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2．実施細則（S／W）
3．協議議事録（M／M）
4．ムザファルガー区灌漑事業所組織図
5．第８次５カ年計画（1993～1998年）農業分野抜粋
6．第９次５カ年計画（1998～2003年）農業分野抜粋
7．収集資料リスト

1．要請書（T／R）

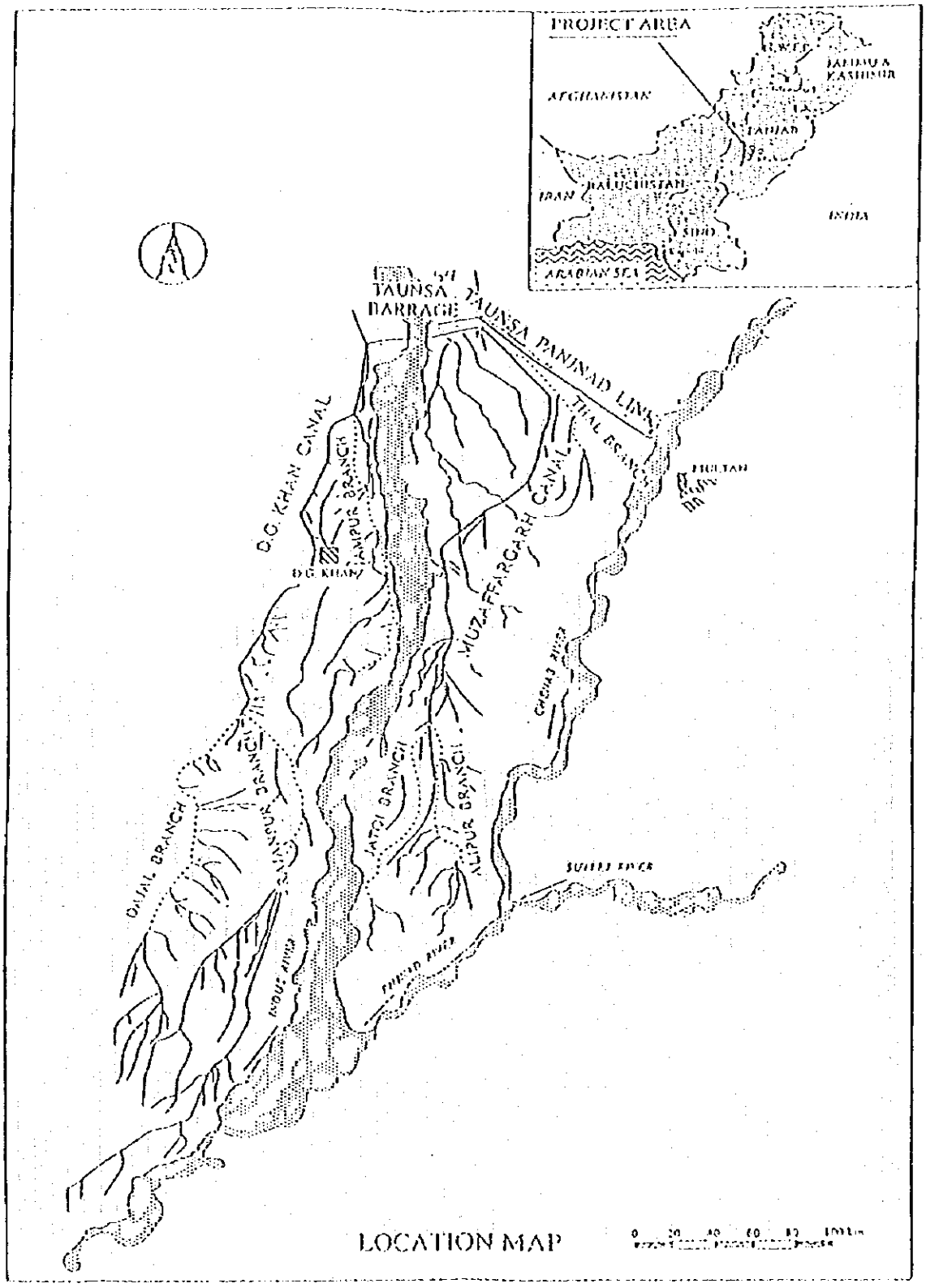
GOVERNMENT OF THE PUNJAB
IRRIGATION AND POWER DEPARTMENT

Project Concept Clearance Paper

For

TAUNSA BARRAGE IRRIGATION SYSTEM REHABILITATION STUDY

AUGUST 1995


PROJECT AREA
AFGHANISTAN
IRAN
BALUCHISTAN
SIND
ARABIAN SEA
INDIA
TAUNSA BARRAGE
TAUNSA PANJNAD LINK
TIBAL BRANCH
D.G. KHAN CANAL
D.G. KHAN
MUZAFFARGARH CANAL
MULTAN
CHENAB RIVER
SUTLEJ RIVER
INDUS RIVER
JHELUM RIVER
DAJAL BRANCH
JATOI BRANCH
ALIPUR BRANCH
LOCATION MAP

CONCEPT PAPER

NAME OF PROJECT:	Taunsa Barrage Irrigation System Rehabilitation Study.
SPONSORING AGENCY:	Government of the Punjab.
EXECUTING AGENCY:	Government of the Punjab.
LOCATION:	Taunsa Barrage, District Muzaffargarh Punjab.

1. PROJECT ABSTRACT.

Taunsa Barrage on River Indus was constructed in 1955-58. The gates and gearing mechanism of the Barrage have worn out and developed a number of defects resulting in faulty operation of gates and risk of severe damage to the Barrage. Replacement of Mechanical Components subjected to wear & tear is done during annual canal closure, but almost the same defects re-appear. The defective working of gates also creates problems in smooth regulation of off-taking canals and river supplies through the barrage. In addition the civil structure of the barrage is also suffering from deterioration & malfunctioning due to which operational water level in the reservoir cannot be maintained to the designed maximum level, thereby making it impossible to operate the canals at designed discharges. Furthermore the two non-perennial canals off-taking from the barrage are also suffering from leakage and deterioration of facilities creating water logging and salinity in the command area.

It is therefore, proposed to carryout a study to identify the causes of malfunctioning of barrage machinery and civil structure as well as prepare

a work plan to rehabilitate the gates and gearing system, suggest improvements in civil structure and canal water management so as to enable the canal system to operate at designed discharges without the fear of salinity and waterlogging. The study shall also propose methodology, equipment, T&P etc. to carryout the rehabilitation work round the year.

2. BRIEF HISTORY

(a) Mechanical Works.

Taunsa Barrage serves a command area of some 1.72 million acres with a design total withdrawal of 36.501 cusecs.

The Barrage was constructed in 1955-58 on River Indus and has 64 gates, each 61.67 ft. wide, with a height of 19 ft. for the weir and 22 ft. for the under-sluice. Due to continuous operation over the years, the hoisting mechanism and other moveable components have worn out and the gates are not operating smoothly. Defects like dismantling and falling of Rollers from the lower portion of Roller Train due to opening of side plates, gradual buldging of end girders of the gates, loosening of ropes and failure of side and bottom sealing arrangement have been experienced. The Roller Track fitted in civil structure has worn out causing jamming of Roller Trains & stiff working of gates. During annual canal closures each year, necessary repairs are carried out but the time for maintenance is only two weeks which restricts the scope of repair and the same defects re-occur. Gradually the situation has arrived that in almost all the Roller Trains of gates, the original stainless steel Rollers have been replaced with cast iron rollers in the lower portion while the cast iron built-in-grooves in the civil structure against which the roller

trains move, have worn out in the lower half portion. Resultantly the operation of gates is no more smooth and excessive load has to be applied to operate the gates. *Chart* showing defects in Roller Trains, Rocker Assembly and hoist machines is exhibited at *Annex-VI*. The continuing deterioration of machinery/ components may lead to ultimate failure of one or more of the gates such that the pond of water will no longer able to maintained to feed the canals off-taking from the Barrage. This would result in a loss of controlled water supplies to irrigated area of some 17,20,000 acres.

Earlier, in 1988 the department had nominated a team of officers, who, after detailed inspection of barrages in Punjab prepared a Report highlighting the defects and suggestions for repair. Again in 1990 Harza Engineering Consultants (USAID Consultants) in association with departmental officers, prepared a detailed Report for "Rehabilitation of Gates Equipment at various Barrages". Consequently major repair work was undertaken at Jinnah Barrage (Kalabagh) and some works were also done at Balloki Headworks under USAID Programme during 1991-93. Taunsa Barrage has been shown as in "Serious Condition", it considered essential that study be taken up to prepare the way for the ultimate rehabilitation and repair of the gates and hoisting mechanism to prevent what could be a catastrophic loss of agricultural production with all the associated economic as well as social problems.

(b) Civil Works.

In addition to the above mentioned mechanical defects, civil structures of the Barrage have been suffering from deterioration, malfunctioning under severe natural condition.

Firstly, s ill concrete under the gates has eroded seriously because of constant extreme leakage flow and continuous operation. A few of them have been rehabilitated, but most of them are necessary to check and repair.

Secondly, operational water level in the reservoir have never been risen to the design maximum water level because of some problems in foundation, so that it is impossible to distribute design discharge to the canals matching the demand of beneficial irrigators.

Thirdly, scour in the downstream of the Barrage is critical. This will endanger the stability of the Barrage. On the contrary, there is a problem of siltation in the front bay of the off-taking to the canals. Construction of silt extruder may be recommended to lessen siltation.

The last, main water course in the upstream of the Barrage is turning away from the Barrage to the east bank remarkably, because of meandering of the River Indus. Flood flow of River Indus turns to east at about 5 to 6 km upstream of the Barrage and is attacking right to the east bank. This is the most dangerous situation leading to the System as worthless.

(c) Canals

There are two non-perennial irrigation canals, D.G. Khan Canal and Muzaffargarh Canal and a link Canal, T-P Link (Taunsa-Panjnad Link Canal) from the Barrage.

Muzaffargarh Canal

Muzaffargarh Canal is on the east bank of River Indus with capacity of 204 cumecs and 113 km long main canal. Total length of main, distributaries and minors except on-farm ditches reaches at about 1,000 km with its command area of 376,000 hectares, discharge in main canal is 204 cumecs at the inlet and 79 cumecs at the tail. Average slope of the main is 1/8,000. Muzaffargarh Canal System was rehabilitated in canal earth works of distributaries and minors several years ago. Rehabilitation plan for the Main Canal including lining is under study at the moment. Muzaffargarh Canal System is also suffering from the leakage and deterioration of the facilities. Water logging and salinity problems are distinct in its command area. Structures are seriously deteriorated, especially most of gates are badly leaking.

D.G. Khan Canal

It is on the west bank of River Indus with its capacity of 330 cumecs. Length of main canal is 105 km and total length of the canal system except on farm ditches counts about 1,800 km with 522,000 hectares of service area. Average slope of the canal is 1/10,000.

In D.G. Khan Canal System, structures are seriously deteriorated particularly of the gates and water logging and salinity, which is caused by leakage, are distinct everywhere in the irrigated area. Most of the part of the main canal and its major branch canal of Dajal Branch Canal have heavy leakage because they pass on the edge of hill torrent which composed semi-pervious silt.

In addition to these, hill torrent floods damage the Canal System seriously. Every heavy flood, which hits once a few years, damages the canal facilities and the irrigated area.

3. Study for the Rehabilitation Plan

3.1 General

Due to continuous operation over the years, several important components of Taunsa Barrage Irrigation System suffers serious defects. It is, therefore, essential that the study shall be taken up to prepare the way for the ultimate rehabilitation and repair of total Taunsa Barrage irrigation System to prevent what could be catastrophic loss of agricultural production as well as social Problems. In order to explore the possibility of facilitating Japanese Grant in Aid for the Project, the problem was referred to the Japanese Consultants engaged on Mithawan Hill Torrent Project in D.G. Khan area, Consequently a two member Fact Finding Mission of Agricultural Development Consultant Association (ADCA) of Japan visited the Taunsa Barrage from March 7-9, 1995 (Annex-I). The purpose of the mission was to identify the problems being faced at the barrage and to recommend the scheme for implementation under Japan's Grant in Aid Programme. Based on the report of ADCA, another three members specialist mission from Kawasaki Heavy Industries Japan visited the Taunsa Barrage, Bhalwal Irrigation Workshop and Heavy Mechanical Complex Texla from June 3, 1995 to the 7th June, 1995 (Annex-II). As a result the Irrigation Department has been given the indication that the project of Taunsa

Barrage Irrigation System Rehabilitation, would be picked up under the Japan's Grant in Aid Programme. Following are the major items for the rehabilitation study.

3.2 Taunsa Barrage

Mechanical Works

- o Precise inspection for defective parts of the gates and hoisting mechanism, such as roller trains, rocker assembly, roller tracks, side plates, end girders of the gates, side and bottom sealing arrangement, ropes, etc.
- o Introduction of mechanized operation system,
- o Improvement of the inspection facilities in the super structure.
- o Introduction of principle of future improvement for centralized operation system including automatic measuring and operation system for accurate and easy control of entire Taunsa Barrage System.

Civil Works

- o Inspection of sill concrete for rehabilitation,
- o Observation and analysis between the pond water level and behavior of the civil and the mechanical structures to clarify the foundation problem,

- o Measurement and analysis on the siltation and scouring and meandering of the River,

- o Recommendation of rehabilitation methods for Barrage.

3.3 Canals

Muzaffargarh Canal

- o Preparation of the rehabilitation plan for the facilities, including replacement of the gates, lining of the canals, etc.

- o Introduction of automatic operation system for rational water management based on accurate measurement.

D.G. Khan Canal

- o Preparation of rehabilitation plan for the facilities, including replacement of the gates, lining of the canals, etc.

- o Introduction of remedy measures against hill torrent floods,

- o Introduction of automatic operation system for sophisticated water management based on accurate measurement.

TERMS OF REFERENCE

FOR

TAUNSA BARRAGE IRRIGATION SYSTEM REHABILITATION STUDY

1. BACKGROUND

The backbone of Pakistan's economy is agriculture, of which share in the country's GDP is 24 per cent in 1993-94. At present, as stated in the Eighth Five Year Plan (1993-98), the total cropped area is 22 million hectares. The major part of the country, however, falls in the arid and semi-arid regions so that irrigation is a necessity all over the country for assured agriculture, because of these conditions 75 per cent of the cropped area is under irrigation. Easily exploitable water resources have already harnessed and the country is short of irrigation water, even for the existing agricultural area. On the other hand, most of irrigation systems have contributed long time to activate agriculture of the country so that important parts of the systems have deteriorated. Improvement and/or rehabilitation works to the existing irrigation systems are extremely important to maintain the country's economy stable.

Since 1988, the Irrigation and Power Department of Punjab has inspected the barrages in Punjab to find out their defects and to suggest repairing. By the effort of the Department to keep the facilities in reliable condition, major

repair work was undertaken at Jinnah Barrage (Kalabagh) and some works were also done at Balloki Head Works.

Taunsa Barrage, however, has been left without any repair works though shown "in serious condition" by the inspection. Due to continuous operation over the years, several important components of Taunsa Barrage Irrigation System reveals serious defects. Gates and gearing mechanism of the Barrage have worn out and the gates are not operating smoothly. The defective working of gates creates problems in smooth regulation of off-taking canals and river supplies through the Barrage. In addition to the mechanical defects, civil structures of the Barrage have also shown deterioration and malfunctioning. Abrasion of sill concrete by continuous flow, scouring in downstream and siltation in upstream of the River and risk in raising pond water surface level up to design level are the defects in civil work around the Barrage. Off-taking Canals from the Barrage are also suffering from leakage, deterioration of the facilities, and flood damages. It is, therefore, considered essential that the study shall be taken up to prepare the way for the ultimate rehabilitation of Taunsa Barrage Irrigation System to prevent what could be a catastrophic loss of agricultural production as well as social problems.

2. SCOPE OF THE STUDY

The purpose of the study is to identify and formulate Taunsa Barrage Rehabilitation Project. The study consists of Phase-I and consecutive Phase-II and Phase-III studies and shall be completed by JICA study team in collaboration with Irrigation and Power Department of Punjab.

Phase-I study involves mainly inspection and outline design on mechanical works and civil works of the Barrage, Phase-

II study includes cost estimate and work plan of the Barrage, outline design of facilities and measuring system and cost estimate of the Canals, and economic analysis of the Project.

Phase-I

(A) Barrage

Mechanical works

- Inspection of gates, guides and hoisting mechanism,
- Inspection of piers and other related structural elements,
- Forecast of potential damage,
- Evaluation of modes of failure,
- Introduction of mechanized operation system,
- Improvement of inspection facilities in the superstructure,
- Recommendation of repair method,
- Feasibility level outline design

Civil works

- Inspection of sill concrete for rehabilitation,
- Observation and analysis on the behavior of the civil and the mechanical structures to clarify the foundation problem,
- Recommendation of repair method,
- Measurement and analysis on the siltation and scouring around the Barrage,
- Recommendation of rehabilitation methods for the Barrage,
- Feasibility level outline design

(B) River works

- Measurement and analysis on the siltation and scouring and meandering of the River

(C) Physical condition and Socio-economical study

- Meteorology and Hydrology
- Topography and Geology
- Soils and other
- Agriculture
- Infrastructure
- Socio-economy

Phase-II

(A) Barrage

Mechanical works

- Cost estimate for repairs,
- Plan for equipment, tools and plants (with cost) needed to undertake the repair round the year

Civil works

- Feasibility level outline design and cost estimate for repairs,
- Plan for the rehabilitation work schedule

(B) River works

- Feasibility level outline design and cost estimate for the de-siltation and de-scouring works and works against meandering of the River

(C) Canal works

- Identification of the rehabilitation plan for the facilities, including replacement of the gates, lining of the canals, etc.,
- Introduction of automatic operation system with measurement system

(D) Overall works

- Introduction of principle of centralized operation system,
- Introduction of automatic measuring and operation

system for control of entire Taunsa Barrage Irrigation System,

- Economic analysis of the identified rehabilitation works.

3. STAFFING AND SCHEDULE

It is anticipated that the study will take place over eleven (11) month period: Phase-I six (6) months; Phase-II five (5) months.

The staffing envisaged will comprise:

Team Leader /Irrigation Engineer	(Ph-I: 4 +Ph-II: 3)	7 months
Assistant Team Leader /Gates Specialist	(6+2)	8 months
Mechanical Engineer	(6+3)	8 months
Civil/Structural Engineer	(6+4)	10 months
Irrigation Engineer	(3+5)	8 months
Sediment Control Specialist	(6+5)	11 months
Hydraulic Engineer	(6+5)	11 months
Measurement Specialist	(0+5)	5 months
Economist	(3+2)	5 months
Quantity surveyor	(0+5)	5 months
Assistant Engineer (2 nos.)	(6+5)	11 months

In addition supporting staff will be required which are likely comprise:

Computer operator	11 months
Draftsman	7 months
Driver (3 nos.)	7 months

Implementation Cost

The implementation cost will be in two parts i.e. cost of International Consultants both in local and foreign currencies and the cost of departmental supervision in local currency. These costs have been worked out as per annex-III.

Period of Implementation:	11 Months.
i) Planned Commencement date	01-12-95.
ii) Expected completion date	30-10-96

Implementation schedule is exhibited at Annex-IV.

Total Project Cost

Local	Rs.	2.336 million
F.E.C.	Rs.	20.228 million
Total	Rs.	22.564 million

Financing Plan

a) Government Contribution through Budgetary Resources		
i) Provincial PSDP/M & R		Rs. 0.315 million
ii) Federal PSDP		Nil
iii) SDP		Nil
b) Through Non-budgetary Resources, self financing bank equity, etc.		Nil
c) Amount of Capital Assistance	Rs.	22.249 million
Specify whether grant or loan		Grant in Aid
Total a + b + c	Rs.	22.564 million

Name of Possible Donor	JICA
Recurrent Cost	Not Applicable
Whether included in 5 year plan	There is a provision for survey and investigation in the 8th 5- year plan.
Whether feasibility study carried out	No.
Status of PC-I/PC-II	To be prepared after the study.

Prepared by:

Superintending Engineer
Mechanical Circle, Lahore.

Recommended by:

23/8/95
Chief Engineer Irrigation
Development Zone, Lahore.

Secretary to Govt. of the Punjab
Irrigation & Power Deptt.
LAHORE

IMPLEMENTATION COST OF FOREIGN CONSULTANTS

1. Charges in Foreign Currency (Grant)

1.1 Salery Charge

Sr. No:	Staff Designation	Nos.	Period in Months Phase I+II	Monthly Salery US $	Total Salery US $
1.	Team Leader Irrigation Engineer	1	4+3 = 7	11,000	77,000
2.	Assistant Team Leader/ Gate Specialist	1	6+2 = 8	8,000	64,000
3.	Mechanical Engineer	1	6+3 = 9	6,000	54,000
4.	Civil / Structural Engineer	1	6+4 = 10	6,000	60,000
5.	Irrigation Engineer	1	3+5 = 8	6,000	48,000
6.	Sediment Control Specialist	1	6+5 = 11	6,000	66,000
7.	Hydraulic Engineer	1	6+5 = 11	6,000	66,000
8.	Measurement Specialist	1	0+5 = 5	6,000	30,000
9.	Economist	1	3+2 = 5	6,000	30,000
10.	Quantity Surveyer	1	0+5 = 5	5,000	25,000
11.	Assistant Engineer	2	6+5 = 11	4,000	88,000
			46+44=90	Totals:-	608,000
	1.2 Travelling Expenses @ $ 600 per head x 2 = 600 x 2 x 12 =				14,400
				G. Total:-	622,400
	Convertion in local currency @ Rs. 32.5 per US $			= Rs.	20,228,000

Charges in Local Currency (Grant)

(i) Transport Charges

(a) Vehicles: Cost of 2 Nos. Suzuki Jeeps @Rs. 4,50000 = Rs. 900,000

(b) POL Charges @ Rs. 20000 P/Month = Rs. 220,000

(ii) Office Furniture & Furnishing of Office = Rs. 150,000

(iii) Computers (2 Nos.) = Rs. 300,000

(iv) Stationary Charges @ Rs.10000 P/Month = Rs. 110,000

(v) Local Support Staff For 11 months

Drivers 2 Nos. @Rs. 3000 P/Month	=	Rs.	66,000
Draftsman 1 No. @Rs. 5000 P/Month	=	Rs.	55,000
Computer Operator 2 Nos. @Rs. 5000 P/month	=	Rs.	110,000
(vi) Misc/Contigent Expenditure @Rs.10000 P/Month	=	Rs.	110,000
	Total:-		2,021,000

EXPENDITURE ON COUNTERPART SUPERVISORY STAFF OF MUGHALPURA IRRIGATION WORKSHOP*

Necessary assistance to the consultants shall be provided by the the existing staff of Taunsa Barrage & Mughalpura Workshop at Lahore.

(i) Transport Charges @ Rs. 10000 P/Month
(ii) T.A/D/A of officers/staff @ Rs. 10000 P/Month
(iii) Misc expenditure of stationary, worshop charges & work charge T&P etc. @ Rs. 15000 P/Month

Total Charges for 9 months = 35000 x 9	=	Rs.	315,000
	=	Rs 0.315 million	

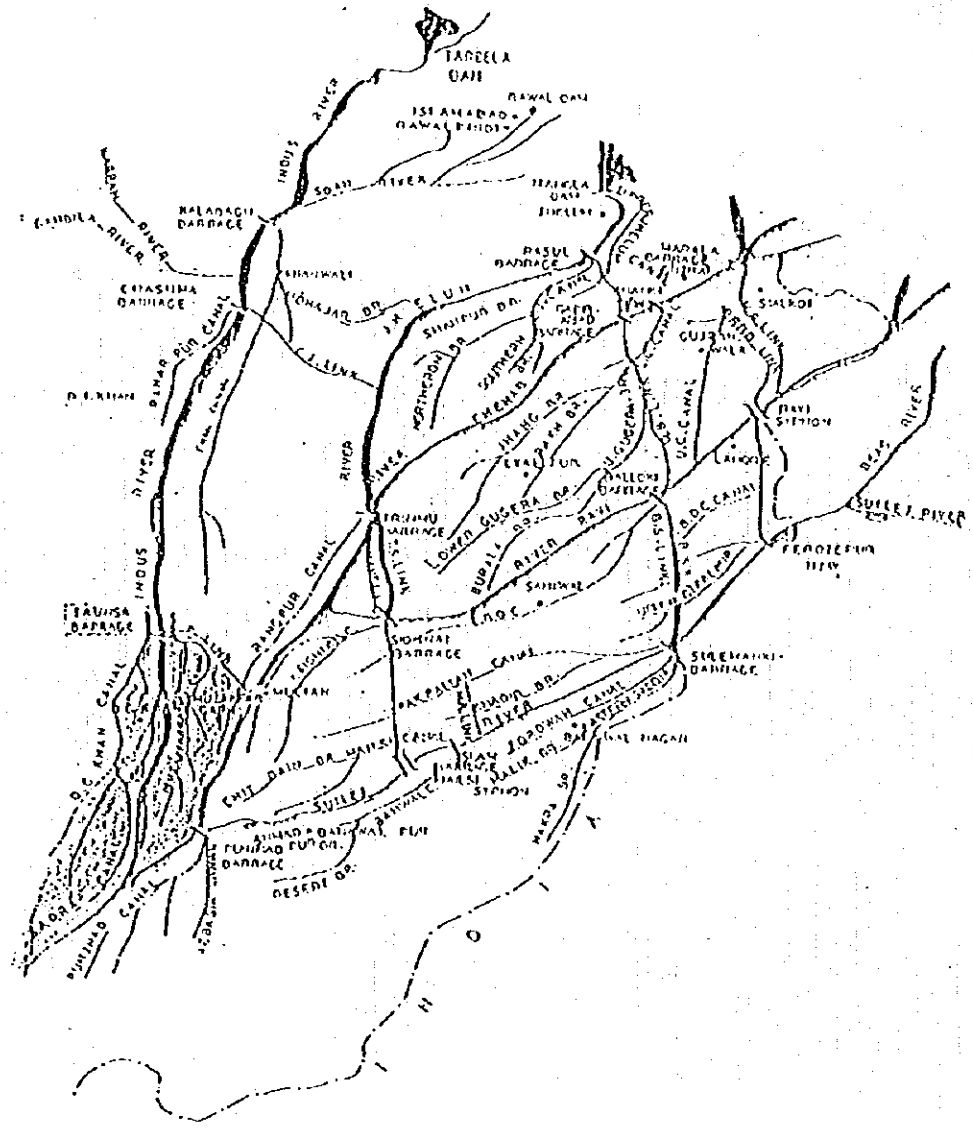
These charges shall be met out of normal maintenance and operation budget for Taunsa Barrage & no separate allocation is needed.

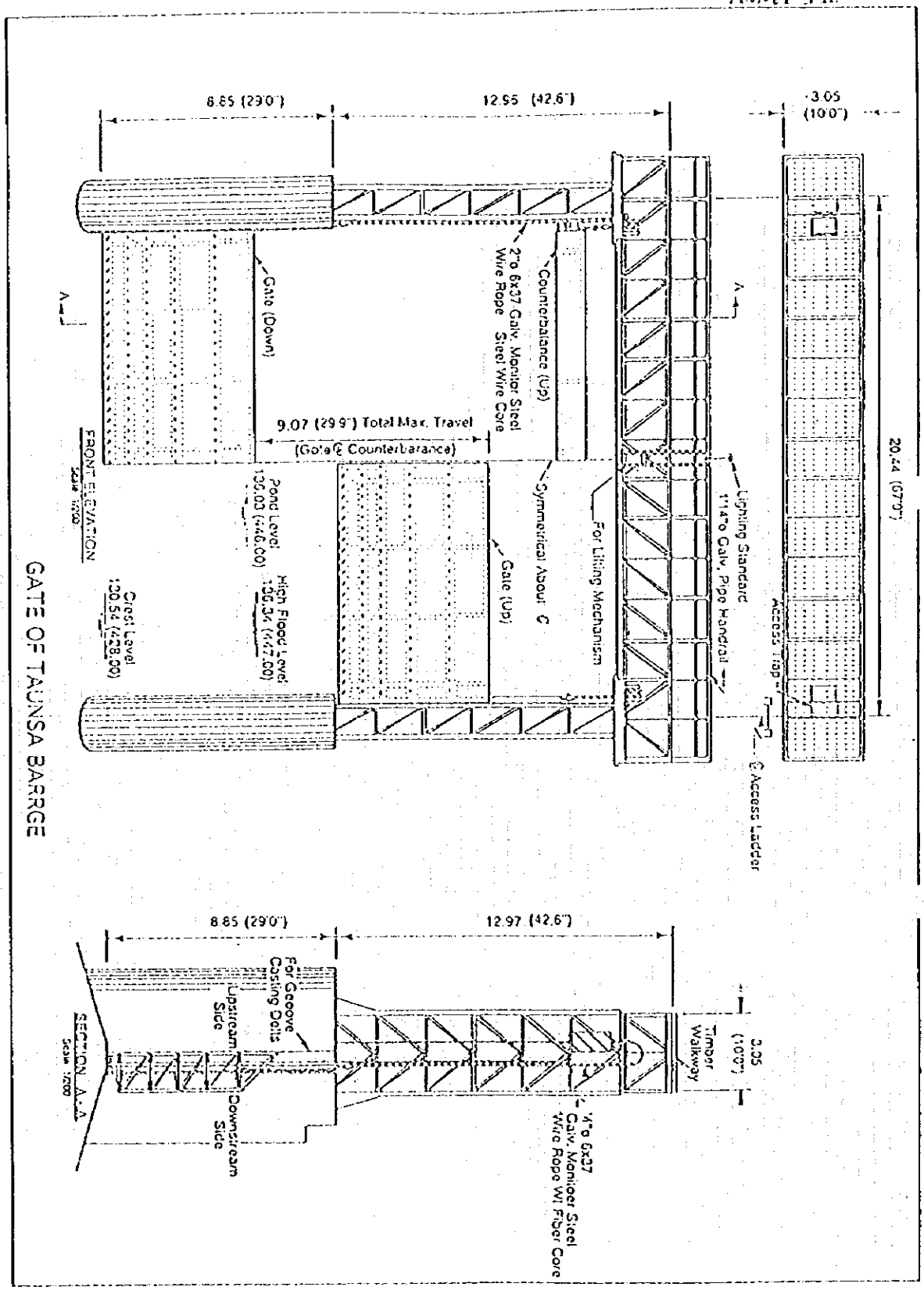
Annex–IV

IMPLEMENTATION SCHEDULE

SR. No:	Activities	1995 Dec.	1996 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
	Stage–I											
1.	Inspection of Civil & Mechanical Components & identification of problems.											
2.	Evaluation & Masurement of potential damage											
3.	Observation and Analysis on the behaviour of Civil & Mechanical Structures & Recommendation of rehabilitation/ repair methods											
4.	Feasibility level out line design for civil & mechanical works											
	Stage–II											
1.	Plan for equipment, T&P (with cost) needed to under–take repairs											
2.	Cost Estimates for repair/rehabilitation works											
3.	Introduction of automatic operation system with measurement system & centralized control											
4.	Economic analysis of identified rehabilitation works											

PROJECT AREA AND CANAL SYSTEM




8.85 (29'0")
12.95 (42'6")
3.05 (10'0")
20.44 (67'0")
Gate (Down)
2"ø 6x37 Galv. Monitor Steel Wire Rope
Steel Wire Core
Counterbalance (Up)
9.07 (29'9") Total Max. Travel
(Gate & Counterbarance)
FRONT ELEVATION
Pond Level
Crest Level
High Flood Level
Gate (Up)
Symmetrical About ℄
For Lifting Mechanism
Lighting Standard
1"ø Galv. Pipe Handrail
Access Trap
℄ Access Ladder
GATE OF TAUNSA BARRGE
8.85 (29'0")
12.97 (42'6")
SECTION A-A
For Groove Casting Dells
Upstream Side
Downstream Side
Timber Walkway
3.05 (10'0")
1"ø 6x37 Galv. Monitor Steel Wire Rope Wt Fiber Core

2．実施細則（S／W）

SCOPE OF WORK
FOR
THE FEASIBILITY STUDY
ON
TAUNSA BARRAGE IRRIGATION SYSTEM REHABILITATION
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AGREED UPON BETWEEN
THE GOVERNMENT OF THE PUNJAB
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Lahore, April 14, 1997

14/4/97

Mr.Sulemán Ghani
Secretary,
Irrigation and Power Department,
Government of the Punjab

石坂邦美

Mr. Kuniyoshi Ishizaka
Leader,
Preparatory Study Team,
Japan International Cooperation Agency

I. INTRODUCTION

In response to the request of the Government of The Islamic Republic of Pakistan(hereinafter referred to as "GOP"), The Government of Japan has decided to conduct the Feasibility Study on Taunsa Barrage Irrigation System Rehabilitation in Punjab of the Islamic Republic of Pakistan (hereinafter referred as "the Study") in accordance with the relevant laws and regulations in Japan.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as"JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will undertake the Study in close cooperation with authorities concerned of GOP and the Government of Punjab (hereinafter referred to as"GOPunjab").

The present document sets forth the Scope of Work with regard to the Study.

II. OBJECTIVES OF THE STUDY

The objectives of the Study are;

1.to conduct a feasibility study on Taunsa Barrage Irrigation System Rehabilitation in Punjab, and
2.to carry out, in the course of the Study, technology transfer to the Pakistani counterpart personnel concerned through on-the-job training.

III. STUDY AREA

The study covers Taunsa Barrage and related facilities which are located at southwest of the Punjab Region,900km upstream from the mouth of the Indus River. .

On the course of the Study, Taunsa Barrage Irrigation System which has approximately 10,340km2 of command area and the surrounding areas may be investigated and studied as technically required. (ANNEX 1)

IV. SCOPE OF THE STUDY

In order to achieve the above mentioned objectives, the Study consists of two(2) phases and will cover the following items.

1.Phase 1

1.1 Review of the existing Taunsa Barrage Irrigation System.

1.2 Inspection and analysis on the condition of the Taunsa Barrage through the field survey.

(1)Mechanical works
- a)Gates
- b)Guides assemblies
- c)Hoisting mechanism
- d)Gate seals
- e)Others

(2)Civil works
a)Siltation and scouring around the Barrage
b)Piers
c)Sill concrete
d)Others

(3)Operation and Maintenance
a)Control system
b)Operation system
c)Maintenance system
d)Operation and maintenance organization
e)Others

1.3 Collection and analysis of the following data and information on the Taunsa Barrage Irrigation System through the field survey and interviewing the farmers:

(1)Natural conditions
a)topography
b)meteorology
c)hydrology
d)geology
e)soil
f)water quality
g)others

(2)Socio-economic condition
a)population, birthrate, food situation, etc
b)educational level(literacy rate),etc
c)administrative organizations related to the projects
d)social infrastructure
e)regional and other donors' development plan
f)others

(3)Agricultural and Agro-economic conditions
a)land use
b)land tenure
c)cultivation technique
d)cropping pattern and yield
e)trend of supply and demand of crop
f)farmer's economy
g)agricultural credit system
h)others

(4)Agricultural infrastructure
a)major irrigation facilities
b)construction materials
c)others

(5)Agricultural supporting service
a)government institutions
b)farmer's organizations
c)extension service
(extension worker, farmers' recognition level of irrigation)
d)supply of seed, fertilizer and chemicals
e)mechanization
f)others

(6)Operation and maintenance
a)water management organizations
b)customs of water use,water right, water charge, etc.
c)others

(7)Environmental aspects
a)natural environmental aspects
b)social environmental aspects

1.4 Initial Environmental Examination (IEE).

1.5 Identification of basic concept on rehabilitation plan for the Taunsa Barrage.

2.Phase 2

2.1 Field survey to collect supplementary data and information on the study area .

2.2 Formulation of an optimum rehabilitation plan for Taunsa Barrage Irrigation System;
(1)Taunsa Barrage
a)Mechanical works
b)Civil works
c)Gate operation and maintenance
(2)Operation and maintenance for irrigation system

2.3 Preliminary design for the major structure

2.4 Environmental Impact Assessment (EIA)

2.5 Preparation of implementation schedule

2.6 Estimation of the project costs and benefits

2.7 Overall evaluation of the project

2.8 Recommendations

V. STUDY SCHEDULE

The Study will be carried out in accordance with the attached tentative work schedule.(ANNEX 2)

VI. REPORTS

JICA shall prepare and submit the following reports in English to GOP and GOPunjab.

1.Inception Report
Thirty (30) copies at the commencement of the Phase 1 field work.

2.Progress Report(1)
Thirty (30) copies at the end of the Phase 1 field work.

3.Interim Report
Thirty (30) copies at the end of the Phase 1 home office work.

4.Progress Report(2)
Thirty (30) copies at the end of the Phase 2 field work.

5.Draft Final Report
Thirty (30) copies after the Phase 2 home office work. GOPunjab shall provide its comments in the Draft Final Report to JICA within one (1) month after receiving the Draft Final Report.

6.Final Report
Fifty (50) copies within one (1) months after the receipt of comments on the Draft Final Report.

VII. UNDERTAKING OF THE GOP AND GOPUNJAB

1.To facilitate the smooth conduct of the Study, GOP shall take necessary measures;

(1)to secure the safety of the Japanese study team,
(2)to permit the members of the Japanese study team to enter, leave and sojourn in the Islamic Republic of Pakistan for the duration of their assignment therein, and exempt them from foreign registration requirements and consular fees,
(3)to exempt the members of the Japanese study team from taxes, duties, fees and other charges on equipment, machinery and other materials brought into and out of the Islamic Republic of Pakistan for the conduct of the Study,
(4)to exempt the members of the Japanese study team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Japanese study team for their services in connection with the implementation of the Study,
(5)to provide necessary facilities to the Japanese study team for remittance as well as utilization of the funds introduced into the Islamic Republic of Pakistan from Japan in connection with the implementation of the Study,
(6)to secure permission for entry into private properties or restricted areas for the implementation of the Study,
(7)to secure permission for the Japanese study team to take necessary data and documents(including photographs and maps) related to the Study out of the Islamic Republic of Pakistan to Japan, and
(8)to provide medical services as needed. Its expenses will be chargeable to members of the Japanese study team.

2.GOPunjab shall bear claims, if any arises, against the members of the Japanese study team resulting from , occurring in the courses of , or otherwise connected with , the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the members of the Japanese study team.

3.GOPunjab has all responsibilities for the implementation of the Study and also as coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

4.GOPunjab shall, at its own expense, provide the Japanese study team with the following, in cooperation with other organizations concerned:

(1)available maps, data and information (hydrological and meteorological etc.) related to the Study,
(2)counterpart personnel,
(3)credentials or identification cards, and
(4)Suitable office space with necessary equipment in Lahore and Taunsa.

VII.UNDERTAKING OF JICA

For the implementation of the Study , JICA shall take the following measures:

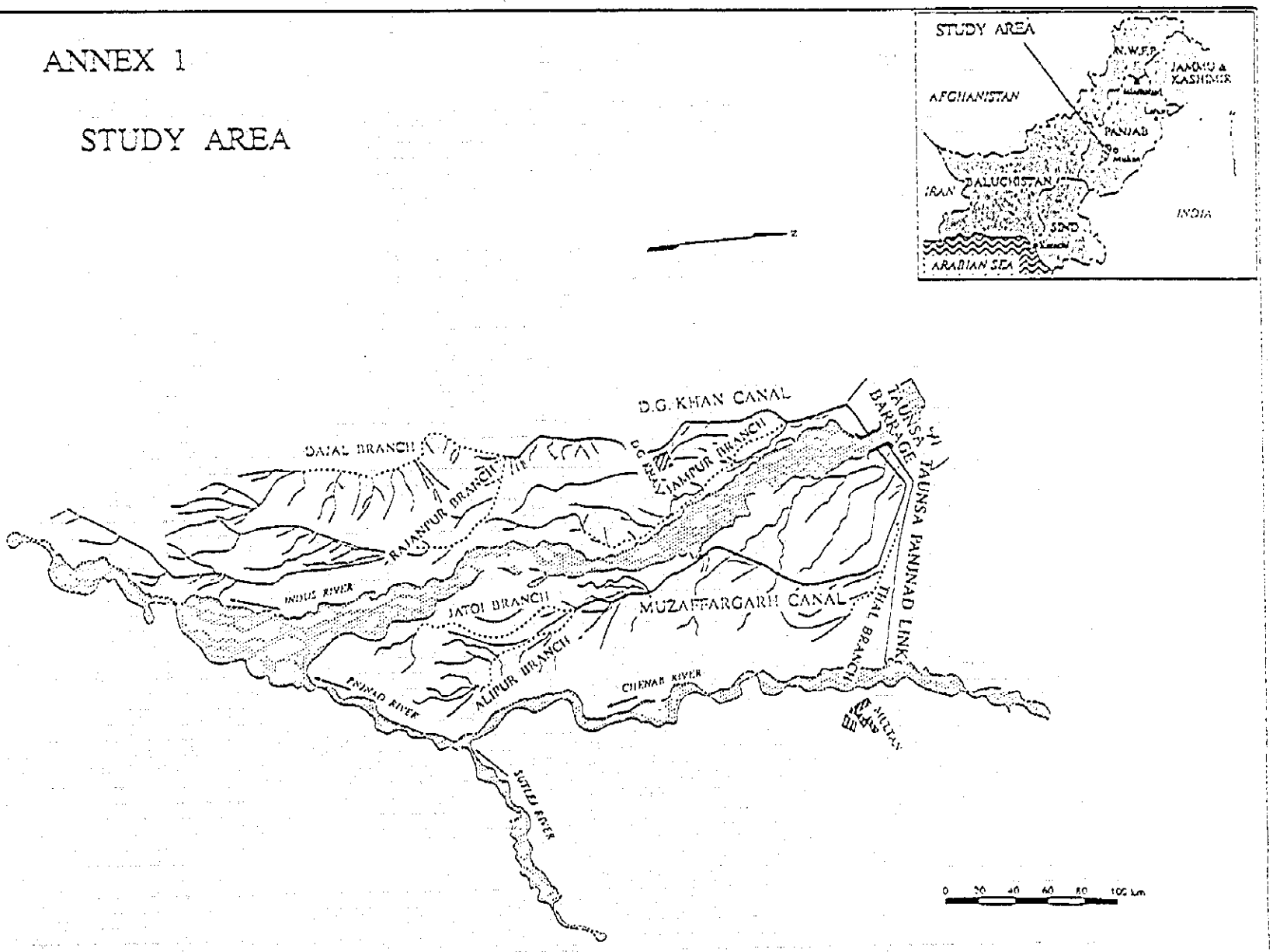
(1)to dispatch at its own expense, the study team to the Islamic Republic of Pakistan, and
(2)to pursue technology transfer to the Pakistani counterpart personnel in the course of the Study.

IX.CONSULTATION

GOP and JICA shall consult with each other in respect of any matter that may arise from or in connection with the Study.

ANNEX 1

STUDY AREA



ANNEX 2

TENTATIVE WORK SCHEDULE

Months	1	2	3	4	5	6	7	8	9	10	11	17
Work in Pakistan	■	■	■			■	■	■	■	◎		
Home office work in Japan	□		□	□	□			□				
Submission of reports	△ Ic / R		△ P / R(1)		△ Ir / R		△ P/ R(2)	△	Df/ R		△ F / R	

(Remarks)

Ic / R	: Inception Report
P / R(1)	: Progress Report(1)
Ir / R	: Interim Report
P / R(2)	: Progress Report(2)
Df / R	: Draft Final Report
F / R	: Final Report
◎	: Comments on DF /R by the Pakistan side

3．協議議事録（M／M）

MINUTES OF MEETING
ON
SCOPE OF WORK
FOR
THE FEASIBILITY STUDY
ON
TAUNSA BARRAGE IRRIGATION SYSTEM REHABILITATION
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AGREED UPON BETWEEN
THE GOVERNMENT OF THE PUNJAB
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Lahore, April 14, 1997

14/4/97

Mr. Suleman Ghani
Secretary,
Irrigation and Power Department,
Government of the Panjab

石坂邦美

Mr. Kuniyoshi Ishizaka
Leader,
Preparatory Study Team,
Japan International Cooperation Agency

The preparatory study team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA"), and headed by Mr. Kuniyoshi Ishizaka, visited The Islamic Republic of Pakistan from April 6 to 17, 1997 for the purpose of discussing and confirming the Scope of Work for the Feasibility Study on Taunsa Barrage Irrigation System Rehabilitation (hereinafter referred as "the Study").

The Team had a series of discussions with the officials concerned of Irrigation and Power Department, Punjab Province (hereinafter referred to as "PID") and other organizations on the Scope of Work for the Study. The list of participants in the meetings is attached in the ANNEX 1.

As a result of the discussions, PID and the Team agreed on the Scope of Work for the Study.

The following are the main issues discussed and agreed on by both sides in relation to the Scope of Work for the Study:

1. The Study should be conducted on the physical rehabilitation of Taunsa barrage. The first priority of the Study should be given to the mechanical rehabilitation of gates, the second priority should be given to structural rehabilitation on the intake of D.G.Khan canal and third priority to the operation and maintenance, as a part of which was function of the workshop.

2. The siltation and scouring would be studied around the barrage in structural design as a integral part of the barrage rehabilitation. PID agreed on this point.

3. Both sides agreed that motor-mounted gate system would be suitable for the Taunsa barrage in operation.

4. PID requested the study for countermeasures of siltation at intake of D.G.Khan canal. The Team understood detail of the current situation which would be considered in the study.

5. PID requested reparation of one gate in the phase 2 study period on trial basis, utilizing the workshop for the smooth maintenance of the gates in the future. The Team promised to convey the request to the Government of Japan.

6. PID requested the study for keeping the designed water level at the barrage for irrigation. The Team proposed survey should be initiated to identify adequate measures. PID accepted the proposal.

7. Initial Environmental Examination (IEE) will be carried out in the phase 1 study by the Japanese study team in consultation with PID, mainly taking into account of the waterlogging and salinization. Environmental Impact Assessment (EIA), if necessary, will be carried out in the phase 2 study.

8. The Team requested that PID should assign the qualified and necessary number of counterpart personnel for the Study. PID ensured an arrangement to meet the request.

9. PID requested a counterpart training in the appropriate field in Japan. The Team promised to convey the request to the Government of Japan.

10.PID requested that the following equipment would be necessary for the study team to be arranged by JICA. The Team promised to convey the request to the Government of Japan.

- vehicle(s)(4WD)
- photocopier
-engine for testing gate operation
-survey equipment

ANNEX I

LIST OF PARTICIPANTS

1.Pakistan Side

Irrigation and Power Department

Mr.Suleman Ghani	Secretary
Mr.Tahir Ahmed Malik	Chief Engineer
Mr.Mian Yousaf Ali	Chief Engineer (Development)
Mr.Qazi Anwar Ali	S.E. Mechanical Circle
Mr.Muhammad Irfan	S.E. Muzaffargarh Canal Circle
Mr.Ch. Irshad-ul-Haque	Deputy Secretary

2.Japanese Side

JICA Preparatory Study Team

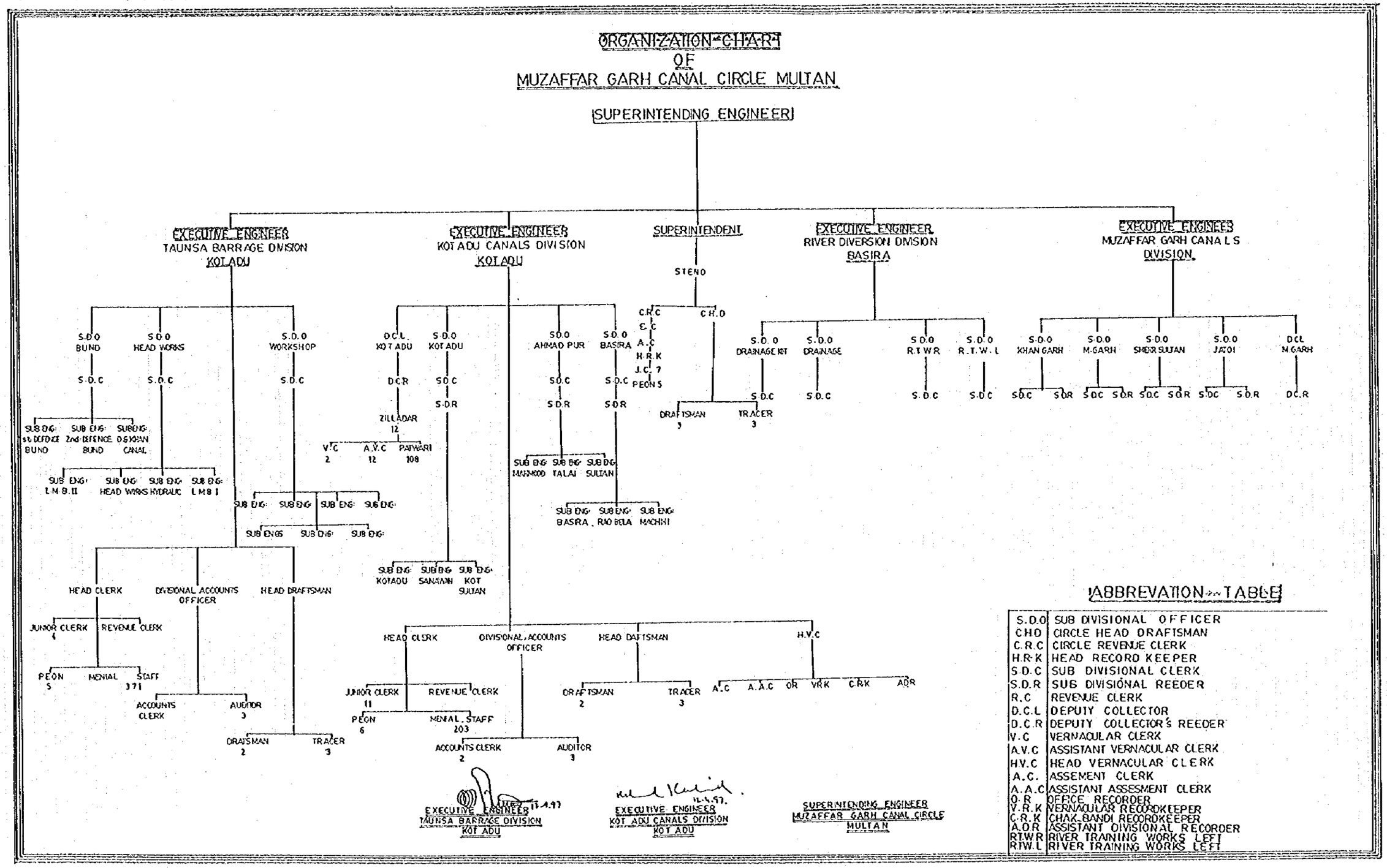
Mr.Kuniyoshi Ishizaka	Team Leader
Mr.Shigenori Nagashima	Construction Equipment Engineering
Mr.Naoto Tsunezumi	Irrigation Engineering
Mr.Tomoshi Noguchi	Agriculture
Mr.Makoto Kitanaka	Coordinator / Environment

JICA Pakistan Office

Mr.Noriaki Nagatomo

Mr.Sohail

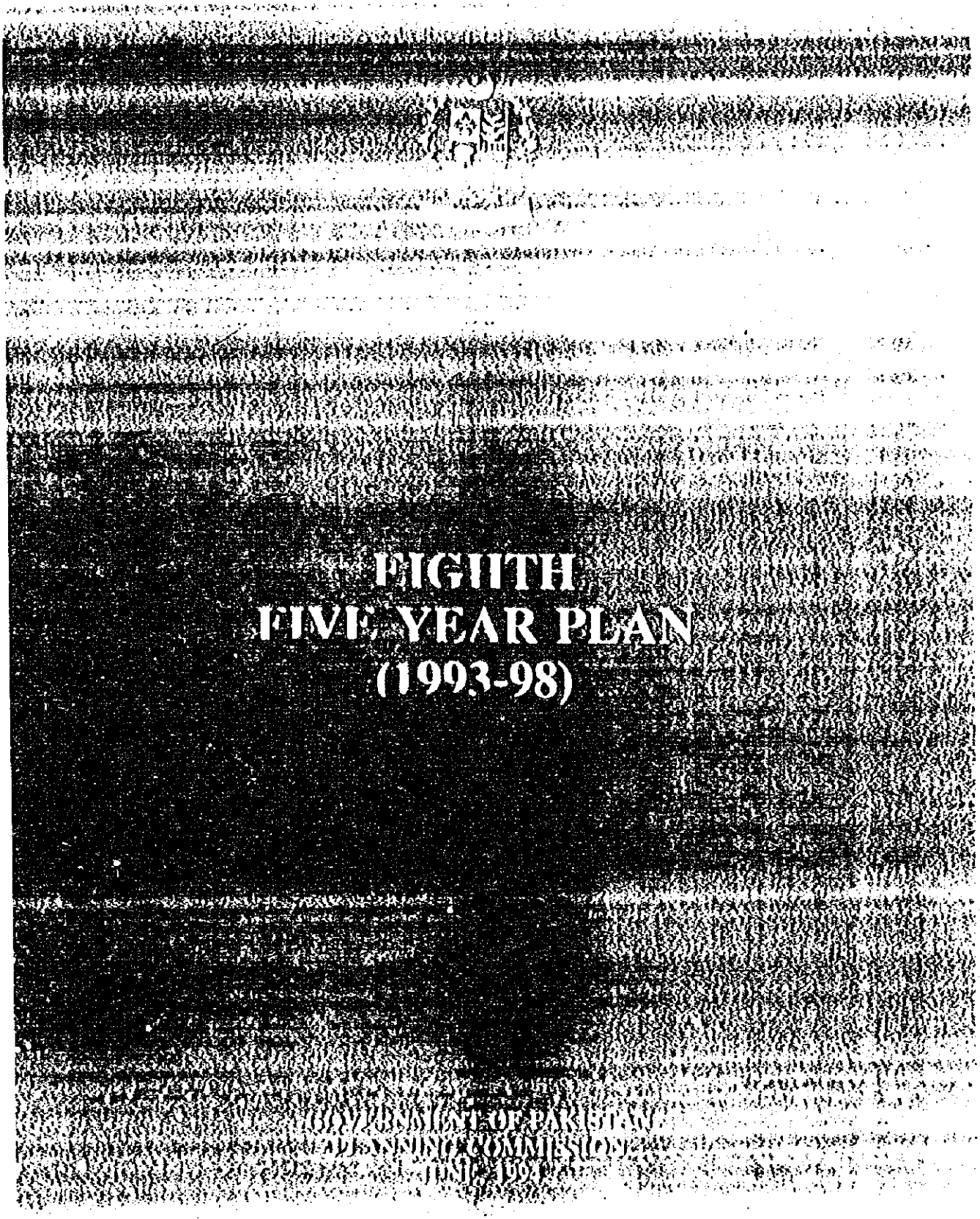
4．ムザファルガー区灌漑事業所組織図



ABBREVATION TABLE

S.D.O	SUB DIVISIONAL OFFICER
CHD	CIRCLE HEAD DRAFTSMAN
C.R.C	CIRCLE REVENUE CLERK
H.R.K	HEAD RECORD KEEPER
S.D.C	SUB DIVISIONAL CLERK
S.D.R	SUB DIVISIONAL REEDER
R.C	REVENUE CLERK
D.C.L	DEPUTY COLLECTOR
D.C.R	DEPUTY COLLECTOR'S REEDER
V.C	VERNAQULAR CLERK
A.V.C	ASSISTANT VERNACULAR CLERK
H.V.C	HEAD VERNACULAR CLERK
A.C.	ASSEMENT CLERK
A.A.C	ASSISTANT ASSESMENT CLERK
O.R	OFFICE RECORDER
V.R.K	VERNAQULAR RECORDKEEPER
C.R.K	CHAK-BANDI RECORDKEEPER
A.D.R	ASSISTANT DIVISIONAL RECORDER
R.T.W.R	RIVER TRAINING WORKS LEFT
R.T.W.L	RIVER TRAINING WORKS LEFT

5．第8次5カ年計画（1993～1998年）農業分野抜粋



III-1

AGRICULTURE

Introduction

Agriculture is the single largest sector of the economy of Pakistan accounting for over one-fourth of the Gross Domestic Product (GDP), employing about half of the labour force and generating a substantial share in export earnings. Agriculture has maintained an average annual growth rate of 4.4 per cent during the last decade.

2. The emphasis of the Eighth Plan is on using the agriculture sector as the main instrument of growth and development. The primary sectoral goal is the achievement of a growth rate higher than the population growth, in order to ensure food security, self-sufficiency and large exportable surpluses. With the agreement on water accord, emphasis will now be laid on:

- Integrated management of agriculture, irrigation and drainage.
- Efficient land management.
- Efficient water management.

High priority will be given to optimize productivity from the available land and water resources through efficient use of other inputs while conserving the resource base. The main priorities would be as follows:-

- developing agriculture and irrigation facilities in an integrated manner, and their coordinated management.
- improving land and water management practices.
- larger use of medicide improvement in fertilizer response ratios, provision of land levelling, consolidation of on farm water management.
- better linkages between the systems of research, education, extension and production.
- integrated pest management.
- diversification to higher value crops, and non-farm activities i.e. livestock, fisheries and forestry.
- encouraging agro-industries in rural areas.

- improving productivity of barani areas.

- encouraging participation of women.

3. There is little possibility of horizontal expansion in the land area to increase agricultural production. Even the existing fertile land is shrinking because of non-agricultural uses, water-logging and salinity. Of the total cropped area of about 22 million hectares, about three fourth is irrigated, the remaining one fourth is dependent on rainfall. Presently, there are about 9 million hectares of land which is termed as "culturable waste", but cannot be brought under cultivation for lack of water. The easily exploitable water resources have already been harnessed and the country is short of irrigation water even for the existing agricultural areas. Increasing population requires a diversion of the already limited water supplies for non-agricultural uses.

4. While the barani and mountainous areas are capable of yielding higher productivity through improved management of the agricultural production systems, the real hope for a breakthrough in the medium term for rapidly increasing agricultural productivity, is in the vast irrigated areas. Estimates of the potential and actual yields in most parts of the irrigated plain indicate that the available resources of land and water are capable of producing more than twice as much agricultural produce compared to the current production. This, however, requires major changes in agricultural policies, institutions (education, research and extension system) and support services for agricultural production and marketing. Above all it requires a realization that the vast irrigation set-up is primarily meant for agriculture and should be planned and operated in close association with the agriculture sector. This would also require several administrative measures to effectively integrate policy formulation, planning and development of irrigated agriculture at various levels from the federal through provincial, regional and grass-root levels.

5. Substantial investment has been made in the previous development plans to create an infrastructure for both the agriculture and irrigation. The Eighth Plan will concentrate on getting the maximum return from this investment by improving operational efficiency through adequate investment in repair and maintenance, and provision of sufficient operational funds.

Management Issues

6. Agriculture production system is a complex enterprise requiring interaction of large number of organizations, institutions and specialized agencies at federal, provincial and grass root levels. Poor inter action between the agencies directly involved in agricultural development is the single most important factor responsible for the low efficiency of the agriculture sector. This will receive special attention.

7. The linkages between education, research and extension, and the farmers have remained fragile. The latest developments in agriculture, emphasis on agro-industry and production of export-oriented high value crops,require urgent strengthening of these linkages.

a) *Education*: Quality of agriculture education, especially higher education at college and university level should be improved by i) improvement of curriculum structure and production of textbooks relevant to the local conditions ii) improvement of student and teacher discipline and iii) providing adequate funds for the institutions to undertake quality teaching with proper emphasis on field and laboratory based training.

b) *Research*: The prevalent research system in the country will be thoroughly reviewed to assign specific responsibilities to the institutions and have a streamlined procedure for program planning, allocation of resources and monitoring of research results. Maximum efforts should be made to provide sufficient funds to enable the trained scientists in all research institutions including universities to pursue their research interests within the national research plan.

c) *Extension*: Major deficiency in extension is because of a poor career structure for the field staff which results in low morale and lack of motivation. Perhaps the answer is to privatize agricultural extension as far as possible, taking the lead from the cotton success story. More reliance should be placed on the audio-visual media and less on the individual extension agents who cannot have expertise in all commodities and farming systems. Electronic media can bring in experts on any aspect of agriculture for advising the farmers. TV and videos are particularly effective.

Consolidation and Rehabilitation

8. Agricultural policies during the Eighth Plan period will take into account ecological differences which exacerbate social and economic disparities. Special efforts will be made to channel technology and resources, differentiated by agro-climatic and ecological zones, to small and medium-sized farms. More attention will also be given to rainfed, dryland and desert and hilly areas, which have often been neglected.

9. The profitability of the agriculture sector will be improved through sustained improvement in agricultural productivity, availability of institutional credit for purchase of inputs, machinery and implements, and provision of remunerative support prices to farmers. Under the Productivity Enhancement Programme, farmers will be provided gypsum for reclamation of sodic soils, good quality seed, deep tillage equipments, etc for increasing the yield and production of crops.

10. In order to improve the socio-economic conditions of people residing in rural areas, non-farm activities such as livestock, agro-forestry, fisheries, agro-industries will be promoted. The Agri-Business Cell of the Ministry of Food and Agriculture, will promote private sector investment and participation in agro-industries. The private sector will be encouraged to establish processing, packaging, marketing and grading facilities for horticultural products with a view

to meet requirements of the export market. The Government has already formulated policies for rapid rural industrialization.

11. A major challenge would be to reverse the degradation of natural resources caused by deforestation, overgrazing, and minimize damaging effects of agro-chemicals on the environment. For this purpose, a 25-year Forestry Master Plan has been prepared and its implementation would be started during the Eighth Plan. An environmental protection project will also be implemented during the Eighth Plan.

12. In the livestock sub-sector, programmes for livestock research, extension, disease control and productivity improvement will be implemented.

13. In research, the use of biotechnology in improving crop and livestock productivity will be promoted.

14. The operational elements of the agricultural policy shall be as follows:

- The Pakistan Agricultural Research Council and the provincial agricultural research institutes will carry out site specific, problem oriented research, the result of which will be transmitted to the farmers through the agricultural extension system. Linkages between research and extension would be strengthened;

- research and development activities will be undertaken for the production of improved seed specially of sugarcane, rice, wheat, oilseeds and pulses;

- crop productivity will be enhanced by improving the efficiency of agricultural inputs particularly fertilizer and water. Integrated pest management would be promoted for control of insects and pests;

- improved irrigation practices will be popularized. Farmers will be guided on the water requirement and frequency of irrigation of different crops. Conjunctive use of water (tubewell + canal water) would be encouraged in water deficit areas where the ground water is suitable for irrigation;

- sprinkler, trickle and drip irrigation system will be introduced in water scarce areas, particularly for orchards and other high value crops;

- proper soil management will be promoted under the Productivity Enhancement Programme by providing deep tillage equipments to the farmers for breaking of the hard pan where necessary and conservation of soil moisture in barani areas. Precision land levelling will also be encouraged;

- the availability of certified quality seed of high yielding varieties of major crops, fruits, vegetables and oilseeds would be ensured. Private sector would be further encouraged to undertake production and distribution of good quality seed;

- the availability of agricultural credit will be ensured particularly for small and medium farmers through supervised credit system, in order to enable them to purchase agricultural machinery, equipment and other inputs. The activities of the Agricultural Development Bank of Pakistan and Federal Bank for Cooperatives will be expanded to meet the credit requirements;

- in the field of agricultural extension, the traditional emphasis of personal contact between extension workers and farmers will be supplemented by intensive use of audio-visual media, thus making more effective use of the limited number of expert communicators available in the country. A substantial portion of the facility of the second television channel will be used for agricultural progammes;

- in barani areas, high yielding, drought tolerant varieties of food and fodder crops shall be further promoted, with a view to improve the agricultural productivity and farm incomes of people of these areas. Dryland farming techniques will be disseminated among the farmers;

- the private sector will be encouraged to establish supply centers for providing standard agricultural inputs in every union council;

- consolidation of land holdings would be encouraged in order to arrest the declining production trend of farmlands subjected to continued fragmentation. The Provincial Governments should take appropriate measures in this regard;

- livestock research and extension will be strengthened in order to increase the production of milk, meat and other livestock products. Feed and fodder resources will be developed in order to provide a balanced and nutritious feed to livestock;

- intensive forest management will be carried out on Government forests and farm forestry will be promoted on private lands, to meet the growing demand for timber and firewood;

- comprehensive programmes will be implemented to reduce the degradation of land and water resources and environmental protection;

- in order to increase the production of fish, aquaculture and marine fisheries will be promoted. For inland fisheries, the existing hatcheries and research facilities will be strengthened. In case of marine fisheries, the infrastructure facilities, equipment and management of fish harbour would be further improved;

- in case of high value crops, special emphasis will be laid on growing for the export market. The private sector will be encouraged to establish processing, grading, packaging and cold storage, etc. through provision of liberal credit. The Agri-Business Cell in the Ministry of Food and Agriculture would provide advice to entrepreneurs regarding quality standards and other requirements of the different export markets; and

commercial tea cultivation will be promoted in Mansehra district of NWFP. Extension services and credit facilities will be geared to this objective.

Landmarks of Eighth Plan

15. The crop production targets for the Plan are related to water availability and additional areas expected to be brought under cultivation during the next five years. The water resources development programme is designed to provide an additional 8.16 million acre feet (MAF) of irrigation water at the farmgate. It is estimated that about 50 per cent of the additional water will be utilized for increasing the cropping intensity and the rest will be utilized for irrigating additional 0.7 million hectares of cropped area. Thus the total cropped area is expected to increase from 21.4 million hectares in 1992-93 to 22.1 million hectares in 1997-98.

16. The major share of additional area expected to be brought under cultivation would be utilized for wheat, oilseeds, fruits and vegetables, fodder, etc. The change in cropping pattern expected due to allocation of additional area to different crops in the next five years is given in Table-1.1

Table-1.1

Estimated Share of Crops in Additional Area to be Brought Under Cultivation During the Eighth Plan

Crop	% Share in Cropped Area		Additional Area	
	Benchmark (1992-93)	Target (1997-98)	(000 Ha)	% Share
Wheat	36.6	36.2	182	26.2
Rice	9.8	9.7	42	6.0
Maize	4.0	4.0	35	5.0
Other cereals	5.1	5.0	-	-
Cotton	12.2	11.8	-	-
Oilseeds	2.1	2.8	175	25.0
Pluses	7.0	7.0	42	6.0
Fruits, Spices and Vegetables	4.0	4.3	84	12.6
Sugarcane	4.0	4.0	28	4.0
Fodder	13.1	13.2	112	16.0
Tobacco	0.2	0.2	-	-
Others	1.9	1.8	-	-
Total:-	100.0	100.0	700	100.0

17. This represents a desirable cropping pattern which would be brought about by suitable policy measures such as support prices, availability of institutional credit, improved seed, marketing facilities and incentives to farmers.

Production Targets

18. The crop production targets have been fixed keeping in view the domestic and export requirement and the technical feasibility to achieve them. The targets have taken into account additional production likely to be obtained from the use of additional water, appropriate dozes of fertilizer, improved seed, better plant protection measures and farm management practices. It has been assumed that adoption of suitable policy measures and modern packages of production technology will increase the per acre yield of crops. The crop production benchmarks and targets for the Eight Plan are given at Statistical Appendix Table-III-1.1

19. The crop production targets will be achieved by adopting the following measures :

- intensive crop maximization programme would be carried out for improving productivity;
- production of selected commodities in a specific ecological zones will be facilitated through input of basic and applied research and packages of improved production technology for farmers;
- balanced application of fertilizers, including micro-nutrients and soil amendment;
- expanded use of certified seed;
- adequate plant protection coverage against pests and diseases. Integrated pest and disease management programmes should be promoted where feasible. In areas and for crops, where conditions permit physically, technically and economically, aerial spraying should be carried out;
- additional water, both surface and sub-soil will be exploited through construction of additional facilities and installation of tubewells so that the declining trend of tubewell installation is not only arrested but also improved;
- effort will be made to ensure uninterrupted supply of power for tubewells, diesel for agricultural machinery and irrigation water for increasing input use efficiency;
- arresting the adverse effect of waterlogging and salinity on the soil status. In addition to pumping of water, drainage should also get a high priority where found economical;
- incentive support prices for different crops keeping in view their cost of production;

- better management practices such as precision land levelling, timely sowing, improved cultural practices, timely application of water, fertilizers, pesticides, etc.; and

- the use of agricultural machinery should be encouraged for agricultural operations for which labour in peak seasons is not adequately available.

20. Some of these elements are discussed below:-

Availability of Inputs

21. The inputs required for the achievement of crop production targets are given in Table-1.2. Appropriate measures will be taken to improve the availability of these inputs.

Table-1.2

Crop Production Inputs: Benchmark and Plan Targets

Inputs	1987-88 (Actual)	1992-93 (Benchmark)	1997-98 (Targets)	Annual Growth Rate	
				Seventh Plan	Eighth Plan
Water availability (MAF)	111.2	125.12	133.28	2.2	1.3
Fertilizer offtake (000 'N' tonnes)	1720	20.65	2730	3.7	5.7
Seed distribution (000' tonnes)	100.0	138.0	260.2	6.7	13,5
Operational Tractors (000' Nos)	221.3	224.4	241.6	0.3	1.5
Plant Protection coverage(ooo hectares)	2664	2745	2870	0.6	0.9

22. In order to realize the crop production targets, fertilizer requirements during the Eighth Plan are expected to increase by 5.7 per cent over the actual 1992-93 offtake. The growth rate for nitrogen is estimated at about 4.9 per cent, phosphate 7.6 per cent and potash 14.8 per cent. In quantitative terms, nitrogen is estimated to increase from 1,575 to 2,000 thousand tonnes, phosphate from 450 to 650 thousand tonnes and potash from 40 to 80 thousand tonnes by the end of the Eighth Plan. The total fertilizer use will increase from 2,065 thousand tonnes in 1992-93 to 2,730 thousand tonnes by 1997-98. This will mean an overall application of about

120 kg nutrients per hectare. The NPK ratio will improve from 3.8:1.0:0.1 in 1992-93 to 3.0:1.0:0.12 in 1997-98. The fertilizer offtake target for the Eighth Plan are given in Table-1.3.

Table-1.3

Fertilizer Offtake Target 1993-94 to 1997-98

(000' Nutrient tonnes)

Year	Nitrogen	Phosphate	Potash	Total
1992-93 (Base year)	1575	450	40	2065
1993-94	1650	475	50	2175
1994-95	1730	515	55	2300
1995-96	1815	555	65	2435
1996-97	1905	600	70	2575
1997-98	2000	650	80	2730
Annual growth rate	**4.90**	**7.63**	**14.87**	**5.74**

23. A major structural change in the fertilizer sector is expected to take place during the Eighth Plan period. The Government is taking measures to deregulate and privatize the import, production, sale and distribution of all kinds of fertilizers. Initial steps toward this objective have already been taken and the process is expected to be completed during the Plan period.

Improved Seed

24. The use of good quality seed is one of the basic requirements for increasing the production and yield of crops. It is a low cost input but has the potential to increase crop yield on an average by 20 per cent over commercial seed. Thus the use of quality seed by farmers remains an area of high priority over the other inputs.

25. The requirement of improved seed during the Eighth Plan are given in Table-1.4.

Table-1.4

Replacement Requirement of Improved Seed by 1997-98

Crops	Area (000 ha)	Seed rate (Kg/ha)	Seed required (000 tonnes)	Replace-ment rate (%)	Replace-ment (000 tons)
Wheat	8100	91	737.1	20	147.4
Rice	2160	20	43.2	20	8.6
Maize	910	40	36.4	33	12.0
Cotton	2600	25	65.0	100	65.0
Gram	1150	40	46.0	20	9.0
Others	-	-	-	-	18.0

26. During the Eighth Plan, all out effort will be made to fully utilize the capacity of the seed processing plants in the public sector. Private sector will also be encouraged to establish seed processing plants. Specific measures will be taken for improving the production and distribution and use of high quality seed.

Plant Protection

27. Pests and diseases are a major constraint in obtaining potential crop yields. It has been estimated that they reduce crop output by about 25 per cent. The use of pesticides has increased from 5,481 tonnes in 1981 to 13,030 tonnes in 1991. Despite the increase in pesticide usage, the plant protection coverage on the national level is only 12 per cent of the total cropped area. About 80 per cent of the pesticides are used on cotton and the remaining 20 per cent on sugarcane, rice, fruits and vegetables. Although the use of chemicals is essential for checking pests, diseases, weeds, etc, its indiscriminate use should be avoided. It causes health hazards, kills predators and other useful insects and damages the environment.

28. During the Eighth Plan, facilities for pest scouting, aerial spraying and quality control of pesticides will be improved and more emphasis will be laid on integrated pest management. Non-chemical approaches, such as use of resistant varieties, bio-control agents, field sanitation, adoption of useful cultural practices, will be promoted.

Mechanization

29. Mechanization has become necessary for intensifying production and increasing the speed of pre-harvest and post-harvest farm operations. The use of agricultural machinery for

cultivation, deep ploughing, ridging, sowing and harvesting of crops is increasing. It is estimated that 82,900 new tractors were inducted during Seventh Plan against a target of 146,000, thus raising the total operational fleet to 224,400 by 1992-93. The shortfall was mainly due to the increase in the rate of down payment to 15-25 per cent based on size of land holding and cost of tractors. In order to overcome these problems, the rate of down payment has been reduced to 10 per cent and a rebate of 5 per cent has been provided to farmers on timely payment of loans for tractor and other implements. The import of standardized make of tractors in complete built up (CBU) condition has also been allowed.

30. The Eighth Plan envisages a sale of 151,200 tractors. The farmers will be encouraged to use deep tillage implements, sub-soilers and ridgers under the productivity enhancement programme. Emphasis will also be given to installation of shallow and deep tubewells and use of sophisticated irrigation systems for increasing productivity. The total population of operational tractors is expected to increase from 224,400 in 1992-93 to 241,600 in 1997-98. A fleet of bulldozers and other heavy machinery will continue to be maintained in the public sector for land reclamation and conservation of water resources.

Agricultural Credit

31. Timely availability of credit to farmers has become essential to meet their production and developmental needs. The agricultural credit disbursement during the Seventh Plan is expected to increase from Rs 14 billion in 1988-89 to around Rs 16 billion in 1992-93. However, the total amount of agricultural credit disbursed during the Seventh Plan period is expected to be Rs 72 billion against a target of Rs 130 billion.

32. The following measures will be taken to improve the availability of credit to farmers :

- provision of credit against hypothecation of stored commodities and saleable assets like livestock to the agriculture sector;
- provision of rotating limits for production loans, to eliminate unnecessary documentation and complexities;
- production loans to small farmers, based on actual crop requirements rather than a flat assessment on acre basis;
- pass books to be provided within 2 years to all farmers by the concerned Revenue Departments; and
- establishment of Kissan Banks.

33. The total agricultural credit requirement during the Eighth Plan is estimated at Rs 303 billion against total estimated disbursement of Rs 72 billion during the Seventh Plan. During the Eighth Plan, the timely availability of agricultural credit, its disbursement and effective utilization specially in case of small and medium farmers will be ensured. The recovery system of agricultural loans will be improved.

Agricultural Marketing

34. An efficient marketing system is important for increasing agricultural production and ensuring better return to the producers. It also assures reasonable prices and quality of products to consumers and helps in minimizing losses between production and consumption centers. The elements of the marketing system which require attention include procurement, pricing, transport, storage, processing, grading, packaging, and proper management at different levels of the marketing channel. The following measures will be taken for improvement of the marketing system :

- the functioning of market committees would be reviewed to identify their shortcomings and remedial measures taken to improve their efficiency;

- federal and provincial marketing organizations need to conduct systematic surveys and research on the marketing of different commodities which would generate useful data for policy decision. For this purpose, the organizations should be adequately strengthened and necessary training facilities provided in their respective fields;

- a programme for improving the functioning of the regulated markets be worked out both in the Punjab and Sindh. The possibilities of setting-up regulated markets in the NWFP ad Balochistan would be explored;

- there is a need for conducting a feasibility study to determine the storage facilities required in these regulated markets particularly for the perishable commodities;

- the grading of agricultural commodities increases returns to farmers and improves marketing efficiency. The process currently being promoted to link prices with quality should be intensified. One way of doing this, is that the implementation of support prices fixed on the basis of grades, should be strictly enforced; and

- the formation of growers associations should be encouraged for collective transportation of the produce to the markets, as well as, its storage and processing.

Support Price Policy

35. The support price for wheat, rice, cotton, sugarcane, gram, onions, potatoes and non-traditional oilseed crops, namely sunflower, soybean and safflower are fixed by the Government with a view to provide economic incentives to the growers. The objectives of the support price policy are to raise production through price intervention, stabilize prices and safeguard the interest of the farmers against undue fall in prices during the post-harvest period. The support prices are reviewed annually keeping in view factors such as cost of production, domestic demand, import and export parity prices, supply and stock position, comparative advantage of

crops, etc and are generally announced before the sowing time, in order to enable the farmers to properly plan allocation of area and input for different crops.

36. The following measures are envisaged to make the support price more effective during the Eighth Plan :

- a constant review of support prices of different crops will continue to be made and fixed in such a manner that the farmers are provided adequate incentive to increase their production and productivity;

- the cost of production methodology will be reviewed in order to obtain consensus of all the parties involved in crop production;

- the Government would provide full support as well as funds for effective implementation of the support price policy particularly for those crops which have failed to receive such assistance in the past;

- in order to implement the support price programme of perishable commodities such as onions and potatoes successfully and avoid undue losses, storage and processing facilities need to be set-up so that excess supply could be withdrawn from the market and released when shortage occurs; and

- Agricultural Prices Commission would periodically work out the domestic and international terms of trade and suggest remedial measures if there are any plausible distortions.

Agricultural Statistics

37. The availability of a comprehensive and uptodate database is a pre-requisite for effective policy formulation. All pertinent data relevant to agriculture such as land and water resources, climate, tenurial situation, land use, major agricultural inputs, irrigation supplies, marketing and consumption, etc should be available in the Ministry of Food and Agriculture for use by policy makers, researchers and farmers. The first step in rationalization of agricultural resource use will be preparation of a comprehensive database to facilitate subsequent analysis for improvement of resource utilization. The Economic Wing of the Ministry of Food and Agriculture will be strengthened to undertake the following activities :

- prepare a computerized database of land, water and climatic resources including quality characteristics and superpose on geographic map; and

- identify zones of agro-ecological similarity and determine land use patterns (crops, horticulture, livestock, forestry, rangelands, aquaculture) and suitable crop rotations which yield highest net incomes and promote resource conservation.

Agricultural Education

38. The existing agricultural education institutions, namely, Agricultural Universities at Faisalabad, Tandojam and Peshawar, Barani Agricultural College, Rawalpindi and Faculty of Agriculture, Gomal University were suitably strengthened during Seventh Plan to meet the requirement of technical manpower for the agriculture sector. The establishment of Agricultural Colleges at Multan, Quetta and Dokri is in progress. During the Eighth Plan these institutions will strive to improve the quality of education by giving emphasis on both the theoretical and practical aspects of agriculture. They would review the curricula, syllabi and text books and incorporate in them the latest developments, in order to make agricultural education responsive to present national requirements. The university staff and students would be encouraged to carry out research on practical problems in order to develop feasible solutions.

Agricultural Research

39. Emphasis will be laid on site-specific, problem oriented and productivity increasing research, the results of which will be transmitted to the farmers through the agricultural extension system and the electronic media.

40. The Pakistan Agricultural Research Council (PARC) will be responsible for coordination of research throughout the country in order to avoid unnecessary duplication of research efforts. It will carry out basic and strategic research while the provincial research institutes will deal with applied and adaptive research. The modest human and financial resources available for research should be judiciously used by prioritization of research needs and consolidation of scattered research efforts into a National Agricultural Research System, to address the urgent issues of agriculture and water sectors.

Agricultural Extension

41. The agricultural extension system is responsible for the dissemination of information and technology developed by research institutes to the farmers for improving agricultural productivity. In the past, there has been a tendency to blame the extension system for most of the problems of agricultural development. While the efficiency and functioning of agricultural extension requires improvement, it is not the major cause of overall inefficiency of the agricultural enterprise. The extension agent can only take knowledge to the farmers which has been developed by research institutes. Most of the research in the country has been carried out on well laid out research plots at experimental stations with little concern for net profitability to the growers. Such research is suitable for well organized resourceful farmers but is often not applicable to resource poor small farmers. Thus there is a need for the development of appropriate technology for small farms, as well as, provision of adequate credit facilities for the purchase of required inputs.

42. During the Eighth Plan, the Provincial Governments will review the extension system with a view to remove the deficiencies which are hampering its effectiveness. The traditional emphasis of personal contact of extension workers with farmers will be supplemented by extensive use of the electronic media. The already successful farm radio broadcasts to rural areas

will be further extended and increasing coverage will be given on the television network to agricultural programmes. The private sector, agribusiness companies and agro-industries will be encouraged to provide extension services to farmers in commodities of their interest.

Forestry

43. The total area under forests is estimated at 4.20 million hectares or 4.8 per cent of the total geographical area of the country which is quite inadequate to meet the growing demand for timber and wood, as well as, conservation and protection of the environment. The existing forests are classified as 42.8 per cent coniferous, 37.6 per cent scrub, 7.6 per cent mangrove and 6.5 per cent riverain. Irrigated forests account for 5.1 per cent and linear plantation 0.4 per cent of the area. A long-term goal of the forest policy would be to increase the forest area from the current level of 4.8 per cent to 10 per cent in the next fifteen years.

44. The productivity of forests is low. Some of the important factors for low productivity are, poor regeneration and low stocking of coniferous forests, faulty logging practices, deterioration of soil fertility, inadequate irrigation, poor quality of planting material, overgrazing and demand for arable land for crop cultivation.

45. There is considerable gap between the wood requirement and sustainable supplies. According to the Forestry Master Plan, the requirement for timber and fuelwood in 1997-98 would be 4.29 million cubic meters and 28.70 million cubic meters, respectively. Against these projections, the current estimates of consumption are 3.53 million cubic meters of timber and 26.02 million cubic meters of fuelwood. The deficit is roughly equivalent to a million hectares of land or 2.5 billion fast growing trees for fuelwood alone. However, the forests are capable of producing more wood per unit area as compared to what is harvested under the present system of management.

46. During the Eighth Plan, high priority will be accorded to the development of forestry, watershed and rangelands. Intensive forest management will be carried out on Government forests and farm forestry will be promoted on private lands to meet the growing demand for timber and firewood. The degradation of watersheds will be arrested through afforestation, soil conservation and proper management practices. In case of rangelands, programmes for reseeding of depleted areas with nutritious, high yielding grasses and plantation of fodder trees will be promoted to meet the feed requirement of livestock. A comprehensive Forestry Masterplan is under preparation and its implementation will be started during the Eighth Plan. An environment protection project would also be implemented to reduce the degradation of land and water resources and conserve the environment. The physical targets for forestry are given in Table-1.5.

Table-1.5

Physical Targets for Forestry Sub-Sector

Product	1987-88 (Actual)	1992-93 (Benchmark)	1997-98 (Projection)	Annual growth rate	
				1988-93	1993-98
Wood production (000 cum)	779	832	958	1.3	2.8
Fuelwood (000 cum)	357	438	505	4.2	2.9
Timber (000 cum)	422	394	453	(-) 1.04	2.8
Compact plantation (hectares)	33,000	46,755	58,000	7.2	4.4
Nursery raising (hectares)	375	1,006	1,200	21.8	3.6
Linear plantation (Av. Km)	2,000	1,677	2,000	(-) 3.5	3.6
Distribution of plants (Million No)	180	245	500	6.4	15.3

47. The management of wildlife will be given due attention. Many animal species are endangered because of pressures from hunting, poaching and habitat destruction. A high priority will be given to habitat preservation and restoration in order to ensure conservation of the whole ecosystem including fauna.

Animal Husbandry

48. The livestock sub-sector contributes about 30 per cent of the agricultural value added and 7 per cent to the GDP. However, the productivity of livestocks is low. There is considerable potential for increase in their productivity in terms of meat and milk, through provision of adequate quantities of fodder and feed, genetic improvement of breeds, disease control and scientific management. There is scope for the establishment of feed lots for fattening of cattle and lamb for increasing meat production.

49. Livestock research, extension and health care facilities will be strengthened in order to increase the production of milk, meat and other livestock products. The development of feed and fodder resources will be given priority to provide balanced and nutritious feed to livestock. Free import of corn would be allowed to meet the requirement of the feed industry. Programmes would be undertaken for breed improvement by cross-breeding, artificial insemination, embryo

transfer technology and genetic engineering. The main goal would be to increase the productivity per animal. For disease control, vaccination coverage against locally endemic diseases will be increased.

50. The dairy development is constrained by seasonal fluctuation in the supply and demand of milk. Its supply exceeds the demand in winter, resulting in depressed prices. During the Eighth Plan, the private sector will be encouraged to set-up plants for drying of surplus milk thus substituting imported powdered milk. It would also stabilize prices throughout the year. In order to prevent spoilage and facilitate marketing of milk, chilling centres will be established in rural areas. A dairy technology training center will be established by the private sector.

51. The targets for livestock products are given in Table-1.6

Table-1.6

Production Targets for Livestock Products
(000 tonnes)

Products	1987-88 (Actual)	1992-93 (Benchmark)	1997-98 (Target)	Annual growth rate	
				1988-93	1993-98
Meat	1,357	1,795	2,484	5.8	6.7
Beef	661	844	1082	5.0	5.1
Mutton	542	763	1075	7.1	7.1
Poultry	154	188	327	4.1	11.7
Milk	13,319	17,120	22,039	5.1	5.2
Eggs (Million Nos)	4,140	5,379	8,448	5.4	9.4
Wool	44.70	50.54	57.74	2.5	2.7

52. During the Eighth Plan, special emphasis will be laid on increasing the poultry meat and egg production to meet the growing demand. Rural poultry which accounts for about 50 per cent of the production will be improved through use of rural breeds such as fayumi, better housing and management practices and increased coverage against contagious diseases. The research and development efforts will be concentrated on control of viral and other infectious diseases, improvement of diagnostic facilities and vaccine production. All the feed mills would be encouraged to establish quality control laboratories in order to guarantee the quality of their products.

Fisheries

53. There is tremendous potential for increasing the fish catch in the coastal and deep sea belt in the Exclusive Economic Zone (EEZ), but it has not been efficiently exploited. Similarly, the inland water resources have not been adequately managed and utilized for optimizing fish

production. Increased production of fish would help earn foreign exchange through increased export of quality fish, create employment opportunities along the coastal belt, provide nutritious food to the people and provide fish meal which is a major ingredient for poultry feed.

54. The construction of fish harbour at Pasni and rehabilitation of Karachi Fish Harbour were completed during the Seventh Plan. The construction of Korangi and Gawadar Fish Harbour will be extended to the Eighth Plan. A Fisheries Training Centre was established at Karachi for training of fishermen, skippers and other shore-based personnel.

55. During the Eighth Plan, the infrastructure facilities, equipment and management of fish harbors would be improved for increasing the quantity and quality of fish catch. The following measures will be taken for development of marine fisheries :

- a shrimp conservation policy will be followed by limiting the number of trawlers from the present level of 1,800 to 600, observe closed season for two months (June and July) to reduce juvenile mortality and forbid trawling inside the Indus delta;
- the conversion of trawlers into gillnetters and long liners would be encouraged to exploit the available demersal resources;
- the quality of catch will be improved by provision of facilities to chill it on board and introduction of quality control measures;
- the exploitation of crustaceans (lobsters and crabs) and bivalves (oyster, clams and mussels) would be promoted especially for the export market;
- research and development activities will be carried out to examine the feasibility of coastal aquaculture; and
- training to fishermen and skippers will be provided.

56. The fish production targets for the Eighth Plan are given in Table-1.7.

Table-1.7

Fish Production Targets

(000 tonnes)

Source	1987-88 (Actual)	1992-93 (Benchmark)	1997-98 (Projection)	Annual growth rate	
				1988-93	1993-98
Inland	96	123	138	5.1	2.3
Marine	349	377	437	1.6	3.0
Total	445	500	575	2.4	2.8

Targets and Allocations

57. As a result of the policies and strategies to be implemented during the Eighth Plan, the growth rate of agriculture sector is expected to be 4.9 per cent. The production targets are at Statistical Appendix Tables-III-1.1 & 1.2.

58. A financial allocation of Rs 5.17 billion, excluding fertilizer subsidy, has been made for the federal programmes of the agriculture sector. The sub-sectorwise details are at Statistical Appendix Table-III-1.3. The major areas of attention are agricultural research, agricultural education, forestry and livestock development. Besides the allocation under PSDP, an indicative investment of the size of Rs 90.8 billion (at 1992-93 prices) has also been made under the private investment.

59. An allocation of Rs 0.5 billion has been made for subsidy on fertilizer during the Eighth Plan. The decline in subsidy is mainly due to elimination of subsidy on phosphatic fertilizers during 1992-93. At present, there is subsidy on potassic fertilizers which is expected to be eliminated during 1995-96.

III-2

WATER RESOURCES DEVELOPMENT

Objectives and Strategy

Pakistan has a vast water resource base which consists of Himalayan Watershed of about 155,000 mile^2 (401554 km^2) with numerous glaciers feeding the Indus River System. In order to harness this resource, 3 major reservoirs, 19 barrages, 12 link canals, about 38000 mile (61152 km) long irrigation canals, more than a million mile (1.61 million km) long watercourses and 10,000 mile (16093 km) long surface drains have been constructed. In addition, there are over 290,000 public and private tubewells to tap the sub-surface water available in the basin.

2. On the average, over 140 million acre feet (MAF) or 17.27 million hectare meter (MHM) of water flows annually in the Indus River System. Additionally, precipitation over approximately 80,000 mile^2 (207254 Km^2) of the Indus Plains and Peshawar Valley contributes about 40 MAF (4.93 MHM), out of which 25 MAF (3.084 MHM) falls in the canal command area. At present, only 105 MAF (12.95 MHM) of surface water supplies from the Indus River System are being diverted at canal heads for irrigation purposes.

3. The major goal of policy and planning in the water sector continues to be that of uplifting the agro-based economy of the country by maximizing crop production. This goal will be accomplished through progressively increasing surface water supplies, replacing public tubewells with private ones, improving existing management practices using the latest technologies available, and protecting land and infrastructure from waterlogging, salinity, and floods. Efforts will also be made to operate and maintain irrigation and drainage sub-systems at a high efficiency level.

4. The productivity of irrigated lands can be increased by minimizing water-logging and salinity and devising a proper mechanism to monitor, evaluate, operate and maintain the system in an integrated manner. In order to lower watertable in irrigated zones, SCARP tubewells were installed but could not produce projected results mainly due to low O&M budgets. Therefore, a gradual shift of tubewells from public to the private sector has been proposed using project approach. This will not only ease the financial burden on the public sector but will also help to narrow the gap between crop water supply and demand. Of course, moving towards a demand-based system would have a high pay-off but it is possible only by constructing large reservoirs at macro level and by improving surface water distribution and application sub-systems and conjunctive use of water at micro level.

5. Operation and maintenance, monitoring, evaluation, consolidation and rehabilitation, and management deficiencies with respect to administrative, institutional, and operational aspects of the Indus basin irrigation system are major issues that require a comprehensive policy.

6. Currently all projects executed by WAPDA have a built-in component of O&M that terminates one year after the completion of the project. Thereafter, the project is handed over to Provincial Irrigation Departments (PIDs) for their operation and maintenance. Such handing over procedure has several drawbacks. The executing agencies feel that their job is over as soon as the project is complete while PID's don't show much enthusiasm in taking over the project since they feel that they were not involved right from the project planning stage. The release and provision of inadequate O&M funds put the physical infrastructure of the project into jeopardy and slows down the personal motivation and project momentum. The existing O&M mechanism should be modified in such a way that only one agency handles both revenue collection and O&M funds allocation. Institutions should be run on self sustainable basis by devolution of responsibilities down to farmers and involving them in decision making. Inability of PIDs to efficiently operate and maintain the system, rigidity in operational rules and regulations are some other issues that deserve special attention from planners, policy-makers, implementers and end-users.

7. Monitoring and Evaluation (M&E) process has not been working satisfactorily in the past. Monitoring during the project execution period should aim at having the project completed in time, within the approved cost and with proper specifications. It must lead towards the refinement of planning and management concepts. Post-project M&E is equally important in order to compare and assess the real benefits of the project in relation with the planned benefits. M&E needs to be carried on actively even after the completion of the project and a mechanism needs to be evolved for its continued funding as projects in water and agriculture can be evaluated only when crops had been grown for a few seasons.

8. Work on consolidation and rehabilitation is proceeding effectively in On-farm Water Management and Irrigation System Rehabilitation Programmes. A similar approach is needed for other programmes in the water sector. In drainage sub-sector, the sector loan concept has already been approved under "National Drainage Programme" which cater to the financial needs of needy projects on a prompt basis.

9. The following strategies, based on the experience gained from the implementation of Seventh Five Year Plan, are proposed for implementation:

i) continue improvements in irrigation system. Additional water storage to be organised;

ii) new irrigation schemes in water deficient areas should be initiated;

iii) monitoring and evaluation should be continued after the project termination so that performance can be evaluated. For this, funding arrangements should be organised;

iv) partial responsibilities for O&M should be given to farmer's associations or private agencies so that O&M financial burden on the public sector is eased;

v) small surface irrigation schemes, check dams, infiltration galleries, diversion weirs, delay action dams and flood irrigation schemes should be constructed in backward regions;

vi) "sailaba" areas should be protected and developed in an environmentally safe manner;

vii) tubewells should be installed to exploit good quality groundwater in potential areas;

viii) conjunctive use of surface and groundwater based on scientific lines should be encouraged so that efforts to convert the rotation-based irrigation system to a demand-based system can bring desired results;

ix) water conveyance efficiency of canals and drains should be improved by lining and remodelling;

x) existing irrigation and drainage systems should be rehabilitated;

xi) optimal water use through OFWM and CWM programmes should be achieved;

xii) fertile lands should be protected from waterlogging and salinity by giving priority to disastrous areas having saline groundwater underneath. The exploitation of groundwater resources in Fresh Groundwater Zones should be left to the private sector;

xiii) borderline waterlogged areas should by treated with preventive measures such as lining of minors and small distributaries, water regulation and management, OFWM and improved cropping pattern;

xiv) in Fresh Groundwater Zones, privatisation should continue through SCARP Transition Programme; and

xv) flood losses should be reduced in an economically sound manner so that resulting benefits of flood damage abatement measures exceed their costs as far as possible.

Management Issues

10. The aging Indus basin irrigation system is facing myriad physical, institutional and management problems. Some of them are threatening its sustainability and environment. These bottlenecks in the system should be removed by prioritising them on the basis of their seriousness.

Waterlogging and Salinity

11. It is proposed to complete on-going reclamation projects as early as possible. New projects should not be entertained. Full financial provision, as given in the plan, has to be made every year until the completion of the projects. In Saline Groundwater Zones, the latest technology will be used for new projects and the most economical measures will be adopted to tackle the disastrous area. However in Fresh Groundwater Zones, no new SCARP project will be initiated in public sector so that the sectoral cost can be reduced. In general, freshwater areas will be tackled by the private sector except where aquifer conditions are hard and difficult for drilling. In fresh groundwater zones, the transition of tubewells from public to the private sector will be accelerated and necessary power facilities will be provided. The borderline areas and areas free from waterlogging and salinity will be tackled by adopting preventive measures such as command and on-farm water management practices, water regulation, lining of minors and distributaries, surface drains, etc.It is observed that at present, surface drainage facilities are not maintained satisfactorily. Therefore, efforts were made to make-up for the maintenance negligence in drainage activities under Irrigation System Rehabilitation Programme. This programme partially covered the drainage system upto main and branch drains. Beyond this, farm or chak drains will be needed which are the responsibility of farmers. In order to achieve this, a legal cover for allowing the right of way through farmlands is proposed.

Mining of Fresh Groundwater Aquifer

12. In a recent study made on private tubewells, it was observed that mining of groundwater was taking place in a number of areas. Consequently, the intrusion of saline into fresh groundwater has started. It will be necessary to have strict regulatory measures that can guide the installation and operation of private tubewells in threatened aquifers.

Combination of Water with Other Inputs

13. The purpose of irrigation is to supply the right amount of water at the right time and at the right place. Besides water, agricultural production is dependent on soil conditions, crop varieties, seed rates, fertilizer use, cultural practices, and plant protection etc. Lack of attention to any of these can result in poor yields affecting the water use efficiency. Hence a programme for irrigation water application has to be integrated into overall farming plan to achieve potential yields. For this purpose, integrated efforts are required by the Irrigation and Agriculture Departments in consultation with the farmers.

Modification of Contractual Procedures

14. The present forms of contract documents need improvement to encourage more responsible tendering. This would be done by standardizing conditions and specifications of the method of measurement, provision for arbitration, interest on late payments, and tenderer's requirement to submit the work plan and stick to it. Standard tender documents for small, medium and large size contracts would be developed separately to reflect modern contracting practices and be adopted for uniform use by all implementing agencies. Also pre-qualification

procedures would be designed to include an appropriate investigative mechanism for verifying the applicant's credentials to prevent entry of unscrupulous elements.

Recovery of Operation and Maintenance Costs

15. The maintenance of completed projects is unsatisfactory. Special consideration would be given to improve O&M funding. Research has demonstrated that there are significant benefits in increasing the efficiency of O&M and providing it with adequate resources, thereby enhancing the agricultural productivity. The system of O&M recoveries from farmers is deficient and needs considerable improvements. The government has completed detailed study on the improvement of water and drainage charges, assessment and revenue collection procedures. An action plan composed of short and long term measures has been prepared for the full recovery of O&M cost of surface irrigation, sub-surface saline drainage and flood control and protection works. This will be done in phases through increased water charges, drainage cess and other appropriate measures.

Linkage between Research and Development

16. Traditionally research and development have been carried separately. There is no feed back to the planners and implementers for corrections or replanning. Therefore, special attention for an effective linkage between research and development is needed. Measures would be initiated to ensure this linkage.

Privatization

17. In the past, no conscious effort was made to mobilize the private sector's resources for development and maintenance of water schemes. The private sector can play an important role in the following areas:

a) Ground Water Development;

b) On-Farm Improvement (water conservation, land levelling, improved water distribution);

c) Construction of field drains; and

d) O&M upto minor and tertiary drain level through water users associations (WUAs), NGOs, and individual contractors.

Updating of Codes and Manuals

18. The codes and manuals used by Provincial Irrigation Departments and WAPDA have become outdated. Although these departments perform important functions regarding public tubewells, small dams, large reservoirs, link canals, afforestation, fisheries, reclamation and subsurface drainage, etc., but no comprehensive manuals are available for such activities. Departmental codes and manuals would be updated.

Co-ordination

19. Considering water as a critical input in the crop production process, the need for close coordination between the Provincial Irrigation and Agriculture Departments is self-evident. At field level, administrative and managerial functions of PIDs regarding water allocation are combined with advisory functions of Agriculture Departments rendered to farmers. At present, there is no coordination between these two functions. In order to achieve maximum water use efficiency, close coordination between these two sectors is a pre-requisite. Coordination Committees would be set up to provide a linkage between the water and agriculture sectors and promote efficient water use.

Research

20. Salient recommendations for research are:

a) conducting research on the lines of Integrated Comprehensive Management (ICM) Concept of irrigated agriculture which stipulates treating the entire river basin as a single entity from the source (catchment) to the end use (farmer's field). This requires research re-orientation from the prevailing "Organization Specific" to "Basin Location Specific" mode;

b) main focus of the research to be on "Applied" rather than "Basic" side tailored to the end user's requirement; and

c) a Standing Committee on Coordination and Review of Water Resources Research would be established under the Ministry of Water and Power with appropriate level representation from concerned federal and provincial agencies.

Consolidation and Rehabilitation

21. In order to make-up for the maintenance backlog and improve the system on modern lines, the rehabilitation and remodelling work was initiated in all provinces under the World Bank and the USAID assisted programmes. Some of the SCARPs also contain rehabilitation, remodelling and lining components. Phase-I of Irrigation System Rehabilitation Programme was completed by the end of Sixth Plan and Phase-II initiated subsequently which will be completed during the eighth plan period. It will increase irrigation channel capacities resulting into increased water availability during early kharif and late kharif periods. With the implementation of Phase-II of the project, the availability of 1.5 MAF (0.185 MHM) of water saved under the Phase-I will be maintained.

Landmarks of the Eighth Plan

22. Chashma Right Bank Canal and Pat Feeder Canal projects will be completed and consequently, additional water of 1.25 MAF (0.154 MHM) will be made available to irrigate an additional area of 0.34 MAC (0.138 MHA).

23. Left Bank Outfall Project (LBOD) will be completed. This would help to reclaim a major portion of the irrigated land in Sindh province, provide safe disposal of agricultural and other effluents into the sea, thereby helping environmental concerns and safeguard human, animal, and wildlife of the area. Work on Right Bank Outfall Drainage Project (RBOD) will be in full swing by the end of the Plan.

24. Water-logging in the disastrous areas would be eliminated.SCARP transition programme will also be in full gear which will ease O&M burden on the public sector and involve the private sector in water resources development to a greater extent.

25. A pilot programme to evaluate the concept of transforming irrigation departments into autonomous bodies will be implemented with the ultimate aim of involving the private sector in irrigation management i.e. privatization.

Targets and Allocations

26. With the completion of ongoing surface irrigation projects like Chashma Right Bank Canal and Pat Feeder Canal additional water of 1.25 MAF (0.154 MHM) will be available to irrigate an additional area of 0.340 MA (0.138 MHA).

27. The fresh groundwater potential in the country will continue to be exploited by the private sector in addition to installation of a small number of tubewells by the provincial governments. The groundwater will be used in conjunction with the surface water. The overall increase in water availability at the end of the Eighth Plan will be about 8.16 MAF (1.00 MHM) from 125.12 MAF (15.43 MHM) to 133.28 MAF (16.44 MHM), of which surface water availability will be 81.95 MAF (10.11 MHM) and the groundwater availability will be 51.33 MAF (6.33 MHM). Water budget for the Eighth Five Year Plan is attached as Statistical Appendix Table-III-2.1.

28. Physical targets are attached as Statistical Appendix Table-III-2.2 and the detailed annual physical targets are attached as Statistical Appendix Table-III-2.3. A brief description of activities and targets in the major sub-sectors and the priorities assigned to these projects and programmes is given below:

Drainage and Reclamation

29. According to watertable appraisal carried out in April/June 1990, 13 percent of gross area i.e. 5.44 MA (2.20 MH) with depth to watertable (DTW) within 150 cm (5 ft.) from the Normal Surface Level (NSL) suffers from severe waterlogging. Province-wise position of depth to watertable showing disastrous areas is given in the Table-2.1.

Table- 2.1

Province-wise area underlain by depth to watertable in April/June, 1990.

Province	0- 150 cm (0 -5')		150 -300 cm (5' - 10')		0 - 300 cm (0 - 10')	
	MHA	MAC	MHA	MAC	MHA	MAC
Punjab	0.710	1.754	2.348	5.891	3.058	7.645
Sindh	1.348	3.331	3.434	8.485	4.782	11.816
Balochistan	0.093	0.230	0.077	0.190	0.170	0.420
NWFP	0.049	0.121	9.133	0.329	9.182	0.450
TOTAL:	2.200	5.436	6.028	14.895	8.228	20.331

Source:- Report of Sub-Committee on Water.

30. In the Eighth Plan, a pragmatic approach has been adopted to solve this problem. Out of 5.436 MAC (2.20 MHA) severely waterlogged area, about 1.072 MAC (0.43 MHA) is used for rice cultivation on non-perennial canal commands in Sindh and Balochistan. Most of it has already been provided with surface drains which would need to be maintained adequately for continued effectiveness. About 1.27 MAC (0.51 MHA) lying in completed SCARPS are also becoming severely waterlogged which can be improved through proper operation and maintenance. The remaining disastrous area of 0.425 MAC (0.172 MHA) lies in the Fresh Groundwater Zone (FGW), most of which is proposed to be controlled by the private sector. Only a small portion of this will be tackled by the public sector due to difficult aquifer conditions. Such areas lie in the commands of Kabul River Gravity Canal, Upper Swat Canal and the Bannu Basin. For the balance untreated area of about 3.4 MAC (1.38 MHA) lying in the Saline Groundwater Zone (SGW) and within the on-going projects, a relatively large program has been drawn up.

31. With the aim of eliminating water-logging in the "disastrous area" by the end of the Eighth Plan, following strategies will be adopted:-

a) completion of on-going schemes as originally conceived would be given first priority;

b) vertical drainage in FGW zone will be tackled by the private Sector, as before, except in difficult aquifer conditions;

c) the areas not severely waterlogged may be tackled by using preventive measures such as (a) deliver only needed supplies of water, (b) provide proper grading to lands, and (c) changeover to extensive rabi cultivation;

d) transition of public tubewells in fresh ground water area would continue in Punjab and Sindh; and

e) gradual replacement of deteriorated SCARP tubewells, which is a provincial responsibility, would be continued. Productive tubewells will be handed over to the willing farmers.

32. Major physical targets expected to be achieved during the 8th plan under Drainage & Reclamation Programme are given in Table-2.2.

Table-2.2

Major physical targets of drainage related activities.

S.No.	Item	Unit	Punjab	Sindh	NWFP	Balochistan	Total
1.	SCARP Tubewells	NO	178	1422	-	-	1600
2.	Surface Drains	MCM	36.47	74.90	22.96	5.67	140
		KM	558	1145	351	87	2141
3.	Tile Drains	HA	165293	22218	20502	-	208013
		AC	408440	54900	50660	-	514000
4.	Transition of STW	NO	6120	1880	-	-	8,000
5.	Disastrous Area	MHA	0.48	0.83	0.030	0.04	1.38
	to be protected	MAC	1.192	2.05	0.081	0.097	3.42

Source:- Report of Sub-committee on Water.

33. An amount of Rs 38.997 billion (70 percent of the total allocation) has been provided for the anti-waterlogging and reclamation programme.

Irrigation

34. Water Budget for the Eighth Plan is at Statistical Appendix Table-III-2.1. An increase of 8.16 MAF (1.01 MHM) in the water availability is expected to be achieved from various sources, of which 3.31 MAF (0.41 MHM) will accrue from surface water and 4.85 MAF (0.60 MHM) from groundwater. In case of surface waters, additional availability of 1.24 MAF (0.150 MHM) is expected to be accrued from the On-Farm Water Management, Command Water Management, Canal Rehabilitation and Canal Remodelling, 1.19 MAF (0.147 MHM) from small irrigation schemes and small dams and 0.88 MAF (0.11 MHM) from lining of minors and distributaries. Chashma Right Bank Canal will contribute additional supplies to the extent of 1.13 MAF (0.14 MHM) after completion of its Stage-III. In the groundwater development, 0.5 MAF (0.06 MHM) is envisaged from SCARP and other public tubewells and 4.35 MAF (0.54 MHM) from private tubewells. As a result the cropped acreage is expected to increase by about 1.7 MA (0.69 MH).

Command Water Management

35. The programme endevours to build a continuing capability, within the provincial agencies, to plan, implement, maintain an integrated and efficient programmes of irrigated agriculture and to strengthen farmers' participation for improving water and non-water input management. It also provides for developing water management techniques and reducing inequities in water deliveries between the head and the tail reaches.

36. Pilot projects in all the four provinces have been completed. Preliminary evaluation conducted by Command Water Management Directorate indicates that there has been an average increase of 8 percent in the cropping intensity . Therefore, there is a need to replicate such activities on wider scale. Financial allocations for this programme are proposed to be shown under the provincial part of the Eighth Plan.

Irrigation System Rehabilitation Programme

37. The rehabilitation programme in the Eighth Plan mainly consists of earthwork to strengthen the banks, provide free board and silt clearance, brick lining of the tail reaches to provide more reliable water supply to the tail users and clearing of drains to bring them back to their original discharge capacity. The Project will rehabilitate about 8870 miles (14275 KM) of irrigation channels benefitting a command area of approximately 10.2 MAC (4.128 MHA) and about 809 miles (1302 KM) long drains benefitting a drainage catchment area of approximately 2.0 MA (0.81 MH). Financial allocations for this programme will be shown under the provincial part of the Eighth Plan.

On-farm Water Management Programme

38. This programme has been continuing since 1976 with the assistance of the World Bank, the USAID and the Asian Development Bank and recently by the Government of Japan. It involves improvement and partial lining of watercourses, precision land levelling, establishment of demonstration plots, installation of micro irrigation systems and water lifting devices in barani areas, formation of Water User Associations, training of farmers and monitoring and evaluation of the accomplishments.

39. Works to be undertaken during the plan period include improvement and lining of 10,000 watercourses, precision land levelling of 55,000 hectares, establishment of 835 demonstration plots, installation of 32 micro irrigation systems and 12 water lifting devices, and training of 9585 farmers.

40. OFWM and Command Water Management Programmes are the only programmes in Pakistan where civil works are carried out by the beneficiaries themselves without any involvement of the contractor. The farmers contribute more than 50% of the improvement cost

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* An Experience for Agricultural Production Directorate of Command Water Management Project Punjab, September 30, 1991.

through the Water User Associations which involves donated labour for the earthen reconstruction, cost of masons for civil works and 25% recovery of the cost of construction materials. As the farmers have realized benefits of the programme, their contribution towards the cost may be increased. Efforts would also be made to increasingly involve the water-users in the water management at the ground level. This programme will be shown as a part of the Provincial Plan.

Small Irrigation Schemes and Reservoirs

41. Under this programme, it is proposed to implement a large number of small schemes which aim at diverting flood waters for irrigation and storing it to recharge aquifers for the subsequent exploitation of groundwater by tubewells. It includes lift irrigation schemes in the water scarce areas of Balochistan, AJ&K, FATA and Northern Areas of Pakistan to increases surface water availability. Flood weirs, check dams, and small dams will be completed during the Eighth Plan. According to the modest estimates, the availability of additional water due to above schemes will increase by 0.06 MAF during the Plan period. Work on the construction of medium reservoirs will also be taken up which includes Mole Dam, Nangar Parkar and small schemes in arid zone of Sindh, Kuram Tangi, Tank Zam and Gomal Zam Dam in NWFP, Bolan, Hingol, Bund Khushdil Khan and Mirani Dam in Balochistan and ADB assisted small dams in Barani areas of Punjab. All these schemes are to be taken up by the provinces.

New Surface Irrigation Projects

42. The above mentioned salvage programme and the small irrigation schemes will not be able to meet the future water requirements beyond the Eighth Five Year Plan. Therefore, for future development, the option is to manage the existing irrigation system in a better way and to undertake new irrigation schemes wherever feasible. Stage-I and II of Chashma Right Bank Canal (CRBC) have already been completed. Stage-III will be implemented during the Eighth Plan. Remodelling of Pat Feeder Canal will be completed during the Plan period. Every year, during monsoon, the bulk of flood water goes unutilized to the sea. The existing system requires development of new irrigation projects on non-perennial basis. In the Eighth Plan, sixteen irrigation/extension projects stemming out of Water Accord have been indicated to be taken up by the Provinces (4 in Punjab, 5 in Sindh, 3 in NWFP and 4 in Balochistan). The methodology of approval for new irrigation schemes has been laid down by the Council of Common Interest (CCI) which require consultation with the Indus River System Authority on availability of water.

Private Tubewells

43. A large number of tubewells have been installed during the last few decades in private as well as in public sectors (about 300,000 by the end of Seventh Five Year Plan). It has been estimated that during the Eighth Five Year Plan private tubewells will be installed at the rate of 6000 per year contributing about 4.35 MAF (0.540 MHM) of water. For the effective development of private tubewells, following guidelines are proposed:

a) fresh water zones would be tackled by the private sector except areas with difficult aquifer conditions;

b) priority would be accorded to the farmers of the disastrous area (0-5' watertable) in the fresh water zones for obtaining the private tubewell subsidy;

c) public tubewells which have outlived the economic life will not be replaced but instead, will be handed over to the willing private sector gradually. Similarly, productive tubewells may also be handed over to the private sector; and

d) SCARP Monitoring Organization of WAPDA will also extend their activities to the private tubewells. Data on quality of groundwater and watertable depth would be made available to the farmers on demand.

Groundwater from SCARP Tubewells

44. During the Eighth Plan, 218 SCARP tubewells, including scavenger tubewells with an average capacity of 2 cusecs will be installed in the saline groundwater areas. The abstracted water will be disposed off into rivers and/or evaporation ponds. Environmental consideration would be given to the disposal of saline effluent. For this purpose, Environment Cell of WAPDA is being strengthened.

Other Public Tubewells

45. Presently, about 3100 number of the Public Sector Tubewells are being operated by the provincial Irrigation Departments. Their average capacity of 1.5 cusecs provides 451 AF of water at 50% utilization factor and 15% delivery losses.

46. The public irrigation tubewells, besides Punjab, are generally installed in Balochistan, FATA, NWFP and PATA areas. In these areas particularly in Balochistan, small irrigation schemes are being implemented to increase recharge rate of aquifer for abstraction through karezes and tubewells. It is estimated that 217 public tubewells will be installed annually during Eighth Plan under various schemes which would contribute 0.5 MAF each year towards total water availability.

Flood Control

47. The flood protection programme in the Eighth Five Year Plan has the following objectives:

i) Planning Flood Management, based on integrated river basin, will continue;

ii) bringing more land under cultivation by encouraging use of flood moisture for crop cultivation in sailaba areas; and

iii) utilizing flood flows for augmenting water availability for irrigation.

For this purpose Rs 2390 million have been earmarked for flood control/protection programmes. A total of 165 number of schemes would be implemented during the plan period (42 schemes in Punjab, 46 in Sindh, 10 in NWFP and 38 in Balochistan, 19 in FATA, 5 in AJK and 5 in NA). The above include schemes to be undertaken under ADB assisted Flood Sector Project. The physical targets to be achieved include about 1428 MCFT of earthwork and 133 MCFT of stonework.

Survey and Investigation

48. The sub-sector comprises survey and investigation programme which is a continued activity being conducted by federal and provincial governments/agencies. In order to fully utilize surface and groundwater resources of the country for the development of agricultural lands of Indus Basin and also lands in other less developed areas, extensive survey and detailed investigations need to be carried out during the Eighth Plan.

49. During the Plan period WAPDA would undertake survey and investigations, inter-alia, in the following major fields:

i) Survey and investigation of snow and ice in the upper catchment areas of Indus river;

ii) Planning and investigation of main and off channel reservoirs;

iii) Water Resources Development and Management Planning for Balochistan, NWFP, FATA and Northern Areas and Islamabad Capital Territory, improvement of existing hydromet network and river forecasting and warning system;

iv) Monitoring of SCARPs areas, particularly, disastrous areas in the completed and under construction projects; and

v) Survey and investigation of potable and irrigation water in the desert areas of the country.

In Punjab especially in Thal and Cholistan areas, extensive survey and detailed investigations are proposed for preparation of irrigation and drainage schemes. In Sindh, survey of arid zone of Thar, Kohistan, Nara and Nangar-Parkar areas will be continued. In NWFP, surveys for groundwater development in the barani area and development along the banks of stream/nallahs are proposed to be carried out. In Balochistan and FATA, investigation programme will be continued in different valleys and basins for surface and groundwater development.

Research

50. The broad areas of research on which attention will be given in the Eighth Plan are: (i) snow and ice hydrology in the upper catchment of Indus rivers system, (ii) dams and reservoirs related activities, (iii) river channels/diversion structures, (iv) conveyance system

below distributaries, (v) Watercourse command/farm managed system, (vi) effective utilization of land and water resources, and (vii) special studies like hill torrent management, promotion of water resources research in universities, strengthening of research institutes, rainfall harvesting, groundwater recharging through artificial methods and conjunctive use of flood and groundwater etc.

Financial Allocations

51. The total outlay for the Federal portion of Eighth Plan, amounting to Rs 55.569 billion has been worked out on the basis of throw-forward from the Seventh Plan amounting to Rs 43.973 billion required for completion of the ongoing projects and funds required for programmes of continuous nature like survey, investigation, research, flood control works and small irrigation projects for Special Areas. The bulk of federal share of Rs 38.997 billion goes to Drainage and Reclamation Programme (SCARPs) followed by Irrigation sub-sector for which Rs 13.483 billion have been proposed. Apart from these programmes Rs 2.390 billion have been earmarked for flood control/protection programme and Rs 0.693 billion for Planning and Investigation. Other major ongoing projects/programme like ISRP, OFWM and new irrigation projects to be implemented in the wake of Water Accord will be undertaken by the provincial governments. Detailed break-up of federal financial allocations may be seen at Statistical Appendix Table-III-2.4. Portfolio of projects with financial allocations is attached as Statistical Appendix Table-III-2.5.

Approach to the Ninth Plan 1998-2003

July 1996

Planning Commission
Government of Pakistan

CHAPTER FIVE

Managing Water and Agriculture

International classification places Pakistan's economy among the exporters of manufactures, i.e., the economies whose exports consist of manufactures to the extent of 50 per cent or more. However Pakistan has a significant dependence on commodity exports also Generally, commodity exporters are slow integrators into the international economy. However, productivity-enhancement measures, capacity to increase value-addition, macroeconomic stability and strong institutional and research support enable even a commodity exporter to integrate fast into the world economy and reap the resulting push to economic growth.

Since the green revolution of the sixties, Pakistan's growth performance in agriculture has been impressive. However, the seed-fertiliser technology is now subject to diminishing returns. The limits to cultivable land have also been reached. There are no prospects to augment the supply of irrigation water by any significant amount. When resources are given, as is the case in agriculture, efficient management is the only way to improve productivity and sustain continually higher contributions to growth.

The Ninth Plan will, therefore, focus on the issues of efficient and effective management. This must happen at four levels the farm, the market, the farmer-departmental relationship and the policy level. The critical ares of concern are, in that order, water, land. access to inputs, extension and agricultural marketing. As far as feasible, the market will be the guide for managerial decisions. However, market imperfections will have to be seriously addressed, in particular for greens, fruits and other minor crops to ensure equitable dispensation to growers and consumers. From an overall perspective, the sector policy dichotomy between agriculture and water will have to end. Both sectors must be planned in an integrated framework to optimise the use of water and land - the two most seriously constrained resources.

As water has emerged as the major constraint on agricultural growth, it will have to be dealt with in an integrated framework encompassing a drainage programme, management of floods and hill torrents, besides the lining of water courses and canals. Inherent in the present design and operation of the irrigation system is the compulsion to supply water without taking into consideration the on-ground demand from agriculture sector. Further, what is supplied is not charged its economic price. Further still, whatever is charged is not fully recovered, which tells adversely on the operation and maintenance of the system. All these factors cause delivery efficiency to be as low as one-third of its potential. The fullest exploitation of this potential requires costly investment in drainage, a larger role for the market in pricing of water and a shift from the departmental approach to delivery to a more participatory approach. The strategy in the Ninth Plan will, therefore, concentrate on the launching of a comprehensive National Drainage Programme, movement towards full recovery of the O&M cost and the evolution of an autonomous, commercially oriented but responsive delivery system.

As land has become a critical constraint on agricultural growth, the question of distributive reform is assuming greater significance. A considerable body of evidence exists to support the view that output per unit of land has an inverse relationship with the size of holding. Implementing land reform is, however, another matter. The two earlier land reforms are cases in point. In any case, land reform is not the only means to achieve the objective of higher agricultural productivity. An undistorted land market, a scrupulous implementation of the laws against eviction in the 1972 land reform and effective re-direction of incentives-structure of official policies towards smaller farms are some of the measures envisaged for ensuring better utilisation of available land in the Ninth Plan. Consideration will also be given to lease marginal and waste lands to the educated unemployed to become farmers after undergoing crash training programmes.

Lastly, the Ninth Plan will prepare for the withdrawal of the state from fixing the prices of agricultural outputs and inputs and pay more attention to extension services and their research base. However, leaving the prices of agriculture free will be predicated by its contribution to national exchequer in proportion to its ability to pay. Agricultural income and wealth taxes will be high on the agenda during the Ninth Plan.

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7．収集資料リスト

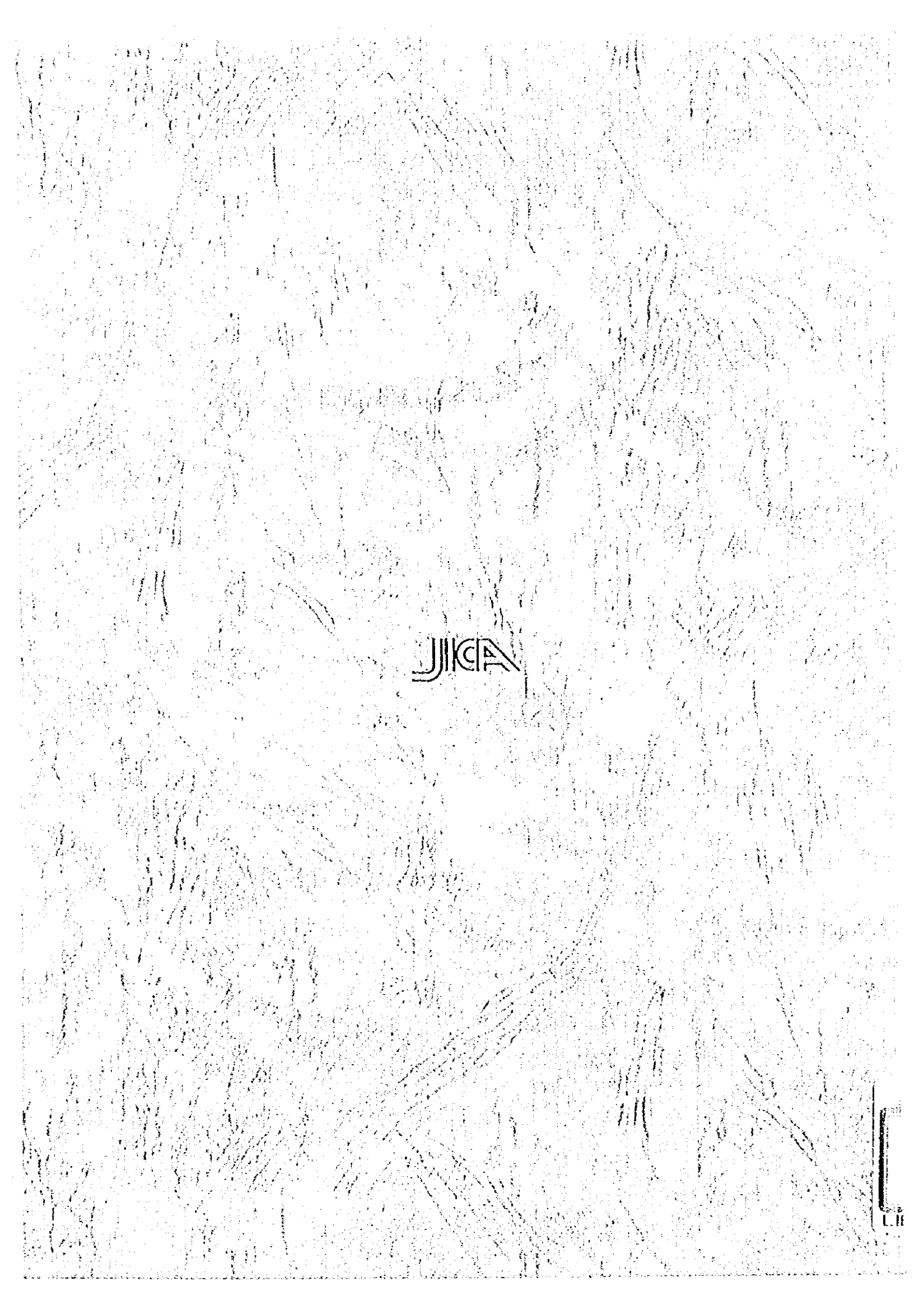
クウンサ堰概要書
クウンサ堰設計図
堰ゲート構造図
クウンサ堰基礎構造図（現地管理所にあることを確認）
揚圧力検知管配置図

クウンサ堰流下流量変動図（1995／1996年）
クウンサ堰流下流量の年間最大値（1962～1996年）
クウンサ堰流下流量計算式等、設計基礎資料

D.G.カーン取水工図面
ムザファルガー取水工図面
T.P.リンク取水工図面
D.G.カーン取水工取水パターン図（1995／1996年）
ムザファルガー取水工取水パターン図（1995／1996年）
T.P.リンク取水工取水パターン図（1995／1996年）

D.G.カーン水路内シルトイジェクター（渦動排砂管）平面図
D.G.カーン水路内堆砂地形測量縦断図

堰上下流水位測定データ（現地管理所にあることを確認）
揚圧力検知管測定データ（現地管理所にあることを確認）
D.G.カーン水路内、D.G.カーン取水工、D.G.カーン側土砂吐水路内の浮遊砂濃度測定データ（現地管理所にあることを確認）
D.G.カーン水路内、D.G.カーン取水口、D.G.カーン側土砂吐水路内の流砂粒径と各粒径の比率を測定したデータ（現地管理所にあることを確認）
パキスタン国灌漑システム概要書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