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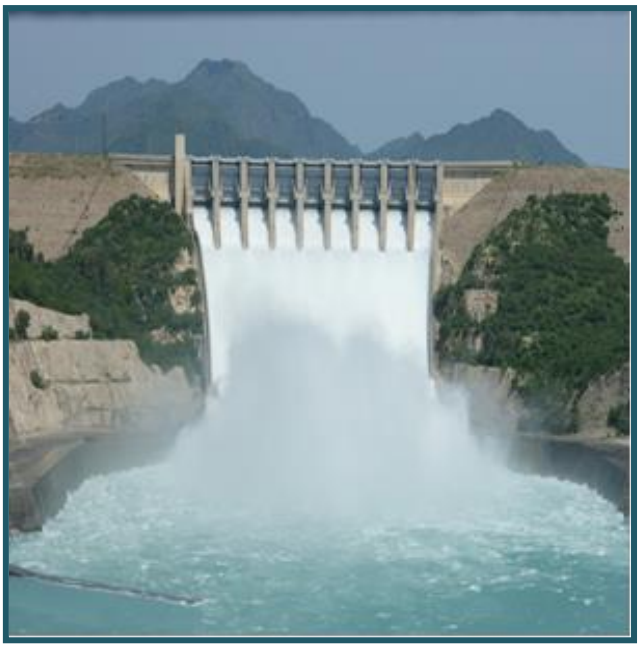
SINDH IRRIGATION & DRAINAGE AUTHORITY



[CHANNEL OPERATION & MAINTENANCE MANUAL FOR FARMERS ORGANIZATIONS]

This document is guideline for Farmers Organization for effective Channel Operation & Maintenance and development of O&M Plans of the Channel

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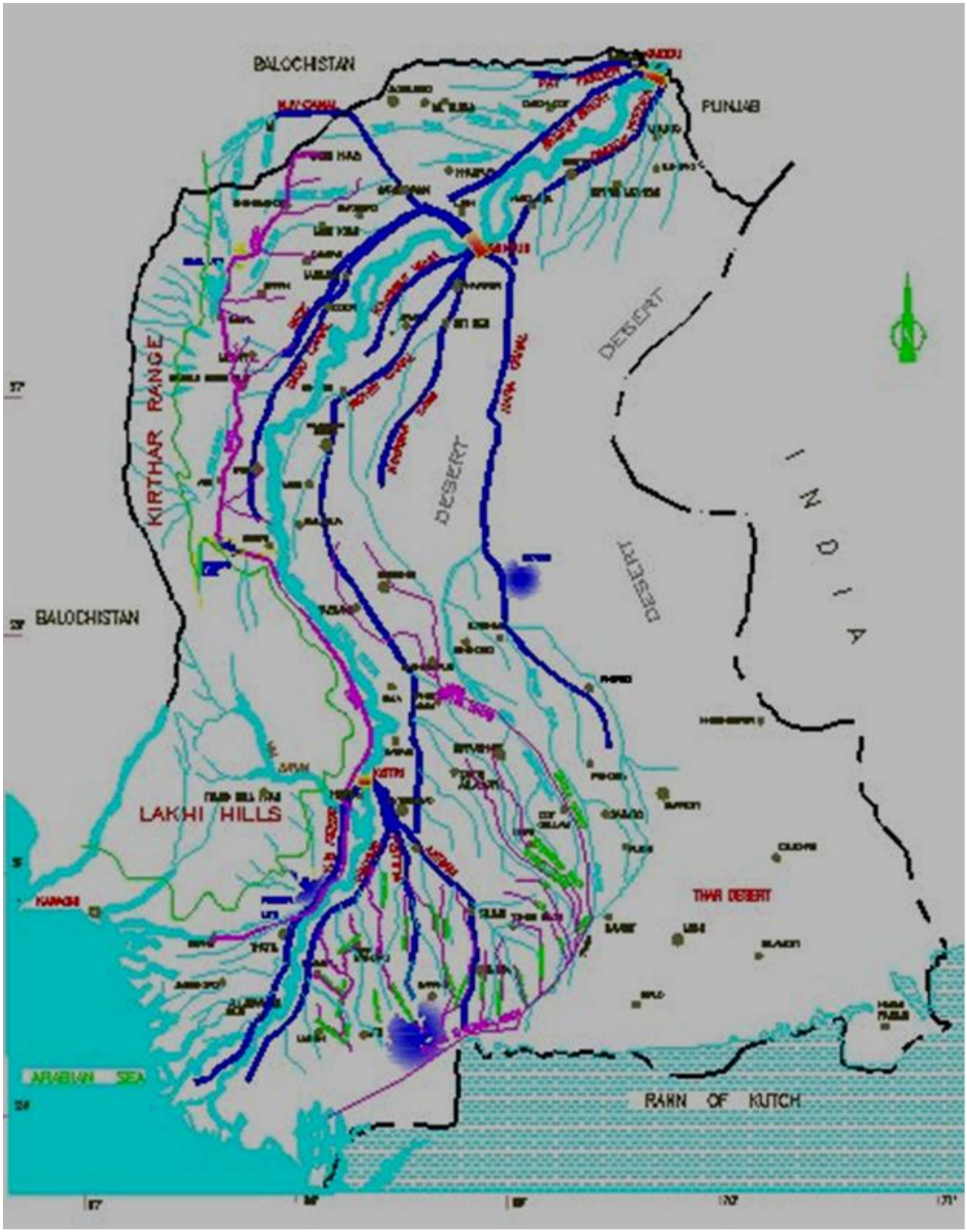


1. INTRODUCTION

The irrigation system of Pakistan is the largest integrated irrigation network in the world. The system is fed by the waters of the Indus River and its tributaries. The salient features of the system are three major storage reservoirs (Dams), namely Tarbella & Chashama on river Indus, and Mangla on river Jhelum, with the present live storage of about 12.5 MAF, 19 Barrages, 12 inter- river link canals and 43 independent Irrigation canal commands.

Diversion of River Waters into off taking canals is made through Barrages, which are gated diversion weirs and a system of link canals. The main canals, in turn deliver water to branch canals, distributaries and minors. The watercourses get their due share of water through outlets in the irrigation channels.

Sindh is one of the primary beneficiaries of Indus Basin irrigation system with three gigantic Barrages that divert about 48 MAF of water annually to the 14 main canal commands in the province.

The Sindh Irrigation & Drainage Authority (SIDA) is an autonomous organization, taking over the Sindh Irrigation & Drainage System from the Sindh Irrigation Department initially the system of Nara Canal, Left Bank Canal (Fulleli & Akram Wah) and Ghotki are operated through Area Water Boards by SIDA, Sindh Irrigation & Drainage Authority (SIDA) has been established in 1997.

As per institutional reforms in irrigation system the Channels up to Distributary / Minor level have been transferred to the Farmers Organizations (FOs) through Irrigation & Drainage Management Transfer Agreement (IDMTA) under Sindh Water Management Ordinance (SWMO) - 2002. The irrigation management of Canal at Province level is to be organized on participatory basis by establishment of Area Water Boards (AWBs) on Canal and Provincial Irrigation & Drainage Authorities (PIDAs) on Province level.

1.1 Tasks and Responsibilities of SIDA

- Supply water from the Barrage to the Canals. These canals will be operated by Area Water Boards.
- Levy Water Charges from the Area Water Boards and other water users.
- Construct, operate and maintain irrigation, drainage and flood protection infrastructures.

1.2 Functions of Area Water Board

- To operate and maintain the parts of the irrigation system conferred on it including but not limited to main canals and branch canals;
- To carry out flood protection and maintain infrastructure within its command area.
- To promote the formation, development and growth of the FOs in its command area into self-

supporting and financially self-sustainable entities

- To monitor equity in water distribution and measures for preventing water theft
- To monitor and review O&M work plan of FO Channels
- To Review & supervise the assessment & collection of Abiana by FOs
- To Prepare & implement of rotational programs of channels
- To Review the expenditures incurred by FOs
- To assessed and support FOs in technical matters related to O&M of the channels
- To Assist in promotion and development of FOs
- To maintain environmental protection.
- To ensure better response to emergencies

Fulfil any other function conferred on it by SWMO-2002

1.3 Functions of Farmers Organizations

- To operate and maintain the parts of distributary / minor
- To repair & maintain the embankments and hydraulic structures
- To ensure equitable and judicious distribution of water including small and tail end farmers
- To supply non-agricultural users and to guarantee minimum drinking water
- To asses & collect the Abiyana
- To Hire staff
- To Maintain the books of Accounts
- To Keep proper record of all activities carried out in FO
- To ensure dispute resolution
- To provide better service to the water users
- To reduce maintenance requirements
- To Minimize environmental issues
- To Publicize all expenditures, which are approved by the Board of Management of FO in General Body Meeting for further review and finalization
- To fulfil any other function conferred on it by SWMO-2002

1.4 Functions of Water Course Association

- To operate, maintain, improve and rehabilitate the watercourse and ancillary structures.
- To improve the water supply from surface or sub-soil water-sources.
- To sanction upgrade and maintain the field outlets.
- To locate, own, operate and maintain tube-wells and lift pumps;

- To establish schedules of water delivery and supervise water allocation and distribution and to ensure that each member gets his entitled share of water in appropriate times.
- To locate, construct, maintain and improve the field drains.
- To remove obstructions in the watercourse during realignment, operation and maintenance.
- To organize labour for general or emergency repairs of the watercourse and allied purposes.
- To assist in the determination and collection of general and special assessment.
- To ensure that all members of the WCA contribute in the agreed manner their share of labour or money to the improvement, maintenance and operation of the watercourse.
- To participate in programs to improve water use and drainage practices at field and water-course command area level:
- To mediate in disputes between farmers for equitable distribution of water
- To assess in the process of Assessment & Collection of Abiyana recovery
-

Provided that the Board of the WCA shall exercise management and supervision of the activities of the WCA in accordance with best practice.

1.5 Environmental Problems at Distributaries / Minors

- Wherever, peasant families / low income families are residing along the banks of the channels, they almost dispose off effluent of sewerage directly into the channel.
- Peasant families wash their clothes directly into the channels causes contamination of the water.
- Bathing of animals inside the channel causing erosion of banks as well as contamination of water.
- Solid garbage thrown directly into the channel by peasant families.
- Encroachment on the banks by the low income people.
- Animal carcasses (remains of dead animals, especially one that's been slaughtered for food) thrown in the channel.
- Mass bathing practices by low income families
- Storage of garbage at upstream nose of the structures like siphon etc.

1.6 Social Phenomena Causing Maintenance Problems at Distributary & Minor Level

It has been observed that so many maintenance requirements are created because of social causes pertaining to local communities such as cutting of banks, putting obstructions in the channel bed, un-authorised outlets / structures / gates, theft of water through unauthorized lift machines.

A common problem in irrigation system is the continual cycle of irrigation system construction, followed by deterioration of the system because of maintenance requirements, and then rehabilitation followed again by deterioration.

ISN'T THERE IS A BETTER WAY

The recurring cycle of construction deterioration rehabilitation (construction) deterioration usually hampered the agriculture growth as well as raising question mark from the part of donor agencies.

Hence it is dire need that channels must maintain season after season as social causes should be minimized through awareness programs.

1.7 Problems at Distributary / Minor level

- Inequity in water distribution.
- Shortage of water particularly at tail.
- Water theft by tampering of outlets / Lift machines.
- Sudden closure of distributaries / minors due to rotation program.
- Fluctuation in supply of water.
- Silt deposition.
- Bad condition of inspection path.
- Free movement of animals on inspection paths.
- Raised spoils along banks.
- Water logging and salinity.
- Less Abiyana recovery.
- Earth taken by peasant families / low income families from embankments and bed.

1.8 Expected outcomes from FOs

- Improved O&M of Distributaries / Minors.
- Improved Abiyana collection.
- Resolved water related issues.
- Ensured reliable water supply up to tail ender's.
- Ensured equitable distribution of water among all water users.
- Ensured increase in crop yield / production per unit of water.
- Improved condition of inspection path.

2. IRRIGATION NETWORK

It is necessary for farmers to know about the Irrigation network, characteristics of good irrigation and activities required for channel operation & maintenance.

2.1 Irrigation

The process of artificial application of water to the land to assist in the production of agricultural crops is known as irrigation.

2.2 Components of the Irrigation System or Irrigation System Network

The main components of an irrigation system are listed below;

- Dam /Barrage
- Canal Head regulator
- Main canal
- Branch Canal
- Distributary Channel
- Minor Channel
- Water courses (W.C)

2.3 Flow Irrigation

The Flow irrigation is the system / network of water flows under gravity from the source to the agricultural land / field. It is also called canal irrigation.

2.4 Canal

An irrigation Canal is a water way, often man made or enhanced, built for the purpose of carrying water from a source such as lake, river or stream, to soil used for crop irrigation.

2.5 Classification of Canals

The canals are classified on the bases of,

(I) Nature of source of supply

(a) Perennial Canals

(b) Non-Perennial Canals

(a) Perennial Canals

Perennial canals are those canals which maintain its flow of water throughout the year even during winter season. These irrigate the field throughout all the year with equitable rate of flow.

(b) Non-Perennial Canals

These are the canals which irrigate the field for only one part of the year usually during summer season or at the beginning and end of winter season, called as non-perennial canals. These canals take-off from rivers which do not have assured supply throughout the year.

(II) Distribution System for Canal Irrigation:

(a) Main Canals

(b) Branch Canals

(c) Distributaries

(d) Minors

(e) Water Courses (Field Channels)

(a) Main Canals

It supplies water from river, reservoir to irrigate lands by gravity flow it carries huge quantum of water and supplies water to branch canals for further distribution among distributaries and minors. The discharge capacity of main canal is greater than 1000 cusecs.

(b) Branch Canals

The branch canals are taken from either side of the main canal at suitable points so that whole command area can be covered by the network. The discharge capacity of branch canal varies from 201 to 1000 cusecs.

(c) Distributaries

These take-off from branch canals. The discharge capacity of distributary channels varies from 01 to 200 cusecs. These are divided as,

(i) Major Distributary

(ii) Minor Distributary

(i) Major Distributary

These take-off from branch canals. Sometimes they may also take-off from main canals but their discharge is always less than the branch canals. These are real irrigation channels because they supply water to the field directly through outlets. The capacity varies from 51 to 200 cusecs.

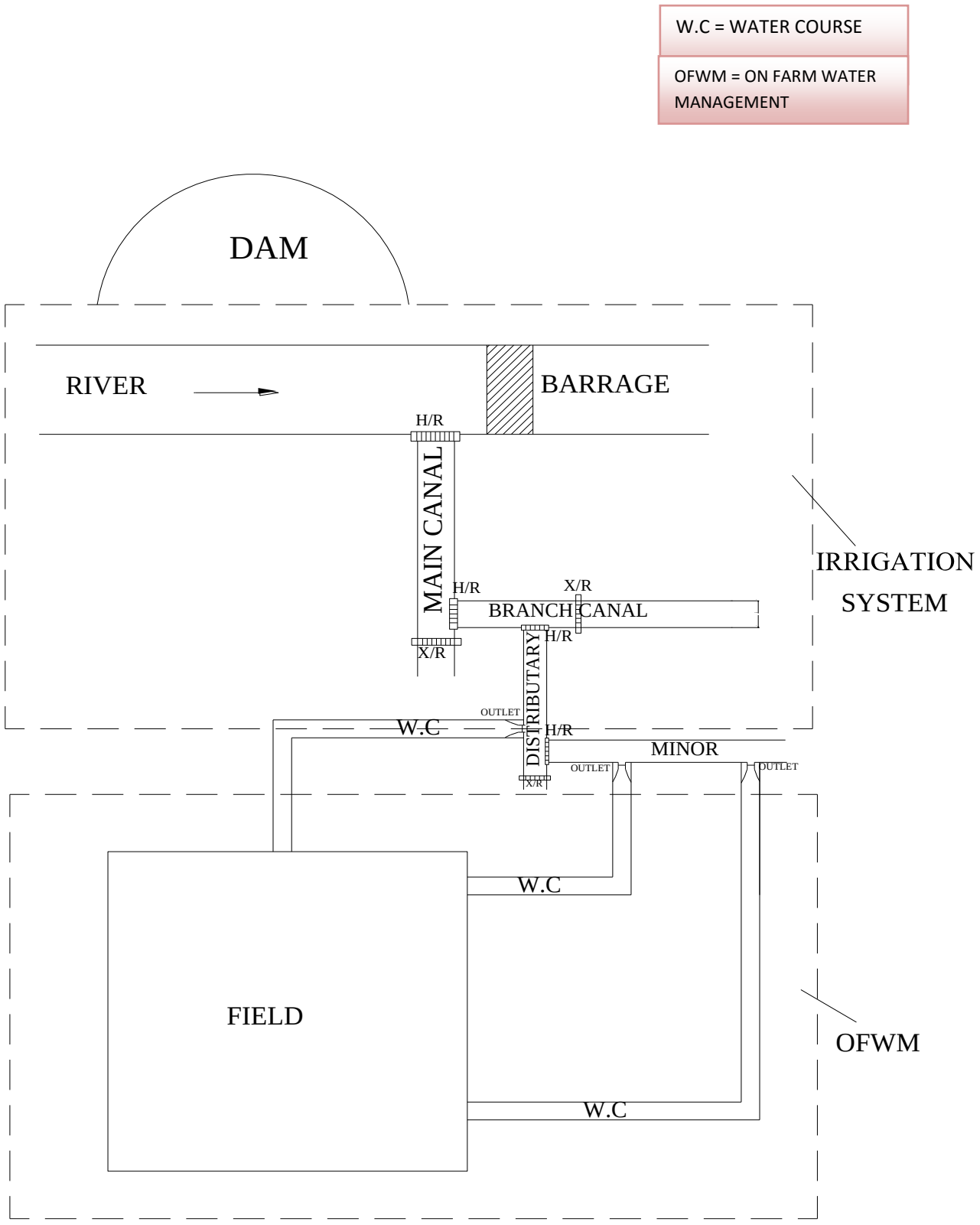
(ii) Minor Distributary

These distributaries take-off from major distributaries or sometimes from branch canals. They also provide water to the water courses through outlets provided along with them. The discharge capacity in this type of channels is 1 to 50 cusecs.

(d) Field Channels (Water Course)

These channels are taken from the outlets of the Distributary / Minors channels by the cultivators to supply water to their own lands. These channels are maintained by the cultivators.

2.6 Layout of Irrigation System / Network



3. HYDRAULIC STRUCTURES

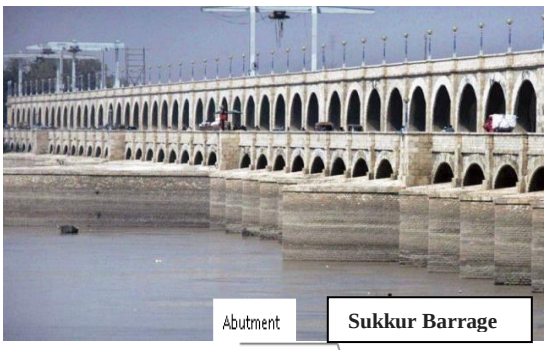
3.1 Dam

A weir / barrier constructed across the stream / river to store a huge quantum of flood water used as a source to generate electricity or maintain the river flow for irrigation purpose.


Tarbela Dam

3.2 Barrage

An artificial barrier / weir constructed across the river with series of gates to raise the water level for diverting the required quantum of water into canals.

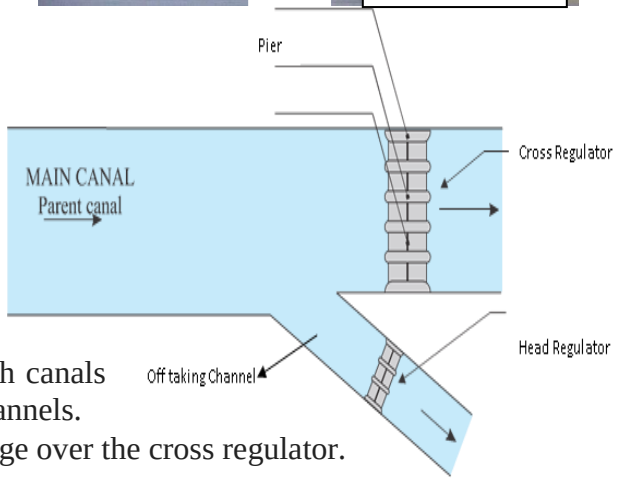


Sukkur Barrage

3.3 Head & Cross Regulators

Cross Regulator is a hydraulic structure constructed across the canal to regulate the irrigation water supplies. It may be constructed across any type of canal main, branch or a distributary.

Head Regulator is a hydraulic structure constructed at the entrance (the head) of the any type of canal. It consists of a raised crest with abutments on both sides. .

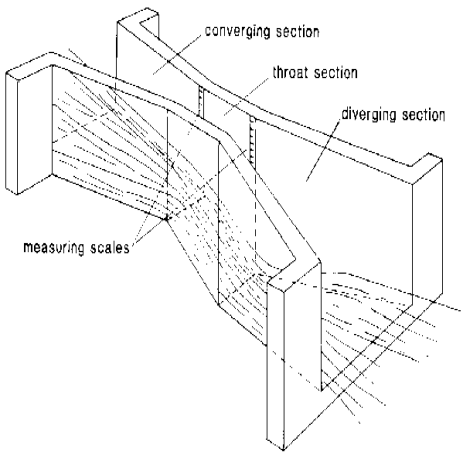


Functions of Cross Regulators

- It regulates the flow of the canal system.
- It raises the water levels in the main canal, branch canals and distributaries in order to feed the off taking channels.
- To facilitate communication by constructing a bridge over the cross regulator.
- To absorb the fluctuations in the canal system.

Functions of Head Regulators

- It regulates the flow of irrigation water entering into the canal.
- It can be used as a meter for measuring the discharge.
- It regulates and prevents excessive silt entry into the canal.

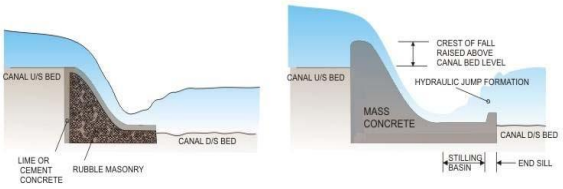


3.4 Outlet or Mogha

It is a hydraulic structure conveying irrigation water from a government owned main, branch canal, distributary or a minor to a private owned field channel / water course for the purpose of agriculture.

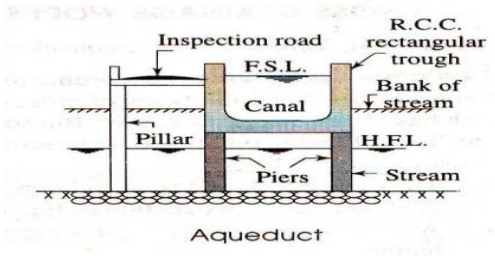
3.5 Fall Structure

Structure constructed in channels having steep gradient to control the water levels to dissipate the energy of falling water.



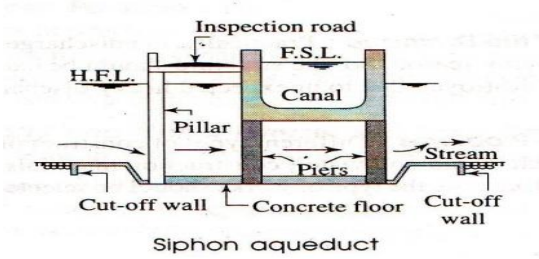
3.6 Aqueduct

The hydraulic structure in which irrigation canal is passing over the drainage is known as aqueduct. This structure is suitable when bed of canal is above the highest flood level of drainage. In this case, the drainage water passes clearly below the canal.



3.7 Siphon Aqueduct

The hydraulic structure in which irrigation canal is passing over the drainage, but the drainage water cannot pass clearly below the canal is known as siphon aqueduct. It flows under siphoned action. This structure is suitable when the bed level of canal is below the highest flood level of the drainage.



3.8 Bridge

A bridge is a structure built to span physical obstacles such as a body of water, valley, or road, for the purpose of providing passage over the obstacle.

3.9 Escapes

These are hydraulic structures meant to release excess water from a canal, which could be main canal, branch canal, distributary, minors etc.

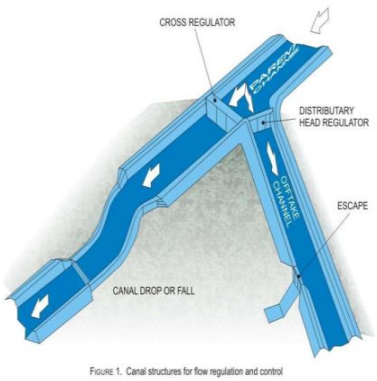


FIGURE 1. Canal structures for flow regulation and control

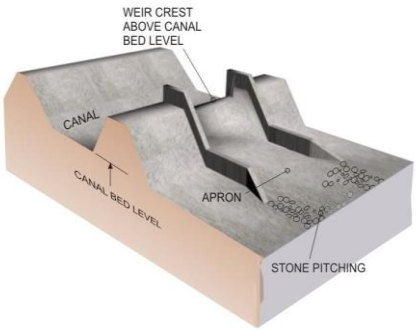


FIGURE 26. Weir Escape
Energy dissipation structures not shown

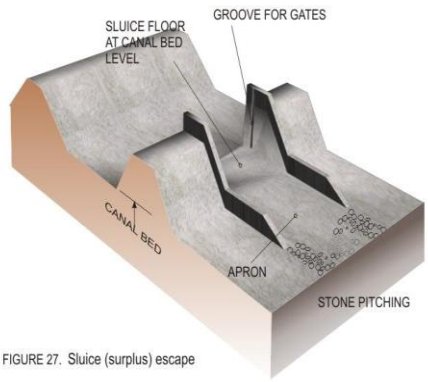


FIGURE 27. Sluice (surplus) escape

4. IRRIGATION TERMINOLOGY

4.1 Crops

This is the field / farm produce natural or cultivated crops for human and animal life. Every crop requires water right from pre- sowing to maturity.

4.2 Kharif Season

Kharif season starts from 15th April to 14th October and the main crops of kharif season are rice, bajra, jawar, maize, tobacco, ground nut etc.

4.3 Rabi Season

Rabi season starts from 15th October to 14th April. The main crops of rabi season are Wheat, Barely, Gram, Mustard, Potato etc.

4.4 Cash Crop

A cash crop refers to the crops, which need processing marketing before consumption. Crops like Cotton, Sugar Cane, etc. .

4.5 Crop Water Requirement

The total quantity of water a crop requires at different intervals of time from pre-sowing to harvesting is called the crop water requirement of that crop. Different crops will have different water requirements depending on climate, type of soil, method of cultivation, water table, ground slope, intensity of irrigation etc.

4.6 Crop Period

The time between sowing and harvesting is called crop period.

4.7 Base Period

The time between first watering to a crop at its sowing to its last watering before harvesting is called base period

Generally Crop Period, Base Period and Growth Period have same meaning.

4.8 Delta of a crop

The total depth of water in ‘cm’ or ‘ft’ required by a crop from sowing to maturity is called its delta. As the amount of each watering and the interval of watering are fixed for each crop, the total quantity of water required by each crop is also fixed and is different for various crops.

For example: A crop requires about 10 cm depth of water 12 times watering from sowing to maturity. The delta of the crop would be 10 x12 = 120 cm.

Average deltas for some crops are as under:

S.No	Crop	Delta on field in cm
1	Rice	120
2	Sugar Cane	120
3	Garden Fruits	60
4	Cotton	50
5	Vegetables	45
6	Wheat	30
7	Maize	25
8	Fodder	22.5

4.9 Duty of Water

Duty represents the irrigating capacity of a unit of water. Duty is relationship between the area of crop irrigated and the quantity of irrigation water required during the base period of that crop.

For example, if 3 cumecs of water supply is required for a crop sown in area of 5100 hectares, the duty of irrigation water will be 5100/3 = 1700 hectares/cumecs, and the discharge of 3 cumec will be required throughout the base period.

4.10 Gross Command Area (G.C.A)

The Gross command area (G.C.A) of canal irrigation project includes cultivable land as well as barren land, forests, houses, wasteland, roads etc.

Gross Command Area = Cultivable Command Area + Uncultivable Command Area

4.11 Uncultivable Command Area (Un-C.C.A)

Uncultivable Command Area (Un-CCA) is that part of gross command Area, which is not fit for cultivating crops such as Forests, Barren land, Villages, Lakes & Ponds etc.

4.12 Cultivable Command Area (C.C.A)

Cultivable Command Area (CCA) is that part of gross command Area, which is fit for cultivation crops and it can be physically irrigated from canal irrigation network.

$$C.C.A = G.C.A - UnC.C.A$$

4.13 Intensity of Irrigation

It is defined as the ratio of cultivated land for a particular crop to the total C.C.A. It is expressed as a % age of C.C.A.

For example, if the total C.C.A is 1000 acres where wheat is cultivated in 250 acres

Then,

$$Intensity\ of\ irrigation\ for\ wheat = \frac{250}{1000} \times 100 = 25\%$$

4.14 Daily Gauges of Distributaries and Minors

The daily gauges on heads of distributaries and minors are recorded in the Sub- Division and Division offices respectively after every six hours. The designed gauges with respect to designed discharge of each distributary / minor are fixed by the technical personnel of sub division at the head of channel and it may be calibrated from time to time whenever it feels necessary. The head gauge should be monitored by Farmer organization's in daily routine that whether the channel is being run according to it authorized / designed full supply level or otherwise.

The Farmer organizations are also responsible to monitor the tail gauges of their respective channel. If the channel receives at head less water level than its authorized full supply level the FO Chairman May immediate contact its sub divisional officer and divisional officer for any unexpected reduction of water levels at head of channel.

5. CHARACTERISTICS OF A GOOD IRRIGATION SYSTEM

1. Reliability
2. Equitability
3. Least water wastage
4. Accountability of Water distribution and record maintenance
5. Least external interference in water distribution

If all above characters are present in an irrigation system then it can be said that it is a suitable and efficient irrigation system and can deliver water as per design.

6. CHANNEL OPERATION

Pakistan's Irrigation System was designed to distribute water with minimum human interference, and low operation cost. There are few structures to regulate canal flow and the outlets run whenever a distributary or minor is running; no escapes are provided at the tail of the system and the surplus flows have to be absorbed within the command. The channels are designed as the water could be supplied on equitable basis from head to tail. Farmers are the principle users of canal water delivery system. The damages or disturbance in any part of the system will disturb the water flow and equitable water distribution. Therefore it is very essential to monitor and repair the effected parts on time.

The main parts of a channel are described as under and shown in the following diagram.

6.1 Main Parts of a Channel

NIP = Non Inspection Path mean embankment (Bund) of a channel which is non motor able for any inspection or visit.

IP = Inspection Path mean embankment (Bund) of a channel which is motor able for inspection / monitoring.

Berm = In the prism of channel the area between the water way and embankment.

FSL = The Full Supply Level of water at which the channel is designed.

FB = Free Board is the depth between the FSL & Top level of embankment.

Bed = It is the base of the area of the waterway of channel.

Slope = The inclined area under the Prism of Channel.

Toe = The meeting point between the channel end & Natural Surface Level**.**

CL = The Center Line of the Channel

NSL / NGL = Natural Surface Level or Natural Ground Level

TW = Top Width of the Channel

BW = Bottom Width of the Channel

D = Depth of the Channel

d = **F**low depth of the Channel

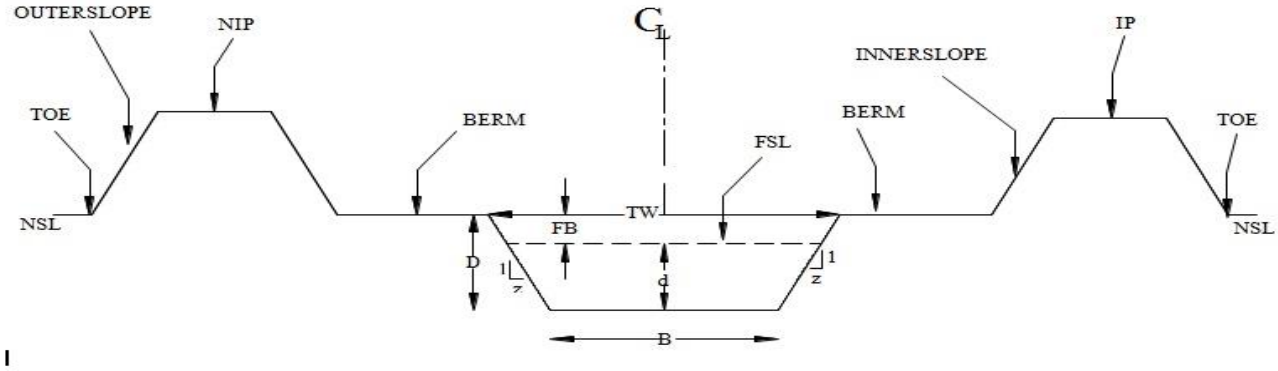
RL = Reduced Level is the elevation with respect of Sea Level.

Q = Discharge (the volumetric flow rate of water) measured as cusecs (ft^3/sec) or cumecs (m^3/Sec)

RD = Reduced Distance in Irrigation practice 1RD = 1000 feet.

DIAGRAM =

TYPICAL CROSS SECTION OF CHANNEL



6.2 Main causes of difficulties in channel operation

- The channels are designed on the basis of specific percentage of land for cultivation of different crops, but due to high water consumption in fields resulting in water shortages at the tail portion of the channel.
- Due to changes in cropping pattern the channels are running on increased discharge which causes erosion of Banks, seepage etc.
- Flood irrigation areas shifted to lifts or vice versa, both practices have created the damaging effects.
- Slow water flow in channels due to flute gradient and wide section creates silt problem.
- Obstruction in water flow due to rapid growth of vegetation causes deposition of silt and erosion problems in channels.

Note: *The vegetation could be controlled through chemicals, Machines, labor or biological.*

- Erosion and extension of width in head reach of the channels due to sudden opening of the channel gates, extensive discharge.

Note: *In beginning it is necessary that the water should be open from head regulator not more than 1.2 feet and gradually the release may be increased, the full supply Otherwise the sudden opening will create erosion and extension of width in head portion of the channel.*

- If freeboard's totally covered by water, it damages the berm and banks. It is necessary that at any cost the clear freeboard depth should be 50% of the design Free Board. The sudden increase or decrease of water supply in channels damages the berms, banks also the structures.

Note: *It is necessary that during opening and closing after three hour the 10% water should be increased.*

6.3 Operation of Gates

While raising or lowering the water level in the Distributary / Minor, the gate should be lowered or raised gradually and uniformly to avoid confrontation and uneven distribution of flow. For example if the gates are to be lowered or opened by one feet per hour, then the gates should be first lowered or opened by one feet per hour, then the gates should be first lowered by 0.3 feet at a time until the target of 1 ft is achieved.

6.4 Important checks of the channel

- It should be checked that the bed width of channel is as per design.
- It should be checked that the water depth is as per design.
- It should be checked that the berms are available as per design.
- It should be checked that the berms are clear from the vegetation.

6.5 Instructions about banks

- Width of banks should be as per design.
- Free board should be as per design. In case of 50% coverage of free board the channel should be de-silted or the height of banks should be increased.
- The outside slopes of banks should be as per design.
- If the outside slopes of banks are showing seepage then the back berms should be constructed.
- Back berm should be as per design.
- The vehicles which, damage the banks, should be controlled and damaged banks should be rehabilitated.
- The animal ghats should be constructed.
- Flood rain breaches should be closed immediately.
- Peasant families should strictly be restricted for not taking earth from the banks of the channel for their domestic purpose

7. MAINTENANCE OF DISTRIBUTARIES & MINORS

The earlier flow, erosion, weather conditions, movements of peoples and animals, these all effects the design of the channel. The repairing of the channel is necessary to maintain / restore the original designs of the all parts of the channels.

An effective maintenance program includes the following components.

- Routine Maintenance
- Preventive maintenance
- Seasonal Maintenance
- Annual Maintenance
- Un-Scheduled Maintenance
- Emergency Maintenance

7.1- Routine Maintenance

Those works which must be carried out on daily or weekly basis such as pertaining to embankment maintenance work like jungle clearance, vegetation control, rain cut repairs, repairing of berms by groyns as well on oiling and greasing of the gates.

7.2- Preventive Maintenance

In order to prevent major problems such as leakages and deterioration of banks, the channel system should be regularly inspected throughout the irrigation season. Rat holes in channel banks, small leakages, erosion of channel and cracks in banks can cause severe problems. Hence these minor issues must be noticed and repaired immediately.

7.3- Seasonal Maintenance

These works are carried out through casual labor these includes such as grading inspection paths, repair of animal crossing and large scale rain cuts and groyons programs.

7.4- Annual Maintenance

These works are usually carried out during canal closure period. These works includes; repairing of outlets, head to tail, Desilting of Distributaries and Minors and repairing of the regulators by oiling & greasing etc.

7.5- Un-Scheduled Maintenance

Due to weather or other un-predictable reasons unscheduled maintenance / repairs requires on urgent basis and that must be performed quickly to return the system to normal operation.

7.6- Emergency Repairs

These repairs are carried out at the time of occurrence of breaches due to faulty maintenance unusual weather conditions or un-noticed burrowing by rodents.

8- CAUSES OF LEAKAGES & BREACHES IN DISTRIBUTARIES AND MINORS

- Sometimes excess water (more than designed) passes into the distributaries / minors due to bad regulation at the head works or lower down in the system. If the regulation staff is involved then excessive discharge is generally passed down the system and channel in the tail reaches get discharges in excess of its design capacity. On such channel a breach is likely to occur at site due to inadequate free board.

- Sometimes a channel is deliberately breached or cut by farmers. Such channel must be closed at once for repairs.

- During high winds, branches from trees standing on banks of channel may break off or entire trees may fall into the channel. This debris may obstruct flow at bridges, or other structures raising water elevation at upstream. These high water levels may over top channel banks resulting in breaches.
- During periods of low demands, generally at the end of each cropping season, or when there are wide spread rain falls, farmers are prone to plug their outlets to save their crops from excessive watering. This can cause flooding of the tail reaches of the channels and lead to breaches where free board is insufficient.
- Silt deposition in the channels should be monitored through the observations made monthly in the "H" register. If there is excessive silt deposit in the channels, its free board will be reduced. Silt should either be removed through mechanical means during closure period or Khati should be arranged through local labours of WCAs.
- Rat holes are also responsible for breaches and it should be well monitored through vigilant watch all the time.

8.1. Closing of leakages and breaches in distributary / minors

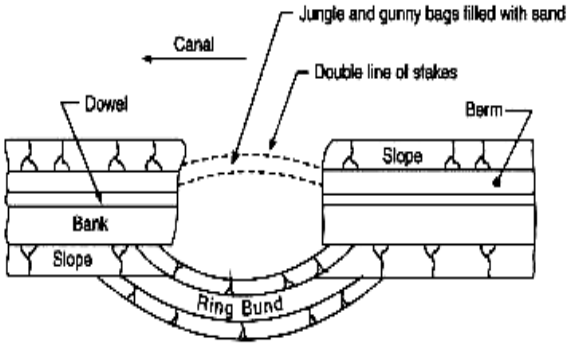
8.1.1 Closing Leakages

Rat holes in embankments are the major causes of leakages. If the water flowing through the leak is sluggish and clear, it may be seepage water and there is no immediate danger. If however, it is muddy, flows freely, and carries the soil particles from the embankment, the leak needs immediate attention. The location of the hole should be pointed out correctly on both sides of the channel bank. The hole either small or large shall be closed both sides (inner/outer) at once with the help of Beldars.

8.1.2 Closing of Breaches

The flow in the channel shall preferably reduce from head as straight closure is not possible. The labour and material (such as; Earth, Sand, Gunny Bags, Stakes and Brushwood) shall be collected at the site.

The ends of the breached banks shall be protected first to prevent further widening. A double line of stakes shall be driven in shape of ring then jungle shall be filled between the stakes and pressing it down with bags filled with sand and then men walking over gunny bags. When the flow through the breach has been so controlled to some extend it temporary bank of gunny bags shall be raised in the portion of stakes. The closing of breach is then started from both sides by slipping earth in the form of a ring bund behind temporary bund of gunny bags.



CLOSING BREACH OF CHANNELS

9- JOB – RELATED FUNCTIONS IN NORMAL MAINTENANCE & EQUIPMENT REQUIRED

9.1. Job – Related Functions in Normal Maintenance

The normal maintenance program needs the services of the following personal:

- **Beldars / Khalasi**; Most of the routine maintenance workers are unskilled labourers, called beldars and khalasis. The functions of beldars in general are:

a. Jungle Clearance, removal of floating weeds.

b. Plantation of Trees, pruning of trees.

c. Watering of Banks.

d. Normal maintenance of the channel and its banks, filling of rain cuts, closing of rat holes and patrolling along the channel.

e. Repair of structure where ever required.

- **Gauge Readers and Tyndels**;

a. Operation and regulation of gates.

b. To observe gauges properly and regularly and report in time daily to concerned Daroghas and Sub- Engineer.

c. Gauge Reader is responsible to maintain the gauge register.

- **Daroghas** are responsible to supervise the work of Beldars in his section and to carry out the outlet observations and maintain the outlets at design level.
- **Sub-Engineers** are responsible to supervise the work of Daroghas and Beldars in his section. They are responsible to maintain the outlet book and also responsible to survey, prepare estimates and provide technical help in all respect to FOs for maintaining the periodically O&M plan of Distributary / Minor in accordance with its design.
- **Abdars** are responsible to support and assess FOs in Assessment & Collection of Abiana delivering the bills within time to farmers and ensure transparency in collection of Abiyana recovery
- **Canal Assistant** is responsible to supervise the work of Abdars and to prepare a return of weekly cultivation in Form 99-B (E) for Kharif Season and 99-A (E) for Rabi Season and then send to FO Chairman as well as to concerned AXENs and XENs. Canal Assistance is also responsible to scrutinize and check every share list before sending to competent authority. The Canal Assistant shall also supervise and help FO body in Assessment and Recovery of Abiyana for Kharif & Rabi seasons. The Canal Assistant is also responsible to inspect the Abdars record and confirm that, it is in accordance with correct procedure and as per rules.

9.2. Equipments required for Normal Maintenance of Channel

Equipments necessary for a normal repairing maintenance works are as follow:

- Axe (Kuhari)
- Speeder (Kodar)
- Bucket (Tokree)
- Rope (100 feet)
- Daito
- Rambo
- Bottle
- Torch
- Bamboo (6 to 12 feet)

After IDMT Agreement the responsibility of operation & maintenance of the channel is transferred to the related farmers' organization. The farmers' organization has to care their own field staff for this purpose as per IDMT A. The salaries of staff and payments against operation & maintenance works will be made from 40% share of Abiyana.

A sufficient amount should be earmarked for maintenance budget of the channel.

10- CROP ASSESSMENT & ABIYANA COLLECTION

The Farmer Organizations are entirely responsible for assessment and collection of Abiyana after IDMTA of their respective channel.

10.1. Deh- Map

The maps shows all the survey / block number location marks, sanctioned villages, old water courses, Pacca Roads etc.

10.2. Water Course Command Map

The irrigation department for the allocation of Water prepares water course command maps. The Water course map shows the survey/ block numbers, the outlet location in the deh and the demarcation of field channels.

10.3. Filed Book

The field book is kept to enter all the survey / block numbers that have crops.

10.4. Filed Khasro

The field khasro is the register containing names of the owners, their land holding and cropped area. Almost all entries from filed books are transferred to this book.

10.5. Jamabandi Register

In the Jamabandi (Collection) Register the cropped area is transferred from the field khasro and calculation of Abiyana is made. The classification of crops and rates changed against crops are maintained.

10.6. Bill Book

The bill book is maintained for the record keeping procedure of Abiyana assessment. The bills are issued to individual on the assessment figures mentioned in field Khasro and Jamabandi register.

It is suggested that a Revenue Assistant should be hired by each FO for keeping the record of financial activities like Abiyana assessment / collection, recording the Operation and Maintenance expenditures as well as salaries and wages of hired staff and other miscellaneous expenses.

11- PERIODICALLY O&M PLAN OF MINOR / DISTRIBUTARY

Dated: _____

Name of the Minor/ Distributary: _____

Parent Channel: _____

Main Canal: _____

Division / Sub-Division: _____

S#	Technical Specification	Current Data
1	Name of Darogha of the Channel	
2	Name of Sub-Engineer of the Channel	
3	Length of Channels (in RDs)	
4	Total No. of Water Coursers	
5	Gross Command Area (GCA)	
6	Cultivable Command Area (CCA)	**Rabi:** **Kharif**
7	Designed Discharge	
8	Actual Discharge	
9	Designed Gauge at Head	
10	Actual Gauge at Head	
11	Gauge Register, whether properly maintained day to day or not (Yes or NO)	
12	Designed Surface full supply Levels	
13	Actual working Water Levels	
14	Berm Erosion Observing (Mention RDs)	
15	Existence of Bush & Weed growth on section of channel (Mention RDs)	
16	Encroachment on Channels Banks IP & NIP (Mention RDs)	

S#	Technical Specification	Current Data
17	Designed Bank Width	
18	Reduced Bank Width (Mention RDs)	
19	Designed Free Board	
20	Actual Free Board	
21	Silt clearance required (Mention RDs)	
22	Condition of Outer Slope	
23	Earth Work Requires (Mention RDs)	
24	Condition of Toe of the Outer Bank (Weather Dry or Wet) If wet Earth Work requires. Mention RD	
25	Cattle Trespass sites.(Mention RDs)	
26	Rain Cuts. (Mention RDs)	
27	Rat Holes. (Mention RDs)	
28	Condition of Inspection Paths	
29	The top surface of IP watered regularly or dry	
30	Appearance of fallen trees and debris in channel. If any (Mention RDs)	
31	Open cracks or other defects in structure (Name the structure with location	
32	Condition of Gates of Regulator (Rusted or Rust Free)	
33	Gear & Threads of Warm Shaft (Needs Grease or No Need)	
34	Condition of Walls of Regulator (Need Cement Plaster or No Need)	
35	Condition of Bridges (Write Remarks e.g. if needs plaster, removal of sticking debris etc)	
36	Condition of Ramp of Bridges (Need repair or No need)	
37	Outlet Observations (List only tempered outlets)	

S#	Technical Specification	Current Data
38	No. of Village Road Bridges (VRB). (*Attach recent Photograph)*	
39	No. of Foot Bridges. *Attach recent Photograph*	
40	No of Washing Ghats (Need repair or No need) *Attach recent Photograph*	
41	No. of Hand Pumps (Workable / Non Workable)	
42	Establishment of FO Office (In which project & Year)	
43	Condition of FO Office (In Use / Misuse)	
44	Status of Collection of Abiyana Recovery	**Rabi Target: _____** **Achievement: _____** **Kharif Target:_____** **Achievement:_____**
45	Any other observations	

Signatures of Concerned

Note: Following are the Responsible persons for caring out above activities periodically.

1- Farmer Organization Body
2- Sub- Engineer (Concerned)
3- Darogha
4- Beldar
5- Canal Assistant and Abdar

11.1 Important Instructions for implementation of Periodically O&M Plan of Minor/Distributary

- The top width of the Channel (Distributary / Minor) prism shall be maintained in accordance to design.

- The designed surface water level of channel (Distributary / Minor) shall be maintained properly by desilting through local zamindari labors.
- Existence of bushes and weeds growth on berms of channels shall be removed periodically

- Bank widths of channel shall be maintained in accordance with its design.
- The free board of channel should be maintained according to design. If it is less than 50% of the design, the channel required either silt clearance or rising of banks.

- Outer slopes shall be maintained to the design if slopes are steeper then earth work on slopes is required.
- If the toe of the outer banks is wet then earth work for back berm is required at such places where it is wet.
- The berms shall be maintained according to design section.

- Cattle trespass sites shall be carefully watched.
- Rain cuts on slopes shall be properly repaired.
- The rat holes shall be treated properly.
- Inspection path shall be watered properly and maintained for motor able condition.
- Fallen Trees and Debris in channel shall be got removed immediately.
- Open cracks or other defects in structures shall be attended properly.
- The Gates of regulator shall be painted regularly.
- The gears and the threads of warm shafts shall be kept oiled and greased regularly.
- The sticking debris with piers of bridges shall be getting removed through Beldars.
- The size of outlets shall be confirmed to design twice in a month.