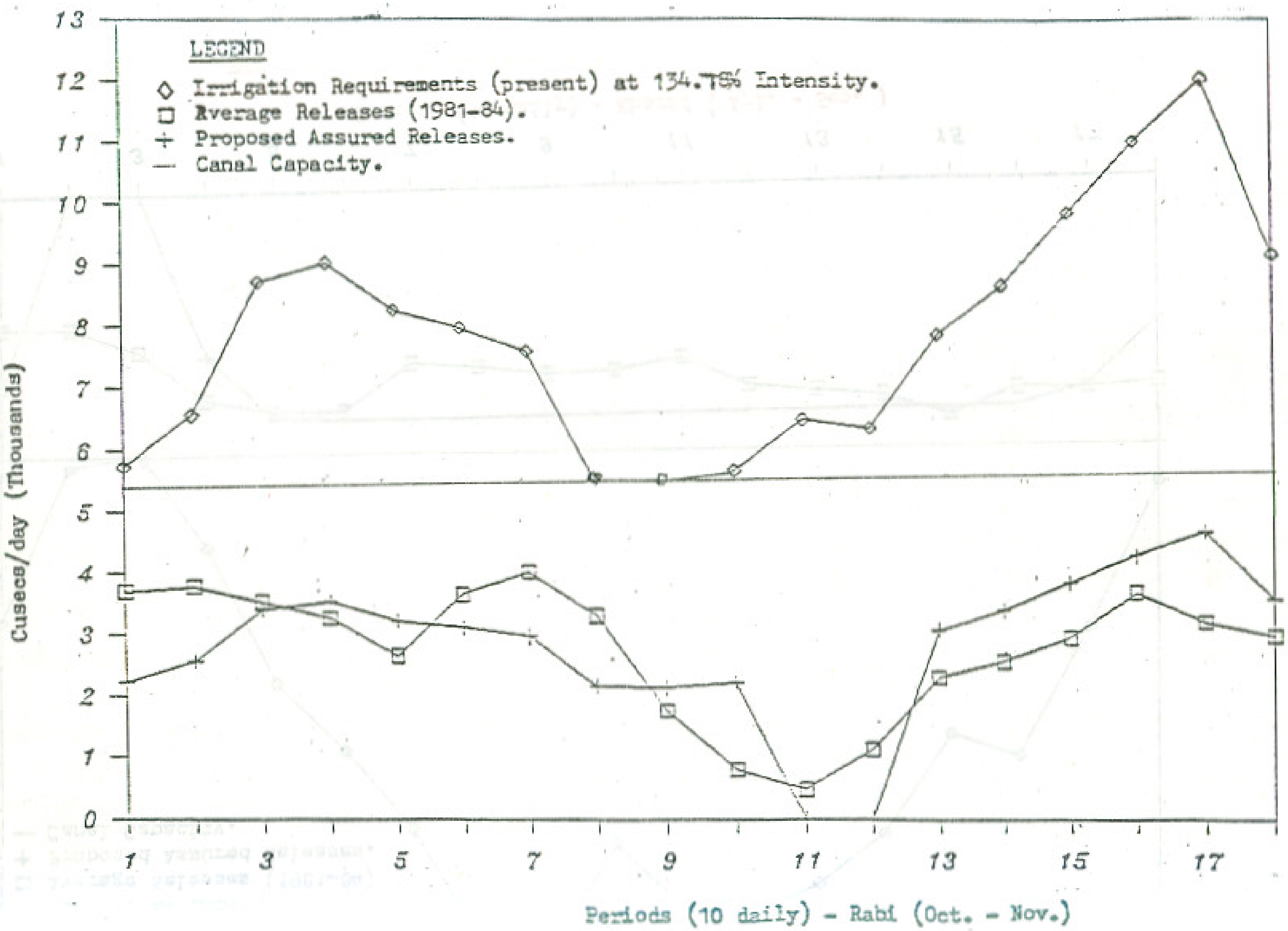


FIG. 7 ——— Comparison of Irrigation Requirements, Average Releases (1981-84) Proposed Assured Releases for Rabi season in Pakpattan Canal (U).

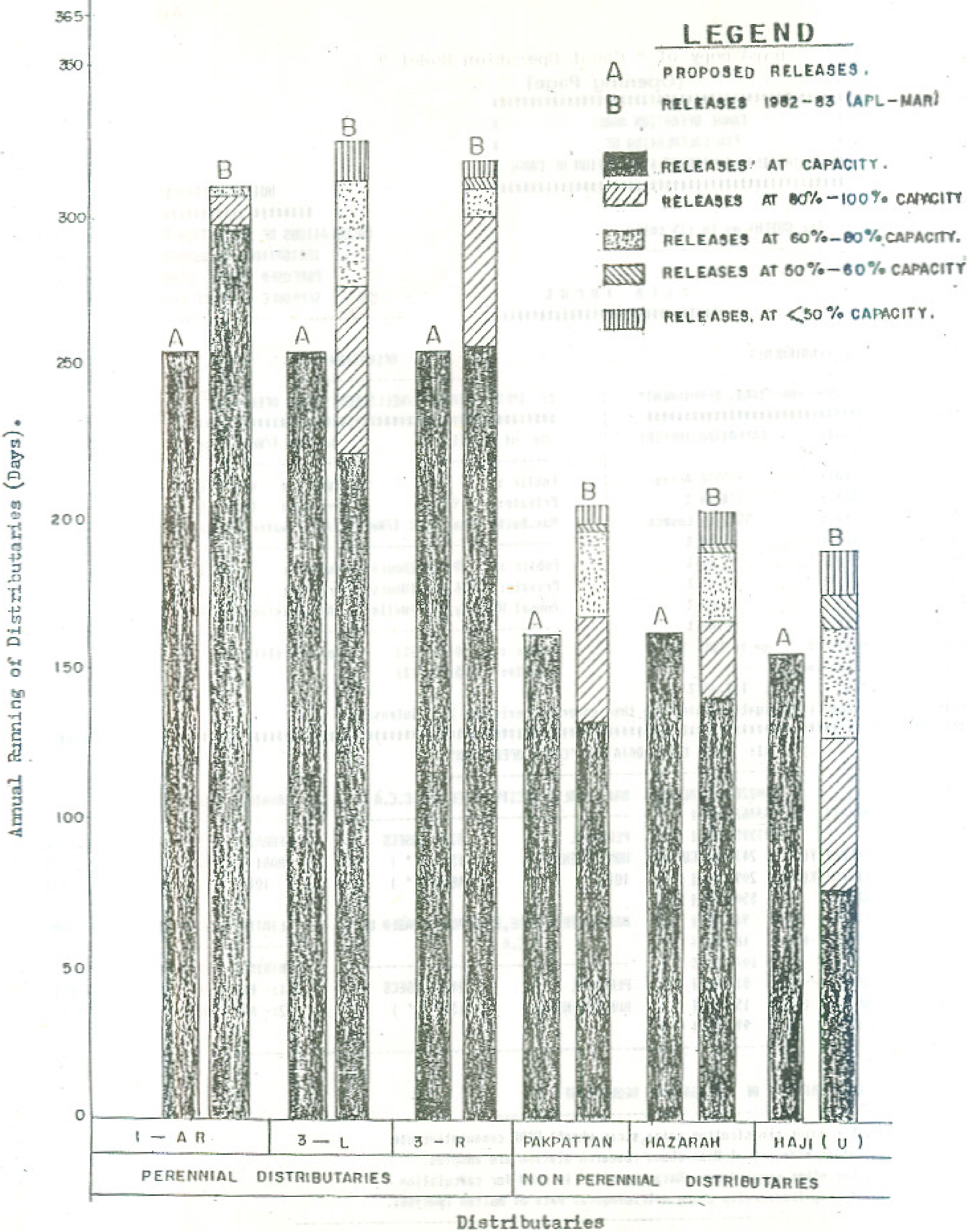


FIG. 8 —— Comparison of Proposed Annual Releases and Releases in year 1982-83 (Apl.-March) in Distributaries of Pakpattan Canal (U).

Annexure-A

Hard copy of " Canal Operation Model "

(Opening Page)

CANAL OPERATION MODEL
FOR CALCULATION OF
IRRIGATION REQUIRMENT & OPERATION OF CANAL

NOTE : For OUTPUT go to :J5 cell

OUTPUT REFRENCES

CALCULATIONS OF IRRIGATION REQUIRMENT:A47 cell
IRRIGATION REQUIRMENTS :FD46 "
PROPOSED CANAL OPERATION :FZ100 "
SCHEDULE OF CANAL OPERATION :GT100 "

D A T A I N P U T

1:- IRRIGATION REQUIRMENTS

INPUT DATA OF CANAL FOR "IRRI. REQUIRMENT"

Name of Canal:	FATTATIAN (UPPER)
Cult.Com.Area(CA):	935956 Acres
Existing Irr. Int.:	134.78 %
Canal Aitho.Dischg.:	5508.00 Cusecs
Conveyance Effici.:	75.00 %
Delivery Efficien.:	55.00 %
Application Effi. :	75.00 %
Leach. Requiremnt :	0.00 %
Designed Irr. Int.:	60.00 %
Cropping Intensities:	go to CELL V14
Any Changed Irrigation Intensity :	134.78 %

Note: If no change in Irrigation Intensity then enter the existing Irr. Intensity

2:- CANAL OPERATION

I:- INPUT DATA OF T/WELLS FOR "CANAL OPERATION"

No. of T/Wells		Average T/Well Capacity	
Public :	0	Public :	0.00 (Cusecs)
Private:	9342	Private:	1.00 (Cusecs)

Max.Daily Running of T/Wells		T/Well water Course Efficiency	
Public :	0.00 (Hours)	Public :	0 (%)
Private:	16.00 (Hours)	Private:	75 (%)

Annual Utility of T/Wells		Avg.Existing Utility Of T/Wells	
Public :	0.00 (%)	Total Utility :	25 (%)
Private:	25.00 (%)		

II:- INPUT CANAL DATA FOR "CANAL OPERATION"

C.C.A (Perenial)	:602285.00 ACRES
C.C.A(Non-perenial)	:333671.00 (")
TOTAL C.C.A	:935956.00 (")
DISTRIBUTION CAPACITY(P) :	2434.00 CUSECS
DISTRIBUTION CAPACITY(NP):	2098.00 (")
TOTAL CANAL CAPACITY :	5508.00 (")
KHARIF CANAL LOSSES---(P):	910.00 (")
KHARIF CANAL LOSSES--(NP):	166.00 (")
TOTAL KHARIF LOSSES :	1076.00 (")
RABI CANAL LOSSES-----(P):	837.00 (")
RABI CANAL LOSSES ---(NP):	153.00 (")
TOTAL RABI LOSSES :	990.00 (")

MAX.CANAL CAPACITY BASED ON C.C.A

PERENIAL :	3344 CUSECS
NON-PERENIAL:	1514 (")
TOTAL :	4858 (")

MAX.DISTRIBUTRIE,S CAPACITY BASED ON C.C.A

PERENIAL :	2434 CUSECS
NON-PERENIAL:	1348 (")

AVAILABLE SUPPLY

KHARIF(APR-SEP):	1482883 ACRE FOU
RABI (OCT-MARCH):	993749 (")
TOTAL	:2476832 (")

LIMITATIONS FOR CANAL OPERATION

MINIMUM SUPPLY :	50 %
1:- PERENIAL :	3344 CUSECS
2:- NON-PERANIAL:	2023 (")

CALCULATIONS OF IRRIGATION REQUIRMENT

NOTE : a. For major crops(cotton,maize,s.can,wheat) PARC consumptive use values measured at Mian chunu research station are adopted.

b. For other crops Jenson-Haize equation is used for calculation of evapotraspiratin using metriological Data of Multan (punjab).