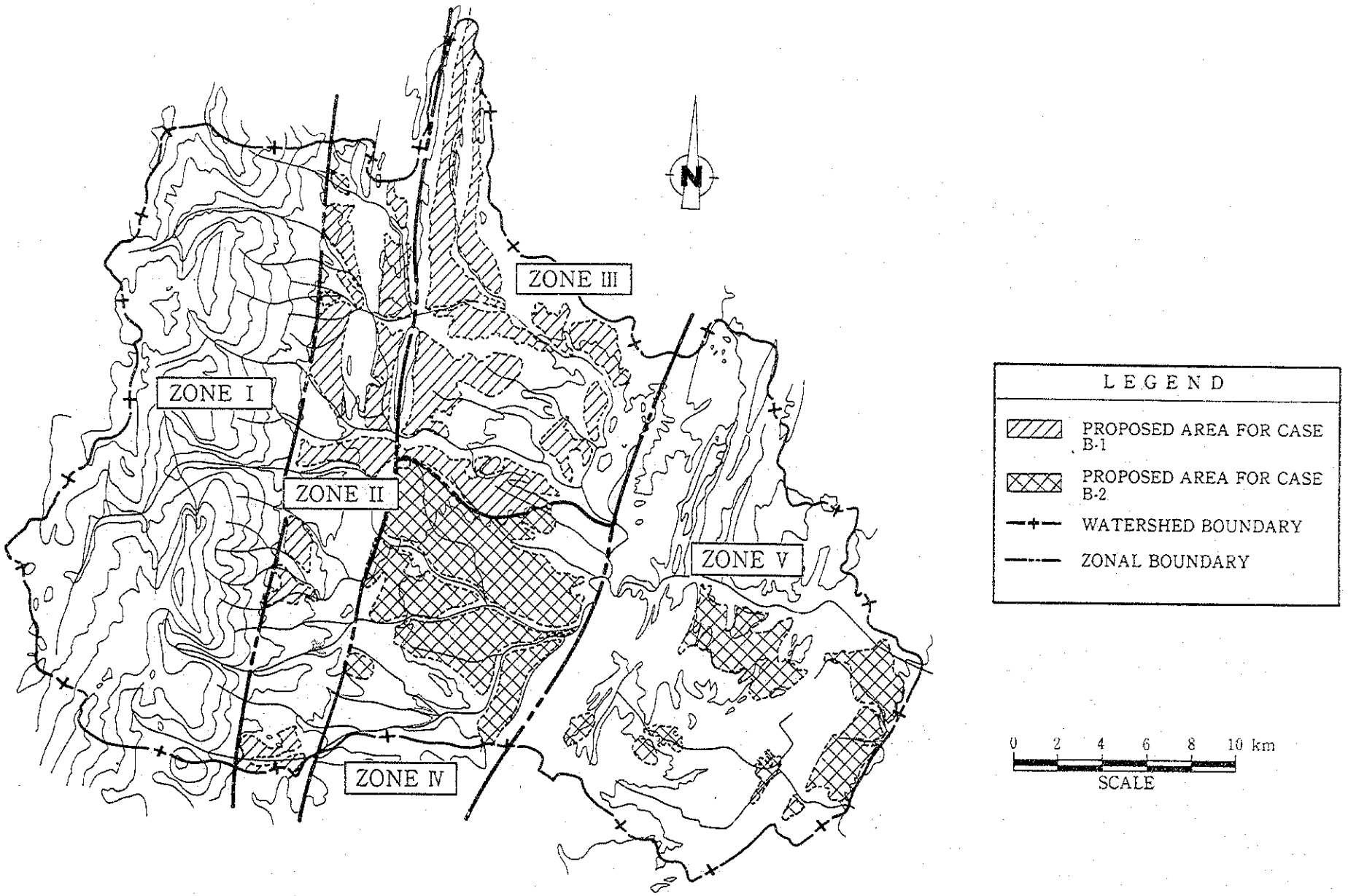
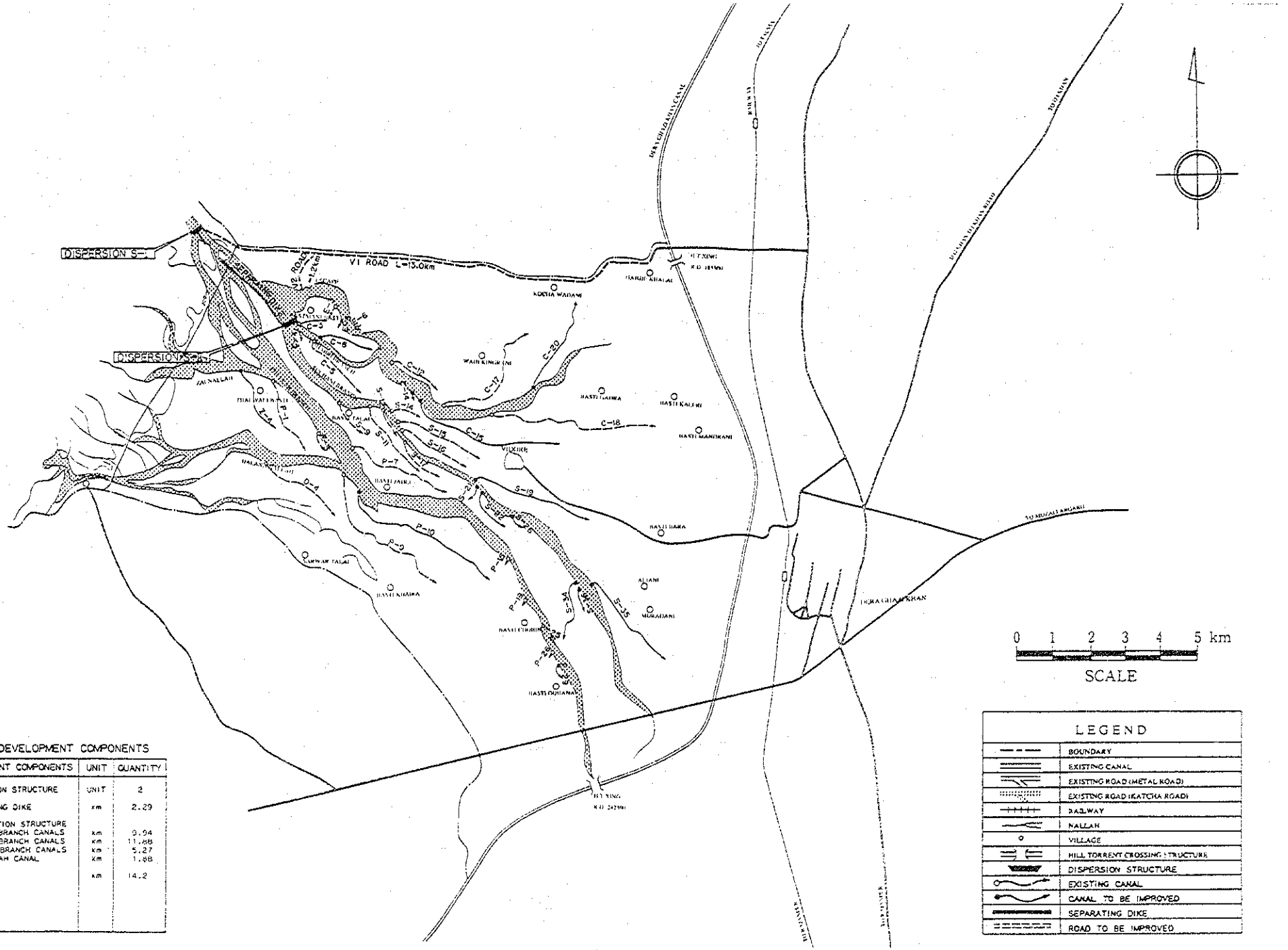


FIGURE 6.6 GENERAL PLAN FOR THE WATERSHED MANAGEMENT



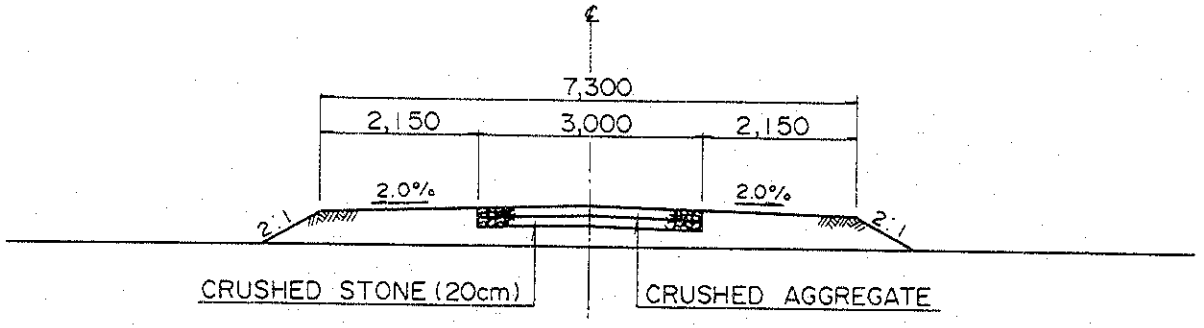
MAJOR DEVELOPMENT COMPONENTS

DEVELOPMENT COMPONENTS	UNIT	QUANTITY
1. DISPERSION STRUCTURE	UNIT	2
2. SEPARATING DIKE	km	2.29
3. DISTRIBUTION STRUCTURE		
CHHABRI BRANCH CANALS	km	9.94
SUCHANI BRANCH CANALS	km	11.68
PHULLAR BRANCH CANALS	km	5.27
ZAI NALLAH CANAL	km	1.88
4. ROAD	km	14.2

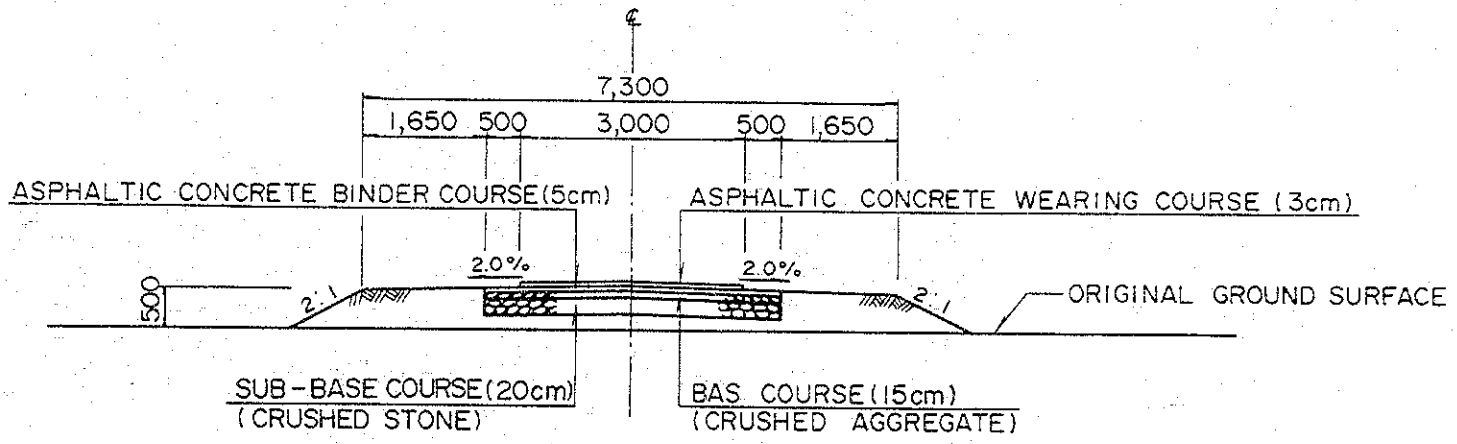
LEGEND

	BOUNDARY
	EXISTING CANAL
	EXISTING ROAD (METAL ROAD)
	EXISTING ROAD (KATCHA ROAD)
	RAILWAY
	NALLAH
	VILLAGE
	HILL TORRENT CROSSING STRUCTURE
	DISPERSION STRUCTURE
	EXISTING CANAL
	CANAL TO BE IMPROVED
	SEPARATING DIKE
	ROAD TO BE IMPROVED

FIGURE 6.7 GENERAL PLAN OF STUDY AREA



Gravel Pavement



Asphalt Pavement

FIGURE 6.8 TYPICAL CROSS SECTION OF ROAD

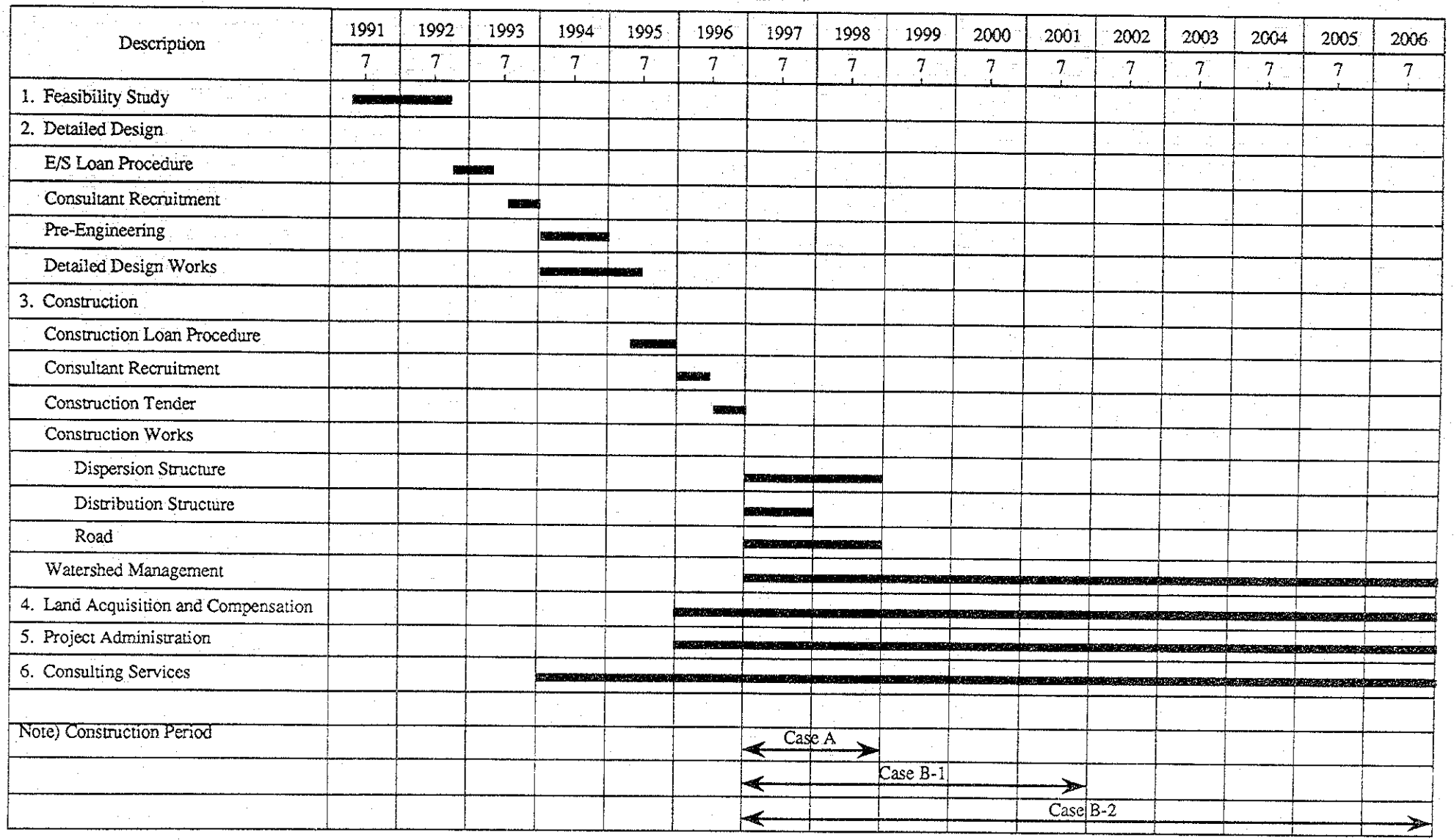


FIGURE 7.1 IMPLEMENTATION PROGRAM FOR THE PROJECT

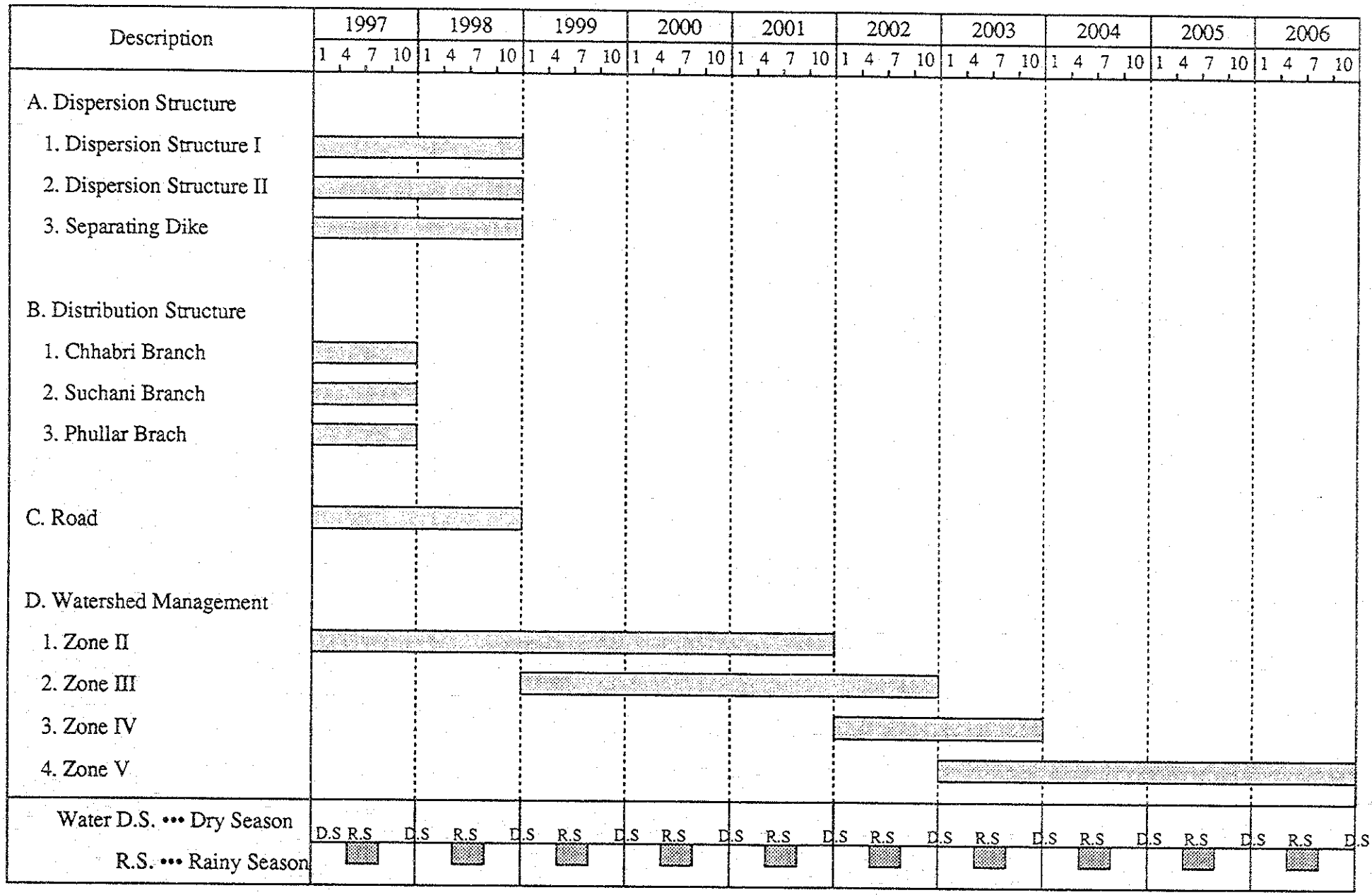


FIGURE 7.2 CONSTRUCTION SCHEDULE

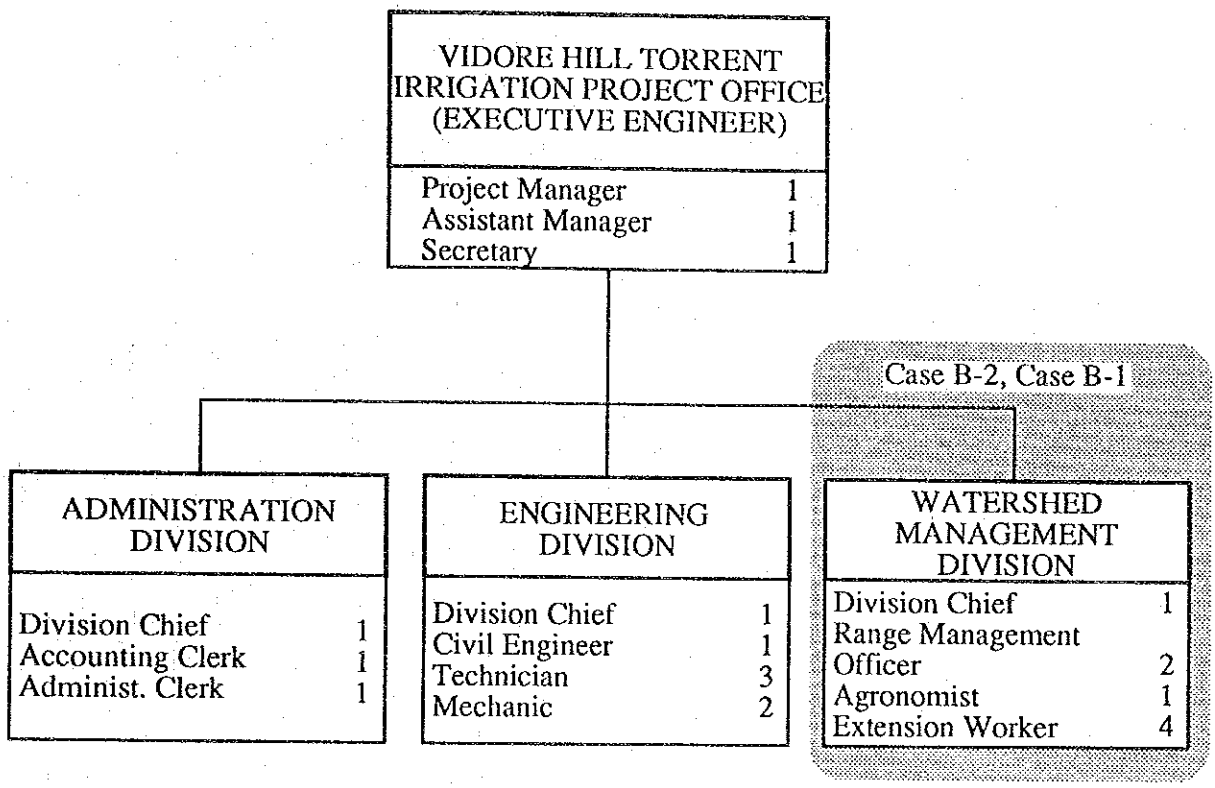


FIGURE 7.3 PROPOSED ORGANIZATION OF PROJECT IMPLEMENTATION

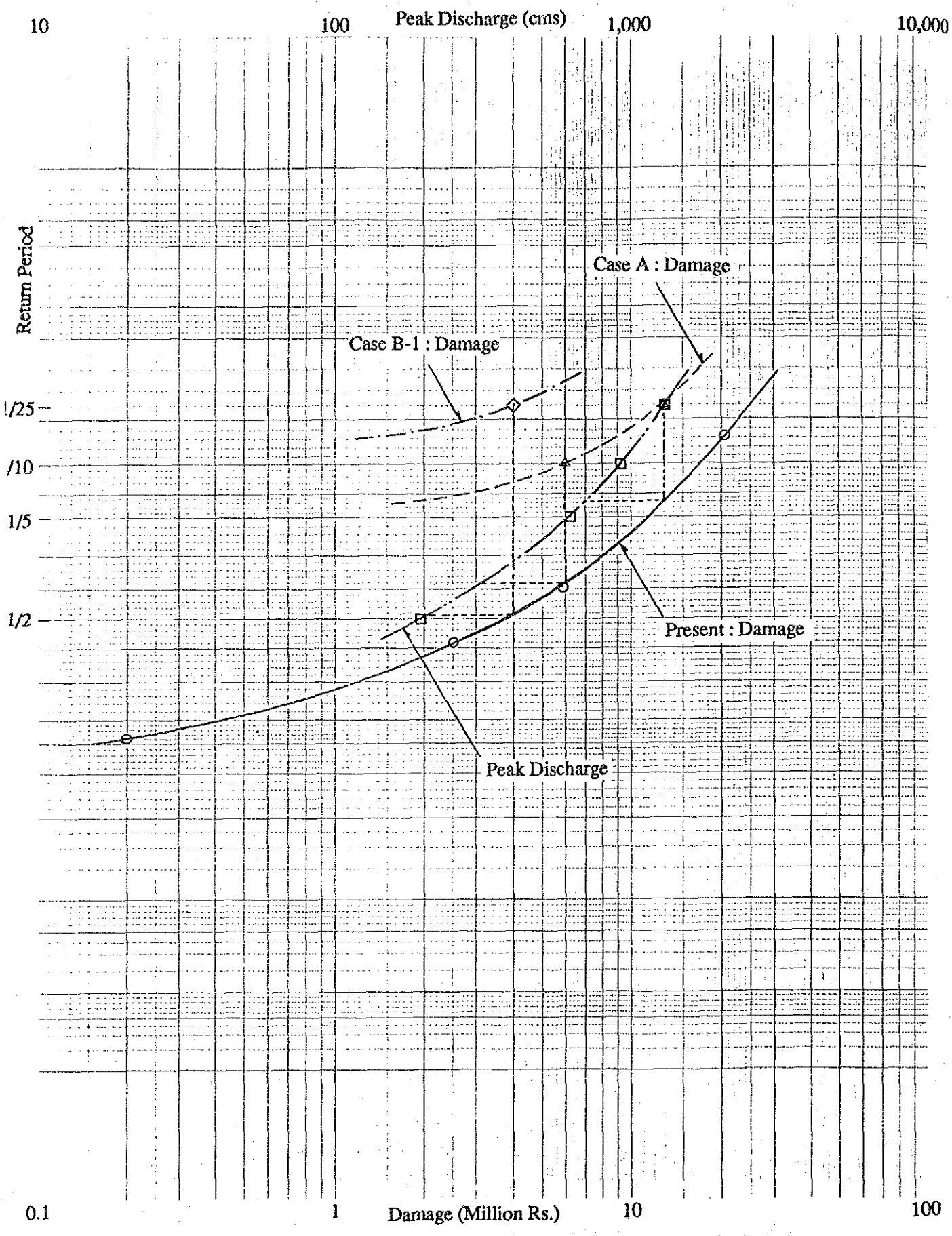


FIGURE 8.1 PLANNED FLOOD DAMAGE

添付資料

SCOPE OF WORK
FOR
THE FEASIBILITY STUDY
ON
DEVELOPMENT OF IRRIGATION BASED UPON FLOOD
FLOWS OF D. G. KHAN HILL TORRENTS

AGREED UPON BETWEEN
THE GOVERNMENT OF ISLAMIC REPUBLIC OF PAKISTAN
AND
THE JAPAN INTERNATIONAL COOPERATION AGENCY

ISLAMABAD, 29TH AUGUST 1990

ASIF H. KAZI
CHIEF ENGINEERING ADVISOR/
CHAIRMAN,
FEDERAL FLOOD COMMISSION,
MINISTRY OF WATER AND POWER,
THE GOVERNMENT OF PAKISTAN

SUMIO KONDO
LEADER,
THE PRELIMINARY STUDY TEAM,
THE JAPAN INTERNATIONAL
COOPERATION AGENCY

RANA KHURSHID ANVER
SECRETARY, IRRIGATION AND
POWER DEPARTMENT,
THE GOVERNMENT OF PUNJAB

I . INTRODUCTION

In response to the request of the Government of the Islamic Republic of Pakistan, the Government of Japan has decided to undertake the feasibility study on Development of Irrigation Based upon Flood Flows of D.G. Khan Hill Torrents (hereinafter referred to as "the Study") in accordance with the relevant laws and regulations in force in Japan.

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

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 formulate the Feasibility Study on Development of Irrigation Based upon Flood Flows of D. G. Khan Hill Torrents

2. to undertake on-the-job training of the Government's officials in the course of the study

III. STUDY AREA

The Study area is to cover hill torrents at D. G. Khan and Rajanpur Districts of Punjab Province.

IV. SCOPE OF THE STUDY

In order to achieve the above objectives, the Study will cover the following items.

PHASE I STUDY

1. Collection and review of the relevant existing data and information, and field survey including:

(1) Natural condition
   a. Topography
   b. Meteorology and hydrology
   c. Geology and soil
   d. Others

(2) Agriculture
   a. Land use and tenure
   b. Cropping pattern and yield
   c. Agro-economy and institution
   d. Others

(3) Agricultural infrastructure
   a. Irrigation and drainage
   b. Farm road
   c. Other rural infrastructure

(4) Socio-economic situation
   a. Population, household and farmers
   b. Regional socio-economy and farm household economy
   c. Extension services
   d. Social and farmers organizations
   e. Agricultural credit
   f. Farmers' intension
   g. Historical right for irrigation
   h. Others

(5) Other information related to the project
   a. Administrative organizations related to the project
   b. Environmental impact
   c. Others

2. Review of all hill torrent programme, excluding Kaha hill torrent.

3. Identification of the project priority, excluding Kaha and Mithawan hill torrents.

PHASE II STUDY

1. Feasibility Study of First priority project
   The Study, based on the results of the phase I Study, covers the following items:

(1) Additional field survey, data collection and analysis including;

a. Hydrology and meteorology
b. Geology and soil classification
c. Land use and tenure
d. Cropping pattern and yield
e. Irrigation and drainage
f. Inundation problem; flood damage
g. Water requirement for crop and domestic use.
h. Regional socio-economy and farm household economy
i. Social and farmers organizations
j. Construction materials
k. Environment
l. Others

(2) Formulation of an agricultural development programme based upon the sound measures for the management of hill torrent floods.

(3) Preliminary design of the major structures of the project including supplementary topographic survey

(4) Preparation of the implementation schedule

(5) Estimate of the project costs and benefits

(6) Recommendation

V. THE STUDY SCHEDULE

The Study will be carried out in accordance with the tentative schedule attached.

VI. REPORTS

JICA will prepare and submit the following reports in English to the Government of Pakistan.

1. Inception Report
   Thirty (30) copies at the commencement of the phase I Study.
2. Progress Report(I)
   Thirty (30) copies at the end of the field work of the phase I Study.
3. Interim Report
   Thirty (30) copies at the commence of the phase II Study.
4. Progress Report(II)
   Thirty (30) copies at the end of the field work of the phase II Study.
5. Draft Final Report
   Thirty (30) copies within one (1) month after the end of the phase II Study.
   The Government of Pakistan shall provide its comments on the Draft Final Report within one (1) month after its reception.
6. Final Report
   Hundred (100) copies within two (2) months after the recept of the comments on the Draft Final Report.

VII. UNDERTAKING OF THE GOVERNMENT OF PAKISTAN

1. To facilitate smooth conduct of the Study, the Government of Pakistan shall take necessary measures:

   (1) to secure the safety of the Study Team,
   (2) to permit the members of the Japanese Study Team, to enter, leave and sojourn in Pakistan for the duration of their assignment therein, and exempt them from 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 Pakistan for the conduct of the Study.

(4) to exempt the members of the Japanese Study Team from income tax and other charges of any kind imposed on or in connection with any emoluments or allowance 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 remittances as well as utilization of the funds introduced into 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 conduct of the Study, according to prevailing regulations of the Government of Pakistan.

(7) to secure permission to use all data and documents related to the Study including photographs (excluding restricted area) in Japan.

(8) to provide medical services as needed. Its expenses will be chargeable on the members of the Japanese Study Team.

2. The Government of Pakistan will bear claims, if any arises, against the members of the Japanese Study Team resulting from, occurring in the course 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. Irrigation and Power Department, the Government of Punjab (here in after referred to as "the Department") shall act as a counterpart agency to the Japanese Study Team and also as a coordinating body to other relevant organizations for the smooth implementation of the Study.

4. The Department shall, at its own expense, provide the Japanese Study Team with the following, in cooperation with other agencies concerned, if necessary:

(1) Available data and information related to the Study

(2) Counterpart personnel

(3) Suitable office with necessary equipment and furniture

(4) Credentials or identification cards to the members of the Japanese Study Team.

Ⅷ. 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 Pakistan.
2. To pursue technology transfer to the Pakistani counterpart personnel in the course of the Study.

Ⅸ OTHERS

JICA and Ministry of Water and Power of Pakistan will consult with each other in respect of any matter that may arise from or in connection with the Study.

MINUTES OF MEETING

THE FEASIBILITY STUDY ON DEVELOPMENT OF IRRIGATION BASED UPON FLOOD FLOWS OF D. G. KHAN HILL TORRENTS

ISLAMABAD, 29TH AUGUST 1990

ASIF H. KAZI
CHIEF ENGINEERING ADVISOR/
CHAIRMAN,
FEDERAL FLOOD COMMISSION,
MINISTRY OF WATER AND POWER,
THE GOVERNMENT OF PAKISTAN

SUMIO KONDO
LEADER,
THE PRELIMINARY STUDY TEAM,
THE JAPAN INTERNATIONAL
COOPERATION AGENCY

RANA KHURSHID ANVER
SECRETARY,
IRRIGATION AND POWER DEPARTMENT,
THE GOVERNMENT OF PUNJAB

APPENDIX

TENTATIVE SCHEDULE

Item \ Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
WORK IN PAKISTAN		▬	▬	▬					▬	▬	▬	▬			▬	◎		
WORK IN JAPAN	▭					▭	▭	▭	▭				▭	▭				
REPORTS	△ INC/R			△ P/R (I)					△ INT/R			△ P/R (II)			△ DF/R			△ F/R

(Remarks) INC/R : Inception Report P/R : Progress Report

INT/R : Interim Report DF/R : Draft Final Report

F/R : Final Report

◎ Comments on DF/R by Pakistan side

1. The Preliminary Survey Team for the Feasibility Study on Development of Irrigation Based upon Flood Flows of D. G. Khan Hill Torrents (hereinafter referred to as"the Study"), headed by Mr Sumio Kondo and organised by the Japan Internatinal Cooperation Agency (hereinafter referred to as"JICA"), visited Pakistan from 20 August 1990 to 31 August 1990 in order to clarify further the request made by the Government of Islamic Republic of Pakistan, and to discuss the draft Scope of Work for the Study proposed by the Team.

2. The Team exchanged views and had a series of discussions with the Ministry of Water and Power of Pakistan (hereinafter referred to as"MWP") and conducted a field survey in the study area.

3. MWP and the Team agreed to the following matters:

   a. MWP requested JICA to provide necessary vehicles for the Study. The Team confirmed to convey this request to JICA for the further consideration.
   b. Punjab Irrigation Department confirmed to provide one set of topographic maps (1:50,000) in whole Study area before the commencement of the Study.
   c. Mithawan hill torrent is not to be prioritized because it has already been given priority by Punjab Government.
   d. Kaha hill torrent is not to be studied because it is included in ADB programme.
   e. The Team recommended that officials in agricultural sector from Punjab Agricultural Department should be involved in this Study. Necessary coordination in this respect should be carried out through Punjab Irrigation Department.

4. The list of officials attending the discussions is attached in Annex.

Japanese side

I. The Preliminary Study Team

1.	Mr. Sumio KONDO	Leader
2.	Mr. Tetsuro MIYAZATO	Member
3.	Mr. Satoshi NAGATA	〃
4.	Mr. Yoshiaki TSUJI	〃
5.	Mr. Katsumi OTANI	〃

II. Embassy of Japan

1.	Mr. Yutaka SUMITA	First Secretary

III. JICA Pakistan Office

1.	Mr. Kazuo TANIGAWA	Resident Representative

PAKISTAN SIDE

1. Maj. Gen. (Retd.)
Agha Manzoor Rauf
Additional Secretary (W),
Ministry of Water and Power.

3. Mr. Asif H. Kazi,
Chief Engineering Adviser/Chairman,
Federal Flood Commission.

3. Mr. I.B. Sheikh,
Chief Engineer (Flood).

4. Mr. Akbar Hayat Gandpur
Deputy Secretary, M/o Commerce.

5. Mr. Muhammad Raziq,
Deputy Secretary, M/o Interior.

6. Syed Zaki Haider,
Deputy Financial Adviser (W&P).

7. Malik Ahmad Khan,
Director Kalabagh,
I&P Deptt. Punjab.

8. Mr. Mumtaz Ahmad,
Section Officer, M/o Water & Power.

9. Mr. R.K. Anver,
Secretary , I&P Deptt. Punjab.

10. Mr. Khalid Javed,
Section Officer, Economic Affairs Division.

MINUTES OF MEETING

ON

INCEPTION REPORT

OF

THE FEASIBILITY STUDY

ON

DEVELOPMENT OF IRRIGATION BASED

UPON FLOOD FLOWS OF D.G. KHAN HILL TORRENTS

Lahore, May 8th, 1991

AHSAN HUSSAIN ZAIDI
ADDL: SECRETARY,
IRRIGATION & POWER DEPTT:
GOVERNMENT OF PUNJAB.

NORIKAZU TSUJII
CHAIRMAN
ADVISORY COMMITTEE
FOR THE STUDY,
THE JAPAN INTERNATIONAL
COOPERATION AGENCY

I. G. 8/5/91

ILLAHI B. SHEIKH
CHIEF ENGINEER (FLOODS)
FEDERAL FLOOD COMMISSION,
MINISTRY OF WATER & POWER,
THE GOVERNMENT OF PAKISTAN.

TADASHI OHORI
LEADER,
THE STUDY TEAM.

MEETING ON THE INCEPTION REPORT

Date: May 8th, 1991

Place Irrigation & Power Department, Government of the Punjab.

Attendants As per Annex:

In accordance with the scope of works for the feasibility study on development of Irrigation based upon Flood Flows of D.G. Khan Hill Torrents (hereinafter referred to as "the study"), signed on August 29th, 1990 between the Japan International Cooperation Agency (hereinafter referred to as "JICA") and the Govt. of Pakistan, the JICA Study Team prepared and submitted the Inception Report to the Irrigation & Power Department of the Govt. of Punjab through the Ministry of Water & Power, Govt. of Pakistan, on May 2nd, 1991 prior to the commencement of the study.

The meeting was held on May 8th, 1991, for the discussion on the Inception Report. Both parties have mutually confirmed the followings :

1. The Inception Report of the study was accepted by both, Ministry Water & Power (Federal Flood Commission) and Irrigation and Power Department, Punjab.
2. The study team requested the Irrigation & Power Department (Punjab) to provide/supply the available data of the Hill Torrents with the Department and with WAPDA. The request was agreed to by the Department as well as by the Federal Flood Commission (Islamabad).

LIST OF ATTENDANTS

	Name	Position/Department
1.	Mushtaq Ahmad Gill	Director on Farm Water Management, Agriculture Department.
2.	Zaka Ullah	Chief, Planning, Agriculture Deptt:
3.	Malik Ahmed Khan	Chief (W&P), R&D Deptt: Govt. of the Punjab.
4.	Tariq Bashir Dar	Deputy Secretary (Development) Irrigation & Power Department.
5.	Muhammad Iqbal	Chief Engineer, Irrigation, Multan.
6.	I.B. SHEIKH	Chief Engineer(Federal Flood Commission) Ministry Water & Power, Islamabad.
7.	A.H. Zaidi	Addl: Secretary, Irrigation & Power Department.
8.	Norikazu Tsujii	Chairman of Advisory Committee, JICA
9.	Mitsubiko Ota	Coordinator of Advisory Mission, JICA
10.	Tadanbi Chori	Team leader of JICA Study Team
11.	Motoo Taki	Irrigation & Drainage
12.	Shigeru Kimura	Watershed Management
13.	Olivier Daniel Serrat	Agro-Economy & Project Evaluation
14.	Qazi Anwar Ali	Under Secretary, Irrigation & Power Department.
15.	Fazl-ul-Hassan	Deputy Director, P&R Zone Representing Chief Engineer P&R Zone.
16.	Sajjad Nasim	Executive Engineer, Rajanpur Canal Division, D.G. Khan.

MINUTES OF THE MEETING
HELD ON
OCTOBER 8, 1991 IN THE
IRRIGATION AND POWER DEPARTMENT
GOVERNMENT OF PUNJAB,
LAHORE.

In response to the request of the Government of the Islamic Republic of Pakistan, the Government of Japan decided to under take the Feasibility Study for Development of Irrigation based upon flood flows of D.G.Khan hill torrents. Accordingly the Japan International Cooperation Agency (JICA) was instructed to despatch a study team to undertake the said study.

The Team has now completed phase-I of the study and as stipulated in the acope of works for the study presented this day to the Federal Flood Commission, Ministry of Water and Power Government of Pakistan, and to the Irrigation and Power Department, Government of Punjab, thirty(30) copies of Progress Report(1). A brief explanation of the study area and project strategy was given using satellite pictures by the Team Leader.

The Ministry of Water and Power, Government of Pakistan, and the Irrigation and Power Department, Government of Punjab, acknowledged reception of the said report, discussed its contants, and agreed to the proposed program Presented in the Report.

The Team took careful note of the points raised in the course of the discussion and requested the Irrigation and Power Department to facilitate the smooth conduct of phase-II for the study, scheduled to begin from January 1992, and provide the Team with the Aerial

Contd...P/2.

Photographs for the Phase-II.

RANA KHURSHEED ANVER,
SECRETARY,
IRRIGATION AND POWER DEPARTMENT
GOVERNMENT OF PUNJAB, LAHORE.

TADASHI OHORI
TEAM LEADER
JICA STUDY TEAM

AHSAN HUSSAIN ZAIDI,
ADDITIONAL SECRETARY,
IRRIGATION AND POWER DEPARTMENT,
GOVERNMENT OF PUNJAB, LAHORE.

...

LIST OF ATTENDANTS

	Name	Position/Department
1.	Rana Khurshid Anver	Secretary, Irrigation & Power Department.
2.	A.H. Zaidi	Addl. Secretary, Irrigation & Power Department.
3.	Qazi Anwar Ali	Under Secretary, Irrigation & Power Department.
4.	Tariq Bashir Dar	Deputy Secretary, Irrigation & Power Department.
5.	Mahammad Dilpazer	O.S.D Irrigation & Power Department.
6.	M. Arif Khan	S.E(flood) Water & Power, Islamabad
7.	S.M. Ilyas	Superintending engineer, D.G.Khan
8.	Sajjad H. Nassim	XEN JMP Constructino Division, D.G.Khan
9.	Tahir Ahmad Malial	Principal Punjab Engineering Academy
10.	Tadashi Ohori	Team Leader of JICA Study Team
11.	Motoo Taki	Irrigation & Drainage
12.	Kunihiko Ohno	Agronomy
13.	Akira Kotou	Soil & Land Use
14.	Atushi Kikuoki	Meteorology & Hydrology
15.	Olivier Daniel Serrat	Agro economy & Project Evaluation
16.	Yoichi Kishi	Watershed Management
17.	Kenichi Takase	Assistant Engineer

MINUTES OF MEETING

ON

INTERIM REPORT

OF

THE FEASIBILITY STUDY

ON

DEVELOPMENT OF IRRIGATION BASED

UPON FLOOD FLOWS OF D.G.KHAN HILL TORRENTS

LAHORE, JANUARY 14TH, 1992.

AHSAN HUSSAIN ZAIDI
ADDL.SECRETARY,
IRRIGATION & POWER DEPTT.
GOVERNMENT OF PUNJAB.

TSUJII NORIKAZU
CHAIRMAN
ADVISORY COMMITTEE
FOR THE STUDY,
THE JAPAN INTERNATIONAL
COOPERATION AGENCY

MR.RIAZUL HAQ SHEIKH
CHIEF ENGINEER (DRAINAGE &
FLOODS) IRRIGATION & POWER
DEPARTMENT, GOVERNMENT OF
THE PUNJAB.

TADASHI OHORI
LEADER,
THE STUDY TEAM.

MEETING ON THE INTERIM REPORT

DATE JANUARY 14TH, 1992.

PLACE: IRRIGATION & POWER DEPARTMENT
GOVERNMENT OF THE PUNJAB.

ATTENDANTS: AS PER ANNEX.

In accordance with the scope of work for the feasibility study on development of Irrigation based upon Flood Flows of D.G.Khan Hill Torrents signed on August 29th, 1990 between the Japan International Cooperation Agency(JICA) and the Government of Pakistan, the JICA Study Team prepared and submitted the Interim Report to the Irrigation & Power Department of the Government of the Punjab, on January 09th, 1992 prior to the commencement of the Phase II of the study.

The meeting was held on January 14th, 1992, for the discussion on the Interim Report. Both parties have mutually confirmed the followings :

1. The Interim Report of the study was accepted by Irrigation & Power Department, Punjab.
2. The Chairman of Supervisory Committee explained that the Interim Report had also been aggreed upon by the Committee.
3. It was suggested by the Director General of Agriculture Department that the Feasibility Study may also include provisions for Agricultural Management such as improvement of Agricultural practices, cropping patterns and establishment of demonstration Farms so as to educate farmers.
4. The JICA Team Leader acknowledged the importance of on-Farm Management of Agriculture Practices in the Project Area but elaborated that Ist priority of the Study should be given to the Flood Water Management, which will provide assured water supply to the farmers ultimately developing confidence among them to adopt improved agricultural practices.
5. The Mithawan Pilot Project was also discussed among participants:

   i) It was advised by the Committee to replace the proposed construction of large scale check dams with low check dams, and also to include the

Contd.....P/2.

experimental provisions for vetiver grass application to watershed management within the scope of Mithawan Pilot Project.

ii) The Chief Engineer, Drainage & Flood Zone, suggested the importance of management and monitoring of the project activities since it is a Pilot Project.

iii) It was then agreed by the participants to revise the project components of Mithawan Pilot Project so as to replace large check dams with low check dams,and to include experimental provisions for vetiver grass and also monitoring activities within the scope of experimental provisions.

LIST OF PARTICIPANTS.

	Name	Position
A.	**Irrigation & Power Deptt.Punjab.**	
	1. Mr. A. H. Zaidi	Additional Secretary.
	2. Mr. Riaz Ul Haq.	Chief Engineer, D&F.
	3. Rana M. Akhtar Chehan.	Chief Engineer,P&R Zone.
	4. Mr. Tariq Bashir Dar.	Deputy Secretary(Development).
	5. Mr.Muhammad Dilpazir.	Officer on Special Duty.
	6. Qazi Anwar Ali.	Under Secretary(Floods)
	7. Mr.Sajjad H.Hasim.	Executive Engineer Jampur. Construction Division,D.G.Khan.
B.	**Planning and Development Department.**	
	1. Mr.Abdul Hafeez.	Assistant Chief(Water & Power).
C.	**Agriculture Department.**	
	1. Mr.Mushtaq A Gill.	Director General Agri W.M.Pb.
D.	**Supervisory Committee /JICA.**	
	1. Mr. Norikazu Tsujii.	Leader.
	2. Mr. Yoshimi Katsumata.	Co-Ordinator (JICA,H.Qs).
E.	**JICA Study Team.**	
	1. Tadashi Oheri.	Team Leader.
	2. Motoo Taki.	Irrigation & Drainage.
	3. Atsushi Kikuoki	Hydrology.

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MINUTES OF MEETING

ON

PROGRESS REPORT

OF

THE FEASIBILITY STUDY

ON

DEVELOPMENT OF IRRIGATION BASED
UPON FLOOD FLOWS OF D.G. KHAN
HILL TORRENTS

AHSAN HSSAIN ZAIDI
ADDITIONAL SECRETARY
IRRIGATION & POWER DEPARTMENT
GOVERNMENT OF THE PUNJAB

TADASHI OHORI
LEADER
THE STUDY TEAM
JICA

MEETING ON THE PROGRESS REPORT-II

DATE: MARCH 17TH, 1992.

PLACE: IRRIGATION & POWER DEPARTMENT
GOVERNMENT OF THE PUNJAB.

ATTENDANTS: AS PER ANNEX.

In accordance with the scope of work for the feasibility study on development of Irrigation based upon Flood Flows of Dera Ghazi Khan Hill Torrents signed on August 29th, 1990 between the Japan International Cooperation Agency (JICA) and the Government of Pakistan, the JICA Study Team prepared and submitted thirty (30) copies of the Progress Report (II) to the Irrigation & Power Department of the Government of Punjab, on March 17th, 1992.

The meeting was held on March 17th, 1992 for the explanation on the Progress Report (II). Both parties have mutually confirmed the followings:

i. The progress report (II) of the Project was accepted by Irrigation & Power Department Punjab.

ii. The Team Leader of the consultants study team explained the different parameters of the detailed progress report (II).

iii. It was suggested by the Irrigation and Power Department that the water rights as existing under Minor Government Act of 1905 should not be disturbed. The dispersion structures should be designed as per share of each branch as described in the said act.

Contd...P/2

iv. Efforts should be made to introduce the local grasses in the water shed area. For this purpose the agencies working on such Projects in Pakistan may be consulted.

ANNEXURE

LIST OF PARTICIPANTS.

Sr.No.	NAME	POSITION.
	A. IRRIGATION & POWER DEPARTMENT, PUNJAB.	
1.	Mr. Rana Anver	Secretary.
2.	Mr. A. H. Zaidi	Additional Secretary
3.	Mr. Muhammad Dilpazir	Officer on Special Duty
4.	Mr. Malik Ahmed	Chief (Water & Power)
5.	Mr. Qazi Anwar Ali	Under Secretary (Floods)
6.	Mr. Muhammad Zarif	Director Floods
7.	Mr. Muhammad Ilyas	S.E. Derajat
	B. AGRICULTURE DEPARTMENT.	
1.	Mr. Zaka Ullah	Chief (Planning)
2.	Mr. Mushtaq Ahmed Gill	Director General Agriculture (Water Management)
	C. JICA STUDY TEAM.	
1.	Tadashi Ohori	Team Leader
2.	Motoo Taki	Irrigation & Drainage Asst. Team Leader
3.	Kunihiko Ohno	Agronomy
4.	Motoyoshi Yamada	Agro-economy & Project Evaluatio
5.	Fumihiko Komada	Design & Cost Estimate
6.	Yoichi Kishi	Watershed Management

＜ICRISAT におけるベティベル草の資料収集に関する報告書＞

1．目的

インド・ハイデラバードにある ICRISAT（INTERNATIONAL CROP RESEARCH INSTITUTE FOR SEMI-ARID TROPICS）においてベティベル草及び流域保全に関する資料を収集する。

2．調査期間

平成４年３月５日～平成４年３月１１日

3．行程

月　日（曜日）	行　　程
３月５日（木）	カラチ～ボンベイ（PK274）
	ボンベイ～ハイデラバード（IC617）
３月６日（金）	ICRISAT にて資料収集
３月７日（土）	資料整理
３月８日（日）	休日
３月９日（月）	ICRISAT にて資料収集
３月10日（火）	ICRISAT にて資料収集
	ハイデラバード～デリー（IC458）
３月11日（水）	デリー～バンコク（TG915）
	バンコク～成田（TG640）

4．主な面談者と面談内容

(1) Dr.A.L.COGLE : Resource Management Project/Vetiver grass 担当者

① ICRISAT におけるベティベル草研究の概要

- 現在７年目：Dr.SMITH(3年)、Dr.YULE(3年)、Dr.COGLE(3年契約の1年目)
- 処理は 0.6%, 2.8% の２種類の傾斜 x control, 石積み, レモン草, ベティベル草の４種類を比較している。
- 人工降雨を降らせ、流出量、土壌侵食量などを測定している。
- Dr.COGLE は Inter-bund に作物、牧草を植えることが重要であると考えている。
- 別添写真のようなナーサリーを作って苗を増やしている。

② 収集資料

- 前任者 の Dr.YULE の２論文を入手した。また、別添リストの資料も入手した。
- ベティベル草サンプルを入手した。

③ D.G.KHAN 地区での使用について

- 筆者滞在中は前々人者の Dr.SMITH が Dr.COGLE を訪問中であったため、あまり詳しい話が聞けなかったので、INTERIM REPORT を渡して後日のコメントをお願いした。そのコメントによると、D.G.KHAN のような降雨の少ないところではベティベル草の活着や生育(establishment)が遅いことが予測されるため、石積み(stone bund)も検討してみるべきだという返事だった。

(2) Dr.K.K.Lee : Resource Management Project/soil group の 前リーダー)

① ベティベル草について

- Erosion control としての効果はある。
- 縦に伸びる、横には増えない。
- 種では増えない＝雑草にはならない。ナーサリー管理が必要。
- 栄養分いらない。
- 乾燥に強い。
- World Bank がフィジー諸島で20年ぐらいやり、Soil Erosion Control の良い方法として推薦している。
- インドではどこにでもある。

② ベティベル草の問題点

- 家畜の飼料にならない＝農民がやりたがらない。
  同様の目的で飼料になるものがある(例: Punicum maximum)。
- 寄生植物ストライガ(Striga spp.): millet, sorghum につく寄生植物で
  ベティベル草につく場合もある。（相手が生きている限りは生きている。）

③ その他

- 全体の感じでは、動物が食べるとしても他の草でもいいような気がする。
  (＝ベティベル草にそれほどこだわる必要はない。)
- 石積みよりもベティベル草の方がよい。
  (＝石積みでは草ほど土砂が止まらない。)
- CRIDA(Central Research Institute for Dryland Agriculture) は ICRISAT
  よりも農民に近いことをやっている。

(3) Dr.Subba Reddy/CRIDA(Central Research Institute for Dryland Agriculture)

① Vegetative method は比較的低コストでできるが、問題はメンテナンスで農民の協力が重要である。

② 植え方:

- 10cm plant distance, 10cm row distance X 2 rows.
- ある種のホルモンを使うと活着がよい。
- 植栽時期：６月では90%成功するが、７－８月では50-60%。

③ 作物への影響

- drought spell が長い場合、水分や養分を作物と競合するため、３列目まで影響する。
- そのためベティベル草を 30cm or 50-60cm の高さに刈り取る。

④ 問題点

- 白蟻(White ants)がつく。
- millet と共通の virus がつき、病気が次年に持ち越す。
- そのため 2-3年でギャップ（隙間）が出始めるので植え直す必要あり。

(4) Mr.Shri Niwas Sharma / Head, Division of Resource Management, CRIDA.

① Nursery

- 水、deep soil が必要。
- 3ヶ月以上かかる。

② Mixed approach が重要

- bund をつくる。
- 植生を植える。
- inter-bund で牧草、shurub、果樹を育てる。

③ 生育条件

- 600-700mm 必要、 300mm では doubtfull.
- 3% slope まで。

④ ベティベル草以外に何を植えるか

- natural vegetation が良い？
- Prosopis juliflora, Acacia nilotica, Acacia tortilis などの樹木。

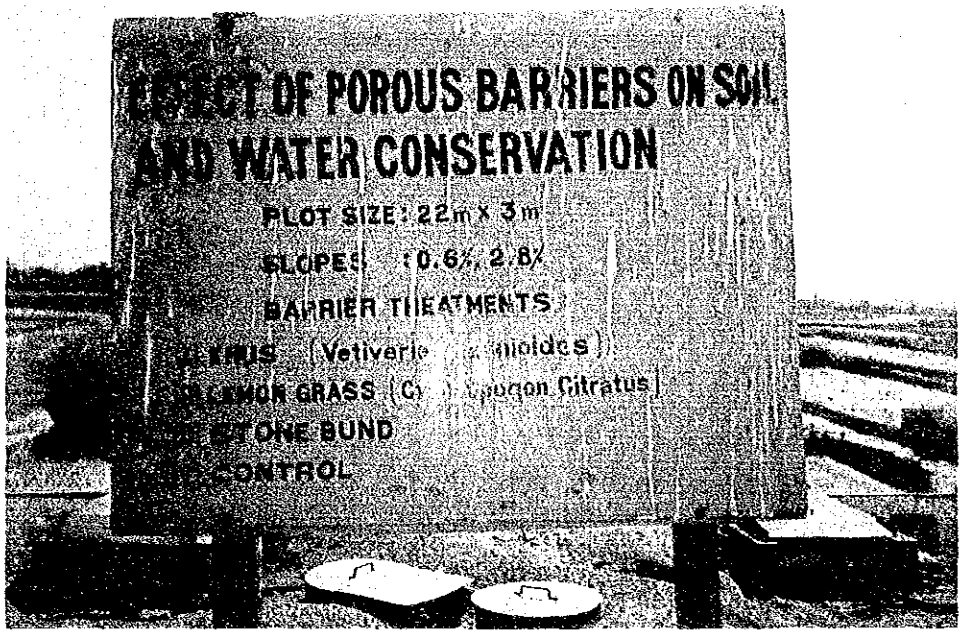
＊ 最終的に何がよいかは農民の意見（farmers'choice）が重要である。

ＩＣＲＩＳＡＴにおける収集資料リスト

(1)Establishment and Management of Vetiver as a Porous Barrier for Soil and Water Conservation (ICRISAT, 1991).
(2)Porus Barrier for Soil and Water Conservation (ICRISAT, 1991).

(3)Watershed-Based Dryland Farming in Black and Red Soils of Peninsular India (ICRISAT, 1984).
(4)Small Watershed Hydrology (ICRISAT, 1988).
(5)Farmers' Practices and Soil and Water Conservation Programs (ICRISAT, 1991).
(6)Tank Irrigation in Semi-Arid Tropical India - Economic Evaluation and Alternatives for Improvement (ICRISAT, 1987).
(7)Uses of Sorghum and Millets (ICRISAT, 1988).
(8)Weather Data for 1974-1992 Recorded at Meteorological Observatory (ICRISAT, 1922).

(9)Conservation Farming on Steep Lands (Soil and Water Conservation Society).
(10)Agroforestry for Soil Conservation (C.A.B. International)
(11)Evaluation of Catchment Area Development Programme - A Case Study of Dantiwada Catchment in Gujarat (Sardar Patel University, 1987).
(12)A Method of Watershed Land Classification and Assessment for the Tropics: A Case Study of Rio Guanare, Venezuela (Cornell University, 1980).
(13)National Seminor Soil Conservation and Watershed Management, Proceedings (Ministry of Agricultura, India, 1985).
(14)Dry-Land Sorghum and Oat Forage Production under Microwatersheds and Soil Profile Modification Treatments (University of California, 1970).
(15)Soil and Water Conservation in Tamilnadu (Goverment of Tamilnadu, 1989).
(16)An Improved Contour Bunding System for Alfisols of the Semi-arid Toropics (ICRISAT, 1987).
(17)The Potential of Agroforestry for Soil Conservation and Sustainable Land Use (ICRAF, 1987).


EFFECT OF POROUS BARRIERS ON SOIL
AND WATER CONSERVATION
PLOT SIZE : 22m x 3m
SLOPES : 0.6%, 2.8%
BARRIER TREATMENTS :
VETIVERUS (Vetiveria
LEMON GRASS (Cy
STONE BUND
CONTROL