****
*3860467 INDIA *
* RAJASTHAN MEDIUM IRRIGATION *
* FY80 TO FY85 *
****

PROJECT SUMMARY DESCRIPTION

Grant and loan are provided to the Government of India to increase crop production in southeast Rajasthan by increasing and improving medium irrigation projects (MIP's). The project will be implemented, under USAID management, by the Government of Rajasthan's (GOR) Department of Irrigation and Agriculture (IA) as part of its five-year MIP plan.

A total of 15-20 MIP subprojects will be financed, including construction of new MIP's and upgrading of those already underway or planned. Construction will include dams and control works; canals; distributaries; roads needed for project operation; land drainage works; physical improvements needed to make the MIP system of water storage and conveyance efficient and effective; and civil works for resettlement. GOR will finance auxiliary services such as compensation for land acquisition, on-farm land development, and off-farm facilities.

For all qualifying MIP subprojects, the following will be developed: (1) improved quantitative budget procedures; (2) improved canal designs in terms of adequate control and safety structures to prevent damage by cross drainage and to empty canals completely for maintenance purposes; (3) improved watercourses with division boxes where streams are divided, with gated outlets and check structures at each turnout point, and with lining in selected reaches; (4) drainage works to eliminate standing water during rainfall and to relieve water-logged areas; and (5) reconnaissance-level or, in threatened areas, semi-detailed soil surveys. In addition, IA personnel will be trained in improved techniques of subproject appraisal.

Loan funds will finance MIP subprojects. Grant funds will finance IA training, as well as socioeconomic surveys to collect baseline data for subprojects.

New or improved MIP's will provide reliable water supplies for cultivation of both summer (kharif) and winter-autumn (rabi) crops and will permit crop cultivation during the dry season. As a result of the project, a total of 65,000 hectares of land in the project area will be irrigated or will have their irrigation modernized, with a benefit to some 32,000 families.

DESCRIPTORS

CROP YIELD	IRRIGATION	IRRIG CANALS	IRRIG FARM
WATER DELIV SYS	INDIGENOUS TRNG	WATER STORAGE	WATER SUPPLY
GEOLOG SURVEY	SOCIO ECON RES	WATER TECH TRNG	FARMS
ROAD CONSTRUCT	DRAINAGE	AQUEDUCT CONSTR	INSTIT BUILDING
PROJ ANLYS TRNG			

SUB-PROJECT NUMBER: 00 BATCH NUMBER: 98

BEST AVAILABLE

386046700420 1

PROJECT PAPER

RAJASTHAN MEDIUM IRRIGATION PROJECT
(386-0467)

USAID/NEW DELHI
MAY 1980

PROJECT PAPER

RAJASTHAN MEDIUM IRRIGATION PROJECT
(386-0467)

USAID/NEW DELHI
MAY 1980

JUN 19 1980

ACTION MEMORANDUM FOR THE ADMINISTRATOR

THRU: ES

THRU: AA/PPC, Alexander Shakow

FROM: AA/ASIA, John H. Sullivan

SUBJECT: INDIA - Rajasthan Medium Irrigation Project (386-0467)

Problem: Your approval is requested for a loan of $35,000,000 and a grant of $500,000 from the FAA Section 103 Agriculture, Rural Development and Nutrition appropriation to India for the Rajasthan Medium Irrigation Project (386-0467). The project will be incrementally funded during FYs 1980 and 1981 with a planned FY 1980 obligation of $15,500,000.

Discussion: The State of Rajasthan in northwest India is arid and highly susceptible to drought. Availability of water is dependent on monsoons, and this, in turn, limits the number and types of food crops which can be produced in a year. Therefore an increased and more reliable supply of water, including improved water management, is one of the highest priorities of the State Government of Rajasthan (GOR).

Ground water development in Rajasthan has been intensive. Seventy-five percent of the capacity is currently being exploited and this is the maximum desirable. Consequently, the State is now focusing on major and medium irrigation projects that maximize the use of surface water. Medium irrigation will capture the potential of small rivers and catchments for the benefit of thousands of small farmers who would otherwise not be able to take advantage of irrigation.

Medium irrigation projects (MIPs) collect monsoon runoff in surface reservoirs, store and convey it as needed through a canal system to culturable command areas (CCA) of 2,000 to 10,000 hectares. MIPs are relatively simple to engineer and construct and have comparatively short development periods. Stored water is used primarily for the dry autumn and winter cropping seasons. Cropping intensities in the MIPs are expected at least to double once irrigation is introduced.

The project will loan-finance a five-year time portion of Rajasthan's program for construction of new medium irrigation subprojects and for the modernization of existing MIPs. It will (1) increase agricultural

production and income of the rural poor, (2) increase rural employment, and (3) reduce the impact of drought in the project area. Approximately 65,000 hectares of land will receive new or improved irrigation, benefitting 32,000 predominantly poor rural families.

The project includes a loan to finance part of the construction costs. The loan will reimburse the Government of India (GOI) for 67 percent of the costs of constructing the civil works. Works eligible for financing will include construction and improvement of dams, control works, canals, distributaries, watercourses (including lining), roads necessary for project operation, land drainage works, civil works for resettlement, and other physical improvements necessary to make MIPs operate efficiently and effectively.

All subprojects for which AID funds will be used will be designed by the Government of Rajasthan and approved by the Government of India and USAID/India. Subprojects that are AID-financed in any part will be undertaken by the GOR in accordance with agreed upon engineering, beneficiary, environmental, economic and financial criteria. The GOR, as the implementing agency, will be responsible for selecting, designing and carrying out the project. The Irrigation and Agriculture Departments of the GOR will design individual subprojects within the Medium Irrigation Project criteria. An Appraisal Committee constituted in the Central Water Commission of the Government of India will appraise and, where appropriate, approve subprojects having CCAs of 2,000 hectares or more and will also approve all those projects being modernized.

The rate of return for this project is not as high as it is for more complex, larger-scale irrigation programs. This is primarily due to the fact that these MIPs are designed to reach as many farmers as possible rather than maximize economic returns of discrete schemes by intensive application of water less extensively distributed. Social soundness analysis indicates that landholders in the project area are predominantly small farmers. The GOR's social water allocation program will provide additional assurance that AID's target group will be the principal beneficiary of the project.

The project provides a small grant-financed component for training and special studies. Short-term training will be provided for engineers responsible for design, construction, evaluation and/or operation of the MIPs. GOR officials responsible for the economic analysis will review and study practices and participate in special courses in the United States. In-service training will be provided for GOR project design officers. The project will support the development of training modules and special courses in water management for the GOR's Irrigation and Agricultural Departments. Studies will include: (a) base-line socio-economic surveys, (b) water management studies, (c) organization and management studies, and (d) evaluation. The content and timing of studies will be mutually agreed by the GOR and USAID.

CDSS: The FY 1982 CDSS for India directs AID's efforts toward reducing the constraints to growth in agricultural output and employment and improving access of the rural poor to productive infrastructure. Irrigated agricultural development is key to the growth of agricultural production and to increased acceptance of the new agricultural technologies that increase and stabilize yields. It is also a significant generator of additional rural employment. The project is fully in accord with the CDSS.

Conditions: No conditions precedent or covenants are proposed other than those contained in the standard Project Agreement.

Congressional Notification/Waivers: The loan portion of this project is described on p. 52 of the FY 80 CP, but a Congressional Notification will be required for the $500,000 grant. This CN will be forwarded later this fiscal year. The grant funds will be obligated under a separate agreement. The loan-financed component of the project is viable by itself if a problem were to develop with respect to this grant. There are no outstanding issues regarding GAO or AID audits.

No Waivers are requested.

Recommendation: That you sign the attached Project Authorization.

Attachments:

1. Project Authorization
2. Project Paper

Clearance:
GC:NHolmes KCK for Date 6/19/80

ASIA/PD/SA:KFinan:fv/eb:6/19/80:X58450 KAF

UNCLASSIFIED

Department of State

INCOMING TELEGRAM

PAGE 01 NEW DE 13454 240847Z 013065 AID8577
ACTION AID-35

ACTION OFFICE ASBI-02
INFO AAAS-01 ASEM-01 ASDR-02 PPCE-01 PPPB-02 AG-01 GC-01
PPEA-01 GCAS-01 GCFL-01 ASPD-03 ASTR-01 AADS-01 C-01
CASI-02 DSAG-02 ENGR-02 IIS-02 PIA-01 CHS-01 TRSY-05
XMB-06 RELO-01 MAST-01 PDPR-01 /044 A1 4

INFO OCT-01 SSO-00 NEA-07 (AS-01, AID-01,) W
127731 251711Z /10

O 240722Z JUN 80
FM AMEMBASSY NEW DELHI
TO SECSTATE WASHDC IMMEDIATE 0015

UNCLAS NEW DELHI 13454

AIDAC

E.O. 12065: N/A
SUBJECT: RAJASTHAN MEDIUM IRRIGATION (386-0467) - GOI LETTER REQUEST

1. FOLLOWING S EXACT TEXT OF GOI LETTER REQUEST FOR ASSISTANCE FOR RAJASTHAN MEDIUM IRRIGATION PROJECT:

" JUNE 23, 1980

DEAR MR. GUNNING:

THE GOVERNMENT OF INDIA HEREBY REQUESTS A LOAN FROM THE GOVERNMENT OF THE UNITED STATES IN THE AMOUNT OF DOLS15 MILLION TO ASSIST IN FINANCING THE RAJASTHAN MEDIUM IRRIGATION PROJECT. THESE FUNDS ALONG WITH FURTHER US ASSISTANCE OF DOLS20.5 MILLION EXPECTED IN THE FUTURE AS WELL AS THE INDIAN CONTRIBUTION IN THE AMOUNT OF DOLS22.5 MILLION WILL FINANCE THE CONSTRUCTION OF DAMS, CANALS, CONTROL WORKS DISTRIBUTORIES, WATER COURSES ETC. FOR MEDIUM SIZED IRRIGATIN SYSTEMS IN THE STATE OF RAJASTHAN. TECHNICAL ASSISTANCE IN WATER MANAGEMENT, TRAINING AND SPECIAL STUDIES WOULD ALSO BE PART OF THE OVERALL PROJECT.

WE WOULD APPRECIATE YOUR EARLIEST CONSIDERATION OF THIS REQUEST FOR ASSISTANCE.

SINCERELY,
(SIGNED)
S.N. KAO
DIRECTOR
DEPARTMENT OF ECONOMIC AFFAIRS
MINISTRY OF FINANCE

SUMMARY

INDIA: Rajasthan Medium Irrigation Project (386-0467)

The Rajasthan Medium Irrigation Project has been designed to increase the reliable availability of water to farmers in the State of Rajasthan in northwest India. Previously, Rajasthanians depended on groundwater, primarily derived from the monsoon rain, for irrigation. However, it was recognized that to increase agricultural production significantly, water needs to be provided during the dry months of the year, and that the use of groundwater has reached its natural limit. The Medium Irrigation Project (MIP) approach in Rajasthan provides a comparatively uncomplicated means of reaching the maximum number of rural farmers. A MIP collects monsoon runoff in surface reservoirs, stores it, and coveys it as needed through a canal system to cultural command areas. MIPs are simple to construct and have comparatively short developmental periods.

The project will provide $35,000,000 in loan financing over a two-year period to construct and improve dams and control works, canals, distributaries, and watercourses in a time-slice of the Government of Rajasthan (GOR) overall irrigation program. It will also finance roads necessary for project operation, land drainage works, and other such physical improvements necessary to make the MIP system of water storage and conveyance operate efficiently and effectively. These improvements will be planned, approved, and managed in the form of discrete sub-projects which treat command areas of 2,000 to 10,000 hectares. Each sub-project prepared by the GOR will be reviewed by both the Central Water Commission of the Government of India (GOI) and USAID. Sub-projects will be approved for AID financing if they meet criteria set out in the Loan Agreement concerning, inter alia, their economic return, beneficiaries, and engineering and environmental standards.

There will be an additional $500,000 grant to finance special studies and training. The studies will include base-line socio-economic surveys and evaluations. Training will be provided for various personnel in the GOR's Irrigation and Agriculture Departments responsible for engineering, construction, and economic aspects of the sub-projects particularly with respect to improved techniques of sub-project appraisal that have been agreed to among AID, GOR, and GOI.

The FY 1981 CDSS directs AID's efforts toward reducing the constraints to growth in agricultural output and employment and improving access of the rural poor to productive infrastructure. This project, through an increase in available water, is expected to double the cropping intensities in Rajasthan. There will be an increase in agricultural production and income to the rural poor. It has been designed so that eighty percent of the recipients of this service have land holdings of less than four hectares. The total benefit will accrue to 32,000 families in terms of an additional 65,000 hectares of land under irrigation. Rural employment will increase both on the farm and at the construction sides. Finally, the overall impact of drought will be reduced.

BEST AVAILABLE

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE: A (A = Add, C = Change, D = Delete) — Amendment Number

DOCUMENT CODE: 3

2. COUNTRY/ENTITY: INDIA

3. PROJECT NUMBER: 386-0467

4. BUREAU/OFFICE: ASIA — 04

5. PROJECT TITLE (maximum 40 characters): Rajasthan Medium Irrigation

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 06 DD 30 YY 85

7. ESTIMATED DATE OF OBLIGATION (Under 'B.' below, enter 1, 2, 3, or 4)

A. Initial FY 80 B. Quarter 4 C. Final FY 81

8. COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY 80 B. FX	C. L/C	D. Total	LIFE OF PROJECT E. FX	F. L/C	G. Total
AID Appropriated Total						
(Grant)	(300)	(200)	(500)	(300)	(200)	(500)
(Loan)	( )	(15,000)	(15,000)	( )	(35,000)	(35,000)
Other U.S. 1.						
Other U.S. 2.						
Host Country		10,000	10,000		22,500	22,500
Other Donor(s)						
TOTALS						58,000

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	2. Loan	D. OBLIGATIONS TO DATE 1. Grant	2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	2. Loan	F. LIFE OF PROJECT 1. Grant	2. Loan
(1) FN	B213	064	064			500	15,000	500	35,000
(2)									
(3)									
(4)									
TOTALS									

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each)

11. SECONDARY PURPOSE COD

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code

B. Amount

13. PROJECT PURPOSE (maximum 480 characters)

Increase food production
Decrease risk of drought

14. SCHEDULED EVALUATIONS

Interim MM 02 YY 83 MM YY Final MM 11 YY 85

15. SOURCE/ORIGIN OF GOODS AND SERVICES

[X] 000 [ ] 941 [X] Local [ ] Other (Specify)

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of a ____ page PP Amendment.)

17. APPROVED BY

Signature: Priscilla M. Boughton

Title: Director USAID/India

Date Signed: MM 05 DD 14 YY 80

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION

MM 05 DD 18 YY 80

AID 1330-4 (8-79)

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT IDENTIFICATION DOCUMENT FACESHEET

TO BE COMPLETED BY ORIGINATING OFFICE

1. TRANSACTION CODE: A (A = ADD, C = CHANGE, D = DELETE)

PID

6. DOCUMENT CODE: 1

3. COUNTRY/ENTITY: INDIA

4. DOCUMENT REVISION NUMBER:

5. PROJECT NUMBER (7 DIGITS): 386-0467

6. BUREAU/OFFICE: A. SYMBOL: ASIA; B. CODE: 04

7. PROJECT TITLE (MAXIMUM 40 CHARACTERS): RAJASTHAN MEDIUM IRRIGATION

8. PROPOSED NEXT DOCUMENT: A. 3 (2 = PRP, 3 = PP); B. DATE: MM 05, YY 79

9. ESTIMATED FY OF AUTHORIZATION/OBLIGATION: B. INITIAL FY 80; B. FINAL FY 80

10. ESTIMATED COSTS ($000 OR EQUIVALENT, $1 = 8.5 Rupees)

FUNDING SOURCE	$000
A. AID APPROPRIATED	35,000
B. OTHER U.S. 1.	
B. OTHER U.S. 2.	
C. HOST COUNTRY	25,000
D. OTHER DONOR(S)	
TOTAL	60,000

11. PROPOSED BUDGET AID APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	E. FIRST FY 80 F. GRANT	E. FIRST FY 80 G. LOAN	LIFE OF PROJECT H. GRANT	LIFE OF PROJECT I. LOAN
(1) FN	B213		064		35,000		35,000
(2)							
(3)							
(4)							
TOTAL							

SECONDARY TECHNICAL CODES (MAXIMUM SIX CODES OF THREE POSITIONS EACH)

SPECIAL CONCERNS CODES (MAXIMUM SIX CODES OF FOUR POSITIONS EACH)

J. SECONDARY PURPOSE CODE

PROJECT GOAL (MAXIMUM 240 CHARACTERS)

Increase small farmer income, expand rural employment opportunities and increase availability of food to rural and urban poor.

PROJECT PURPOSE (MAXIMUM 480 CHARACTERS)

To increase small farm production and decrease the risk of drought to the producer in the State of Rajasthan.

PLANNING RESOURCES REQUIREMENTS (staff/funds)

Irrigation engineer, on-farm water management specialist and rural sociologist for about one month each.

14. ORIGINATING OFFICE CLEARANCE

TITLE	SIGNATURE	DATE SIGNED
John L. Withers Mission Director U.S.A.I.D./India		MM 02, DD 14, YY 79

15. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM 03, DD 31, YY 79

1330-2 (3-76)

TABLE OF CONTENTS

		PAGE
I.	Recommendations and Summary	
	A. Recommendations	1
	B. Summary Description	1
	C. Project Issues	3
II.	Background and Rationale	
	A. Background	
	1. Agriculture in Rajasthan - General	4
	2. Rationale for Medium Irrigation Projects	
	3. Agriculture in Medium Irrigation Projects	
	B. Relation to AID's Target Group	8
	C. Logical Framework	9
III.	Detailed Project Analyses	
	A. Water Supply and Water Use in MIPs	9
	B. Engineering	10
	C. Economics	14
	D. Financial Analysis and Plan	19
	E. Social Analysis	22
	F. Environmental Impact	27
IV.	Implementation	
	A. GOI/GOR Administrative Arrangements	28
	B. AID Implementation/Monitoring	31
	C. Evaluation Plan	32
	D. Conditions, Covenants and Understandings	33

ANNEXES

A. Statistical Tables
B. Maps
C. Logical Framework
D. 611(e) Certification
E. Statutory Checklist
F. PID Approval Cable
G. Economic Analysis
H. GOI's Letter of Request
I. Draft Authorization
J. Environmental Assessment
K. Grant Funding
L. Project Description

APPENDICES

A. Agriculture
B. Water Management and Engineering

SEPARATELY BOUND

A. Economic Analysis Report

GLOSSARY OF ACRONYMS, ABBREVIATIONS AND MEASURES

AC	Appraisal Committee (of CWC or GOR)
AID, AID/W	Agency for International Development, Washington
APM	Adjustable Proportion Module
ARR	Associated Rate of Return
B/C	Benefit-Cost Ratio
CAD	Command Area Development
CDSS	Country Development Strategy Statement (of USAID/I)
CHAK	Area of land, ca. 40 ha, served by a single canal outlet
CRORE	10 million (1,00,00,000)
CWC	Central Water Commission (of GOI)
DEA	Department of Economic Affairs (of GOI/MOF)
DOA	Department of Agriculture of GOR
DRA	Direct Reimbursement Authority (AID)
DRR	Direct Rate of Return
ERR	Economic Rate of Return
FX	Foreign Exchange
FY	Fiscal Year: U.S. = Oct. 1st - Sept. 30th GOI = Apr. 1st - March 31st
GOI	Government of India
GOR	Government of Rajasthan
GOR/DOA	GOR's Department of Agriculture
HA	Hectare = 2.47 acres
ID	Irrigation Department of GOR
IDA	International Development Association (World Bank)
IFAD	International Fund for Agricultural Development
KG	Kilogram = 2.21 pounds
KHARIF	Summer monsoon crop or season
KM	Kilometer = 0.62 miles
LAKH	100,000 (1,00,000)
LC	Local Costs
LOP	Life of Project
M	Meter = 3.28 feet
M^2	Square Meter = 10.75 sq. ft.
MIP	Medium Irrigation Project
MOF	Ministry of Finance of GOI
MT	Metric Ton = 1.1 short ton
O&M	Operation and Maintenance
PID	Project Identification Document (of AID)
RABI	Winter crop or season
Rs	Indian Rupee: 8 Rs = U.S. $ 1
SRR	Social Rate of Return
T&V	Training and Visit - Agricultural Extension System
USAID, USAID/I	AID Mission in India
WUC	Water Utilization Cell of DOA
ZAID	Hot dry spring crop or season

RAJASTHAN MEDIUM IRRIGATION PROJECT

I. SUMMARY AND RECOMMENDATIONS

A. Recommendation

Approval of a loan to finance the construction of medium irrigation projects in the State of Rajasthan; and a grant to finance training and associated base-line socio-economic surveys, water management and organizational studies and evaluations.

1. Borrower and Grantee: The President of India GOI

2. Implementing Agency: Government of Rajasthan, Departments of Irrigation and Agriculture

3. Financing:

   a. AID Contribution: Loan of $35 million
      Grant of $500,000

   b. AID Loan Terms: Repayment of principal and payment of interest within forty years, including a ten year grace period of repayment of principal, with interest of two percent (2%) per annum during the grace period and three percent (3%) per annum thereafter.

   c. Borrower Contribution: $22.5 million equivalent

   d. Total Cost: $58 million

B. Summary Description

The Rajasthan Medium Irrigation Project is a five year irrigation sector support project that will attempt to remove a prime constraint to increasing food production and rural employment in Rajasthan: the reliable availability of water. This project finances a time slice of the medium irrigation program of the State of Rajasthan within the overall irrigation program of India through loan financing of construction and grant financing of training and studies. It will irrigate or modernize the irrigation of approximately 65,000 ha of land, benefitting 32,000 families. Medium irrigation project (MIP) construction activities will be financed in discrete sub-projects, i.e. irrigation schemes. These will be of the following types: (a) new projects, (b) projects currently under construction to be continued and upgraded to the level planned in new projects, and (c) modernization of existing irrigation projects. The command area for typical sub-projects ranges from 2,000 to 10,000 ha. Fifteen to twenty sub-projects are expected to be financed - half new and on going and half modernized.

The Project will finance the construction and improvement of dams and control works, canals, distributaries and watercourses. It will also finance roads necessary for project operation, land drainage works, other such physical improvements necessary to make the MIP system of water storage and conveyance to farm level operate efficiently and effectively, and civil works for resettlement. Compensation for land acquistion, on-farm land development such as contour shaping and land-leveling, and off-farm facilities such as markets, warehousing and farm-to-market roads will not be eligible for reimbursement by AID. Attention is given to all of these ancillary services in the preparation of MIP plans and GOR will provide financing for them.

Training will be provided for engineers of the GOR/ID (Irrigation Department) and GOI responsible for design, construction, operations and water management to review and study practices in the United States. GOR/DOA (Department of Agriculture) and GOI staff specializing in economic analysis will be provided training in-country, with selected staff receiving project feasibility analysis training in the United States.

Studies to be financed include (a) base-line socio-economic surveys, (b) water management studies at chak (ca. 40 ha) level, with expert assistance as needed, (c) local-level organization and management studies, and (d) evaluations. Content and timing of studies will be determined through consultation between the GOR and USAID.

Sub-project proposals will be approved for AID financing if criteria embodied in the Project Agreement are met (See Annex L). Primary among these are: (a) rural poor are the target population (i.e. 50 percent of the farms in the CCA are less than four ha in size); (b) sub-projects have a direct rate of return of nine percent or greater; (c) soils and other physical conditions are appropriate to medium irrigation as planned; (d) improved canals and watercourses are provided to approximately the eight hectare level and selected reaches of watercourses are lined as necessary; (e) appropriate water budgets are prepared; (f) adequate provision is made for system drainage; (g) all works meet recognized engineering design standards; (h) qualified personnel will be available to undertake all associated activites; and (i) adequate agricultural support services are available, and (j) construction of individual MIPs will be completed within five years of initiation. Economic analyses will use procedures developed during the course of this Project's design.

Each sub-project will be appraised by the Central Water Commission's (CWC) Appraisal Committee (AC), or by a GOR Appraisal Commitee for sub-projects under 2,000 ha in area, on the basis of the GOR's design report and criteria agreed among the GOI/CWC, GOR and USAID. USAID

will participate in selected appraisals. Sub-projects approved by the CWC/AC or GOR/AC will be eligible for financing under the AID loan. CWC/AC or GOR/AC will prepare a summary report for each sub-project

C. Project Issues

The principal issues raised in the PID review are expressed in the AID Approval Cable reproduced as Annex F. Below is a brief summary of how the Project responds to these concerns.

Watercourse Lining: Watercourses will be designed, constructed, and maintained to the eight ha level by GOR/ID. Alternative methods and extent of watercourse lining have been thoroughly analyzed from technical and economic perspectives. Based on these analyses, principles have been developed to determine the appropriate extent of watercourse lining for any sub-project. Generally, lining will be provided in selected reaches where the value of water saved from seepage is 80 percent or more of the per hectare cost of new construction. Typically this will mean lining of one-quarter to one-third of the watercourses.

Water Rates: A standard procedure involving a high level State Committee to review water rates regularly is established. Over the past twenty-two years, charges have doubled, with a 27.5 percent increase occuring last year. Nonetheless, surface irrigation is still subsidized. This benefits the predominantly small farmer group within the Project area and supports the policy of increasing incomes within this group. Every practical effort is being made by the GOR to increase cost recovery while not doing damage to the principal of helping the rural poor to increase production and income. Farm budget analyses indicate that following full transition to improved, irrigated agriculture, further cost recovery would be possible.

Cost Sharing: Even though high priority and impressive budgetary allocations are accorded to irrigation by the GOI and GOR, the pace of MIP construction does not now meet urgent needs. The GOR, with GOI support, has made strong representations for two-thirds financing of this project by AID. This would accelerate MIP construction by making more resources available quicker, reduce USAID monitoring load, and assure timely disbursement of the loan. In addition, the application of agreed criteria will result in higher unit costs of construction. Therefore, USAID proposes to finance 67 percent of the costs of civil works by loan and to finance fully the necessary training and studies by grant. The cost of land acquisition borne by the GOR will bring the overall cost sharing ratio to an estimated 60/40 for USAID/GOR.

Water Management: The operating philosophy of the GOR's Irrigation Department is that local water use decisions should be handled by the cultivators through Water Users Committees. This was examined

at the local level and found to be working within the limited physical capabilities of the systems. Better watercourses will improve the functioning of these systems. Further studies by the GOR will suggest improvements in water management.

Markets and Market Accessibility: The Appraisal Team analysed the market situation in Rajasthan and concluded that produce markets function adequately and will do so as production expands and the crop mix changes as a result of the Project (See Appendix A).

Beneficiaries: As noted, AID will finance only sub-projects where small farmers predominate (50 percent or more with farms four ha or less). Under GOR policy, first priority is given to ensuring full irrigation supply to farms under one hectare. Improved watercourses will make equitable distribution physically possible.

II. BACKGROUND AND DETAILED DESCRIPTION

A. Background

1. Agriculture in Rajasthan - General: Agriculture in Rajasthan is limited by natural moisture. In the project area (the southeastern half of Rajasthan) rainfall, occurring principally during late June, July and August and early September, permits kharif crops and permits rabi crops based on residual moisture and limited winter rains. Irrigation from groundwater or surface sources may be used to supplement kharif, but is used primarily for rabi, with limited use during the hot-dry "zaid" season for multi-season or perennial crops such as sugarcane, fodder, limited cotton and fruits and vegetables.

Of Rajasthan's 34 million hectares, about 16 million are sown annually but some double cropping raises the cropped area to about 18 million hectares or about 10 percent of India's total of 171 million hectares. Irrigation is provided to only about 2.7 million hectares, or about 17 percent of cultivable land, compared to the all India average of 25 percent irrigated. Principal cereal crops are gram, wheat, sorghum, maize and millet. Groundnut is a common oilseed crop, but a wide variety of oilseeds is grown. Crops grown by area and percentage of area and yield comparisons are provided in Annex A, Table 2. Livestock and grazing are significant in Rajasthani agriculture. In 1972, Rajasthan reported 39 million livestock or 11 percent of India's total. Rajasthan has 21 percent of the country's sheep and 18 percent of its goats.

Rajasthan's use of fertilizer falls far below the national average. The State consumed only 112,900 tons or 2.6 percent of the national total in 1977-78. Average applications to crops was 7 kg/ha in 1977-78 compared to an all-India average of 26 kg/ha and high values of 77 and 64 kg/ha in Punjab and Tamil Nadu. Only three states had lower fertilizer use rates. Fertilizer use in the

economic analysis is at recommended levels consistent with yield assumptions. The State is relatively better off in terms of markets. Currently there are 118 regulated markets and 174 submarkets. The State also has over 200 wholesale assembling markets, five percent of the country's total.

2. Rationale for Medium Irrigation Projects: In contrast to the northwest of Rajasthan (which has poor soil and inadequate rainfall and water resources and needs large scale projects), the southeast of Rajasthan has good soil, but a highly variable monsoon which provides 90 percent of the rainfall. The main rainfed (kharif, summer) crop is grown during the monsoon and is often adversely affected by the irregular arrival and intensity of rain. A second, unirrigated (rabi, autumn-winter) crop is grown following the monsoon, drawing on residual soil moisture and even more unpredictable and sparce winter rainfall. Crops cannot be grown during the hot dry (zaid, spring) season without irrigation. Under these uncertain conditions, crop yields have remained extremely low.

Irrigation from MIPs can mitigate the risk of monsoon failure during kharif, provide increased and more reliable supplies for rabi, and permit limited cultivation of crops during the hot dry season. In the project area, medium-scale irrigation schemes are appropriate to existing landforms, climate, and the availability of productively irrigable land as complemented by limited groundwater. In Rajasthan, irrigation is provided to only 17 percent of cultivable land. Irrigated land can return up to 10-fold more due to greater reliability of water supply and multiple cropping. It is, therefore, a key to increased production. Roughly 60 to 75 percent of groundwater potential has already been developed in Rajasthan. Thus expanded surface irrigation must provide the major increase in exploiting Rajasthan's potential. Moreover, a great deal can be gained by increasing the efficiency of existing projects, which currently operate between 30 and 60 percent of potential. These are the major problems the Project will address.

MIPs are relatively simple to engineer and construct and have comparatively short developmental periods. They collect monsoon runoff in surface reservoirs, store it, and convey it as needed by canals to culturable command areas (CCAs) ranging in area from approximately 2,000 to 10,000 ha. MIPs constructed so far (mostly since 1951) have had a significant impact on agricultural production in southeast Rajasthan; however, yield increases have been low and development has been slow. Difficulties stem from (a) minimal investments in canals and distribution channels leading to inadequate performance and waste of water; (b) lack of defined responsibility for water management; (c) lack of distribution ditches serving farmers' fields and (d) deficiencies in supporting agricultural services such as research and extension, credit, technical inputs, markets and roads. India and the GOR have recognized these shortcomings and are taking steps to rectify most of

them. The application of criteria for qualification of sub-projects under this loan will reinforce these efforts quite satisfactorily.

3. Agriculture in Medium Irrigation Projects

Cropping Patterns and Intensities: Numerous crops are grown in medium irrigation project areas. Cereals include wheat, sorghum, millet, barley, maize and rice. Pulses, including gram and moong; oilseeds, mostly mustard and groundnut; fodder, sugarcane, cotton, chillies and condiments, and fruits and vegetables complete the list. The general cropping system is complex, involving, besides crops, a matrix of three growing seasons and irrigated and non-irrigated dimensions in each season.

Intensity of cropping or of irrigation is expressed as the percentage of the Culturable Command Area (CCA) under a crop or under irrigation (or rainfed) during any season. Annual intensity is the sum of the seasonal intensities and may exceed 100 percent. Examination of four MIPs, one for modernization, first constructed in 1958 (Morel), two proposed new projects (Gosunda and Chappi) and one ongoing (Bhimsagar) shows very low cropping intensities prior to the MIP completion, as follows:

Irrigated Kharif	0.8 - 4.3%
Unirrigated Kharif	23.0 - 63.8%
Irrigated Rabi	2.0 - 17.0%
Unirrigated Rabi	3.4 - 31.2%
MIP Overall	41.5 - 92.9%

Cropping patterns were examined on two of these (Morel and Gosunda). They were quite different. Sorghum and millet were the dominant kharif crops in Gosunda, maize in the Morel. In Gosunda, barley and mustard dominated rabi in contrast to wheat and gram in Morel.

Under irrigation, cropping intensity shows a marked improvement. Three candidate modernization MIPs, Morel, Jaisamand and Gudha together showed the following present intensities:

Irrigated Kharif	3.4 - 15.3%
Unirrigated Kharif	50.0 - 64.0%
Irrigated Rabi	41.3 - 71.8%
Unirrigated Rabi	11.3 - 36.8%
Project Totals	147.7 - 154.8%

Even unirrigated intensities wer substantially higher under irrigation.

Kharif irrigation intensities are low, so large areas of land are not involved. Rabi irrigation emphasizes wheat (66 - 77 per-

cent) in all projects, with barley (5 - 10 percent) and pulses (10 - 21 percent) significant components of the mix and fodder and fruits and vegetables important but relatively small in area. Unirrigated rabi leans heavily toward pulses (38 - 72 percent) with wheat and barley (24 - 48 percent) and oilseeds (4 percent) filling out the pattern.

Yields: Yields for all crops are low in the Project Area. Annex A, Table 6 shows yields reported for Sawai Madhopur District (includes Morel) for the period 1970-75. Yields are district-wide averages which include a mix of irrigated crops and the higher district yields reflect the effect of irrigation. Yield differences due to irrigation (col. 3 vs col. 2) are significant but nevertheless are disappointing. A principal impact of irrigation is increased areas of crops, both irrigated and unirrigated. Since water is scarce relative to available land, irrigating more land at less than full water requirement makes sense generally. However, since only a fraction of the flow water is actually delivered to the field, more optimal water applications and potential for substantially increased yields can be achieved by making conveyance systems more effective and reliable. Column 5 shows projected yields used by the GOR in evaluating economic viability of the selected MIPs. The levels are high but achievable if water supplies are reliably delivered to all farms along with necessary technology, inputs, and market incentives.

Agricultural Support Services: Provision of irrigation water is not sufficient to bring about full development of the agricultural potential of an area. All of the so-called package of practices are required - information on new technology, fertilizer, improved seeds, plant protection, production credit, and reasonable product prices through an efficient and effective marketing system. Roads, warehousing, etc. are part of the necessary infrastructure. The GOR has district level programs dealing with each of these support services.

The Ministry of Agriculture is responsible for execution of all agricultural programs in the State (see Organization Chart, Appendix A). The Department of Agriculture is directly responsible for agricultural extension. The project area is fully covered by the training and visit (T&V) system of agricultural extension being financed by IDA. The T&V system has been operational since 1978 and is functioning effectively. It is described in Appendix A-1.

Market development under control of the Agricultural Marketing Board, has been very effective in Rajasthan. When the volume of marketable produce increases in an area to Rs 30 million, a regulated market is established replacing existing traditional markets. All the required physical facilities for handling farm products, input supplies, and convenience facilities for farmers, are established

by the Marketing Board. A one percent fee supports these facilities and services (See Appendix A-2).

The Ministry of Agriculture is assisted by State level organizations dealing with seeds (State Seed Corporation and the Seed Certification Agency), fertilizer (various commercial firms and state organizations), credit (Commercial and Cooperative Banks), plant protection (commercial and DOA), warehousing (Rajasthan State Warehousing Corporation), roads (PWD) and the like. The agricultural program planning process, which brings each of these agencies services to irrigated areas, is described in Appendix A-3.

USAID staff and the consultants involved in project preparation have had extensive discussions with GOR/DOA officials, reviewed available documentation, interviewed a limited number of farmers, and are satisfied that the agricultural support services are adequate to meet project needs. For each MIP proposal submitted for CWC approval for AID financing, the GOR/DOA will prepare for the project report a statement of the specific agricultural support services available, and to be made available, to serve the command area of the MIP. Adequacy of the proposed support services will be a factor for consideration in project approval.

B. Relation to AID Target Group

The USAID/India CDSS for FY 1981 focuses on the degree of poverty in India and its basic causes. It concludes that efforts should be directed toward reducing the constraints to growth in agricultural output and employment and improving access of the rural poor to productive infrastructure. The CDSS and other analyses show that irrigated agricultural development can be a major factor in both growth of agricultural production and access to and acceptance of the new agricultural technologies that increase and stablize yields. It is also a significant generator of additional employment.

This project will impact on the target group directly in the case of small and marginal farmers through increasing production and incomes. Average farm size in existing and proposed MIPs range from less than two to about three ha. In existing projects, 80 percent or more of the holdings are less than four ha in size. Farmers in the prospective new MIPs, though their holdings are larger, are even poorer because of low productivity without irrigation. The Project as a whole should result in a 65,000 MT increase in food grain production and a Rs 125 million annual increase in net farm income.

The project will also provide employment to the unemployed and under-employed during the construction phase and, subsequently, through agricultural intensification. Rural artisans and laborers will benefit indirectly as increased economic activity stimulates

increased rural demand for off-farm employment. Resulting construction employment should approximate 50,000 person-years and additional annual agricultural employment 26,000 person-years.

C. Logical Framework Narrative

The Logical Framework is attached as Annex C. It hypothesizes that the construction, completion or modernization of medium irrigation schemes in Rajasthan (with the associated outputs of increased acreage under irrigation, greater reliability of irrigation and improved water use efficiencies) will support the achievement of project purposes: increases in agricultural production by small farmers and reduction of the impact of drought (which disproportionately affects small farmers). As discussed above and in the following sections (and in Appendix A), there appear to be good prospects that the irrigation projects financed by the AID loan will be constructed and operated (and that the complementary inputs and services will be provided) so as to assure that the purpose-level objectives will be achieved.

The hypothesis linking the output and purpose levels to the goal level are that achievement of the purposes will increase the level and security of small farmer incomes (and the supply of foodgrains), and that expanded rural employment will result both from construction activities (output level) and from increased output, or agricultural intensification (purpose level). The analyses discussed below and in Appendix A similarly indicate that there are reasonable prospects that the hypothesized relationships will hold. For a discussion of data sources and evaluation plans, see section IV C below.

III. METHODS AND CONCLUSIONS OF SUPPORTING ANALYSES

A. Water Supply and Water Use in MIPs

1. Water Supply: Rainfall in southeast Rajasthan averages about 24 inches, 90 percent occurring during the summer. Rainfall is highly variable and severe drought years occur in about one year out of five or six. Stream runoff responds to rain and there are few permanent streams. Streamflow measurements are made at forty-eight gauging stations in the State and additional runoff information can be calculated using reservoir storage records. About 10 percent of the irrigated area in MIPs is irrigated now by large-diameter dugwells and there is some potential for increasing this although aquifer capacity is limited. Increased credit for well construction and increased electrification as well as higher charges for surface water will help stimulate groundwater development.

2. Use of Water in MIP Systems: In normal years all but a small percentage of stored reservoir water is used for winter (rabi) crops. While supplementing monsoon rainfall with marginal supplies at critical times during summer (kharif) is theoretically attractive, uncertainty about heavy rainfall in the near future tends to delay decisions to irrigate, so that only a part of the command area can be covered within required time periods. Reservoir water is frequently made available to help mature a kharif crop following cessation of the monsoon, but total volumes of water are small. In drought years, proportionately more water may be allocated to kharif. Because of high requirements reservoir water is not ordinarily used for hot dry season (zaid) crops which normally depend on well water but there are exceptions. Optimization of water supplies can be improved by more sophisticated reservoir operation studies, taking into account weekly rainfall and potential evapotranspiration based on weather records. These are not recommended at this time but should be considered for the future.

B. Engineering

1. Staffing and Capability: Civil engineering, especially hydraulic engineering, is very well developed in India. The prestigious well-staffed Central Water Commission (1,000 graduate engineers) sets design and construction standards and reviews designs for all irrigation projects exceeding 2,000 hectares in area. The GOR Irrigation Department, which has a large and experienced staff, including 4,000 graduate engineers, is responsible for design, construction and operation of MIPs within CWC guidelines and standards. The Department is well qualified to design and operate dams and other hydraulic works. The GOR/ID is an experienced and well administered organization with a history of successful construction and management of large, complex irrigation projects as well as medium and minor ones. The budget of the GOR/ID doubled during the four years from Rs 392 million in 1974/75 to Rs 809 million in 1978/79. Draft Sixth Five Year Plan projections call for an irrigation expenditure of more than Rs 3,300 million (Annex A, Table 7).

The GOR/ID is staffed by 4,000 graduate engineers with experience averaging more than ten years. Senior staff have twenty to thirty years experience in irrigation construction and management. The Department's Chief Engineer is responsible for the MIP program. Activities throughout the state are subdivided by districts according to the size of their budgets and managed by Superintending Engineers responsible for Rs 20 to 30 million in budget. Under a Superintending Engineer are three or more Executive Engineers, each responsible for a Rs eight million program. Under the Executive Engineer, each project is staffed by a Project Engineer and four or more Assistant Engineers, depending on the size and complexity of the project.

Assistant Engineers are supported by about four Junior Engineers at graduate (five years) or diploma (three years) levels who have responsibilities for specific components of construction or investigation. Mistries/foremen who also supervise mates (sub-foremen) report to Junior Engineers on construction jobs. The Department has increased its staff by 40 percent during the past few years and no difficulties are foreseen in expanding the staff to manage and implement an accelerated MIP program.

AID-financed sub-projects will be handled under the above described organizational structure. No special arrangements will be required. An organization chart and staffing pattern for the ID are in Appendix B.

2. Sub-project Design

a. Water Budgets: Improved accuracy in water conveyance budgeting and more accurate assessment of the impact of water supply variability is needed in order to allocate water supplies properly and to determine lining needs. A quantitative water budget based on average annual reservoir water supplies and taking into account evapotranspiration, field irrigation efficiency, all conveyance losses and reservoir operations studies will be included in feasibility reports for qualifying sub-projects.

b. Canals: Improved canal design and operation is necessary if irrigation investment benefits are to be realized and water equitably distributed. At present, chaks farthest from the diversion tend to receive less than their share of water. Amounts of water delivered to chaks are not accurately proportioned to farmed areas and use uncontrolled pipe outlets. MIPs qualifying for the loan will have adequate control and safety structures to prevent damage by cross drainage and to completely empty canals for maintenance, now a serious operational problem because of rapid weed growth. Designs will (1) ensure full supply to fields when operating at 50 percent capacity, and (2) provide adequate measuring facilities so that flow can be calculated in all reaches at all times and (3) all canals, minors and distributaries will be fully lined to outlets serving chaks of approximately 40 ha size. Information on seepage losses adequate for canal and watercourse lining design decisions will be compiled or collected by the GOR as necessary. In order to provide water supplies at outlets which are accurately proportioned to chak areas, Adjustable Proportion Modules (APMs) will be used instead of the customary ungated pipe canal outlets. These improvements will greatly increase the ability to convey large quantities of water efficiently, thus significantly reducing present inequitable distribution to outlets.

c. Watercourses: Ungated outlets deliver continuous

streams of water to chak areas whenever canals are full. Chak areas are nominally 40 hectares but range from less than four to more than 100 hectares depending on topography. Canals are constructed and operated by the Irrigation Department but the farmers, often 100 or more, are responsible for constructing, maintaining and operating watercourses which convey the stream from the outlet to individual farms. These are technical and administrative functions which small farmers are ill-equipped to handle. The result is that properly designed watercourses are not constructed. They are usually tortuous, clogged by weeds and plagued with continuing leaks at earthen farm turnouts and through poorly maintained banks, thus much of the water from the canal outlet does not reach the crop for which it is intended. Amount and reliability of water supply tends to vary inversely with distance from the outlet; smaller and weaker farmers may be disadvantaged further because of competition from larger farmers. With low water-supply reliability, farmers will make only limited investments in other agricultural technology. Distribution of water within a chak is the responsibility of a water distribution committee (Jal Vitaran) assisted by the ID when conflicts cannot be resolved.

In sub-projects under the loan, the Irrigation Department will engineer, construct and maintain improved watercourses with division boxes where streams are divided and with gated outlets and check structures at each turnout point and lining in selected reaches delivering water to areas of approximately eight hectares and will monitor watercourse operation. If necessary, based on monitoring results, the Irrigation Department will design and enforce a formal schedule of timings (warabundi) providing equitable water allocation to each farm. Responsibility for operation is under study by the ID which has instituted intensive investigations of operations in 40 watercourses. The ID will recommend organizational arrangements based on these studies to be completed by April 1981.

In watercourses, all or part of the irrigation stream is rotated timewise rather than subdivided. This requires establishment of an equitable time schedule based on areas and crops irrigated. Existing communal management by farmers attempts this but with little apparent success. Under rotation the full length of the watercourse is not used continuously, but will be 100 percent of the time up to the first branch and successively less with distance from the canal outlet. Most seepage loss, bank and turnout leakage, weed growth, rapid deterioration and structural damage to watercourses by animals and people can be overcome by installing permanent lining of tile or concrete. This also reduces the time required to move the stream from one field to another. Extent of watercourse to be lined in project MIPs shall be determined by the economic value of the water saved from seepage. In view of the additional benefits in reduction of operation and maintenance cost, and increased operational efficiency, watercourses will be lined, even if the economic benefits based on seepage alone

are 20 percent lower than alternative sources of irrigation water delivered to the field turnout. Studies of losses under various watercourse conditions carried out by GOR will be used in such evaluations.

Improved watercourses and canals will essentially eliminate the inequitites suffered by smaller and disadvantaged farmers that are inherent in the present physical system. This will be insured by the ID responsibility for maintenance and monitoring and AID review. The present watercourse management study initiated by the ID and the studies proposed under the Project will be used to evaluate results achieved.

d. Drainage: Waterlogging is common in MIPs and affects about 10 percent of the land in the sample projects studied. It can be controlled by lining leaky canals and ditches, better system and farm-level water management practices, and increased use of wells. Drainage works designed to eliminate standing water during rain or from irrigation and to relieve waterlogged areas will be installed in all Project MIPs.

e. Soil Surveys: Soil surveys are desirable in selecting land for irrigation and in anticipating needs for drainage works and canal lining. Reconnaissance level surveys with semi-detailed surveys in areas now waterlogged or threatened will be provided for all Project MIPs.

3. Construction: The GOR/ID is the responsible agency for the MIP construction program, and associated civil works such as roads, wells, and other community facilities required to replace facilities inundated by reservoirs. Construction is executed under competitive bid procedure by local contractors, or by force account for highly technical jobs. Resettlement works, less than one percent of project costs, are sometimes turned over by the ID to the Public Works Department (PWD). USAID has reviewed bidding, contract supervision, and other contracting procedures and finds them satisfactory.

4. Cost Estimates and Summary Findings: USAID has reviewed cost estimating procedures for MIPs and actual cost estimates for six potential sub-projects and finds them reasonably firm. Cost estimates are prepared by GOR/ID according to standards set by CWC which has established a separate Directorate on Rate and Cost. CWC reviews sub-project cost estimates and forwards them with their recommendations to the GOI Planning Commission as part of the sub-project approval process. Detailed quantities are taken from engineering plans for major and non-replicated minor works and are projected from sample studies for replicated minor works. Schedules of prices and unit costs are upgraded continuously to reflect current conditions.

While all sub-projects have not been finally selected, a list of projects likely to be included plus others which exceed the availability of AID funding have been provided (See Annex A, Table 1). Since there are a number of proposed sub-projects likely to meet project criteria in excess of project funding, the USAID is satisfied that funds will be drawn down on a reasonable schedule during the life of the Project. Several of these sub-projects have been analyzed in detail as indicated in other parts of this PP. On the basis of such analysis, plus a review of the institutions involved, their current staff and experience, the conclusions on the adequacy of design and firmness of cost estimates have been drawn. Conformance to project design and planning is assured by the requirement, earlier described, that all sub-projects meet agreed-upon criteria. Based on the analysis discussed in this Section, the Project meets the requirements of 611(a).

C. Economics*

The economic feasibility of this project was treated by applying standard discounted cash flow techniques to three selected sub-projects. As prepared by GOR/ID these three projects vary in design - Gosunda is a new project, Morel is partially modernized, and Gudha is nearly fully modernized. This selection of cases provided an opportunity for testing various sub-project designs all leading to full, or nearly full modernization. Application of the GOR/CWC/USAID design criteria will result in most projects approaching the full modernization design.

Each of the three sub-projects was subjected to the same type of analysis, which represents an expansion of that currently used by the Water Utilization Cell (WUC) of the DOA. The main points of difference are, first, the application of discounted cash flow analysis for the direct rate of return (DRR), the economic rate of return (ERR), and the associated rate of return (ARR). Secondly, costs and benefits were lagged by transition periods for (1) construction and other capital outlays; (2) land coming under irrigation; (3) full yield development, and (4) transition in cropping pattern. GOR/WUC benefit cost analysis procedures deal with benefits and costs only at full project development, and farm family labor is not included as a production cost. Annex G describes GOR/WUC procedures and those used in this analysis.

Direct and Economic Rate of Return: The DRR provides the basic

---

* This section is abstracted from the full economic analysis bound separately and on file in ASIA/PD and USAID/India. See "Economic Analysis - Rajasthan Medium Irrigation Project". USAID/New Delhi, 1980

economic analysis of the project as proposed by GOR/ID and various alternatives selected to reflect project design criteria. The ERR uses the same format as the DRR but uses "economic prices" for farm produce and inputs and values farm labor at its opportunity cost. Roughly this results in ERR prices 25 percent higher than DRR (local) prices and farm labor costs of Rs three per man day compared to Rs five per man day. Sensitivity to labor costs and yields were tested. Tables one through seven in the separate Economic Analysis Report provide the full set of input data used in the economic evaluation. The analytical methodology outlined in Sections 2 and 3 of Annex G was applied to these data to obtain the results summarized below, and discussed for each sub-project in the following sections.

Investment Alternatives: A number of investment alternatives were analyzed for each project. The more interesting ones are discussed below. The DRR for the base case and each of the alternatives analyzed are presented in Tables A, B, and C of Annex A in the Economic Analysis Report. The economic feasibility analysis required minor adjustments in the investment costs prepared by the GOR/ID, primarily to provide consistency between the three sub-projects. These adjustments are in Tables D, E, and F, Annex A of the Economic Analysis Report.

Economic Feasibility Indicators

		Gudha	Morel	Gosunda
1.	DRR			
	A. Base case	9.761	7.869	5.059
	B. Full modernization	10.822	8.260	8.481
	C. Advanced construction		9.903	6.193
	D. Adjusted DRR (B & C)	10.822	10.294	9.700
2.	ERR			
	A. Base case	14.055	10.630	7.668
	B. Adjusted ERR	15.116	12.886	12.918
3.	ARR			
	A. Base case	5.498	3.116	2.616
4.	SRR (Social Rate of Return)			
	A. Adjusted DRR + ARR	16.320	13.241	12.231

Gudha

The Gudha Project is fully modernized except for watercourse lining and the GOR/ID proposed project yields a DRR of 9.761 which is a fully justified project. Lining one-third of the watercourse, which would increase yields by five percent and add 600 to 1,200 ha of rabi and kharif irrigated area, would increase the DRR by .52 to 1.1 percentage points over the base case.

Medium irrigation projects are sensitive to both yields and farm labor cost assumptions. In the case of Gudha, reducing farm labor costs by one rupee (20 percent) increases the DRR about one percentage point. For Gosunda, a similar reduction in farm labor costs increased the DRR about one half percentage points. Since full development farm income and farm labor costs are comparable for the two projects, the difference results from the delayed occurrence (nine years vs one year) of costs and benefits for Gosunda due to its long construction period.

A similar relationship exists in the case of crop yields with a 20 percent yield increase adding two points to the DRR for Gudha and only one for Gosunda.

Morel

The Morel Project is partly modernized. As prepared by the GOR/ID, the DRR is 7.869. By adding lining to one third of the watercourses, yields on rabi and kharif surface irrigation would increase five percent, resulting in a DRR of 8.260.

The GOR/ID report lags investment in roads - two years, market development - five years, on-farm works - three years, and fisheries three years from project initiation. Assuming that these investments were advanced two years and the net revenue stream advanced accordingly, the resulting adjusted DRR would be 9.903 a fully justified project.

A number of other sensitivity tests were made, including various yield assumptions and alternative investment packages. Generally, yield increase increments of 5 percent raise the DRR about 0.3, i.e. 20 percent higher yields would increase the DRR by 1.2 percentage points. Various alternatives that reduced on-farm investments resulted in lower DRR's than the base case.

The base case ERR of 10.630 increases to 12.886 with full modernization and a shortened construction period.

Gosunda

Gosunda is a new project. As proposed in the GOR/ID report it is not an economically viable project. The DRR is 5.059. However, when modernized according to the criteria agreed upon between GOR and USAID, the Gosunda project is economically feasible at the lower standard accepted for projects in tribal and backward areas with a DRR of 8.481.

Only main and branch canals are lined in the base case. Modernization of the Gosunda project involves lining of minors and distributaries, and construction of modernized watercourses. This would more than double the investment in land development. The resulting more assured water supply is expected to increase yields by 20 percent and water savings from lining permits the expansion of 1,590 ha of irrigated area in rabi and kharif. This increased the DRR by 1.817. In addition, with modernization, rainfed kharif is expected to increase from 2,365 ha to 4,730 ha, an adjustment similar to that experienced on the Morel project. This increased the DRR by 1.605.

A major problem in the economic feasibility of the Gosunda project is the long construction period. With a construction period of eight years and land development, yield, and cropping pattern transitions assumed for the analysis, the full benefit stream is not achieved until the nineteenth year after starting construction. By reducing the number of new starts and concentrating available resources and staff on fewer projects, the GOR/ID could accelerate the construction program for all projects undertaken, albeit a small number. For purposes of illustration it was assumed that the construction period for Gosunda could be reduced from eight to five years, bringing the benefit stream forward three years. This results in an increase of 1.134 in the base case DRR. Combining all three adjustments - modernization, increased rainfall kharif, and rescheduling construction - results in a DRR of 9.700, a fully justified project. The combined ERR is 12.918. Whether the adjustments in construction schedules and the implied shifts in resource allocation are feasbile is a matter for the GOR to investigate.

Typically, MIPs are designed for extensive use of available water - canal systems are longer and serve a larger area. Higher rates of return can be achieved by reducing the distribution system and the area served but increasing available water per ha, cropping intensity, and yields. The Gosunda sub-project was experimentally redesigned in this fashion. (See Annex A, Table C in the Economic Analysis Report for details). The resulting DRR is 17.279, more than three times the base case DRR. The ERR is 22.615. However, the number of beneficiaries was reduced by about 30 percent.

Economic Feasibility Criteria: The standard feasibility criterion applied by international donors is usually an ERR on the order of 12 percent. There are a number of reasons why this standard is not proposed for application in this Project. In the first place, the GOR/GOI do not find an internal need for the ERR but deal with what approximates the DRR. Therefore, a DRR criterion was selected.

Secondly, the design of MIPs by the GOR/ID provides for extensive use of available water - canal systems are longer and serve a larger area than if the design were to provide an economically optimum investment. However, the GOR approach serves a larger number of beneficiaries, provides better equity and reduces social welfare costs. Experimental redesign of the Gosunda sub-project as indicated above, substantially increased rates of return but benefited 30 percent fewer farmers.

Therefore, USAID proposes to accept as economically feasible, sub-projects with a DRR of nine percent. Following the practices of the GOR for accepting lower rates of return for sub-projects in tribal or other disadvantages area, USAID proposes accepting a DRR of 7.5 percent for such projects. These are comparable to ERRs of about 11.5 and 10 percent, respectively.

Associated Rate of Return: The ARR for each sub-project is shown in the summary above. The ARR provides a measure of the additional benefits generated by the sub-project through direct linkages to the economy of the sub-project area. (Details are in the Economic Analysis Report.) The ARR is additive to the DRR to provide an estimate of the total economic development impact of the sub-project - the Social Rate of Return (SRR). Procedures currently used by the GOR for some sub-projects include costs for "non-project" investments* but do not include associated benefits. Such costs have been included in the three cases analyzed.

Economic Analysis Procedures: In summary, the GOR will assess the economic viability of sub-projects according to the following procedures.

1. Use fully discounted cash flow analysis.
2. Provide for transitions in yields, land development and cropping patterns.
3. Provide separate analyses for major elements of a sub-project, e.g. conjunctive ground and surface water areas

---

*Morel, for example, has capital costs for market development, farm to market roads, as well as fisheries development.

should be evaluated separately from surface only areas.

4. Standardize on the costs to be included in a sub-project and estimate benefits accordingly. For example, if only direct benefits are to be included, costs should be limited to reservoirs and canals and appurtenances, drainage, water-course construction and lining, land development, and roads internal to the CCA. Market development, farm to market roads, etc. would not be included. If all of the above costs are included, associated benefits and costs should be included.

D. Financial Analysis and Plan

The total program of the Department of Irrigation has doubled over the past five years, from about Rs 400 million in 1974-75 to over Rs 800 million in 1978-79. (See Annex A, Table 7). Of this amount, medium irrigation is a rather small proportion, but increased from Rs 16 million or four percent in 1974-75 to Rs 103 million or 13 percent in 1978-79. Estimated 1979-80 and proposed 1980-81 budgets for medium irrigation are Rs 142 million and Rs 219 million respectively. The GOR's VI Plan (1978-79 to 1983) projections total Rs. one billion for medium irrigation.

The number of MIPs identified and at various stages of design and approval at present total an estimated $116 million. These, plus additional projects to be identified under a continuing program by the GOR/ID, will be of sufficient volume to include this $58 million Project. Generally speaking, application of the criteria jointly agreed by GOI/GOR and USAID will increase individual sub-project costs on the order of 30 percent to 45 percent. So the above estimate is conservative.

Water Rates: Water charges are the sole source of direct financial returns to the State on irrigation investments. These are low, approximately equal to operation and maintenance (O&M) costs. They are assessed against each farmer on the basis of areas of irrigated crop and are different for each crop. Water rate schedules are reviewed by a state-level standing committee; changes are proposed by the Irrigation Department, but are actually set by the Legislature The GOR has been active in attempting to increase rates and the Legislature has responded in seven different years between 1957 and 1979. Over this twenty-two year period, rates have more than doubled for most crops - have increased by from 50 to 100 percent since 1972, and were most recently adjusted in 1979. (See Annex A, Table 8)

Data developed in the economic analyses show that the high financial returns to farmers from irrigation, for all but the very smallest farms, would support higher water charges. For example, a two ha farm in the Gudha project currently yields a net farm

revenue of Rs 2,400 which leaves a family of six below the poverty line of Rs 3,600. At full development, which takes place after the fifth year, net farm revenue would be Rs 5,800 of which Rs 2,600 is attributed to the project. Water charges on two ha at present rates would be approximately Rs 100, a small fraction of added net revenue. Clearly, there is little economic or financial rationale for not increasing water rates. In order to ensure recovery of costs of operation and maintenance and, insofar as possible, costs for capital investments, and considering incentives and capacity of farmers to repay, the GOR standing committee will continue to review water and water-related charges and make recommendations to the GOR and the Legislature based on this review.

Land Revenues: Land revenue assessments vary by village. There is no specific state schedule for revisions. They are made periodically. On new MIPs, new assessment rates for land coming under irrigation are fixed by the State Government after settlement operations. On two new MIP projects, tax rates for land irrigated by wells ranged from 10 to 26 Rs/ha, which is two to 2.5 times that for rainfed, and about 50% of the level of water rates.

Rajasthan is strengthening its tax effort. In 1977-78 tax revenues (not including the State's share of Central Government taxes) were estimated at 58 Rs/capita. This is projected to rise by 34 percent in 1979-80. The share of tax revenues contributed by land revenues will rise even faster, from 5.2 percent in 1977-78 to 6 percent in 1979-80.

SUMMARY OF COST ESTIMATE AND FINANCIAL PLAN
($ Millions)

	AID				GOI/GOR						Others		Total
	Grant		Loan		Civil Works		Land Aquis.		Total				
	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC	
MIP CONSTRUCTION				27.00		13.00		4.25		17.25			44.25
STUDIES & OTHER TECHNICAL ASSISTANCE	.27	.18											0.45
25% INFLATION	.03	.02		6.75		3.25		1.05		4.30			11.10
5% CONTINGENCIES				1.25		0.75		0.20		0.95			2.20
TOTAL	.30	.20		35.00		17.00		5.50		22.50			58.00

PROJECTION OF EXPENDITURES BY FISCAL YEAR
($ Thousands)

	AID				GOI/GOR						
	Grant		Loan		Civil Works		Land Aquis.		Total		
	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC	Total
1981	50	50		4,000		2,000		900		2,900	7,000
1982	150	50		6,000		3,000		1,800		4,800	11,000
1983	50	50		9,000		4,500		1,400		5,900	15,000
1984	50	50		9,000		4,500		1,400		5,900	15,000
1985	--	---		7,000		3,000		---		3,000	10,000
Total	300	200		35,000		17,000		5,500		22,500	58,000

E. Social Analysis

1. General Background

Socio-Cultural Setting: Over 80 percent of Rajasthan's population lives in the 33,000 villages of its rural areas; most villages have fewer than 500 people. Children under 14 constitute 44 percent of the population; those over 60 make up only 6 percent. Population growth averages 2.8 percent per year, and total population can be expected to double by the year 2004. Literacy was 19 percent in 1971, life expectancy at birth 46.4 (males) and 44.7 (females), and per capita income in 1974 was Rs 819 ($103). Scheduled castes constitute 10 percent and scheduled tribes 12 percent of the population.

Social Organization: In southeastern Rajasthan, people typically live in small villages and farm lands surrounding the villages. Self-sufficiency and maintenance of a subsistence "floor" are household goals. Holdings must be able to support a labor unit - a family of two to fifteen members - without excessive dependence on outside resources and within the technological limits of bullock cultivation. In southeastern Rajasthan, the average holding is about 3.5 hectares, about the minimum rainfed area for family survival.

Land Holding is fairly stable and mostly owner-operated, for example, 90 percent in the Chambal command area. Although partible inheritance is usual, the holding continues to operate as a unit under the control of the senior male of a household. Nominee holdings, set up to avoid the statutory land ceilings, exist but are not widespread.

Cultivators are responsible for providing all equipment, animal labor, and working capital for farm units and for bearing full risks. Capitalization concentrates on the most essential items. Where resources are inadequate, credit mechanisms are available to cultivators through relatives and friends and through local moneylenders. Institutional credit is available to satisfy a share of ongoing needs.

Labor for most farm operations is provided by the household members. Heavy work is done by men and boys, but women participate in virtually all other operations. Farmers collab orate with neighbors and kinsemen for necessary labor, especially at peak seasons such as harvest. In addition, larger farmers hire laborers at a fixed daily cash wage. During the slack periods family members, both men and women, work either as agricultural labor or on public works projects such as road or canal construction. Generally a reservoir of labor in India is found among the

scheduled caste and the scheduled tribe populations.

Key social elements of the farming system are: (a) the joint family household, (b) the set of patrilineally-linked kinsmen in a community, (c) the wider caste group linked by common custom and marriage alliances, (d) the local configuration of hierarchical castes, (e) the village community and (f) the regional society. The household is the basic social unit. Women join their husbands' households at marriage with inheritance through the male line. Each household is tied in a web of marriage alliances with other local communities.

In southeastern Rajasthan, many small castes coexist. The majority of the population belongs to "middle-range" cultivating castes. Caste distinctions are manifested primarily in restrictions of marriage and in minor ritual customs. The scheduled castes and the scheduled tribes (who are descendants of earlier inhabitants) are usually extremely poor, whether cultivators or laborers.

From two to as many as thirty caste groups may make up a village population, but usually one or two castes of cultivators constitute a majority, with dependent groups of artisans and laborers attached to the community as well.

2. Demography of MIPs: The total population in the 19 districts in which MIPs concentrate was 20,179,000 in 1971 or 78.2 percent of the State's population. The two semi-arid districts of Jalore and Jodhpur accounted for 1,821,000 or 7.0 percent of this population. Population of scheduled tribes totalled 3,025,000 or 15 percent in the project area. Population of scheduled castes was 3,215,000. Population of scheduled tribes was 39 percent in five southeastern districts in the project area. Rural population (by census definition) in 21 districts comprising the project area totalled 16,673,000 or 90.8 percent. Annual population growth in the ten years following 1961 in a sample of nine districts ranged from 1.99 to 3.04 percent. Literacy rates in these same districts ranged from 15 to 25 percent.

Detailed population and other demographic information is difficult to obtain for command areas of specific MIPs. However, two samples of existing projects, Morel and Gudha, show a narrow range of population density, all of it rural, with an average 1.93 per hectare (193/sq kilometer or 500/sq. mile). Sex ratios (male/female) are 1.1 to 1 in both cases. Of the total labor force in the two project areas, about 75 percent are cultivators and the remainder are landless (See Annex A, Table 10).

3. Farm Size Distribution and Tenancy Rights: Average farm size in Rajasthan is 5.45 hectares. Farms are smaller in the districts where this project is concentrated (the "normal zone") and larger in the semi-arid and arid zones of the northwest,

averaging about 3.0 ha in the project area and rising to 18.63 ha in the four arid zone districts. (See Annex A, Table 4).

Using Tehsil level census data (1971) farm size distribution estimates were made for the three MIPs (See Table 11, Annex A). Average sizes are: Jaisamand 2.29 ha; Morel 2.74 ha; Gudha 2.10 ha. Population growth of about 25 percent since 1971 will have reduced these average sizes. Persons per rural household range from five to seven. Average number of tracts per farm were 2.5 in the Morel project.

Two case studies of farm size distribution (see Table 11, Annex A) lead to the conclusion that two-thirds of the farms in an MIP will be average size or less and 90 percent less than twice the average size. In the three projects studied between 80 and 88 percent of the farms are less than 4 hectares.

Table 12, Annex A, shows an abbreviated farm budget based on the economic analysis of the Gosunda project. Considering yields, cropping patterns and farm production costs under existing pre-project rainfed conditions, net farm revenue is estimated at Rs 500/ha. USAID CDSS defines the "reduced" rural poverty line at $75 per capita. For a family of six, about seven ha would be required to yield a poverty line existence.

Again, using data from the economic analysis, the Gudha project with well, surface, and some rainfed areas, net farm revenue was estimated under present, future without project and future with the project conditions. The hypothetical two ha farm is a composite of all farms and cropping conditions in the command area. Present net farm revenue is Rs 2,400, and will increase at full development to Rs 5,800. The average farm in Gudha is about two ha. Such an average farmer would add Rs 2,600 per year to net farm income as a direct result of the project. Using the same poverty criterion as above, the higher productivity of irrigated areas is striking. Three ha is required under present conditions to provide a poverty line family income. At full development only 1.25 ha would be required (see Table 13, Annex A).

These two projects are typical of those to be financed and this had lead to a small farmer criterion of 50 percent or more of farm households having four ha or less for qualifying MIPs.

While ownerhsip of land legally resides in the State, tenants normally exercise all rights of ownership including transfer by sale, subletting, inheritance and mortgage. Under the Rajasthan Tenancy Act, in order to protect their rights as a class, members of scheduled tribes and castes may not transfer their tenancy interests to persons who are not members of scheduled tribes or castes.

Legislation fixes ceilings on land held in single family ownership at 10.8 ha for irrigated land capable of growing one crop and 7.2 ha for land with assured irrigation capable of growing two crops. These are sufficiently high that they are generally inoperative in MIPs except for a few holders in new projects.

4. Reservoir Area Displacement and Land Acquisition: Procedures for land acquisiton for public works are prescribed by the Rajasthan Land Acquistion Act of 1954 and are based on the constitutional principle that no one can be deprived of property without due compensation. Courts have ruled that rights of use are equivalent to property. These procedures apply to land and other property required for reservoirs, canals, roads, and other public facilities.

In reservoir areas displaced residents are compensated but not with AID funds for loss of land, and standing crops located below the level where 75 percent of the reservoir area is submerged, and for all houses, outbuildings, wells and trees located below full submergence level. Lands above 75 percent submergence level may be farmed by their owners utilizing residual moisture as the reservoir recedes. Rates of compensation are set at market value by the appropriate Revenue Department authorities. Government-held land, if available in the irrigated area, may be exchanged for reservoir lands and displaced persons are given first opportunity to purchase such lands but not at special concessional prices, although such government lands are priced well below market value.

These procedures appear fair and equitable, though, typically, strong objections often are raised by affected land owners. The CWC/AC will report on the implementation of these procedures. Baseline studies to be conducted in new and on-going projects will provide the facts to assess the impact of an MIP on this special group.

5. Social Water Allocation: This practice is designed to ensure that the smallest farmers receive full water supply (Rule 10 (1)(1), Rajasthan Irrigation and Drainage Act of 1954). Water delivery programs are developed by a Water Users Committee chaired by the project Executive Engineer. Application of the rule varies according to circumstances and available water in any year. The approved minutes of the Jawai Project Water Users Committee meeting for 1977-78, for example, provide for allocation of full water supply to all holdings of less than two acres, full water supply for two acres for holdings ranging from two to eight acres in size, and full supply for 25 percent of all holdings greater than eight acres.

6. Targeted Rural Development Programs: Several different

agencies were created by GOI over the past decade to implement programs aimed at specific groups - small and marginal farmers or those in drought hazard areas. The one most relevant to the Rajasthan MIP Project is organized under the Small Farmer Development Agency (SFDA) which provides funding to lending agencies for subsidies for capital development for small and marginal farmers. Subsidies are 25 percent for small farmers (less than two ha rainfed or one ha irrigated), 33 1/3 percent for marginal farmers (less than 1.0 ha rainfed, 0.5 ha irrigated) and 50 percent for community projects where half the beneficiaries are small and/or marginal farmers. This is important to MIPs in the Project because of the large number of small farmers and because on-farm and communal development works in MIPs are financed by the farmers themselves.

7. Social Soundness: Project benefits will tend to accrue in proportion to irrigated land holdings. That AIDs target group will be benefitted is assured (a) by the social water allocation program described above; (b) by the fact that landholders in the project area are very predominantly small farmers; specifically 50 percent of land holdings in qualifying MIPs must be less than four hectares; and (c) because improvements in canals and watercourses under the Project will make it physically possible to distribute water equitably.

8. The Role of Women: Women in the project area investigated play an active role in virtually all aspects of rural life. They are, in ritual and in theory, subordinate to men; in fact, women and especially mature women, play an important part in village economic and political life. In poorer families and among smaller farmers, women and girls may earn substantial income through seasonal labor on other farms or by off-farm employment. Women may participate in Panchayats, and they occupy reserved seats on local government bodies. Nine women hold seats in the State Legislative Assembly.

Women will make up a significant percentage of the labor force on construction work associated with the project, and will be paid at a rate equal to male workers. Women will also take part in constructing and maintaining the watercourses for family land.

Women and girls will benefit from project inputs primarily through the increased productivity of farms. Greater farm income, as well as a larger amount of food for subsistence, should increase nutrition and health for all family members and reduce seasonal shortages and permit purchase of necessary consumer durables. Expenditure on activities often considered "socially" wasteful, such as marriages, not only provide recreation, but also associate the families of castes in a socio-economic web which has important "social insurance" implications, especially for poorer farmers

who must call on relatives in time of need. Another important enhancement of the quality of life in participating project areas is the increased opportunity for women's participation in religious pilgrimages and festivals brought about by higher income from the farm.

F. Environmental Impact

The PID review for this project called for an Environmental Assessment (EA) during project design. The EA of this project represents the culmination of a series of events as follows: (1) U.S. environmental consultant assistance to USAID/India in identifying Indian institutions to undertake AID project EAs with particular emphasis on medium irrigation projects, (2) preparation of a scope of work for undertaking this EA, and (3) the solicitation of proposals and the award of a contract to a local institution. The central GOI and the state Governments of Rajasthan and Gujarat (for which a concurrent EA is being conducted on a similar project that is AID/IDA co-financed) played active roles in developing the scope of work and in identifying capable Indian institutions In carrying out this assessment, the local contractor, Operations Research Group (ORG), worked closely with GOR irrigation department project officials and employed a number of Indian consultants in engineering, zoology, botany and geography.

The methodological approach relied on the development of a model which was used to identify key components (starting with the catchment area and extending to the command area) that are susceptible to environmental change in irrigation systems. A checklist reflecting potentially positive and negative impacts correlated with all parts of the system was prepared. Data on impact were collected from (1) project reports, (2) interviews with farmers in project areas, and (3) field observations. The scope of the study was confined to five projects potentially eligible for AID financing and that were representative of the environmental conditions existing in the five physiographic regions which the entire irrigation program encompasses. Findings on these projects formed the basis of general conclusions regarding the environmental impact of the irrigation program.

These conclusions (see Annex J and complete report on file in ASIA/PD) show that, on the whole, this project will not have a significant adverse impact on the physical and human environment. Potentially adverse secondary impacts such as deforestation and soil erosion in project catchment areas have been identified by both Irrigation and Forestry Department officials and coordinated corrective measures are being taken to restore the forest cover. The direct problems of drainage are associated predominantly with older existing projects. Irrigation officials have devised programs to control the problems of waterlogging in these areas. Under

this project, the lining of canals and other distributaries is expected to reduce significantly the potential of waterlogging in new schemes as well as to go a long way toward solving the problem in existing projects.

Potentially negative social consequences resulting from the dislocation of villagers in submerged areas are recognized, and guidelines, including the placement of villagers on land in project command areas, have been incorporated into a resettlment program. Other potentially negative impacts on the human population such as the increased incidence of malaria are expected to be minimal. In areas where malaria has increased (but not significantly) along with the introduction of surface irrigation systems, further study is needed to determine the degree of correlation between the two variables. Available data suggest no casual relationships.

The EA also recognizes the potentially positive benefits to be derived from irrigation systems. Apart from the direct benefits of increased crop production, incomes, and employment in command areas, fish farming and recreational centers would also be made possible in reservoir areas. Flood control, in addition, is a positive environmental outcome of irrigation projects.

IV. IMPLEMENTATION PLAN

A. GOI/GOR Administrative Arrangements

1. Project Preparation, Appraisal and Implementation: The GOR/ID develops and proposes an overall plan for irrigation development in the State - long range in five year plans and annually for each budget year. The MIP program is a part of this process. GOR/ID proposals are reviewed by the Planning and Financial Departments of the GOR and a final MIP program submitted to the GOI Planning Commission and Ministry of Finance (MOF) for approval. After approval of an overall program, including the identification of specific projects, by the Planning Commission and MOF the GOR/ID proceeds with detailed project development.

The Central Water Commission (CWC) is responsible for technical appraisal and approval of all medium irrigation projects over 2,000 ha in CCA throughout India and, through a special Appraisal Committee, virtually all sub-projects in this Project. To qualify for support under the loan, MIPs must meet certain specified criteria as set forth in the Project Paper and the Loan Agreement. The CWC will be responsible for appraising candidate MIP designs and certifying their compliance with these criteria. These appraisals are done collaboratively with the GOR. USAID would participate in the appraisal of selected projects proposed for AID financing. Sub-projects with CCA less than 2,000 ha will be approved by a GOR Committee (represented by Rajasthan Irrigation, Planning, Finance

and Agricultural Departments) applying the same criteria as does CWC/AC.

The CWC is under the purview of the Department of Irrigation, GOI Ministry of Irrigation and Power. The Department is responsible for setting overall policy and guidelines for the development of MIPs and coordinating foreign donor assistance to states.

Direct involvement of the DOA in MIPs is through the Water Utilization Cell, which is responsible for benefit analysis and determination of the B/C ratio or DRR. The Cell is staffed by agronomists/economists experienced in MIP analysis, and quite competent to perform the B/C ratio analysis currently in use. Training will be provided in discounted cash flow analysis for project design and evaluation and the use of computer techniques if required.

Sub-project Summary Reports prepared by the CWC/AC and the GOR Appraisal Committee will be submitted to USAID. Upon acknowledgement by USAID, payments on the sub-project are eligible for reimbursement.

2. Supporting Agricultural Services: Complementary to the construction program, but not financed under this project, are necessary agricultural inputs and services including fertilizers, pesticides, credit, markets and market access, and agricultural extension. The Ministry of Agriculture is responsible for supplying or coordinating the supply of these services. The GOR will provide a statement on agricultural support services for each sub-project when submitted to the CWC/AC or GOR/AC for approval for AID financing (see Section II A 3).

Command Area Development (CAD) features of MIPs are the responsibility of GOR/ID for planning and design. Other affected departments of GOR then arrange through their own budgets for conduct of activities such as provision of farm-to-market roads, schools, health centers, and the like. The GOR/ID and DOA assist farmers in preparing applications for loans from institutional financing agencies (e.g. commercial banks or the cooperative land development banks) for on-farm development costs that must be borne by farmers in CAD programs.

3. Water Allocation and Management: Decisions on water distribution for each medium irrigation project are made each year by its Water Committee. The members of the Legislative Assembly

from the constituencies falling in the command area and the Sarpanchas of the local government Pancharat bodies from the area are members. Additional farmer members may be appointed by the Sarpancha. The Executive Engineer in chage of the MIP is Chairman and reports on available water that can be supplied. The number of irrigations and general cropping program is determined by the Commitee. Final decisions are ratified by the Executive Engineer after considering the desires of the farmers and the advice of the irrigation specialists.

Each chak has a Jal Vitaran (Water Distribution or User Committee) for allocation of water within the chak (ca 40 ha) and resolution of disputes. Participation on the chak committee is formally open to all with land in the chak. Disputes which are not settled among the farmers themselves are referred to the Executive Engineer who is empowered to make an official decision. But this is infrequently necessary. Water User Committees are required to supervise construction of watercourses and lining. Irrigation Department officials are required to keep the committees informed of their actions and procedures which may affect operation of watercourses in the chak. With the GOR assuming full responsibility for watercourses down to the farm level, the Water Users Committee should be much smaller and easier to manage.

Deputy collectors reporting to Executive Engineers supervise Ziladars who are responsible for irrigation water management on about 20,000 acres each. Irrigation Patwaris report to Ziladars. Each Patwari supervises distribution of water for about 2,000 hectares. Patwaris prepare water distribution schedules. They are responsible for ensuring equitable distribution of water, keeping records of areas of crops grown by each cultivator, and for imposing penalties for misuse or waste of water. Cultivators who misappropriate water to their own use are assessed penalties equal to twice the annual water charge. Penalties for wasting water are assessed at twenty times normal water charges.

In order to improve water management, particularly at the chak level, training programs will be set up and training modules prepared by the GOR's Irrigation and Agriculture Departments for training of departmental, community level and water-user organizations in applied water management principles and techniques. AID will provide grant assistance as needed for preparation of training modules. If desired by the GOR, AID will provide grant funding for technical assistance in water management organization and administration for extension and water user organization personnel.

B. AID Implementation/Monitoring

1. AID Administrative Arrangements: USAID/New Delhi has designated a Project Manager who will be responsible for coordinating Project analyses and formulation and will handle all facets of Project implementation. A USAID Project Committee has been formed to assist the Project Manager. USAID's Controller will make all project disbursements in accordance with standard AID procedures regarding direct reimbursement.

2. Project Monitoring: USAID staff will participate in selected sub-project appraisals in the initial stages of the project to ensure compliance with the intended appraisal procedures. Thereafter, throughout the life of the project such participation will be on a more selective basis. Periodic trips to monitor construction activities, including contracting procedures, will be made as appropriate. In addition, monitoring activities will cover other aspects of the Project such as baseline studies progress, coordination by the Ministry of Agriculture and use of training and technical assistance. Trip reports covering substantive issues will be prepared and shared with the GOR and CWC. Project reports by the Appraisal Commitee of CWC will provide a further basis on which to monitor sub-projects progress and identify issues. Mission staffing will be adequate to carry out the above monitoring responsibilities. This includes one irrigation engineer who will be joining the USAID staff in the summer of 1980, as well as the agriculturists and loan officers currently part of the Project Committee.

3. Progress Reporting: CWC/AC will prepare and submit the following progress reports: (a) Project Implementation Reports will be prepared annually after a review with GOR officials. It will include status of sub-projects under planning, implementation and operation and projections for the ensuing year and the remaining life of the project, giving particular attention to management and financial considerations, (b) Reports will be submitted following visits to Divisional Offices and/or field sites for each-sub-project on the following schedule: (1) Preparation Report every six months; (2) Implementation Report three times during the construction season; (3) Operation Report annually after completion of implementation. Reports will comment on scheduled activities, assess performance and flag present and potential problem areas.

4. Disbursements: Sub-projects approved either by the CWC or the GOR Appraisal Commitee, as described above, will be eligible for reimbursement in the amount of 67 percent of civil works. The Mission will seek Direct Reimbursement Authority (DRA) from AID/W and reimburse the Ministry of Finance upon the submission of appropriate vouchers. Documentation required will include a summary

expenditure statement from the GOR/ID indicating the contract to be reimbursed, work completed, and a certification that expenditures have been incurred during the period of the report. The Project authorities will retain all contracts, vouchers, etc. for AID monitoring and audit purposes. Once sub-projects have been approved, payments for sub-projects made subsequent to signing of the Loan Agreement will be eligible for reimbursement. Projects that are AID financed in any part will be completed by the GOR according to agreed criteria.

5. Implementation Schedule:

June 1980 - sign Project Agreement, obligate first tranche of $15 million.

November/December - Initial sub-project Summary Reports submitted to USAID

Second Quarter FY 81 - Disbursement begins

October 1981 - First Annual Evaluation

February 1983 - Special Evaluation

June 1985 - Project Assistance Completion Date; followed by final evaluation.

C. Evaluation Plan

1. Regular Evaluation: The GOR/USAID will conduct regular evaluations at appropriate intervals following commencement of the Project. These evaluations will cover progress on physical construction, funds disbursed, status of special studies required under the project and area actually brought under irrigation. The GOR will provide USAID with an annual summary report including the above, and other mutually agreed data.

2. Special Evaluation. The GOR and USAID have agreed to conduct a special evaluation of project performance at the mid-point of project implementation, probably about thirty months after initiation. This evaluation will include, in addition to review and analysis of items covered in regular evaluation, information on cultivators benefitted, employment generated, yield changes, changes in output and income for benefitted farmers, increases in available water, operational/implementation problems requiring action and training, an in-depth analysis of the performance of selected improved watercourses, appropriateness of design criteria, agricultural performance, organizational arrangements for the allocation and management of irrigation water, special

attention to beneficiary and environmental impact, and detailed analysis of implementation problems with recommendations for resolution. USAID will provide grant financing for the services of an irrigation engineer, hydrologist, agronomist, and agricultural economist to assist in the evaluation. The CWC will also participate. The scope of work for the evaluation team will be prepared by the GOR in consultation with CWC and USAID.

3. Baseline Surveys: Detailed socio-economic baseline surveys for selected sub-projects (notionally, eight or ten) will be conducted by the GOR, either directly or with contract assistance. AID will provide grant financing of these studies as part of the project if requested by the GOR. Baseline surveys will be tailored to each selected sub-project but a standard set of data will also be obtained in each survey. Particular attention will be paid to assessing the situation in the market town or towns serving the command areas of sub-projects. This will include an assessment of the off-site employment generating effects of irrigation development as well as the adequacy of input systems. Baseline data will be used in the full mid-project evaluation and for post-project evaluations. Conduct of these will be undertaken in the same MIPs where water management studies are made, where this is practical.

4. Water Management Studies: There is a need to determine specifically how much and when, in relation to crop needs, the water provided to a watercourse actually reaches cropped fields. This can be done by measuring the water at the turnout and at the fields during the irrigation season on a sample basis including unimproved, improved and lined watercourses. Such studies will be conducted over a period of four years in order to see what changes take place under modernization and improvement. This is fundamental to understanding the operation of watercourses, improvement in management, and economic evaluation of investment in watercourse implementation. In addition to Indian research staff, USAID proposes short-term grant financed consultancies by experts in the field, as mutually agreed by GOR/GOI and USAID.

D. Conditions Precedent, Covenants and Understandings

No special Conditions Precedent (CPs) or Covenants to this loan will be required.

ANNEX A - STATISTICAL TABLES

1. Tentative List of Projects Proposed for USAID Assistance

2. Areas and Yields - Principal Crops 1977-78

3. Areas Irrigated and Cropped in Rajasthan

4. District-wise Position of average Size og Holding and Percentage of Holdings and Areas to State Total

5. Summary of Costs and Areas for Study MIPs

6. Yields in Sample MIPs - Qtls/ha

7. Expenditure by GOR Irrigation Department

8. Water Charges Applicable to Medium Irrigation Projects Rs/Acre

9. District-wise Position of Rural and Urgan Population as also the Population of Scheduled Tribes

10. Population and Labor Force in Two Sample MIPs

11. Farm Size Distribution in MIPs

12. One Hectare Rainfed Farm Budget - Gosunda

13. Composite Farm Budgets - Gudha

TABLE 1

TENTATIVE LIST OF PROJECTS PROPOSED FOR USAID ASSISTANCE

#	Projects	District	Environmental Region	Irrigated Area (Ha)
New Projects				
1	Khotari	Bhilwara	North Mewar Upland	3,077
2	Gosunda	Chittogurh	Mewar Plateau	9,569
3	Bassi	Chittogurh	N. Mewar Upland	2,892
4	Hindlot	Kota	Hadoti Plateau	2,965
5	Chhapi	Jhalawar	Hadoti Plateau	7,000
6	Bilas	Kota	Hadoti Plateau	2,480
7	Gagrin	Jhalawar	Hadoit Plateau	7,676
				35,659
Ongoing				
9	Meja Feeder	Bhilwara	N. Mewar Upland	4,000
10	Harischander Sagar	Jhalawar	Hadoti Plateau	8,000
11	Bhimsagar	Jhalawar	Hadoti Plateau	7,000
12	Panchana	Sawaimahoupaur	Eastern Plains	5,600
				(24,600)
Modernization				
13	Meja	Bhalwara	N. Mewar Upland	2,480
14	Gombhiri	Chittogarh	Mewar Plateau	2,960
15	Morel	Swamaimahoupaur	Jaipur Uplands	4,100
16	Parwan Weir	Kota	Hadoti Plateau	1,600
17	Gudha	Burdi	Hadoti Plateau	1,940
18	Jawai	Pali	Luni Basin	3,600
19	Alnia	Kota	Hadoti Plateau	1,616
20	Parwati	Kota	Hadoti Plateau	3,160
21	Galwa	Tonk	Hadoti Plateau	1,120
22	Jaswant Sagar	Jodhpur	Luni Basin	2,005
23	Mashi	Tonk	Jaipur Uplands	2,020
24	Jaisamand	Udaipur	Mewar Plateau	5,500
25	Rajsamand	Udaipur	Mewar Plateau	2,800
26	Jagger Bund	Sawaimodhopur	Eastern Plains	3,698
27	Chhaparwada	Jaipur	Jaipur Uplands	2,575
28	Kalakhsagar	Jaipur	Jaipur Uplands	1,313
29	Parbati	Bharatpur	Eastern Plains	2,906

TABLE 2 AREAS AND YIELDS - PRINCIPAL CROPS 1977-78

Crop	Area 000 ha			Yields kg/ha	
	India	Rajasthan	%	India	Rajasthan
Rice	40,002	183.5	4.6	1,317	1,296
Jowar	16,273	722.7	4.4	726	396
Bajra	11,035	4,074.2	36.9	427	197
Maize	5,700	749.2	13.1	1,043	688
Wheat	21,203	1,831.3	8.6	1,477	1,424
Barley	1,992	470.5	23.6	1,159	1,403
Total Cereals	103,597	8,089.9	7.8	1,099	—
Pulses	23,536	4,019.9	17.1	501	504
Major Oilseeds	15,506	1,116.0	7.2	576	—

Source: Indian Agriculture in Brief 17th Edition

TABLE 3 AREAS IRRIGATED AND CROPPED IN RAJASTHAN

	Area 000 Ha	% Area	Percent Irrigated Rajasthan	Percent Irrigated All India
Rice	(155)	(0.9)	37.4	38.2
Jowar	(713)	(4.2)	0.1	5.0
Wheat	(1762)	(10.3)	64.9	61.9
Total - Cereals and Millets	7912	46.1	22.3	30.9
Gram	(1953)	(11.4)	17.8	16.7
Total Pulses	4479	26.1	8.1	8.0
Total Foodgrains	12391	72.2	17.2	26.5
Sugarcane	40	0.2	95.0	78.3
Condiments & Spices	177	1.0		
Fruits	10	0.0		
Total Vegetables	31	0.2		
Groundnut	(280)	(1.6)	0.4	7.0
Total Oilseeds	1116	6.5	8.3	7.8
Cotton	309	1.8	74.8	22.8
Unreported	3087	18.0		
	17,164			

Principal irrigated crops are wheat, 1,144,000 hectares, gram, 347,000 hectares and cotton, 231,000 hectares out of a total of 2,934,000 hectares reported irrigated in 1975-76. Nearly all sugarcane, which is a relatively minor crop, is irrigated. Most barley is irrigated, but very little (less than 1 percent) of jowar, bajra and maize is.

As shown by Table 2 yields for wheat, rice and pulses, crops which are irrigated, are very hear to the national average but Jowar yields are only about one-half. This table also shows that, compared to India, pulses are emphasixed in the cropping pattern. Areas in cereals, particularly wheat, fall short but approach the national average.

TABLE 6

District-wise Position of average Size of Holding and Percentage of Holdings and Areas to State total

District	Average size of holding (hectares)	Percentage to state total	
		Holdings	Area
Normal Zone			
(a) NTA			
1 Ajmer	2.95	4.42	2.39
2 Alwar	2.41	5.83	2.58
3 Bharatpur	2.25	7.86	3.25
4 Bhilwara	2.80	5.47	2.81
5 Bundi	3.67	1.68	1.13
6 Ganganagar	8.96	4.26	6.99
7 Jaipur	3.93	6.82	4.96
8 Jhalawar	3.51	2.82	1.81
9 Kota	4.27	3.95	3.09
10 Pali	5.14	4.15	3.91
11 Sawai Madhopur	2.80	5.17	2.66
12 Tonk	4.46	3.05	2.49
Non-tribal area	3.75	55.50	38.07
(b) TA			
13 Banswara	2.53	2.56	1.19
14 Chittorgarh	3.27	4.18	2.51
15 Dungarpur	2.13	2.15	0.84
16 Sirohi	3.22	1.76	1.04
17 Udaipur	1.37	8.15	3.27
Tribal area	2.57	18.80	8.85
Arid Zone			
18 Barmer	19.71	2.85	10.28
19 Bikaner	22.01	1.29	5.20
20 Churu	14.72	2.73	7.37
21 Jaisalmer	25.14	0.56	2.53
Arid zone	18.63	7.43	25.38
Semi-arid Zone			
22 Jalore	8.95	2.56	4.18
23 Jhunjhunu	4.72	2.71	2.35
24 Jodhpur	12.82	3.67	8.63
25 Nagaur	8.52	4.75	7.42
26 Sikar	4.67	3.57	3.06
Semi-arid zone	8.11	17.26	25.64
27 Colonisation area	1.10	1.01	2.06
State	5.68	100.00	100.00

TABLE 5

SUMMARY OF COSTS AND AREAS FOR STUDY MIPs

Project	Cost (Lacs Rs)	Culturable Command Area - has	Nor Irrig. After Project	Add'l Normal Irrig. has	Cost Rs/ha Add'l Normal Irrigated Area - Rs	Notes
Chappi	587.45	9,336	7,000	7,000	8,392	New Project Main canals only lined
Gosunda	709.50	10,000	9,569	7,632	9,296	New Project Main canals only lined
Bhimsagar	664.70	9,990	8,301	8,301	8,007	On going project Dam and unlined canals
Jaisamand	625.00	26,200	11,548	5,497	11,370	Modernization Main canals, distrib-utaries and minors lined
(with W.C.)	(689.00)			(8,010)	(8,602)	W.C. est questionable
Gudha	266.51	10,860	10,704	3,475	7,670	Modernization Main canals, distrib-utaries and minors lined
Morel	582.50	21,600	22,355*	7,028	8,280	Modernization Raise dam. Line main canals, distributaries and minors
	3,435.66	87,986	69,477	38,933	8,824	

*16,200 rabi

TABLE 6 YIELDS IN SAMPLE MIPs - Qtls/Ha.

Crop	Mixed Sawai Madhopur 1/	Unirrigated	Irrigated Present	Irrigated Projected
Wheat HVY				30.0
Wheat	11.3	7.3	12.8	20.0 - 25.0
Mixed Rabi		6.5	8.4	18.0
Jowar	4.2	5.6	10.0	20.0
Bajra	4.5		15.0	
Barley	10.7	1.0	13.6	20.0
Maize	4.3	7.0	9.7	
Maize, Hybrid				30.0
Rice	11.8	11.0		35.0
Pulses, Kharif	2.7	3.5	4.0	
Pulses, Rabi	5.8	6.0	7.0	10.0
Gram	6.5	5.3	7.4	15.0
Mustard	3.5	5.0	6.0	10.0
Groundnut	6.1	4.7	7.0	
Oilseeds		1.6	5.0	
Fodder, Rabi			125.0	200 - 250
Sugarcane			150-527	700
Cotton	8.0	3.0	5.0	
Cotton, American				15.0
Til	1.9	2.7	5.0	
Chillies		4.0	5.8	5.0
Moong		4.0		8.0

1/ 1970 - 75.

TABLE 7

EXPENDITURE BY GOR IRRIGATION DEPARTMENT

UNITS : Rs. Crore

SOURCE	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80 Estimated	1980-81 Proposed	78-79-82-83 VI Plan indicated
1. Govt. of Rajasthan.	4.16	4.89	6.45	7.47	8.03	8.49	9.50	*
2. Central Grants								
Major:	27.85	34.82	47.38	52.64	48.86	37.21	44.03	298.97
Medium:	1.63	2.61	3.28	5.81	10.26	11.37	17.55	106.03
Minor:	1.60	1.78	3.78	3.80	4.75	6.40	5.00	25.00
3. Centrally Sponsered schemes(LOAN)	3.98	2.72	6.10	4.67	9.02	28.17	9.00	*
TOTAL:	39.21	46.83	66.99	74.40	80.92	91.65	85.08	

* Not yet known.

TABLE 8

WATER CHARGES APPLICABLE TO MEDIUM IRRIGATION PROJECTS Rs/Acre

Name of Crops	1957	1958	1967	1970	1972	1974	1976	1979
Sugar Cane	22.00	22.00	27.00	27.00	30.00	35.00	40.00	46.00
Rice		8.50	8.50	10.00	14.00	25.00	28.00	32.00
Cotton		8.00	13.00	13.00	20.00	25.00		29.00
Garden	12.00	12.00	17.00	34.00		50.00		58.00
Maize			7.00	7.00		12.00		14.00
Jawar (Sorghum)			7.00	7.00	7.00	12.00		14.00
Bajra (millet)			7.00	7.00		12.00		14.00
Pulses				12.00		15.00		17.00
Sunhemp & grass				12.00		12.00		14.00
Gowar				12.00	12.00	15.00		17.00
Vegetables	12.00	12.00	17.00	14.00		20.00		23.00
Spices & other Kharif crops				12.00		16.00		18.00
Oilseeds				12.00		16.00		18.00
Waternuts				17.00		25.00		29.00
Indigo & other dyes				12.00		25.00		29.00
Zeera		8.00	13.00	13.00		25.00		29.00
Lucern, Poppy, Tobacco		10.00	15.00	15.00		25.00		29.00
Palewa		4.00	4.00	4.00		6.00		7.00
Wheat	10.00	8.00	10.00	8.00	12.00	15.00	21.00	24.00
Barley, Oats	8.00		7.00	7.00		11.00	15.00	17.00
Fodder				12.00		12.00		14.00
Bajar, Gochari				12.00	12.00	16.00	20.00	23.00
Melons, All other Rabi crops				12.00		18.00		21.00
Gram with 1 watering	7.00		7.00	7.00	7.00	10.00	14.00	16.00
Gram with 2 waterings				12.00	12.00	15.00	20.00	23.00
All Other Crops	7.00	7.00	12.00					

TABLE 9

District-wise Position of rural and urban Population as also the Population of Scheduled Tribes

Thousands

District	Population			Population of Scheduled Tribes	Scheduled Castes
	Rural	Urban	Total		
Normal Zone					
(a) NTA					
1 Ajmer	716	432	1148	15	198
2 Alwar	1264	127	1391	111	241
3 Bharatpur	1285	205	1490	44	311
4 Bhilwara	939	116	1055	98	167
5 Bundi	387	98	485	87	84
6 Ganganagar	1164	230	1394	2	385
7 Jaipur	1736	746	2482	276	400
8 Jhalawar	563	59	622	64	102
9 Kota	869	275	1144	166	207
10 Pali	862	108	970	46	146
11 Sawai Madhopur	1051	142	1193	270	253
12 Tonk	517	109	626	71	123
Sub-total	11353	2647	14000	1250	2567
(b) TA					
13 Banswara	621	34	655	477	25
14 Chittorgarh	847	98	945	185	129
15 Dungarpur	499	31	530	338	21
16 Sirohi	348	76	424	91	71
17 Udaipur	1582	222	1804	607	139
Sub-total	3897	461	4358	1698	385
Arid Zone					
18 Barmer	719	56	775	45	111
19 Bikaner	336	237	573	4	89
20 Churu	616	259	875	4	151
21 Jaisalmer	143	24	167	7	23
Sub-total	1814	576	2390	60	374
Semi-arid Zone					
22 Jalore	638	30	668	53	109
23 Jhunjhunu	767	162	929	16	130
24 Jodhpur	785	368	1153	24	154
25 Nagaur	1107	155	1262	2	221
26 Sikar	865	178	1043	26	135
Sub-total	4162	893	5055	121	749
Total	21226	4577	25803	3129	4,076

TABLE 10

POPULATION AND LABOR FORCE IN TWO SAMPLE MIPs

	Morel		Gudha		Total	
	No.	Percent a/	No.	Percent a/	No.	Percent a/
Gross Command Area Has.	23,900		18,146		42,046	
Culturable Command Area Has	21,600		10,860		32,460	
Population	44,999	b/	35,972	b/	80,971	
Sex Ratio M/F	1.1/1.0		1.1/1.0		1.1/1.0	
Literacy Total	5,524	12.27	3,028	8.42	8,548	10.56
Male	4,979	11.06	2,564	7.13	7,543	9.32
Female	545	1.21	461	1.28	1,005	1.24
Work Force	14,014	31.14	12,574	34.95	26,588	32.84
Male	12,094	26.88	10,699	29.74	22,793	28.15
Female	1,920	4.27	1,875	5.21	3,795	4.69
Cultivators	10,900	24.22	8,718	24.24	19,600	24.23
Male	9,128	20.28	7,769	21,60	16,879	20.87
Female	1,772	3.94	949	2.64	2,721	3.36
Agricultural Laborers	1,219	2.71	1,524	4.24	2,923	3.39
Male	939	2.09	851	2.37	1,970	2.21
Female	280	0.62	673	1.87	953	1.18
Other Workers	2,245	4.99	2,332 c/	6.48	4,577	5.65
Male	2,075	4.61	2,079	5.78	4,154	5.13
Female	170	0.38	253	0.70	423	0.52
Number of Farm Families			5,170			
Population/sq km GCE	188		198		193	
Population/sq km CCA	196		331		247	
Farm Families/Ha			0.48			

a/ of total population

b/ Entire population is rural

c/ Mining, quarrying, livestock, poultry fishing, plantations, orchards, etc.

TABLE 11

FARM SIZE DISTRIBUTION IN MIPs

Farm Size (ha)	Gudha a/		Morel b/		Jaisamand		Pali Study c/	
	%	Cum	%	Cum	%	Cum	%	Cum
0-1	44.2	44.2	28	28	32	32	8.7	8.7
1-2	23.1	67.3	26	54	29	61	14.6	23.3
2-3	13.7	81.0	16	70	15	76	16.4	39.7
3-4	7.3	88.3	10	80	10	86	7.9	47.6
4-6	5.8	94.1	11	91	8	94	20.2	67.8
6-10	4.7	98.8	8	99	5	99	19.8	87.6
10 and over	1.2	100.0	1	100	1	100	12.4	100.0
CCA, ha	10,860		21,600		26,200		1,547	
Households	5,175		7,892		11,452		292	
Ave. Size, ha	2.10		2.74		2.29		5.30	
Population	36,000		44,999		57,076		----	
No. of Holdings			19,994		88,345		938	
Holdings/household			2.53		7.71		3.21	

a/ From sub-project report, except households from census

b/ Synthesized from project report and 1971 census data using normalized distribution based on Gudha and Pali.

c/ Studies on the Economics of Farm Management, Pali District Rajasthan, Combined Report 1961-62 to 1964-65. Directorate of Economics and Statistics, Ministry of Agriculture, Gov't. of India.

TABLE 12

ONE HECTARE RAINFED FARM BUDGET - GOSUNDA[1/]

	Net Rev/ha	% Land Use	Net Farm Revenue
RABI			
Wheat	571	---	---
Barley	582	---	---
Oilseeds	853	---	---
Pulses	651	.20	131
Condiments	1082	.05	54
Fallow	---	.75	---
		Sub Total	185
KHARIF			
Maize	624	.20	125
Sorghum	702	.10	70
Oilseeds	654	.10	65
Pulses	395	.05	20
Fodder	699	.05	35
Fallow	---	.50	--
		Sub Total	315

1/ This table based on Gosunda existing rainfed cropping pattern and yields and net revenue from rainfed areas under without project conditions.

TABLE 13

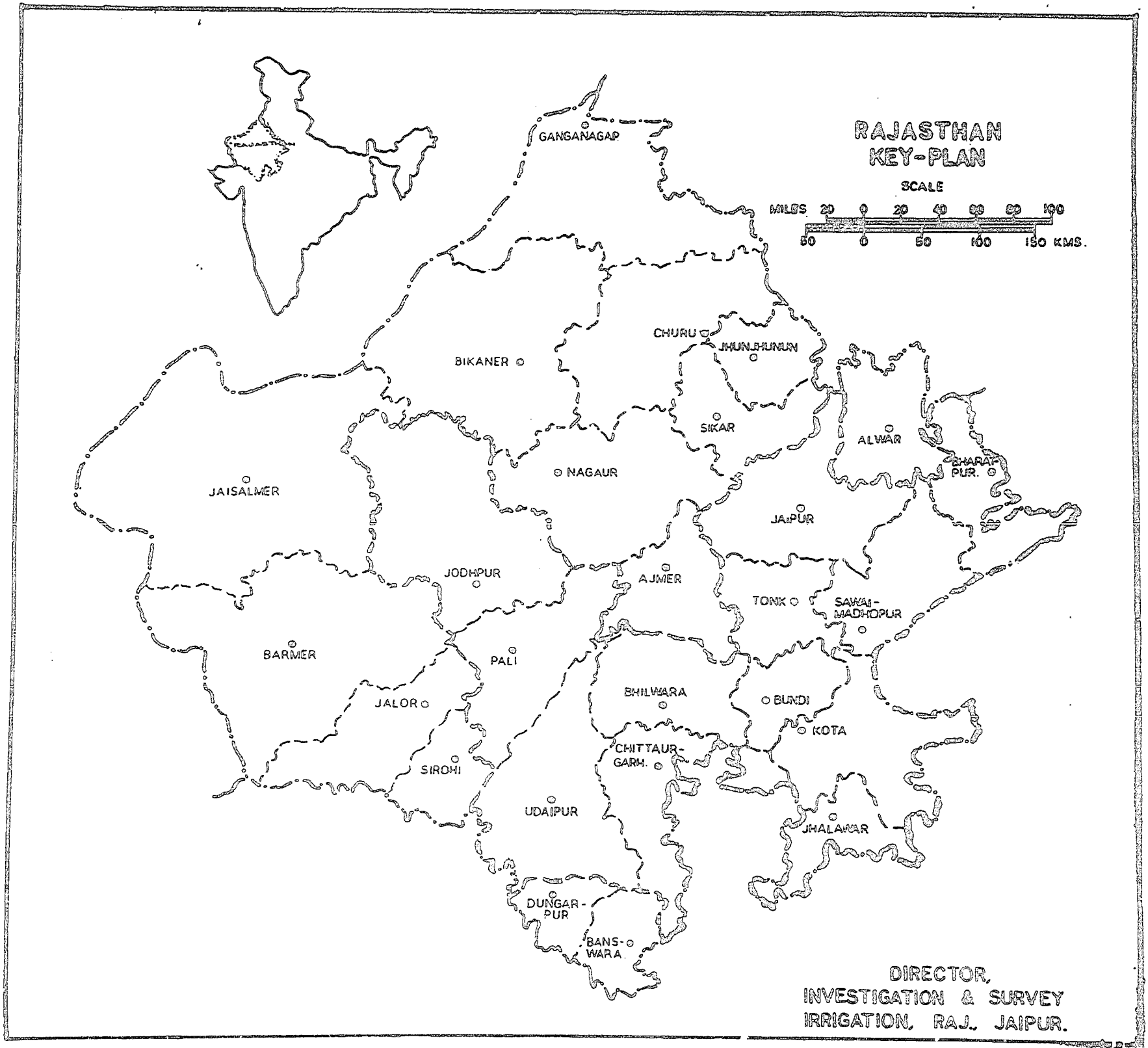
COMPOSITE FARM BUDGETS - GUDHA[1/]

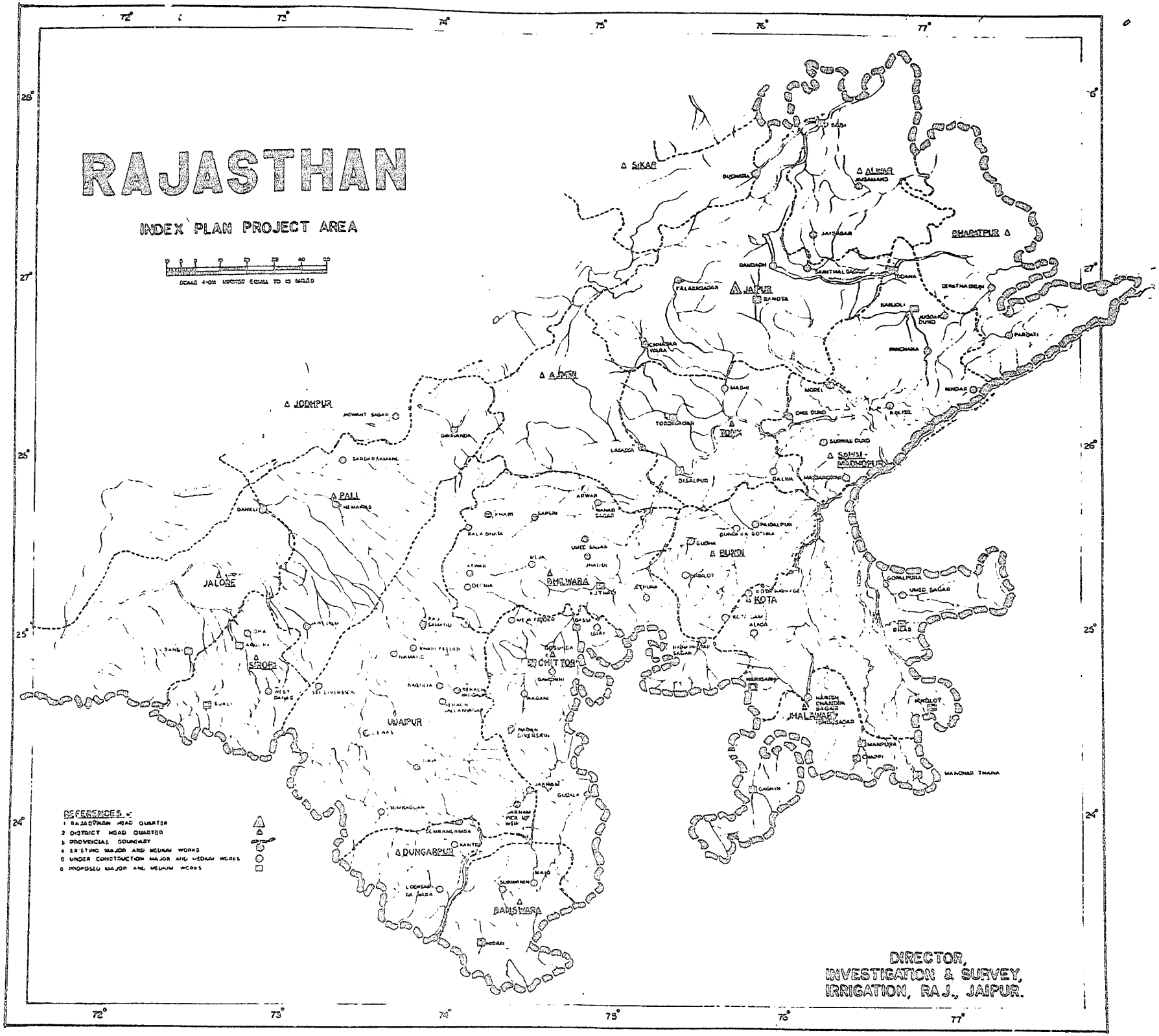
		Future		
	Present	Without Project	With Project	Added by Project
0.5 ha	600	800	1,450	650
1.0 ha	1,200	1,600	2,900	1,300
2.0 ha	2,400	3,200	5,800	2,600
4.0 ha	4,800	6,400	11,600	5,200

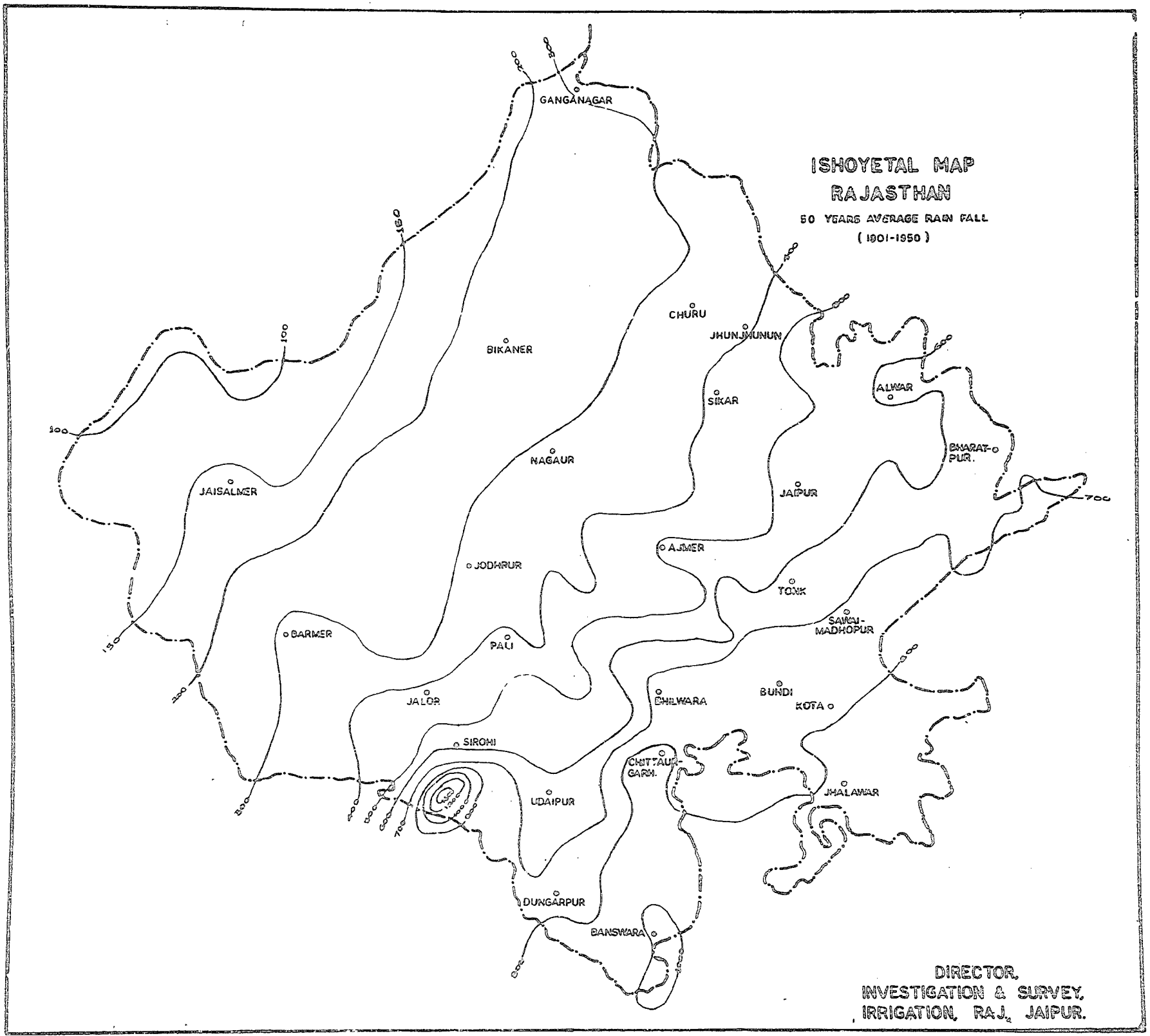
1/ Based on Tables one through seven in the Economic Analysis Report.

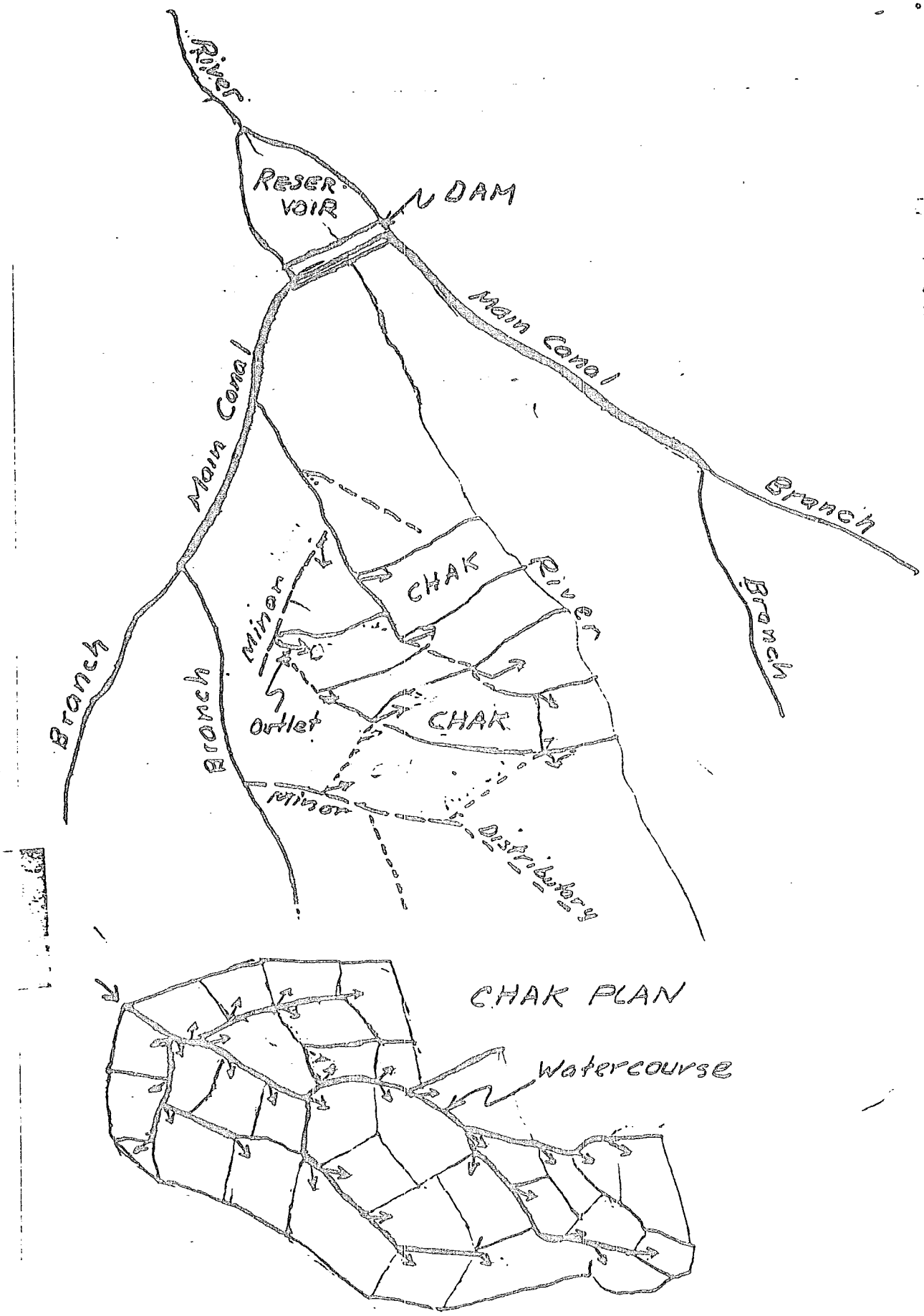
ANNEX B - MAPS

1. Political Map of Rajasthan
2. Location of MIPs
3. Rainfall Map of Rajasthan
4. Schematic of Medium Irrigation Systems


RAJASTHAN
KEY-PLAN
SCALE
MILES 20 0 20 40 60 80 100
50 0 50 100 150 KMS.
GANGANAGAR
BIKANER
CHURU
JHUNJHUNUN
SIKAR
ALWAR
BHARAT-PUR.
NAGAUR
JAISALMER
JAIPUR
JODHPUR
AJMER
TONK
SAWAI-MADHOPUR
BARMER
PALI
BHILWARA
BUNDI
KOTA
JALOR
CHITTAUR-GARH.
SIROHI
UDAIPUR
JHALAWAR
DUNGAR-PUR
BANS-WARA
DIRECTOR,
INVESTIGATION & SURVEY
IRRIGATION, RAJ., JAIPUR.


RAJASTHAN
INDEX PLAN PROJECT AREA
SIKAR
ALWAR
BHARATPUR
JAIPUR
AJMER
JODHPUR
TONK
SAWAI MADHOPUR
PALI
BUNDI
JALORE
BHILWARA
KOTA
SIROHI
CHITTOR
UDAIPUR
JHALAWAR
DUNGARPUR
BANSWARA
REFERENCES :-
1 RAJASTHAN HEAD QUARTER
2 DISTRICT HEAD QUARTER
3 PROVINCIAL BOUNDARY
4 EXISTING MAJOR AND MEDIUM WORKS
5 UNDER CONSTRUCTION MAJOR AND MEDIUM WORKS
6 PROPOSED MAJOR AND MEDIUM WORKS
DIRECTOR,
INVESTIGATION & SURVEY,
IRRIGATION, RAJ., JAIPUR.


ISHOYETAL MAP
RAJASTHAN
50 YEARS AVERAGE RAIN FALL
(1901-1950)
GANGANAGAR
BIKANER
CHURU
JHUNJHUNUN
SIKAR
ALWAR
BHARAT-PUR.
NAGAUR
JAISALMER
JAIPUR
AJMER
JODHPUR
TONK
SAWAI-MADHOPUR
BARMER
PALI
JALOR
BHILWARA
BUNDI
KOTA
SIROHI
CHITTAUR-GARH.
UDAIPUR
JHALAWAR
DUNGARPUR
BANSWARA
100
150
200
300
400
500
600
700
DIRECTOR,
INVESTIGATION & SURVEY,
IRRIGATION, RAJ., JAIPUR.



Schematic of Medium Irrigation Systems

ANNEX C

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title & Number: Rajasthan Medium Irrigation - India 396-0467

Life of Project:
From FY 80 to FY 85
Total U.S Funding: $35.5 million
Date Prepared: 4/10/80
Loan: $35 million

NARRATIVE SUMMARY	OBJECTIVELY VERIFABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: 1. Increase level & security of small farmer income. 2. Expand rural employment opportunities. 3. Increased availability of food to rural and urban poor.	Measures of Goal Achievement: 1. Net farm income increased by 125 million rupees/yr. 2. Added employment in construction of 50,000 person years. 3. Added annual agricultural employment of 26,000 person years.	Data: 1. Baseline studies made under the project. 2. Production statistics from Revenue and Agricultural Depts. 3. Government statistics on food consumption and prices. 4. Evaluation studies.	Assumptions for achieving goal targets: 1. GOI/GOR maintains agricultural price policies which are favorable to small farmers. 2. Construction activities of MIPs continue to use labor intensive methods. 3. Market and storage network remains adequate for increased production.
Project Purposes: 1. Increase small farmer output. 2. Decrease the impact of drought.	Conditions that will indicate purpose has been achieved. End of project status. 1. Food grain production to increase by 65,000 MT. 2. 32,000 or more families directly benefitted; 50% or more with farms of 4 ha. or less. 3. Increase modernized irrigated area 38,000 ha and improve water management on 27,000 additional ha.	1. Farm surveys done as part of MIP feasibility studies and evaluation studies. 2. Rajasthan crop statistics by blocks. 3. Water management studies. 4. CWC, GOR/ID reports.	Assumptions for achieving purpose: 1. Credit available at reasonable rates. 2. Technological inputs remain accessible and at reasonable prices. 3. Ag. extension system strengthened in MIP areas. 4. Ag. & Irrigation Depts. coordinate activities well. 5. Reservoir releases managed to minimize planting risks and optimize production.
Outputs: 1. Increased acreage under irrigation in the project area. 2. Improved reliability and improved distribution of water to farmers. 3. Improved efficiency of water use.	Magnitude of Outputs 1. GOR doubles expenditures on MIPs during LOP. 2. New or modernized irrigation on 65,000 hectares of add'l land. 3. Irrigation intensity increased by 20 percent. 4. Training of ten GOR/ID engineers. Training of six GOR/DOA economists. 5. Ten socio-economic baseline studies. Intensive water mgmt. studies in each sub-project.	1. GOR/ID and AD records and GOR and CWC Project reports. 2. Revenue and Agricultural Dept. cropping reports. 3. Review of baseline socio-economic and water management study reports.	Assumptions for achieving outputs: 1. GOI/GOR budget sufficient resources. 2. GOR engineering & contract mgts. capacility adequate. 3. Adequate number of feasible projects can be identified. 4. GOR staff available for training
Inputs: Financing 67% of construction costs of MIPs by loan. Grant financing of training and studies. USAID participation in evaluations.	Implementation Target (Type & Quantity) Disbursement ($ million) FX LC GOI/GOR Total 1981 .1 4 2.9 7.0 1982 .2 8 5.8 14.0 1983 .1 10 6.4 16.5 1984 .1 8 4.9 13.0 1985 5 2.5 7.5 Total .5 35 22.5 58.0	1. GOR/CWC/AID monitoring. 2. CWC/AC reports 3. Sub-project accounts 4. GOR/GOI audit reports 5. GOR/GOI vouchers.	

ANNEX D

Section 611 (e) Certification

RAJASTHAN MEDIUM IRRIGATION PROJECT (386-0467)

This project will finance 67 percent of the construction costs and 100 percent of associated training and research costs of a set of medium-irrigation sub-projects planned by the Government of Rajasthan to increase food production and rural employment for the rural poor of the southeastern zone of the State of Rajasthan.

I, Priscilla M. Boughton, Principal Officer of the Agency for International Development in India, do hereby certify that in my judgment, the Government of India and the Government of Rajasthan have both the financial capacity and the human resources to carry out, maintain and utilize this project effectively. This judgment is based upon the analyses contained in the Project Paper, as well as the successful maintenance and utilization of projects in India previously financed or assisted by the United States.

Priscilla M. Boughton

Priscilla M. Boughton, Mission Director
USAID/India

May 17, 1980

Date

ANNEX E

5C(1) - COUNTRY CHECKLIST

Listed below are, first, statutory criteria applicable generally to FAA funds, and then criteria applicable to individual fund sources: Development Asistance and Economic Support Fund.

A. GENERAL CRITERIA FOR COUNTRY ELIGIBILITY

1. FAA Sec. 116. Can it be demonstrated that contemplated assistance will directly benefit the needy? If not, has the Department of State determined that this government has engaged in a consistent pattern of gross violations of internationally recognized human rights?	Yes.
2. FAA Sec. 481. Has it been determined that the government of recipient country has failed to take adequate steps to prevent narcotics drugs and other controlled substances (as defined by the Comprehensive Drug Abuse Prevention and Control Act of 1970) produced or processed, in whole or in part, in such country, or transported through such country, from being sold illegally within the jurisdiction of such country to U.S. Government personnel or their dependents, or from entering the United States unlawfully?	No.
3. FAA Sec. 620(b). If assistance is to a government, has the Secretary of State determined that it is not controlled by the International Communist movement?	Yes.
4. FAA Sec. 620(c). If assistance is to government, is the government liable as debtor or unconditional guarantor on any debt to a U.S. citizen for goods or services furnished or ordered where (a) such citizen has exhausted available legal remedies and (b) debt is not denied or contested by such government?	No.
5. FAA Sec. 620(e)(1). If assistance is to a government, has it (including government agencies or subdivisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities?	No.

A.

6. FAA Sec. 620(a), 620(f); FY 79 App. Act, Sec. 108, 114 and 606. Is recipient country a Communist country? Will assistance be provided to the Socialist Republic of Vietnam, Cambodia, Laos, Cuba, Uganda, Mozambique, or Angola?	No. No assistance will be permitted to these countries.
7. FAA Sec. 620(i). Is recipient country in any way involved in (a) subversion of, or military aggression against, the United States or any country receiving U.S. assistance, or (b) the planning of such subversion or aggression?	AID is not aware of any such involvement.
8. FAA Sec. 620 (j). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction, by mob action, of U.S. property?	No.
9. FAA Sec. 620(l). If the country has failed to institute the investment guaranty program for the specific risks of expropriation, inconvertibility or confiscation, has the AID Administrator within the past year considered denying assistance to such government for this reason?	No.
10. FAA Sec. 620(o); Fisherman's Protective Act of 1967, as amended, Sec. 5. If country has seized, or imposed any penalty or sanction against, any U.S. fishing activities in international waters:	No such actions have been taken against U.S. fishing activities in international waters.
a. has any deduction required by the Fisherman's Protective Act been made?	No.
b. has complete denial of assistance been considered by AID Administrator?	No.
11., FAA Sec. 620; FY 79 App. Act, Sec. 603. (a) Is the government of the recipient country in default for more than 6 months on interest or principal of any AID loan to the country? (b) Is country in default exceeding one year on interest or principal on U.S. loan under program for which App. Act appropriates funds?	No.
12. FAA Sec. 620(s). If contemplated assistance is development loan or from Economic Support Fund, has the Administrator taken into account the percentage of the country's budget which is for military expenditures, the amount of foreign exchange spent on military equipment and the	Yes. India spends a relatively small amou of its foreign exchange on military equip ment. Latest available figures are an est mated $300 million military imports or 4% $7.5 billion in total foreign exchange in FY 80. India proposes to spend only 16% its Central Governm ent budget on defense U.S. FY 80-81. India's military purchases include a variety of modern weapon system bought primarily from the U.K. and France

BEST AVAILABLE

amount spent for the purchase of sophisticated weapons systems? (An affirmative answer may refer to the record of the annual "Taking Into Consideration" memo: "Yes, as reported in annual report on implementation of Sec. 620(s)." This report is prepared at time of approval by the Administrator of the Operational Year Budget and can be the basis for an affirmative answer during the fiscal year unless significant changes in circumstances occur.)

13. FAA Sec. 620(t). Has the country severed diplomatic relations with the United States? If so, have they been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption?

No.

14. FAA Sec. 620(u). What is the payment status of the country's U.N. obligations? If the country is in arrears, were such arrearages taken into account by the AID Administrator in determining the current AID Operational Year Budget?

India is not in arrears regarding its U.N.obligations.

15. FAA Sec. 620A, FY 79 App. Act, Sec. 607. Has the country granted sanctuary from prosecution to any individual or group which has committed an act of international terrorism?

No.

16. FAA Sec. 666. Does the country object, on basis of race, religion, national origin or sex, to the presence of any officer or employee of the U.S. there to carry out economic development program under FAA?

No.

17. FAA Sec. 669, 670. Has the country, after August 3, 1977, delivered or received nuclear enrichment or reprocessing equipment, materials, or technology, without specified arrangements or safeguards? Has it detonated a nuclear device after August 3, 1977, although not a "nuclear-weapon State" under the nonproliferation treaty?

Based on information received from the State Department/Embassy the answer to both of these questions is no.

B. FUNDING CRITERIA FOR COUNTRY ELIGIBILITY

1. Development Assistance Country Criteria

a. FAA Sec. 102(b)(4). Have criteria been established and taken into account to assess commitment progress of country in effectively involving the poor in development, on such indexes as: (1) increase in agricultural productivity through small-farm labor intensive agriculture, (2) reduced infant mortality, (3) control of population growth, (4) equality of income distribution, (5) reduction of unemployment, and (6) increased literacy?

Yes. These criteria are based on India's Five Year Development Plan Revised (1978-83) and are incorporat in the Country Development Strategy Statement (CDSS).

8.1.

b. FAA Sec. 104(d)(1). If appropriate, is this development (including Sahel) activity designed to build motivation for smaller families through modification of economic and social conditions supportive of the desire for large families in programs such as education in and out of school, nutrition, disease control, maternal and child health services, agricultural production, rural development, and assistance to urban poor? — Yes.

2. Economic Support Fund Country Criteria

a. FAA Sec. 502B. Has the country engaged in a consistent pattern of gross violations of internationally recognized human rights? — NA

b. FAA Sec. 533(b). Will assistance under the Southern Africa program be provided to Mozambique, Angola, Tanzania, or Zambia? If so, has President determined (and reported to the Congress) that such assistance will further U.S. foreign policy interests? — NA

c. FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made? — NA

d. FY 79 App. Act, Sec. 113. Will assistance be provided for the purpose of aiding directly the efforts of the government of such country to repress the legitimate rights of the population of such country contrary to the Universal Declaration of Human Rights? — NA

e. FAA Sec. 620B. Will security supporting assistance be furnished to Argentina after September 30, 1978? — NA

ANNEX E

5C(2) - PROJECT CHECKLIST

Listed below are statutory criteria applicable generally to projects with FAA funds and project criteria applicable to individual fund sources: Development Assistance (with a sub-category for criteria applicable only to loans); and Economic Support Fund.

CROSS REFERENCES: IS COUNTRY CHECKLIST UP-TO-DATE? Yes
HAS STANDARD ITEM CHECKLIST BEEN REVIEWED FOR THIS PROJECT? Yes

A. General Criteria for Project

1. FY 79 App. Act Unnumbered: FAA Sec. 653 (b): Sec. 634A. (a) Describe how Committees on Appropriations of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that figure)?	(a) Formal notification to Congressional Committees was given in AID's FY 1981 Congressional Presentation. To the extent additional funds or funding categories shift. Proper congressional notifications will be made. (b) Yes.
2. FAA Sec, 611(a)(1). Prior to obligation in excess of $100,000, will there be (a) engineering, financial, and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?	(a) Yes, see Section III Project Paper. (b) Yes, see Section III Project Paper.
3. FAA Sec. 611 (a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?	Not applicable.
4. FAA Sec. 611(b); FY 79 App. Act Sec. 101. If for water or water-related land resource construction, has project met the standards and criteria as per the Principles and Standards	Yes.

A. 4. (con't)
for Planning Water and Related Land Resources dated October 25, 1973?

5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project?	Yes, see Anner D of Project Paper.
6. FAA Sec. 209. Is project susceptible of execution as part of regional or multilateral project? If so, why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.	No, because multi-lateral and other donors have similar projects and the GOI requested AID assistance in this case. However, it will benefit from multilateral suggested projects in Rajasthan in fields of irrigation and agricultural development and in turn should encourage more of the same. Regional development programs are irrelevant in this field in Rajasthan.
7. FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loans associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce: and (f) strengthen free labor unions.	(a) Not applicable. (b) Yes, in letting of certain construction and technical assistance contracts. (c) Yes, especially rural credit institutions and water-user cooperative committees. (d) Not applicable (e) Yes, especially irrigation as managed by the GOR. (f) Not applicable.
8. FAA Sec. 601(b). Information and conclusion on how project will encourage U.S.	Not applicable, except for U.S. technical assistance, which will be encouraged.

A. 8. (con't)
private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).

9. FAA Sec. 612(b); Sec. 636(h). Describe steps taken to assure that, to the maximum estent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.	The GOI will finance 33 percent of construction costs and is contributing sufficient amounts of local currencies for contractual and other services. (See item 10 for U.S. owned currencies.)
10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?	The U.S. owned Rupees are being used for various U.S. government agencies' program and administrative support and these currencies are expected to be liquidated, for current on going activities over the next 10 years.
11. FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?	Yes.
12. FY 79 App. Act Sec 608/ If assistance if for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity.	Not applicable. Agricultural products produced will be consumed in India.

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102(b); 113; 281a. Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries?

(a) These represent the entire intent of the project. See Sections II and III of the Project Paper

(b) See 7(c), above.

(c) This project entirely supports Indian self-help in agricultural development.

(d) See Social Soundness Analysis in the Project Paper.

(e) Not applicable.

b. FAA Sec. 103, 103A, 104, 105, 106, 107. Is assistance being made available: (include only applicable paragraph which corresponds to source of funds used. If more than one fund source is used for project, include relevant paragraph for each fund source.)

(1) [103] for agriculture, rural development or nutrition; if so, extent to which activity

The project is specifically designed to increase productivity of the rural poor, especially small farmers. See

B.1.b.	Social Soundness Analysis in the Project Paper.
c. [107] is appropriate effort placed on use of appropriate technology?	c. Yes, especially regarding agricultural inputs and improved water management.
d. FAA Sec. 110(a). Will the recipeint country provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or has the latter cost-sharing requirement been waived for a "relatively least-developed" country)?	Yes, 38.8%.
e. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to the Congress been made, and efforts for other financing, or is the recipient country "relatively least developed"?	Not applicable
f. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental and political processes essential to self-government.	The project addresses the need for increased food production and will also minimize the risks of drought through the development of irrigation systems. Institutional development will be fostered in so far as the host country's implementing agencies will acquire a strengthened capacity to design, execute and maintain an effective irrigation system. Cooperative water management activities will be strengthened, encouraging local, self-government efforts.
g. FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase or productive capacities and self-sustaining economic growth?	g. Yes, especially land made more productive by irrigation.

2. Development Assistance Project Criteria (Loans Only)

a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan, including reasonableness of repayment prospects.	India's foreign exchange reserves are currently $7.0 billion. This $35 million loan represents .005% of India's average yearly value of exports in an expanding economy.
b. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete in the U.S. with U.S. enterprise, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?	b. Not applicable.

3. Project Criteria Solely for Economic Support Fund

a. FAA Sec. 531(a). Will this assistance support promote economic or political stability? To the extent possible, does it reflect the policy directions of section 102?	Yes, to both.
b. FAA Sec. 533. Will assistance under this chapter be used for military, or paramilitary activities?	No.

ANNEX F

FM SECSTATE WASHDC
TO AMEMBASSY NEW DELHI 2046
BT
UNCLAS STATE 186530

AIDAC

E.O. 11652:N/A

TAGS:

SUBJECT: INDIA RAJASTHAN MEDIUM IRRIGATION PID 386-0467

1. APAC REVIEWED SUBJECT PID JULY 17, 1978. MISSION AUTHORIZED TO PROCEED WITH PROJECT PREPARATION SUBJECT TO PROVISOS DISCUSSED BELOW.

2. WHILE THE OBJECTIVE OF GETTING WATER TO WITHIN EIGHT HECTARES OF INDIVIDUAL FARMERS AND THUS REDUCING USER ORGANIZATION PROBLEMS AND INCREASING SMALL FARMER ACCESS IS APPLAUDED, APAC REMAINS CONCERNED, AS WITH GUJARAT, THAT LINING CANALS TO THIS LEVEL IS EXPENSIVE. A GREATER MILEAGE OF UNLINED CANALS COULD BE FINANCED FOR SAME AMOUNT OF RESOURCES. PP SHOULD, THEREFORE, EXAMINE ALTERNATIVES CAREFULLY IN ORDER TO SUPPORT LINING CANALS TO 8 HA. OR SOME OTHER LEVEL AS MOST COST EFFECTIVE APPROACH. ALTERNATIVES WOULD INCLUDE DIFFERENT TYPES (E.G., USER VS. GOVERNMENT) MAINTENANCE ORGANIZATIONS AND POSSIBLY CHEAPER LINING METHODS. EXAMINATION OF ALTERNATIVES SHOULD COMPARE DISCOUNTED INITIAL CONSTRUCTION AND RECURRING O & M COSTS OF EACH AS WELL AS TECHNICAL AND SOCIAL ADVANTAGES AND DISADVANTAGES. THIS IS NOT TO SAY APAC BELIEVES THERE IS A BETTER WAY, BUT ONLY THAT THE HIGH COST OF CONCERETE LINING MAKES RIGOROUS EXAMINATION OF ALL ALTERNATIVES A NECESSITY.

3. APAC ACKNOWLEDGES SENSITIVITY TO GOI OF WATER RATES, AND RECOGNIZES THAT LITTLE IF ANY LEVERAGE EXISTS TO ENCOURAGE REFORM. NEVERTHELESS, WATER SUBSIDY WAS RAISED AS MAJOR PROJECT ISSUE IN GUJARAT BAS (NEE DLSC) MEETING, AND WE EXPECT IT TO BE RAISED AGAIN WITH RAJASTHAN. ACCORDINGLY, PP SHOULD DISCUSS THE RATE ISSUE IN DETAIL AND PERHAPS EXPLORE ALTERNATIVE WAYS TO COVER COSTS, E.B., THROUGH LAND TAXES, IMPROVEMENT CHARGES, ETC. WE WOULD HOPE PROGRESS ACHIEVED IN GUJARAT AGREEMENT WOULD APPLY EQUALLY TO RAJASTHAN.

4. PID PROPOSED AID FINANCING OF UP TO TWO THIRDS OF PROJECT COSTS. AS WITH RURAL ELECTRIFICATION (yy STATE 308508) AID'S CONTRIBUTION TO THIS OR OTHER INFRASTRUCTURE PROJECTS SHOULD NOT EXCEED FIFTY PERCENT.

5. APAC CONCURS PID RECOMMENDATION THAT EA BE DONE. ASIA/TR EXPECTS TO PROVIDE ASSISTANCE/GUIDANCE? WILL ADVISE.

6. THE PROPOSED ORGANIZATION FOR MANAGEMENT OF THE IRRIGATION SYSTEM AT THE USER LEVEL SHOULD BE DESCRIBED IN THE PP, TOGETHER WITH AN

EVALUATION OF THE EXPECTED EFFECTIVENESS THEREOF AND IF RELEVANT A PLAN FOR MAKING IT AS EFFECTIVE AS PRACTICABLE.

7. THE MARKET AND MARKET ACCESSIBILITY FOR PROJECT PRODUCE SHOULD BE DESCRIBED IN PP.

8. MECHANISM FOR ENSURING THAT WITHIN THE PROJECT AREA BENEFITS WILL GO TO THE POOREST RATHER THAN SELECTIVELY TO THE MORE AFFLUENT SHOULD BE DESCRIBED IN PP.

9. APAC NOTED MENTION IN PID (P.2) OF STUDY TO BE UNDERTAKEN OF AGRO-TECHNICAL AND SOCIO-ECONOMIC FACTORS. WE ENDORSE THIS PROPOSAL AS PART OF PP PREPARATION IF POSSIBLE, AND AS CONTINUING EFFORT DURING IMPLEMENTATION. SUCH A STUDY WOULD ALSO HAVE BEEN VALUABLE ON GUJARAT, IF TIME HAD PERMITTED.

VANCE

ANNEX G - Economic Analysis Procedures*

"2. Current Methodology used by GOR and GOI

The methodology currently used by GOR and GOI for evaluation of Medium Irrigation Projects (and for Major and Minor Irrigation Projects as well) is documented in the recent GOR Guidelines.[1/] The methodology is used widely throughout India, and fully accepted by the Government of India. Benefit cost ratios are calculated, following standardized procedures for all projects. Average annual net incomes at full project development are calculated for the target farmers to be benefitted. The with project net incomes are reduced by the comparable net farm incomes under the existing agriculture in the project command area to estimate the annual net project benefits.

The total capital outlay for project development is taken from the Department of Irrigation engineer's estimates. In most cases, these estimates include an annual acceleration factor for inflation and/or interest during construction for outlays to be incurred in those years after the base year. If relevant for the project in question, they include at least rough estimates of associated capital outlays needed to achieve the targeted benefits. Common examples of these "outside Project" associated capital outlays include rural roads, on-farm development, marketing facilities, accelerated agricultural extension and agricultural credit, and improved facilities for agricultural fertilizers and pesticides. If some of these relevant associated outlays have been overlooked in the engineer's estimates, they are added by Water Utilization Cell at the time the benefit-cost analysis is made.

The adjusted total capital outlays for each project is annualized by the Water Utilization Cell for computing the benefit-cost ration. The computation is done uniformly for all MIPs by the following steps:

1. Multiplying the adjusted total capital outlay by 10 percent

* The material included here is copied from a separate report analyzing sub-project economic feasibility. See "Economic Analysis - Rajasthan Medium Irrigation Project", USAID/New Delhi, 1980, on file in ASIA/PD and USAID/India.

1/ Dr. U. R. Mehta. Guidelines for Evaluation of Benefit Cost Ratios of Irrigation Projects and Achievement up to December 1979. Government of Rajasthan, Department of Agriculture, Water Utilization Cell. Report No. 7. Jaipur, Rajasthan, India

(capitalizing the outlay at 10 percent simple interest).

2. Dividing the adjusted outlay by the projected useful life of the project to determine an annual straight-line depreciation charge.

3. Sum the results of steps 1 and 2.

4. Add an annual charge for administration and maintenance, calculated at a standard per hectare rate applied to the total hectarge in the project command area at full development.

The final sum as determined by these four steps is used as the denominator for the B/C calculation.

The adjustment for a calculated water charge to the benefitted cultivators is subtracted from the numerator rather than added to the denominator for the B/C determination. The calculated water charge is established on a per hectare basis for each crop by the GOR and until revised is applied uniformly for all candidate MIPs under evaluation. Currently these calculated water charges range from Rs 30/ha for such kharif crops as maize and sorghum to Rs 100/ha for the combined-season crop; sugarcane.

The benefits obtained for purposes of the B/C calculations are affected by a number of factors, but the most crucial include the projected (1) pattern of transition to full development, (2) total hectarage to be served, (3) cropping and irrigation intensities, (4) per hectare crop yields, (5) farm prices, (6) production inputs and costs and (7) cropping patterns (crop mix). With the exception of the first one, each of these is reviewed carefully by the Water Utilization Cell in the process of evaluating each candidate project, as explained below. Since only average full development benefits are used in the calculation, the transition to full development is not reflected in the present GOR analysis (except for the inflation and/or interest during construction applied to the capital cost estimates, noted above).

Total hectarge to be served by a given MIP is determined by the topography of the area and the available water for irrigation, through the interdependency with irrigation intensity, cropping intensity and cropping pattern. For most MIPs, the area of suitable soil that can be reached by gravity flow is not the limiting factor; the available water supply is limiting. Nonetheless, those areas within the calculated command of each project are reviewed as to crop production capability, existing land use, existing cropping patterns, existing yield levels, existing well irrigation, existing markets, etc. Where necessary, the proposed area to be benefitted is adjusted in the benefit-cost evaluation.

Irrigation intensity, given the total hectarage to be benefitted and the projected cropping pattern, is a direct function of the available water supply. The hydrological and engineering calculations of the Irrigation Department are carefully reviewed by the Water Utilization Cell. Calculated average supplies rather than normal supplies are used for this purpose (see Section III C). Water requirement tables by season and by crop are reviewed carefully by the Cell. Where necessary, adjustments are made in proposed irrigation intensities to meet the agronomic requirements of the crops included in the cropping pattern.

Cropping intensity, given the projected irrigation patterns, are a function of agroclimatic factors and established farming practices. Often fields irrigated during the rabi season are left fallow during the kharif season, and vice versa, so that cropping intensities in Rajasthan rarely reach 200 percent, even in areas where rainfed crops are regularly grown. Rainfed cropping does increase as areas are developed for irrigation, however, and this fact is reflected in the feasibility analysis. Using historical experience in adjoining project areas, the Water Utilization Cell reviews proposed cropping intensities for each project, and makes upward or downward adjustments when they are indicated.

Crop yields projected for the project area also are reviewed for each candidate MIP by the Water Utilization Cell, and adjusted as needed. Comparisons are made with existing yields in the command area and with those neighboring areas where projects have been developed. Separate estimates of projected yields are made for each MIP, and within each MIP by rabi or kharif season and for irrigated, unirrigated and bed cultivation. To date transitions in yields after development have not been reflected, as noted above. Likewise, separate projections have not been made for well irrigation, for level of watercourse lining and on-farm development, etc.

Farm prices, are projected for each crop and farm input in real terms. For the most part, standard sets of farm prices are used for all candidate MIPs in the same region of the State. Crop prices used by the Water Utilization Cell are based on actual prices received by farmers and, if anything are conservative. Farm prices in Rajasthan average about 30 percent below economic prices based on world markets, introducing additional conservatism in the B/C ratios for projects submitted for international donor support (see Table 5).

Production inputs and costs are computed directly by the Water Utilization Cell, following standard guidelines and worksheets as well as specified input levels of fertilizer, plant protection, seed and other variable inputs needed to achieve projected full development yield levels. Hired farm labor (but not family labor) is included as a production cost in determining projected net benefits.

Cropping patterns used by the Water Utilization Cell represent minimal deviations from those already existing, particularly for projects in tribal areas where customs change slowly. For example, irrigated as well as rainfed fodder is retained to insure adequate forage for the farmer's work and milk animals. Relatively low-yielding crops such as gram are retained because of their ability to produce something, even under adverse "famine" conditions. High-risk crops, especially during the hot zaid season, and crops high in water requirements (e.g., paddy and sugarcane) are discouraged. The sequencing of crops in the cropping pattern is reviewed carefully to insure that practical planting and harvest dates and growing seasons have been projected. Acceptable close-by markets are used as a prerequisite for such crops as vegetables, sugarcane and groundnuts.

3. Recommended Modifications in Methodology

The major modifications 2/ in evaluation procedures recommended for GOR involve moving toward fully discounted cash flow analysis in order to measure the IRR and net present value (NPV) as well as the B/C for candidate MIPs. Once institutionalized, the modifications will permit more complete analysis and support more effective project planning and implementation. In addition, they will meet the standards for outside donor support. They can be applied to the whole range of major, medium and minor Irrigation projects for which GOR has responsibility.

The principal requirements for implementing the recommended modification are (1) procedures for discounting outlay estimates and projected benefits, (2) transition estimates for project development and achievement of full production and (3) separate estimates by major elements such as farms with both well and flow irrigation and those with lined watercourses and full on-farm development. Workable discounting procedures are needed for IRR and NPV determination.

2/ Discussions with responsible GOR officials indicate a genuine interest in modifying the methodology of project evaluation to introduce workable improvement within the constraints of resources and workload. Likewise, USAID officials have indicated interest in technical assistance and training support to help GOR achieve the desired result. Computerized evaluation techniques are to be considered to the extent feasible for India and Rajasthan, primarily for sensitivity analysis and project planning. Revised guidelines and worksheets, together with in-country training and staff analysists represent a major thrust of the contemplated assistance. U.S. training in computerized techniques of feasibility analysis is proposed for two or three key GOR officials, and would be structured around actual Rajasthan medium irrigation projects.

Computer programs were used for doing this in the three prototype cases, but worksheets can be developed for doing so by hand calculation and graphic determination. This has been done by GOR analysists for some MIPs, including one of the prototype cases, Gudha Command Area Development Project.

Estimates of year-by-year transition to full project development and potential agricultural production are needed as input for the cash flow analysis. Such estimates can be developed by MIP planners. Substantial progress has been made in the development of standardized guidelines for this purpose, as reported in Section 4.

Separate estimates are need for additional dimension of certain MIPs in order to evaluate them effectively. For those in which groundwater and surface water need to be managed as complimentary resources, farms with well plus surface irrigation need to be analyzed separately. For those in which watercourse lining is to be undertaken, the impacts on projected crop yields and cropping patterns need to be reflected. For those in which additional command area development activities are to be undertaken, the incremental response of farmers must be anticipated. Substantial progress, has been made in the development of standardized guidelines for these purposes also, as reported in Section 7.

Discounted Cash Flow Analysis can be used to determine (1) the Internal or Direct Rate of Return, (2) the Impact or Associated Rate of Return, and (3) the Economic Rate of Return, together with the corresponding fully-discounted Benefit Cost Ratios and Net Present Values. The Kansas State University computer programs now operating in New Delhi have full capability for direct determination of all three, and for simultaneous sensitivity analysis for a series of alternatives with each of them. The differences among the three are in the requirement for data and the purpose for which the results are used.

The Internal or Direct Rate of Return requires essentially the same set of input data as that now used by the GOR for B/C analysis. It is used for the same purpose -- to measure the net benefits and appraise the project in terms of impacts upon the farmers the MIP is designed to serve. It will measure the B/C ratio at the 10 percent discount rate (or any other specified rate) simultaneously with the IRR or DRR solution.[3/] Thus, starting from the present analytical methodology used by GOR, it represents a more precise and versatile method of accomplishing the same type

3/ The IRR and DRR are identical except for the output format. The DRR represents more precise terminology for public projects such as MIPs where the direct benefits do not accrue to the same entity making the capital investment.

of analysis now used.

The Associated Rate of Return is used for an additional measure of project benefits - that of development impacts upon the total economy of the project area. The use of this measure requires estimation of the impact benefits such as those arising from added employment during project construction, the resulting greater farm production, from the marketing and processing of the additional farm products, from the economic activity stimulated by the additional demand for farm inputs, and from the increased capital value of land and real property resulting from the stimulated economic activity. The GOR has expressed interest in this kind of analysis, out those responsible for MIP evaluation feel that resources are not available presently for making such analysis on a routine basis. As an interim step, it may be possible to present measures of a few of the more important linkage benefits, such as that of added employment to be created by each MIP. The ARR analysis presented for the three prototype MIPs provides basis for judgment regarding the general magnitude of associated benefits that may be expected by implementing MIPs characterized by these prototypes in Rajasthan.

The Economic Rate of Return is a somewhat different measure; one that normally is employed by international donor agencies which must be concerned with alternative uses of development loan funds in many countries around the world. This measure requires estimation of "economic" prices for farm products and farm and product inputs in order that MIPs in Rajasthan would be feasible if all markets were based on free and unrestricted world trate. Precisely applied, it also required pricing family labor and other "non-exchanged" inputs (and outputs) at their opportunity cost in a free world exchange. For their own internal needs the GOR and GOI have only marginal interest in the ERR. The Economic Rate of Return analysis made for the three prototype Rajasthan MIPs provide an adequate basis for determining an equivalent DRR level as a cutoff for project feasibility.

Transition Estimates: Full and accurate application of the DRR and other discounted cash flow analysis requires estimating transition through time of the capital outlays and net project benefits for each MIP. At least four transition schedules are involved.

1. Construction schedule, and year-by-year identification of capital expenditures, including associated expenditures which are "outside" the project for financial purposes.

2. Farm irrigation system and land development schedule.

3. Schedule of transition to full farm production potentials, starting from the time each irrigated farm is completed.

4. Schedule of transition in cropping patterns from those at present to those projected at full development.

The last two of these may be expected to undergo one type of transition without the project and another with the project; therefore, appropriate MIP evaluation is made by comparing "projections with Project" to "projections without project" rather than "projections with Project" to "present".

The first two types of transition usually are estimated by the GOR in the course of MIP evaluation under current procedures. It is believed that the other two will not be difficult to incorporate into the evaluation procedures on a regular basis. Preliminary guidelines are now established for doing so.

Estimates for Added Dimensions: Separate estimates (including transitions) for added dimensions of concern in varying degrees in individual MIP candidates can be incorporated into the standardized evaluation procedures of the GOR. The tentative estimates used for (1) farms with wells plus surface irrigation and (2) farms with surface irrigation only in the Gudha and Morel prototypes have been developed jointly with GOR officials and appear to be reasonable. Certainly they provide a means of more completely and accurately reflecting the full potential direct benefits of MIPs involving complimentary use of surface and ground water resources.

The differential estimates and transitions developed with GOR officials between the modernization prototype under Command Area Development and that with less complete and coordinated development of the project command area provide an example of what can be done to reflect this dimension. Similar differential estimates and transition patterns will be helpful in adequately reflecting the full potential benefits of watercourse lining, alternative degrees of land shaping and leveling, land reclamation and other dimensions of MIPs.

It is recommended that differential estimates be developed and incorporated in the standard GOR project evaluation procedures for those dimensions which prove to have definite merit in most MIPs. Unique dimensions with special merit in only a few MIPs can be incorporated on a case-by-case basis. The present evaluation procedures of the Water Utilization Cell can accommodate the unique dimensions of individual projects, provided that those formulating such projects furnish the accompanying differential estimates and transition schedules.

4. Transition Estimates for Prototype MIPs

The three Rajasthan prototype MIPs analyzed represent three distinct classes of candidate MIPs - modernization projects with

full command area development (Gudha), modernization projects with partial development (Morel), and new projects (Gosunda). Each prototype is distinct with respect to requirements for transition estimates and kinds of sensititivty analysis of most value. It is hoped that these three will serve not only as a representative base for Rajasthan Medium Irrigation Project review, but as a set of models for other MIP candidaces within each prototype.[4/]

Characteristics of the Prototypes: The Gudha project is characterized by the full potential for improvement under CAD. Lack of drainage, seepage from canals and watercourses and salinity are major problems in the upper reaches and lack of dependable water supply is a major problem in lower reaches. Farmers, agricultural leaders and agribusinessmen in the command area who were interviewed are unanimous in their anxiety to see the project move forward. The water table is relatively shallow and irrigation wells are common. There is need for the full dimensions of project modernization.

The Morel project is characterized by less critical multi-dimensional problems, but large unexploited potential. Groundwater represents an important resource, and well irrigation to supplment surface supplies must be considered. There is a need for and potential payoff from serious attention to watercourses, on-farm development, rural roads, drainage, development of marketing and fisheries development along with expanded agricultural extension and farm credit programs. Some of the base data needed for projection of transitions are not yet available, and the preliminary estimates used are subject to revision. They provide a reasonable basis for testing the prototype, however, and indicate that the project is attractive.

The Gosunda project represents a different stage in Rajasthan irrigated agriculture - that much earlier step of turning sparsely-cropped rainfed areas into productive farming; that of exposing many very poor farm families to the first step on the track of potential for irrigated agriculture. A dependable supply of life-giving water is the first step; perhaps a step even more spectacular than the high payoff of the modernization projects.

Transition in Agricultural Production: The standardized schedule of transition to full agricultural production potential

---

4/ Selection of the specific examples under each prototype is arbitrary and implies no preference among candidate MIPs. Each of the GOR Irrigation Department Reports supplied to USAID represent promising candidates, so do many others on the total list.

once water and land development have reached the farm under each of the three prototypes is shown in Table 1. It is expected that the production potential will vary from MIP to MIP within each prototype, but that the transition pattern is a function of the type of MIP. New projects represent the longest transition in this regard because of time required for both the farmer and his hand to make the early transition to irrigated agriculture. The transition under full modernization is a bit slower than that under other modernization projects because of the additional modifications to the existing sys that are involved.

Schedules of Land Area Development: The schedules of land area development are unique to each project but reflect the characteristics of the type into which it falls. The schedules for each of the three prototypes are used as input to the evaluation analysis are shown in the corresponding Table 2. In the cases of Gudha and Morel schedules are developed for without project as well as with projects, and the areas to be added by project obtained by subtraction. In the case of the new project, Gosunda, this is not necessary because without a source of surface water supply little or no change will take place (the transition without project is zero).

For each project the projected land use pattern for the rabi and kharif seasons at full development is summarized in the lower section of Table 2. Gudha is projected to reach irrigation intensity of 90.2% in rabi and 29.4% in kharif, with total cropping intensity of 158.2%. Gosunda will achieve irrigation intensity of 73.9% in rabi and 22.9% in kharif, with total cropping intensity of 124%. The corresponding projections for Morel are 61.5% in rabi and 23.3% in kharif, with total cropping intensity of 158.5%.

It will be noted that rainfed hectarages for Gudha show a declining pattern as more complete irrigation is developed - a shift which is not offset by the additional 3,475 hectares brought under irrigation by raising the dam.

The year-by-year development areas shown in the upper section of Table 2 for Gosunda and in Section C of Table 2 for the other two projects represent those needed for the estimation of net project benefits. The figures upon which they are based are taken from the GOR project reports.

Estimates of Farm Production Expense: Following the existing procedures and reference tables of the GOR Department of Agriculture Water Utilization Cell, the basic data for computing farm production expenses both with and without project are shown in Tables 3A and 3B. These figures are not unique by project type, but rather apply uniformly to all MIPs. They include all projected production expenses except farm labor, which is computed separately.

The variable expenses shown in Table 3A represent a constant percentage of the gross revenue for each crop at varying yield levels. An example of the corresponding Rs value is given for wheat at the yield level of 25 quintals per hectare and farm price of Rs 124 per quintal. The percentage figures shown are based directly upon the GOR tables with the exception of chemical fertilizers. These include upward adjustments based on World Bank projections.[5/]

The fixed production expense estimates shown in Table 3B are taken as constant for each season-crop-type of cultivation combination, regardless of yield levels. They include expenses for seed plus land charges.[6/] In the case of well irrigation they include operating and maintenance expenses for supplemental irrigation based on crop water requirements and well costs. They represent the anticipated pumping, required in an average year; actual costs in a given year will vary from the average, depending upon the supply of surface water available.

Crop Yield Estimates: Crop yield estimates for each of the three prototype MIPs are shown in the corresponding Table 4. The projections with project and without project represent full development. They are applied to the percentages in Table 1 to obtain the yield estimates for transition years. Note that in general, the projections are highest for Gudha and lowest for Gosunda, reflecting the type of MIP represented by each prototype. The relative yields by crops vary somewhat from one prototype to another, reflecting differences in soil and climate suitability.

The difference between projected yield levels with project and without project is a key determinate affecti the magnitute of net benefits for any MIP. Note that on this re Gosunda ranks very well, reflecting the relatively high increm utal production when dry or partially well-irrigated lands are originally brought under surface irrigation.

The bed cultivation category shown for Gosunda represents a new type of cultivation brought in with development of the dam - rabi cultivation of wheat and barley around the perimeter of the reservoir

---

5/ World Bank Report 2529a-IN, Vol. 1, Table 7021. Sept. 13, 1979

6/ Land charges to the GOR Revenue Dept. might be excluded as a transfer payment, but because GOR holds title to the land they are treated herein, as in the nature of land rent rather than tax, per se.

as water is drawn out for irrigation.[7/]

Projected Farm Prices: The projected farm prices used in the evaluation of the three prototype MIPs are shown in units of Rs per quintal in Table 5. The prices represent projected 1990 levels, indexed to current (1980) purchasing power. The figures in column (1) simulate actual prices received by farmers in Rajasthan. Those for groups of pulses, vegetables and oilseed crops are weighted averages for the prevailing kinds of these crops grown in the State. They are based on the list of prices currently used by the Water Utilization Cell for evaluating MIPs. Note that prices are not included for straw and other crop by products which are used dominantly for cattle feed on the farm where used. Such intermediate products are reflected in the factor for net bullock expense included in Table 3A.

The column (1) prices are used in determining the projected added net farm incomes attributed to each prototype project for the DRR analysis and for the farm budgets.

In contrast, the economic prices in column (2) are World Bank estimates of simulated free world market prices, "backed" to the farm gate. They were developed in the recent World Bank report on Maharashtra II Irrigation Project of September 1979 so that they may be considered applicable for Rajasthan. The only adjustment made was to convert them from U.S. dollar values to rupee values at Rs. 8.00 = $1.00. Note that the resulting economic prices are higher than the corresponding actual prices for all of the crops (column 3). This reflects the impact of Indian food and agricultural policies designed to maintain low cost food in the country. The relationship insures that all MIPs meeting feasibility tests by Direct Rate of Return analysis will show enhanced feasibility by the Economic Rate of Return analysis. The magnitude of the positive differential will vary somewhat from one MIP to another depending upon the relative weights of the individual crops and the increased yields achieved.

Corresponding prices for fertilizers and hired farm labor are shown in the lower section of Table 5. In the case of chemical fertilizers the relationship between actual farm prices and economic prices is reversed. In this case the -5 percent differential represents deduction of the State tax (a transfer payment) reflected

---

7/ Following usual procedure in India and elsewhere, the costs of compensation and resettlement within the lake bed are included in the capital cost estimate rather than as a negative benefit from lost revenue.

in the actual farm price of fertilizer materials.

Projected Farm Labor Requirements: The projected farm labor requirements for each of the three prototype MIPs are shown in units of man day per hectare in the corresponding Table 6. The format of these tables follows that of the crop yields (Table 4). The labor requirements listed represent projections at full development; the requirements for each transition year are obtained by applying the transition patterns from Table 1 to those shown in Table 6. As in the case of yields the relevant labor requirements for project evaluations are those with project minus those without project. Those shown under the "existing" column are included for reference only.

From the limited socio-economic data available by project area in Rajasthan, about 10 percent of the total labor requirements is supplied by hired labor. The other 90 percent is supplied by the cultivator and his family. Thus, only 10 percent of the crop labor requirement represents a cash production expense to the cultivator. The economic cost of unpaid family labor depends upon the opportunity cost of such labor. Compared to the prevailing rate of Rs 5.00 per day for hired labor, the opportunity cost of family labor in Rajsthan lies somewhere between Rs. 0.00 and Rs 5.00. Maintaining the labor requirement in man days facilitiates sensitivity analysis to determine the impact of alternative labor rates.

The labor requirements illustrated in Table 6 may be expected to vary from one MIP to another. The figures shown for the three prototypes reflect differences by class of projects, however. The requirements for the most part are highest for Gudha (full modernization) next highest for Morel (partial modernization) and lowest for Gosunda (new project).

Transition in Cropping Patterns: The existing and projected with and without cropping patterns for each project by type of cultivation and cropping season are shown in units of hectares per 1000 hectares cropped in Table 7 for each prototype MIP. The figures are based directly upon the GOR project reports for the three prototypes.

The projected shifts in cropping pattern are relatively minor for all three projects. For the most part they reflect GOR and GOI efforts to encourage certain crops and discourage others. The projections indicate relative decreases in rice for all three crops and decreases in sugarcane in Morel and Gosunda. They indicate small relative increases in garden vegetables in Morel and Gudha, and in pulses and irrigated fodder in all three. All of these reflect policies to decrease water requirements per unit of irrigated area, to improve the nutrition intake of rural families, to reduce the risk of crop loss in drought years and to take care

of the cattle. None of them reflect attempts to maximize cultivators' net incomes and cash flows. Based on the projected yields, prices and production costs used in the analysis herein, several of the projected shifts in cropping pattern decrease rather than increase the projected incomes of cultivators. At least the reviewer may be confident that the feasibility of the three prototypes is not overstated because of unrealistic balances of high earning crops.

7. Suggested Approach to Standardizing Procedures for MIP Evaluation by GOR

The desire of the Department of Irrigation and Department of Agriculture to standardize MIP evaluation procedures is well founded, and deserves attention and support. Standardization can enhance comparability of analysis and findings from one MIP to another. It can provide more orderly and timely procession of each MIP candidate through the planning analytical steps. It can help identify the more important factors and relationships affecting the technical and economic soundness of each project. It can help minimize gaps and interruptions in the total MIP planning, approval and implementation process. It can add to the effectiveness and efficiency of the Water Utilization Cell and others with responsibility for economic evaluation of candidate MIPs.

Starting with the foundation of present procedures, one of the first steps is to standardize the needed input data and the formats in which they are presented (see Section 2). The organization of tabular input material shown by Tables 1 through 7 represent a solid step in this direction (See Section 4). Similar standard input data formatting is needed for technical and engineering information regarding each MIP candidate.

Another early step that deserves attention and standardization is the sequential phasing of the needed steps in MIP planning and evaluation. For example, more effective planning (and more productive MIPs) can be achieved if some of the sensitivity analysis can be done early in the total process. Attention needs to be given to specific points in the process for most effective interaction between those of the different disciplines and responsibilities involved. The more nearly the whole process can be reduced to formal critical path planning, the more rewarding the end result will be.

Perhaps the next step will be to develop a manual of procedures. complete with easy to follow worksheets and specific guidelines for each procedural step. Such a manual can be the vehicle for finalizing and documenting previous steps, for structuring sequential flows through the process of project planning and evaluation, and for design and conduct of training workshops on the procedures.

It will be helpful to focus on the content and details of the final analysis and reports for MIPs, and then determine the most efficient way to get there. Computerized techniques should be considered to the extent that they will facilitate the process, but not beyond. As with the entire process, further thought should be given to what should be computerized first, and how it should be done. It seems probable that final sensitivity analysis at the stage of DRR evaluation is the most logical starting point. If so, the logical next step may be to use comparable computerized procedures as a planning tool at a fairly early stage of project planning and design. If the intermediate steps prior to DRR sensitivity analysis are standardized effectively and reduced to worksheet form, there may be little advantage in using computer analysis at these steps and for the forseeable future.

ANNEX H - GOI's LETTER OF REQUEST

DRAFT PROJECT AUTHORIZATION

Name of Country/Entity:	India	Name of Project:	Rajasthan Medium Irrigation
		Number of Project:	386-0467
		Number of Loan:	386-T-227

1. Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Rajasthan Medium Irrigation Project for India involving planned obligations of not to exceed $35,000,000 in loan funds and $500,000 in grant funds over a five year period from date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/allotment process, to help in financing foreign exchange and local currency costs for the project.

2. The loan project will finance the construction of ongoing and new medium irrigation projects plus the modernization of existing projects. The grant portion of the project will finance training in irrigation design, construction, operation and economic analyses, and studies including water management, socio-economic surveys, organization and evaluation.

3. The Project Agreement which may be negotiated and executed by the officer to whom such authority is delegated in accordance with AID regulations and Delegations of Authority shall be subject to the following essential terms and covenants and major conditions together with such other terms and conditions as AID may deem appropriate.

4. a. Interest Rate and Terms of Repayment

The Cooperating Country shall repay the Loan to AID in U.S. dollars within forty (40) years from the date of first disbursement of the Loan, including a grace period of not to exceed ten (10) years The Cooperating Country shall pay to AID in U.S. Dollars interest from the date of first disbursement of the Loan at the rate of (a) two percent (2%) per annum during the first ten (10) years, and (b) three percent (3%) per annum thereafter, on the outstanding disbursed balance of the Loan and on any due and unpaid interest thereon.

b. Source and Origin of Goods and Services

Goods and services financed by A.I.D. under loan shall have their source and origin in the Cooperating Country or in countries included in A.I.D. Geographic Code 941, except as A.I.D. may otherwise agree in writing. Goods and services financed by A.I.D. under grant shall have their source and origin in the Cooperating Country or in the United States, except as A.I.D. may otherwise agree in writing. No ocean shipping will be financed by A.I.D. under the project.

Typed Name	Office Symbol	Date	Initials
Clearances:			
A. John H. Sullivan	AA/ASIA		
B. Norman Holmes	GC		
C. Alexander Shakow	AA/PPC		

Signature _____

Joseph Wheeler
Typed Name of Authorizing Officer

DA/AID
Office Symbol

Environmental Assessment
Rajasthan Medium Irrigation

The environmental study conducted by Operations Research Group for the Rajasthan Project has made the following recommendations specific to medium irrigation projects based on their study investigations:

1. Maintenance of forest ecology, studies on siltation, afforestation or planting of adaptive plant species along the slopes to check erosion, terracing and benching on the pediment slopes to arrest soil erosion and reduce sediment load in the streams;

2. Horticulture and other dry farming practices should be introduced on the terraces upon pediment slopes;

3. Construction of silt detention dam or check dams in the upstream areas and the work maintenance of riverbeds;

4. Periodic capacity and photogrametric surveys, and constant vigilance on the reservoir is recommended because of gully and sheet erosion and also large number of ravines upstreams and changes in siltation rates;

5. Proper attention needs to be given to the needs and problems of the resettled population. Specially selected enterprising village level workers (Gramasevaks) may be appointed to provide the necessary healing touch to uprooted people at least in the initial few years after the construction of dam;

6. Relevant data should be collected on river channels, both upstream and downstream of the reservoir, which should form an integral part of the stream surveillance;

7. The plantation of trees along the reservoir will serve as wind breaks, and thus help reducing the evaporation losses. This would also help replenishing the forest resources that may go under submergence. The energy problems, especially for rural population, will also be mitigated.

8. Maintenance of natural drainage with a view to avoid any interference with infrastructure development;

9. The conjuctive use, preferably, in areas where scope for ground water use holds good;

10. Proper vigilance on bed cultivation practices, especially in reservoir fringe areas with a view to restrict use of fertilizers which results in eutrophication;

11. Judicious use of insecticides and pesticides in areas where crops need them especially in command areas;

12. Piscicultural activities in reservoir areas should be encouraged wherever feasible;

13. The development of bird sanctuaries and tourist spots may be considered;

14. Proper investigation of probable dangers due to floods, seismic shocks and major potential landslides in submergence areas and

15. Flood warning system should be developed in the entire command areas so as to mitigate any accident.

Grant Funding

Grant funding is proposed for the following activities:

1.	Technical Assistance for stream gauging and seepage measurements.	$ 10,000
2.	Training of engineers in water management in the United States.	110,000
3.	Water management studies	110,000
4.	Socio-economic baseline studies	35,000
5.	Economic analysis training	125,000
6.	Training program in organizational development and operation for water management.	110,000
	TOTAL	$500,000

ANNEX L

PROJECT DESCRIPTION

The objectives of the Rajasthan Medium Irrigation Project are to: (1) increase agricultural production and income of the rural poor, (2) increase rural employment, and (3) reduce the impact of drought in the project area. These objectives will be accomplished through the expansion and improved operation of irrigated areas in Rajasthan, thus alleviating the prime constraint to greater agricultural productivity - lack of a reliable water supply. The Project will be financed by a loan to cover 67 percent of civil works construction costs; and a grant contributing to the costs of engineering and economics training and undertaking special studies.

The Irrigation and Agriculture Departments of the Government of Rajasthan (GOR) will design individual medium irrigation projects (MIPs) and MIP sub-projects. An Appraisal Committee constituted in the Central Water Commission will appraise and where appropriate approve those MIPs or MIP sub-projects having culturable command areas (CCAs) of 2000 or more hectares (ha), A GOR Appraisal Committee will appraise and where appropriate approve those MIPs or MIP subprojects having CCAs of less than 2000 ha.

The criteria to be met for sub-project approval are: (1) 50 percent or more of benefitted cultivators (Khatedars) operate four ha or less of CCA; (2) the direct rate of return on investment for irrigation works and associated watercourses, drainage and internal roads is 9 percent or greater, or 7.5 percent or greater for sub-projects in tribal or other disadvantaged areas; (3) soils and other physical conditions are satisfactory as determined by reconnaissance level soil surveys, with semi-detailed surveys in waterlogged or threatened areas; (4) water supply is adequate for the cropping pattern as shown by a water budget taking into account crop evapotranspiration, and all losses, and a reservoir operations study based on a twenty year water yield analysis; (5) main canals are adequately designed and regulated to permit full delivery to all commanded areas with flows at 50 percent capacity; all canals are adequately protected by cross drainage structures and provided with measuring facilities so the flow can be measured at all times and with Adjustable Proportion Modules at all outlet points; (6) adequate watercourses provided with division boxes where streams are divided and gated outlets and check-structures at each turnout point are constructed and maintained down to an average of 8 hectares; (7) all channels are fully lined to outlets

serving chaks of approximately 40 hectares. For channels between 40 and 8 ha, 50 percent of the cost of lining shall be provided in the financial estimate, but lining will be on a selective basis; (8) adequate provision for system drainage is made to relieve water logging and eliminate all standing water during rain or from irrigation; (9) all works meet recognized engineering design standards; (10) qualified personnel will be available when needed to undertake all supervisory and technical activities; (11) GOR design reports will include a statement of the specific agricultural support services available, and to be made available at implementation to adequately serve the command area; and ~~(12)~~ for new MIP's, construction will be completed within five years of its initiation.

The Project will finance a five year time slice of Rajasthan's program for construction of new and modernization of existing medium irrigation sub-projects. Works eligible for financing will include construction and improvement of dams and control works [illegible] distributaries, watercourses (including lining), road [illegible] for project operation, land drainage works, other physical improvements necessary to make the sub-project system of water storage and conveyance to farm level operate efficiently and effectively, and civil works for resettlement. On-farm land development such as contour shaping and land leveling; and off-farm facilities such as markets, warehousing and credit; and land acquisition and other compensation costs will not be eligible for reimbursement by AID. Once a sub-project has been approved, payments for such sub-projects made subsequent to the signing of the Loan Agreement will be eligible for reimbursement. Sub-projects that are AID financed in any part will be completed by GOR according to agreed criteria.

The following will be carried out under the complementary grant:

(1) Short term training will be provided for engineers responsible for design, construction, evaluation and/or operations and for GOR/GOI officers responsible for economic analysis, to review and study practices and participate in special courses in the United States. In-service training will be provided

BEST AVAILABLE

for project design officers. Development of training modules and special courses and training activities in water management for use by GOR Irrigation and Agricultural Departments will be supported.

(2) Studies will include: (a) base-line socio-economic surveys, (b) water management studies, (c) orgarization studies and (d) evaluation. The content and timing of studies will be mutually agreed upon between GOI/GOR and USAID.

Routine evaluations will occur yearly during the life of the project, with a full evaluation undertaken after thirty months of the Project's implementation and again when the Project is completed.

AID anticipates making $35.5 million available in increments to support the $58 million five-year project: $35 million by loan for civil works construction and $500,000 by grant for training and studies. Of this amount, $15.5 million is being provided for in this Project Agreement and the remaining $20.5 million would be made available in additional agreements this fiscal year and in the U.S. Government fiscal year 1981 subject to the availability of funds for the above purposes and the mutual agreement of the Parties at the time of a subsequent increment to proceed.

APPENDIX A

AGRICULTURAL SUPPORT PROGRAM

CONTENTS

1. Agricultural Extension and Research Project in Rajasthan.

2. Agricultural Marketing in Rajasthan.

3. Agricultural Production Programs with Example of Jaipur District.

4. Farm Credit System in Rajasthan.

APPENDIX A

AGRICULTURAL SUPPORT PROGRAMS

1. Agriculture Extension & Research Project in Rajasthan

The New Extension & Research Project was started in October 1977 and came into full fledged operation from May, 1978. The main concept is a man to man approach for transfer of technology. The farmers are trained to increase their yields by timely use of their available resources and by giving more stress on labor incentive, non-monetary inputs, etc.

The "Training and Visit" system on which the whole methodology is based works as under:

1.1 V.E.W.: Each Village and Extension Worker (VEW) is assigned on an average 720 families, varying between 600-900 farm families. All farm families are divided in 8 convenient working chaks. Each VEW is expected to visit every 2 weeks i.e. 4 chaks a week. The visits are always made on a fixed day and time. Eight to ten contact farmers have been selected in each chak, messages are passed on and demonstrated in their fields. Through these contact farmers, remaining farmers, called followers, also start adopting many of impact points.

1.2 Training: Every fortnight(Friday or Saturday) a training session is organized by the Subject Matter Specialist (SMS) of his area (sub district wise). The training is imparted for specific jobs/crops which he is expected to extend during the next fortnight. Any problems faced in any respect, e.g. field, problem supply of input, etc. is also discussed at length, and in turn, are passed on to the concerned agencies. If the problem is severe the officers of concerning departments specialists are requested to attend the meeting.

One Agricultural Extension Officer (AEO) is provided to supervise and guide the work of 8 VEW's. AEO's also attend fortnightly training sessions. SMS's meet once in a month at district headquarters and review the program. Specialized training courses are also arranged as and when needed.

The AEO's SMS of the district receive training through discussions with the master trainers (specialists) from University/Department.

1.3 Duties of SMS Agronomy (Crops); Plant Protection and Training:

1. Organize fortnightly training for VEW's and AEO's.

2. Responsible for preparing fortnightly training lessons, etc.
3. Develop his own technical knowledge by visiting various research stations, Universities and attending seminars, etc.
4. SMS will also provide technical supervision to the AEO's and VEW's under their jurisdiction.

1.4 District Level:

Duties of District Agriculture Officer

1. To prepare a program of agriculture development.
2. To assess the input and credit requirements of the district.
3. To coordinate the working of various agencies involved in credit and input arrangements.
4. To see that supply arrangements of all the inputs required is made on a timely basis.
5. To keep close contact with the officers of various agencies responsible for supplying inputs.
6. To keep a constant watch on the training and research needs of the district for the extension workers.
7. To help in developing the program of adaptive trials taking into consideration the needs of the district.

1.5 Dy. Director of Agriculture

1. Assures that the monthly training program is drawn out in advance.
2. Assures that the lessons are prepared well in advance with the consultation of the Regional Agronomists and SMS.
3. Assures that the lesson is based on the need of the work to be carried out in the field of that particular area during the coming fortnight. He will also keep close contact with the University Staff and research stations to keep himself up to date, with the latest technological know how for providing necessary guidance to the SMS and other staff.

1.6 Headquarters: The work is being looked after by the Additional Director of Agriculture (Extension) assisted by other senior officers of different disciplines.

1.7 Adaptive Research: Sometimes direct transmission of recommendation from research centers to farmers fields have had derogatory effects causing setback to extension effects in introducing new technology for increasing crop yields. Effective transmission and subsequent adoption of agricultural know how could be accomplished quickly if it is transferred after its orientation and testing under farmers conditions in various agroclimatic zones of the State. Keeping this

in view, a provision for laying out simple adaptive trials both in the identified adaptive trial centres and farmers fields has been made in this project.

1.7.1. Identification of Adaptive Trial Centers: Although 39 different agro-climatic zones have been identified in the state due to non-existence of sharp dissimilarities among some of the agro-climatic zones it was decided to develop 12 adaptive trial centers, out of which five will be main operational centers, one in each division (App.I) and the rest as zonal sub-centers.

Main operational centers	Sub-centers
1. Chhatarpura (Bundi)	1. Tonk 2. Khanpur (Jhalawar)
2. Sumerpur (Pali)	1. Kalyanpura
3. Sri Karanpur (Ganganagar)	2. Yet to be identified
4. Chittorgarh (Udaipur)	1. Sewar (Bharatpur) 2. Sawa Madhopur
5. Tabiji (Ajmer)	3. Navganon

1.7.2. Staff and Work: All of these stations are headed by senior officer Agronomists and are supported by specialists like plant pathologists, Entomologists, Chemists, etc. The Station will carry out the work on the local problems of the cultivators which are sent through various district agencies to centers.

1.8 Specialist and field level workers training Centers: There are two training centers (i)Tonk, (ii)Durgapura(Jaipur), each headed by a Jt.Director of Agriculture (Principal) and supported by various specialists. In both training centers the training on various crops, plant protection, management of fields, etc. is given to subject matter specialists, Agriculture Extension Officers and village extension workers. From time to time orientation courses are also organized. The course length varies from one week to six weeks. All aspects of crops management are dealt with here.

1.9 Water Management Training: The Department is already giving training through various training centers on the consumptive use of water, time of water application, etc. But if there is a special need, the Department of Irrigation can prepare lessons on Water Management and the same can be transmitted to both the training centers, which will then be transmitted to VEWs through the training system.

Special training on water management can also be given up to sub district level where irrigation projects exist. The local irrigation engineer can impart training in cluster meetings of the area and they can also discuss the problems. The staff already working in the district and sub district level will take care of the above mentioned subject.

The Staffing Pattern for the Project is shown on the Ministry of Agriculture organization chart in this appendix.

2. Agriculture Marketing in Rajasthan

Marketing comprises all ancillary services right from the producer's level to the consumer's door. No plan of agriculture production can be successfully completed unless due regard has been paid to adequate marketing facilities. A systematic commercial view is being taken and cultivators may now look forward to adopting sophisticated method not only in agricultural production but also in the disposal of their produce by eliminating middlemen. Regulated marketing is organized under the Rajasthan Agriculture Produce Market Act of 1961 and a market Regulation Scheme has been suggested for Rajasthan. A body known as "Krishi Upaj Mandi Samiti" or Marketing Board was created to enforce the provisions of the Act and Regulation Scheme. A marketing committee consisting of 15 members is nominated. It includes 7 Agriculturists, 2 traders, 2 representatives of cooperatives, 2 local authorities and 2 Government nominees. The Market Committee establishes its principal market yard at its headquarter and sub yards in the market area. The market fee leviable under the present Act and Rules is Rs.1/- per Rs.100/- worth of produce. This fee is the only charge levied on the producer seller.

2.1 Market Projects: Each market yard or mandi consist of the following: shops-cum-gowdowns, separate godowns, big auction platforms, farmer's rest house, water huts, cattle sheds, water troughs, veterinary dispensary, refreshment rooms, shops for daily articles used, fertilizer cum-pesticides shops if needed, post office, banks, ware-houses, grain driers, a grading laboratory and information center.

2.2 Policy for New Markets: GOR has directed that the new regulated markets will be opened only at the places where the minimum income from fees will be Rs.3.0 lakhs annually or the equivalent of Rs.3.0 crores market volume.

2.3 Subsidary Development Plans(Roads): To enable smooth and quick flow of farm produce from the market to the nearest mandi, proper

link roads are necessary. The Marketing Board is contemplating plans to connect all villages in the state with the nearest market town in the next few years.

2.4 Conclusion: Wherever the production of agriculture will increase, the GOR and the Board will provide regulated markets at an appropriate place with necessary connecting roads for transportation of agriculture produce. There will be no problems of proper disposal of surplus agriculture marketable produce for any area brought under new irrigation projects. An excellent example is the regulated market development of Jawai Command Area at Sumerpur. After the introduction of the irrigation system, the mandi became the biggest one in Pali district.(GOR preparing statement on mkt.development for Jawai).

3. Agricultural Production Program with Example of Jaipur District:

The district Officers prepare the Plan for the various inputs and other development activities to be undertaken for agriculture sector well in advance. This plan is sent to the Directorate and a consolidated plan is prepared for whole of the Agriculture Department for the state. The plan is approved by Planning/State. Again the targets are communicated district wise to concerned officers. This program is again approved by the District Agriculture Production Committee.

As per discussion there was a question about how this input will be managed after introduction of irrigation. Here ar example is given for Jaipur district (Ann.3.1 and 3.2). The target for year 1978-79 and 1979-80 will explain how the quantity of different inputs as per local demand is sent and management for the same is done.

3.1 Seeds for High Yielding Varieties:

3.1.1. In the year 1978-79 the target fixed as per demand for various high yielding varieties were 825,11.20, 34.50 and 4200.00 quintals for hybrid bajra, jowar, maize and mexican wheat respectively, but in the year 1979-80 the same were increased as per demand to 875, 17.50, 52.50 and 5000 quintals of bajra, jowar, maize and mexican wheat respectively (table 3.1).

3.1.2 Similarly the target for fertilizer consumption in terms of NPK in the year 1978-79 was 600,60,25 M.tons respectively but the same has been revised in the year 1979-80 as per demand to 900 (N), 200 (P) and 30(K) metric tons. (Table 3.2).

3.2 The two examples will be self explanatory. If any irrigation project will start in the district, the officers concerned will collect the demand for the additional area to be brought under irrigation. This will be sent to H.Q. for the allotment of the same.

Table 3.1

COMPARATIVE PRODUCTION PROGRAM FOR JAIPUR DISTRICT (AGRICULTURE SECTOR)

1. Use of high yielding varieties:

	Area in Hectares		Seed in Quintals	
	1978-79	1979-80	1978-79	1979-80
Hy.Bajra	35,000	33,000	825.00	875.00
Jowar	250	160	17.50	11.20
Maize	350	230	52.50	34.50
Mexican Wheat	42,000	52,000	5,000.00	4,200.00

2. Fertilizers: (Metric tons)

	1978 79	1979-80
N	600.0	900.0
P	60.0	200.0
K	25.0	30.0

ANNEX 3.1

COMPARATIVE PRODUCTION PROGRAM FOR JAIPUR DISTRICT YEAR 1978-79 & 1979-80

A. PLAN FOR 1978-79

1.

	Area in 000 ha.			Production 000 Tons		
	Actual 1976-77	3 yrs average ending 1976-77	Targets 1978-79	Actual 1976-77	3 yrs average ending 1976-77	Target 1978-79
Kharif food grains	396	363	355	223	136	182
Kharif Oilseeds	51	53	60	25	29	28
Sugar Cane	1	1	1	36	21	35
Rabi food grains	336	354	371	438	408	476
Oilseeds	4	5	5	2	2	2

2. Proposed Target for high yielding varieties

	Area in Hectares	Seed distribution in Qtls.
1. Hy. Bajra	33,000	825.00
2. Hy. Jowar	100	11.00
3. Hy. Maize	230	34.50
4. Paddy	---	-----
5. Mexican Wheat	42,000	4200.00

3. Improved Cultural Program for Rabi 1978-79 under Improved Cultural Practices Program

	Area in Hectares	Seed in Quintals
Bajra	23,000	---
Jowar	3,000	---
Maize	1,000	---
Paddy	-----	---
Wheat	10,000	1,000
Barley	20,000	2,000
Gram	12,000	900

4. Compost Development Scheme

No. of Gobar Gas Plants	Town Compost in tons	Rural Compost in tons	Green manuring in ha.
75	20,000	55,000	1000

5. Soil Analysis

Kharif	Rabi	Total
2,700	2,700	5,400

6. Fertilizers (Kharif)

N	P	K
600	60	25

7. Plant Protection in lac. hectares:

Seed Treatment		Soil Treatment		Polypest Control		Intensive Treatment		Rat Control		Weed Control		Total	
K	R	K	R	K	R	K	R	K	R	K	R	K	R
0.50	0.55	0.10	0.10	0.05	0.12	0.60	0.10	0.20	0.35	-	0.10	0.91	1.32

8. Demonstrations

Minikits				Two	Fodder Minikits			
Bajra	Jowar	Maize	Paddy	Crop	Zaid	Rabi	Wheat	Barley
100	20	20	--	40	20	80	15	20

B. PLAN FOR 1979-80

1.

	Area in 000 ha			Production in 000 Tons		
	Actual 1977-78	3 yrs. Average ending 1977-78	Targets 79-80	Actual 1977-78	3 yrs. Average ending 1977-78	Targets 79-80
Jowar	23	25	25	1	3	7
Bajra	174	191	175	32	86	90
Maize	18	20	25	1	8	10
K.Pulses	108	123	115	19	34	40
Arhar	4	4	5	2	2	3
Wheat	139	120	120	229	191	190
Barley	96	113	110	139	169	165
Gram	147	131	130	130	134	115
Rabi Pulses	1	1	-	1	1	-
G.nut	38	38	40	30	24	25
Rape &Mustard	8	5	5	3	2	2

2. High Yielding Varieties

	Area in Hectares	Seed in quintals
Bajra	35,000	875
Jowar	250	17.50
Maize	350	52.50
Max.Wheat	50,000	5,000

3. Fertilizers

N	P	K
900	200	30

4. Compost Development:

Town Compost in Tons	Rural Compost in Tons	Green manuring
20,000	1,20,000	2,000

5. Soil Samples 15,000 (Kharif and Rabi both)

6. Demonstrations

Minikits			Two	Fodder					
Bajra	Jowar	Maize	Crop	Zaid	Rabi	Wheat	Barley	Multiple Crop	Fertilizer Demo
120	20	5	20	50	50	25	10	30	5

7. Plant Protection (Lac hectares)

Seed Treatment		Soil Treatment		Polypest control		Intensive Treatment		Rat Control		Weed Control		Total	
K	R	K	R	K	R	K	R	K	R	K	R	K	R
0.40	0.35	0.05	0.15	0.08	0.05	0.10	0.6	0.30	0.50	--0.10		0.93	1.21

4. Farm Credit System in Rajasthan

There are three types of loans advanced to all the cultivators in the State.

1. Short term loan.
2. Medium term loan.
3. Long term loan.

4.1 Short term loan: This loan is also called crop loan. Such loans are provided for seeds, fertilizers, pesticides, insecticides, etc.

Loaning agencies: The loaning agencies are the (i)Commercial banks and (ii)Cooperative banks.

These banks advance the loans to the cultivators for purchasing seeds, fertilizers, insecticides and the loan is advanced for a short period. All types of cultivators can take the loan. All the districts, sub-districts and Tehsil H.Q. have the branches of the above entioned banks. The cultivators are not to move too far for loans from their villages.

4.2 Medium Term Loans: This loan is given to the cultivators for purchase of draft and milch animals, etc.

Loaning agency:
(i) Commercial banks
(ii)Cooperative banks

All the districts, sub-district and Tehsil H.Q. are having one or other branch of the above said banks/or even both.

4.3 Long Term Loans: This type of loan is given for digging of wells, repairing of wells, tube wells, pump sets, tractors, sprinklers, levellers, other implements, construction of field channels, levelling of fields, etc.

Loaning agency:
(i) Commercial banks
(ii) Primary Land Development Bank

4.4 Subsidies: In addition to above loans there are number of schemes/agencies e.g. SFDA (Small Farmers Development Agency), IRD (Integrated Rural Development Program), DPAP(Drought Prone Area Program). These are all scheme bound programs. These schemes provide subsidies (small farmer 25% and marginal farmer 33.33%) and the remaining amount is given on loan from the cooperative banks or commercial banks to the cultivators.

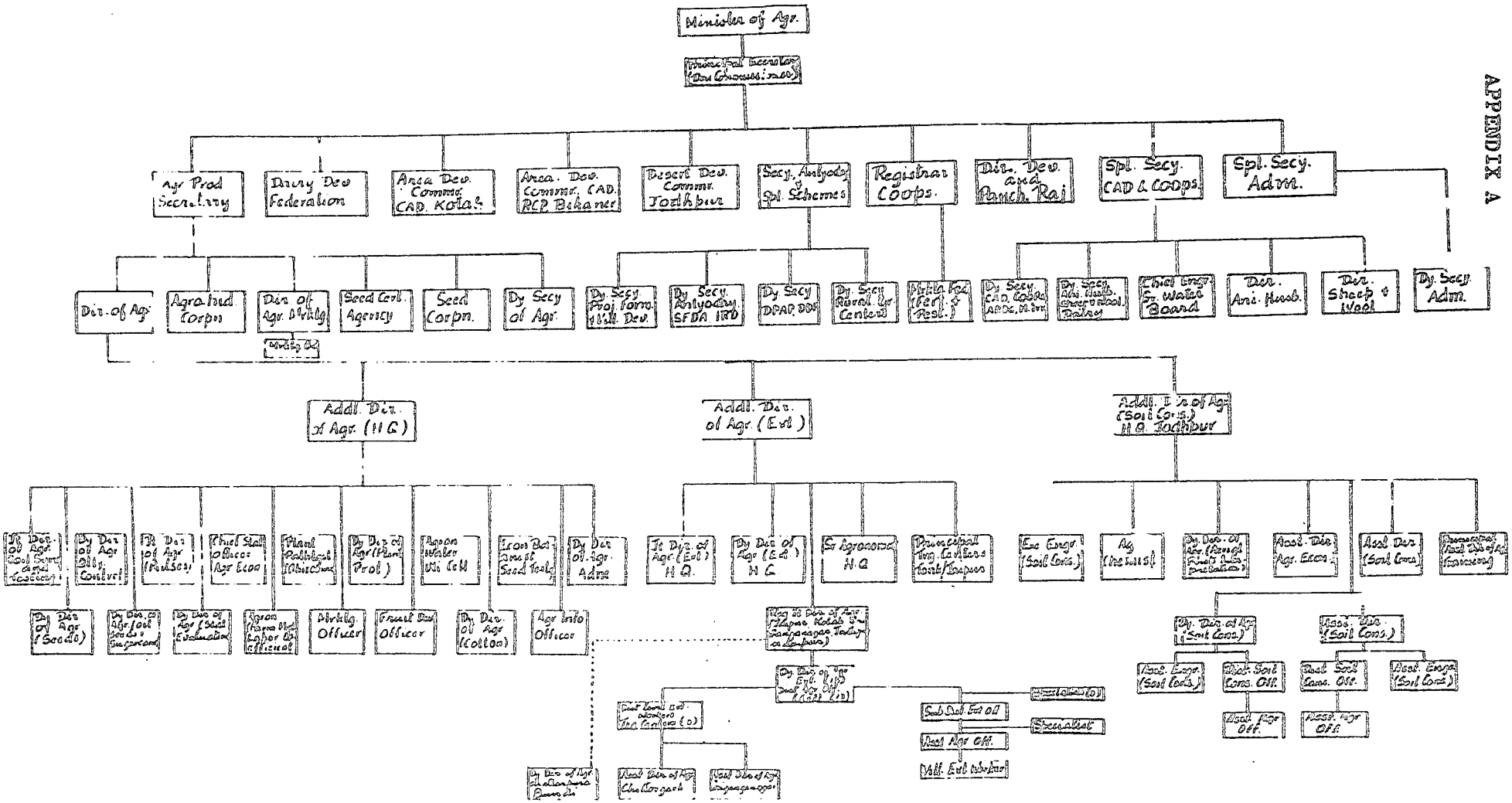
4.4.1. The districts which are covered under various agencies are as follows:

SFDA
Ajmer, Alwar, Bharatpur, S.Madhopur, Jaipur, Kota, Tonk, Bundi, Sirohi, Jhalawar, Chittorgarh, Bhilwara, Udaipur.

DPAP
Jodhpur-Barner, Nagour, Churu-Bikaner, (Bhim,Deogarh, Kherwara-Udaipur),Beawar(Ajmer),Pali, Jalore, Dungarpur, Banswara, Jaisalmer.

4.5 Method of Loaning: In all the areas the loan applications are prepared for cultivators with the help of village extension workers, patwaries and other staff of different agencies working in different villages and this application is got sanctioned from various banking agencies working in their circle.

APPENDIX A


Minister of Agr.
Agr Prod Secretary
Dairy Dev Federation
Area Dev. Commr. CAD. Kota
Area. Dev. Commr. CAD. RCP Bikaner
Desert Dev. Commr. Jodhpur
Secy. Anlyody & Spl. Schemes
Registrar Coops.
Dir. Dev. and Panch. Raj
Spl. Secy. CAD & Coops.
Spl. Secy. Adm.
Dir. of Agr.
Agro Ind Corpn
Dir of Agr. Mrktg
Seed Cert Agency
Seed Corpn.
Dy Secy of Agr.
Dy Secy Proj. Form. & Vill. Dev.
Dy Secy Anlyody SFDA IRD
Dy Secy DPAP, DDP
Dy Secy Rural Gr Centers
Dy Secy CAD Coops ARDC, M. Inv.
Chief Engr Gr. Water Board
Dir. Ani. Husb.
Dir. Sheep & Wool
Dy. Secy. Adm.
Addl. Dir. of Agr. (HQ)
Addl. Dir. of Agr. (Ext)
Addl. Dir of Agr (Soil Cons.) HQ. Jodhpur
Dy Dir. of Agr (Seed Corp. and Seed Cert.)
Dy Dir of Agr Mkt. Control
Dy Dir of Agr (Rubber)
Chief Stat Officer Agr Econ
Plant Pathologist (Mycology)
Dy Dir of Agr (Plant Prot.)
Agron Worker Wh Coll
Iron Bar Analyst Seed Testing
Dy Dir of Agr. Adm.
Jt Dir. of Agr (Ext) HQ.
Dy Dir of Agr (Ext) HQ
Sr Agronomist HQ
Principal Trng. Officer Jodh/Udaipur
Exe Engr. (Soil Cons.)
Ag (Mechanical)
Dy. Dir. of Agr. (Rangel Fire Protection)
Asst. Dir. Agr. Econ.
Asst Dir (Soil Cons.)
Principal Asst Dir of Agr (Engineering)
Dy Dir of Agr (Seeds)
Dy Dir of Agr (Soil & Sugarcane)
Dy Dir of Agr (Soil Evaluation)
Agron (Farm Mgt Labor Dt Officer)
Mrktg Officer
Fruit Dev Officer
Dy Dir of Agr (Cotton)
Agr Info Officer
Dy Dir of Agr (Soil Agr Off) (Ext)
Dy. Dir. of Agr (Soil Cons.)
Asst. Engr. (Soil Cons.)
Asst. Soil Cons. Off.
Asst Soil Cons. Off.
Asst. Engr (Soil Cons.)
Asst Agr Off.
Asst Agr Off.
Specialist
Asst Dir of Agr Chittorgarh
Asst Dir of Agr Jaisalmer

APPENDIX B

WATER SUPPLY AND ENGINEERING

CONTENTS

1. Introduction

2. Physical Conditions

3. Seasonal Allocation of Water

4. Engineering

5. Hydrographic Information

6. Reservoir Sizing

7. Water Balance and Operations Studies

8. Canals

9. Watercourses

10. Groundwater

11. Waterlogging and Drainage

12. Soil Surveys

Tables

Figures

Annex A - Water Budget

Annex B - Value of Water Saved by Lining

1. Value of Water Saved by Watercourse Lining

2. Value of Water Saved by Lining Minors and Distributaries

3. Economics of Watercourse Lining (Morel Modernization Project)

Organization Chart - Rajasthan Irrigation Department

APPENDIX B

WATER SUPPLY AND ENGINEERING

1. Introduction

Very important elements in the success of MIPs are reliable water supplies and properly designed and constructed dams, headworks, canals and watercourses which deliver water in timely, reliable and equitable fashion to all farm fields.

This section describes the physical setting for the Rajasthan Medium Irrigation Project and the relationship of MIP's to this setting.

It also discusses several questions relating to water supply and engineering arising from the Appraisal Team's study, the PID review and subsequent discussions among GOI/GOR officials and the Design team. These include the adequacy of water supply and engineering information generally, the rationale for the size of the reservoir and command area and the area to be irrigated, engineering and economic considerations relating to canal and watercourse modernization and lining, waterlogging and drainage requirements, potential for conjunctive use of groundwater, and need for soil surveys.

2. Physical Conditions

Average annual rainfall in Rajasthan varies from less than 100 mm (4 inches) in the extreme Northwest to over 990 mm (39 inches) in a small area of Southern Rajasthan. All but the winter season twelve to thirteen percent occurs during the Southwest monsoon period between June and September. The northwest one-half of the state is essentially desert, but the southeast half where the project is located receives about 24 inches of rain during the summer monsoon period. However, rainfall and runoff in the project area are extremely variable and not always reliable. Droughts are prolonged and intensive. Streamflows fall below 25 - 30 percent of average in about one year out of five or six. Often two or more years of severe drought occur consecutively greatly aggravating drought impact. In a Typical Case (Table 1) water supply fell below 30 percent in three out of the four years 1965-68. Under these conditions runoff captured in surface reservoirs in MIP's greatly reduced the adverse effects of drought and substantially multiples crop production potential in the Project Area. Limited groundwater is also available either as a separate source of irrigation water supply or in conjunction with surface water from MIP's.

3. Seasonal Allocation of Water

Since the purpose of MIP's is to improve crop production through irrigation, a discussion of the seasonal relationships of cropping practices to water supply is a useful prelude to engineering and water supply considerations. Flow irrigation may be provided during either kharif or rabi and sometimes during the hot dry period of zaid as well. In some cases, water may be provided for a pre-kharif irrigation. In theory, use of irrigation to supplement rain during kharif should be attractive, because a small amount of water at the right time, if rains are short, can dramatically increase yields. Drawing down the reservoir for short-term drought relief during the monsoon costs nothing in terms of water for rabi if the reservoir subsequently refills. The extent to which relief of intra-monsoon drought actually is practiced in Rajasthan is unclear, but it is minimal except possibly during persistent drought.

A critical period occurs at the end of the monsoon, when additional water may be needed to mature crops, especially when the monsoon ends early. Since expectations of reservoir refills are low, use of reservoir water at this time will reduce the amount available for rabi. Both farmers and the Irrigation Department will tend to postpone a decision to irrigate as long as possible in the hope of additional rain. Once the decision is made, time is critical, but canal capacities are not large enough to cover the entire command area in a period of less than three or four weeks, so only part of the crops can be served. Reservoir water ordinarily is not allocated to hot-dry season or "zaid" crops like sugarcane, which are usually irrigated by wells if grown at all, but there are notable exceptions, depending on local needs (see Table 2). Rabi farming has the advantage that weather is reliable. With reliable irrigation, farmers can exercise the maximum amount of control over the crop system. Thus nearly all reservoir supplies in most Rajasthan MIP's now are allocated to rabi.

4. Engineering

The civil engineering profession in India has many years of successful experience in the design and construction of hydraulic works such as dams and reservoirs. Exchange of technology in this field is freely international and India has contributed its share as well as adopted advances of others. Proven design and construction procedures and standards are followed. Design standards are set by the Central Water Commission (CWC), the highest technical water resources authority in India. CWC also reviews designs of all irrigation projects exceeding 2,000 hectares. GOR Irrigation Department, which is responsible for the design of MIP's under

this project has a staff of 4,000 graduate engineers and is fully competent to design and construct major hydraulic structures.

5. Hydrographic Information

One of the reasons frequently given for poor utilization of irrigation works is that streamflow records are inadequate for proper sizing of the reservoir and prediction of irrigated areas. Direct information on runoff is obtained using stream gauging stations and by measuring the canal and spillway discharges and changes in storage in existing tanks and reservoirs. A basic network of forty-eight stream gauging stations is now operational in Rajasthan, but most records are short. Peak flood and annual discharges are available and silt load measurements are taken during the monsoon. Accurate stream gauging of monsoon runoff is difficult because of the extreme size and short duration of the floods which follow the rains. Estimates of total and flood runoff are most commonly made using empirical correlations with rainfall which has been widely recorded for many years, but these estimates are not as reliable as direct measurements. Hydrographic information is judged as minimally adequate and stream gauging activities should be strengthened. GOR should take up stream gauging for at least a few prospective MIP sites. Using grant funds AID will provide technical or other assistance in improving the stream gauging system if desired by GOR and as agreed upon by discussion with USAID officials.

6. Reservoir Sizing

Ordinarily, reservoir size in semi-arid India is chosen such that reservoirs will be filled in 75 percent of the years. In extremely dry areas, because of the greater value of water, this criterion is changed so that reservoirs can be expected to fill in only 50 percent of the years. For a given watershed, the larger the reservoir, the less frequently (lower reliability) it will fill and the more it will cost. On the other hand, if reservoirs are made too small (higher reliability) opportunities to utilize large amounts of water available for agriculture in the wet years are lost. The advantages and disadvantages of shifting to a higher or lower reliability criterion seem to about offset each other. Present procedures for sizing of reservoirs therefore seem appropriate.

An analysis of the consequences of reducing risk was made using the Hindlot project as an example. The curve, Figure 1, shows the amount of water (vertical axis) expected for any given percent of the time (horizontal axis). The area under the curve above the reservoir capacity line represents the volume of water lost over the spillway. The area below is that stored. The deficiency in supply is represented by the area above the curve below the reservoir line on the right. Decreasing the reservoir size so that

it will fill 74 percent of the time (dashed line) instead of 54 percent (solid line) substantially reduces the deficiency, but also greatly increases the water wasted by spillage, reducing the irrigation area by 40 percent and the total cumulative production over the period analyzed by 32 percent.

7. Water Balance and Operations Studies

All of the water stored in a reservoir does not reach the crop root zone. Dead storage is provided below the ouclet sill to trap silt (usually for 100 years). Other losses include evaporation from the reservoir surface, seepage losses from canals and watercourses and operational losses such as leekage from turnouts and losses incurred in filling and emptying canals and ditches. Systematic measurements of water losses are relatively rare in India and estimates are usually optimistic with the result that irrigable areas are over estimated frequently by rule-of-thumb such as ten acres per million cubic feet of storage. This obscures the value of improving water delivery efficiency. System water budgets are made, but incompletely. For economic and technical analysis of Project MIP's water requirements and irrigated area will be based on standard evapotranspiration (Modified Penman or Blaney-Criddle) applied to cropping patterns, considering available rainfall. A quantitative water budget taking into account field irrigation efficiency, seepage and operational losses in watercourses, and canals and reservoir evaporations losses for both average year and full reservoir conditions (Annex A) will be required. Conveyance loss projections will be based on seepage measurements and wetted perimeter and/or on flow measurements over canal reaches. These budgets will determine the irrigated command area for MIPs under the loan. Twenty year reservoir and agricultural operations studies based on the design hydrograph and water requirements as calculated above will be made. These should include both kharif and rabi releases. More sophisticated reservoir operations studies could lead to more optimal use of water and system design. Weekly values of rainfall and evapotranspiration based on historic weather records would need to be computed. Such a computerized program has been devised by World Bank. GOR officials should consider the usefulness of adopting this level of operations study at an early date and to overcoming the inherent obstacles to kharif allocations mentioned in Section 3 above.

8. Canals

Operation of canals needs to be improved by providing better regulation, seepage control and protection from cross-drainage flooding. Inadequate design and maintenance of canals leads to inequitable distribution of water. The longer the canal, the

more the hazard that a full supply will not be delivered. Figure 2 shows measurements of irrigation intensity by chaks plotted against distance from the main canal gate on two canals in Rajasthan. To correct inequitable distribution to chaks, MIP's qualifying under the loan will be provided with canal regulating structures such that (a) full supply to fields can be delivered when canals are operating at 50 percent capacity; (b) flow measurement facilities exist so that flows can be accurately known in all canal, distributary and minor reaches; and (c) cross drainage and by-pass structures are adequate to pass all cross floods and to fully empty canals for maintenance. All canals, branches, distributaries and minors will be fully lined.

An adequate number of seepage tests, using standardized procedures to be developed by CWC/GOR, will be made as a basis for decisions on lining canals and watercourses and for estimation of water savings. Studies will be made to determine possible correlation with the Unified Soil Classification System for Engineering.[1/] If proven, this system may be used to reduce the number of seepage tests. Table 3 gives information on seepage loss tests. These measurements show few cases, if any, in which lining would not be economical. For quality control and in order to collect information on continuing effectiveness of linings, seepage tests shall be conducted on sample lined canal and watercourse sections following completion, and periodically thereafter.

Canals for MIP's traditionally are designed and operated such that extensive distribution of water over the command area is accomplished with minimal operator attention. Main and branch canals, minor canals and distributaries carry water from the reservoir to a watercourse where the farmers take the water and apply it to their fields. The system has no gates so when the canal system is operating there is water in all its various branches. Therefore, a canal so designed and maintained will deliver a prescribed flow of water to each watercourse area or chak, doing so without an operator's attention. This design is a source of operational loss because water often may not be needed in some chaks in the amounts prescribed. The situation is further complicated because pipes come in discrete sizes: 4 inch, 6 inch, etc. Table 4 shows variation in amounts actually delivered to chaks compared with the intended design amount based on studies made of two canals in the Rajasthan Canal Project. Accordingly Adjustable Proportion Modules (APM) in which the flow can be adjusted to fit the area will be installed at all outlets in qualifying MIP's.

9. Watercourses

The watercourse area is the production end of the irrigation system.

1/ Indian Standards Institution Publication: IS:1498-1970

It is where the farms are and where the farmers become involved with the irrigation process. The water is delivered from the canal system to each farm through the watercourse sub-system. Water is taken from the canal through an outlet structure which permits a specified fixed quantity to flow whenever there is water in the canal. In Rajasthan the usual practice is to provide a watercourse outlet for each 40 hectares of land. This is an average value, however, and the watercourse area (chak) sizes vary widely from as low as 4 to more than 100 hectares.

For MIP's in Rajasthan current practice is for the Irrigation Department to construct the canal system down to and including the outlet structure which provides water to the watercourse. At that point, the farmers are responsible for constructing, operating, and maintaining the watercourse sub-system within the chak. The usual practice is for an intricate, rather extensive and often crude ditch system to be built along farm boundaries with each farmer then getting his water from the watercourse through his own field ditch system. Considering that the basic field irrigation unit on the farm is usually no larger than one-eighth acre it is apparent that there is a very complicated, tortuous, and lengthy system of channels.

On Medium Irrigation Projects, the division of water among farmers in the chak is left entirely to the farmers. They manage this in various ways and usually divide the water among several watercourse branches and pass the water among themselves on some prearranged basis. Since it is their own responsibility there is no set pattern of distribution and use among farms and fields, although there is obviously a high probability that inequitable distribution occurs. Considering that often more than 100 farmers are involved voluntarily, the communal problems of constructing and maintaining a watercourse are difficult. Inspection by the Appraisal Team of several MIP's showed that watercourses were not adequately designed or well operated and maintained.

Because of poorly constructed and operated watercourses, much of the water provided does not reach the fields where and when it is needed. Seepage occurs, not only downward, but to a greater amount leaks horizontally through banks and from poorly-controlled turnouts inundating adjacent areas, in effect, multiplying the wetted perimater of the watercourse. Often there is no defined channel, and water flows slowly over wide areas. Channels may be widened by animals. There are practically no permanent structures. At every junction farmers have to build earthen dams and, over time, excavations for soil to build the dams causes large adjacent areas to be inundated most of the time. Watercourse bifurcations practically become small ponds where much loss occurs. Dams often leak and banks may be cut readily or disintegrate while weeds grow rapidly and obstruct water flow unless continually removed. Not

only does inefficiency in water conveyance limit the water available to farmers, but it reduces the confidence of farmers in its reliability. Without confidence, farmers do not invest in costly inputs or in developing their land.

Unlike the canal system, watercourses cannot be operated automatically using ungated outlets. Streams serving less than about 40 hectares are rotated, rather than subdivided, so controlled outlets and a system for controlling them are needed. A stream of about 1 cusec will serve about 40 hectares on a continuous basis, and this is approximately the optimal size of stream needed for field irrigation.

There is merit in having farmers operate and manage their distribution systems below about 40 hectares. A water distribution committee (Jal Vitaram) which is mostly effective in settling disputes exists in each chak. However, problems of financing, organization and training of farmers to a level necessary to handle what is essentially a fairly complex technical system within a reasonable time period seem very difficult. The alternative is for the Irrigation Department to extend its responsibility for distribution down to an outlet serving a much lower number of farmers.

Given the large capital investments and the necessity to accelerate and increase returns, and the history of poor watercourse performance, the Irrigation Department, GOR, will assume responsibility for designing, constructing and maintaining improved watercourses with permanent structures (with division boxes where streams are divided and with outlets and check structures) down to approximately 8 hectares and for either operating them or monitoring their operation at least weekly on MIP's financed under the loan. A suitably trained person will tour each watercourse, observe its operation, note its condition and report any problems to higher authority. If it is determined that it is needed, the Irrigation Department shall establish waribandi[2/] on all watercourses in an MIP.

The GOR Irrigation Department has initiated studies of 40 chaks in eight districts in order to obtain information on which to design guidelines and fix responsibilities for administration of water

---

2/ Formal irrigation scheduling among farms arranged for by the Irrigation Department by the Executive Engineer under Authority of the Irrigation and Drainage Act, Rule 11/4. This system schedules each farm with a specific time of use of the water/water stream. The length of time per farm is dependent on the size of the farm. The schedule is arranged so that all farms in a chak will receive water at precisely the same time and day of the week.

management below canal outlets and to obtain information on seepage losses in order to assess needs for lining. Detailed records of delivery of water to individual farms will be collected, actions of water user groups will be documented and operational difficulties recorded. In situ seepage measurements will be made. Information on seepage losses and water delivery will need to be collected through the next rabi season and will be available in April 1981. At that time GOR will prepare a policy statement on the extent and degree of operation, management and monitoring responsibility to be undertaken by the Irrigation Department and by water users statewide, and a detailed plan setting forth specific responsibilities for allocating water, developing and monitoring schedules, operating gates and dividers, and maintenance. The report will also include an assessment of training needs and a plan for meeting them.

Using appropriate engineering and construction methods (particularly providing appropriate lines and grades and compacting fills at optimal moisture) satisfactory watercourses can be constructed in earth at 300-400 rupees per hectare. These will result in considerable savings of water over traditional installations but there will still be significant seepage losses. Moreover continuous, high-level maintenance is required. Banks are subject to degradation by animals and can readily be cut to make unlawful diversions. Without organized constant maintenance good earthen watercourses will deteriorate rapidly so that they will be little better than present ones.

The problems of rapid deterioration and exposure to hazard inherent in small earthen ditches can be overcome by installing permanent linings of concrete or tile. While expensive in terms of capital investment, the benefits of lining heavily used sections, including water saved from seepage losses, reduction in time needed to move the stream from one field to the next, lower cost and more effective maintenance, and increased reliability of supply, will usually exceed the costs. On new systems, where farmers have not had previous irrigation experience, the transition times to irrigation operations could be shortened substantially.[3/]

For qualifying MIP's, extent of watercourse to be lined will be determined by economic analysis based on the value of the water saved from seepage. In view of the additional benefits in reduction of operational and maintenance cost, operational

---

3/ See "Lining of Small Irrigation Channels", Technical Series DC (WM-A)3/79 No. 4. Water Management Division. Ministry of Agriculture and Irrigation (Department of Agriculture and Cooperation) Government of India for full discussion of seepage loss rates for various soil types of alternative lining technology.

efficiency, etc., watercourses will be lined even when the economic benefits based on seepage losses alone are lesser by 20 percent than the costs of alternative sources of irrigation water. In any event, all watercourses will be lined from the outlet to the second bifurcation. Studies of losses under various watercourse conditions carried out by GOR will be used in such evaluations.

Examples showing methodological approaches to economic analysis of watercourses are contained in Annex B. Unlike canals where the entire length is kept filled during the operation period, many sections of a watercourse may be used relatively infrequently. As the stream is rotated among the branches the reach immediately below the turnout will be used 100 percent of the time, but each reach after the first branch will be used only a fraction of the time and so on for successive branches. Figure 3 shows intensity of use by percentage of watercourse length in sample chaks. Studies made[4/] of watercourse use in Rajasthan show that the equivalent length (100 percent use) is only 31 percent of the total.

The result is that most of the total watercourse loss can be saved by lining only the most frequently used reaches. Figure 4, from studies made by ID/GOR of some typical MIP chaks show for example, that about 50 percent of the total loss can be saved by lining 25 percent of the most used reaches.

Water saved by lining can be used to increase irrigated area at approximately the cost of new or modernized systems if the lined sections are used much of the time. The cost of providing the water supply to a hectare of land at the field turnout should be compared with the cost of other realistic alternatives. Appropriate loss factors must be applied to each alternative source in order to make this comparison.

Annex B-1 shows estimated cost per new irrigated hectare per kilometer of watercourse lined based on a 100-day season at 100 percent usage. These values must be adjusted for different seasonal lengths and usage frequencies. Annex B-3 is another approach. The water budget of an example MIP with various lining alternatives and associated irrigated areas is examined to determine optimal level of lining. Either analysis is suitable, however, the average cost of providing new irrigated land in the overall Project is recommended as the standard for comparison. Studies made by USAID indicate that lining one-third of the watercourses increases the direct rate of return on investment 1.5 to 2.5 percentage points.

4/ Kapoor, A.S., V.K. Sharma and S. K. Magliani. "A Study to Determine the Optimum Length to be Lined in a Watercourse". C.A.D. Rajasthan Canal Project, Office of the Chief Engineer, R.C.P. Bikaner, July 1976.

APAC raised the question of suitability of less expensive lining materials. Alternative lining materials other than concrete have been used but these are subject to puncture by animal hooves and roots. Besides impermeability, structural strength is important in order to hold the section in place. India has had many decades of experience with canal and ditch lining materials. Many designs have been tried and vast quantities have been installed under different cost and environmental conditions. Choice of lining materials of adequate structural strength and impermeability will be left up to the GOR Irrigation Department, however, the Department shall initiate studies designed to reduce the cost of lining without reducing effectiveness.

10. Groundwater

Groundwater exists on most, possibly all candidate MIPs. Of three new sub-project studies, 10 percent of the proposed culturable command areas (CCA) is already irrigated by wells. Since the average area to be irrigated by flow irrigation in these MIPs is 65 percent, well irrigation is very significant. Further utilization of groundwater is considered in MIP feasibility studies, however, potential is estimated to be 50 to 75 percent developed in Rajasthan. Utility of well water will be increased as MIPs are completed. In contrast to flow irrigation, well water is available on demand and conveyance losses to fields are minimal because the wells are nearby. It can be used for perennial crops, which have to be carried through the hot dry season, and to mitigate drought impact in years of monsoon failure.

Because of aquifer characteristics in the project area, large diameter open dug wells irrigating from one to several hectares commonly are used. Generally large tubewells are not possible. Conjunctive groundwater use in MIPs is encouraged by GOI and GOR and its advantages are apparent to many farmers. It will be encouraged by increased availability of electrification, development of markets for higher value crops and relatively higher surface water charges compared to pumping costs.

11. Waterlogging and Drainage

Waterlogging and associated salinity and sodicity has caused serious problems on many MIPs and waterlogged areas continue to expand on most of these. Improved water management, canal and watercourse lining, and conjunctive use of groundwater should greatly reduce waterlogging. However, complete elimination of operational and seepage losses is not possible. These and rainfall add to the load placed on the natural internal drainage capacity of agricultural soils. Thus effective surface drainage is important.

Waterlogging impacts both rabi and kharif crops, but regardless of

waterlogging; good drainage, which costs around 400 Rs. per hectare, can greatly encourage kharif cropping by eliminating standing water during the monsoon.

An adequate surface drainage system will be provided on approved MIPs such that irrigation waste water and rainfall does not accumulate in low or blocked areas.

12. Soil Surveys

Soil Surveys are made by the GOR Agricultural Department which has excellent technical capability but limited workforce. Detailed surveys have been published or completed on eight existing or potential MIP areas. They provide information on production capability, waterlogging hazard, erosion, and need and potential of land forming and they could enhance drainage design and identify areas where special measures, e.g. lining, could reduce waterlogging hazard. GOR/ID has a great deal of empirical information on productivity and performance of soils in MIPs which is transferrable so that requiring detailed soil surveys on all MIPs under this loan is not justified; however, reconnaissance surveys will be made for all projects and semi-detailed surveys will be provided in those areas now waterlogged or threatened.

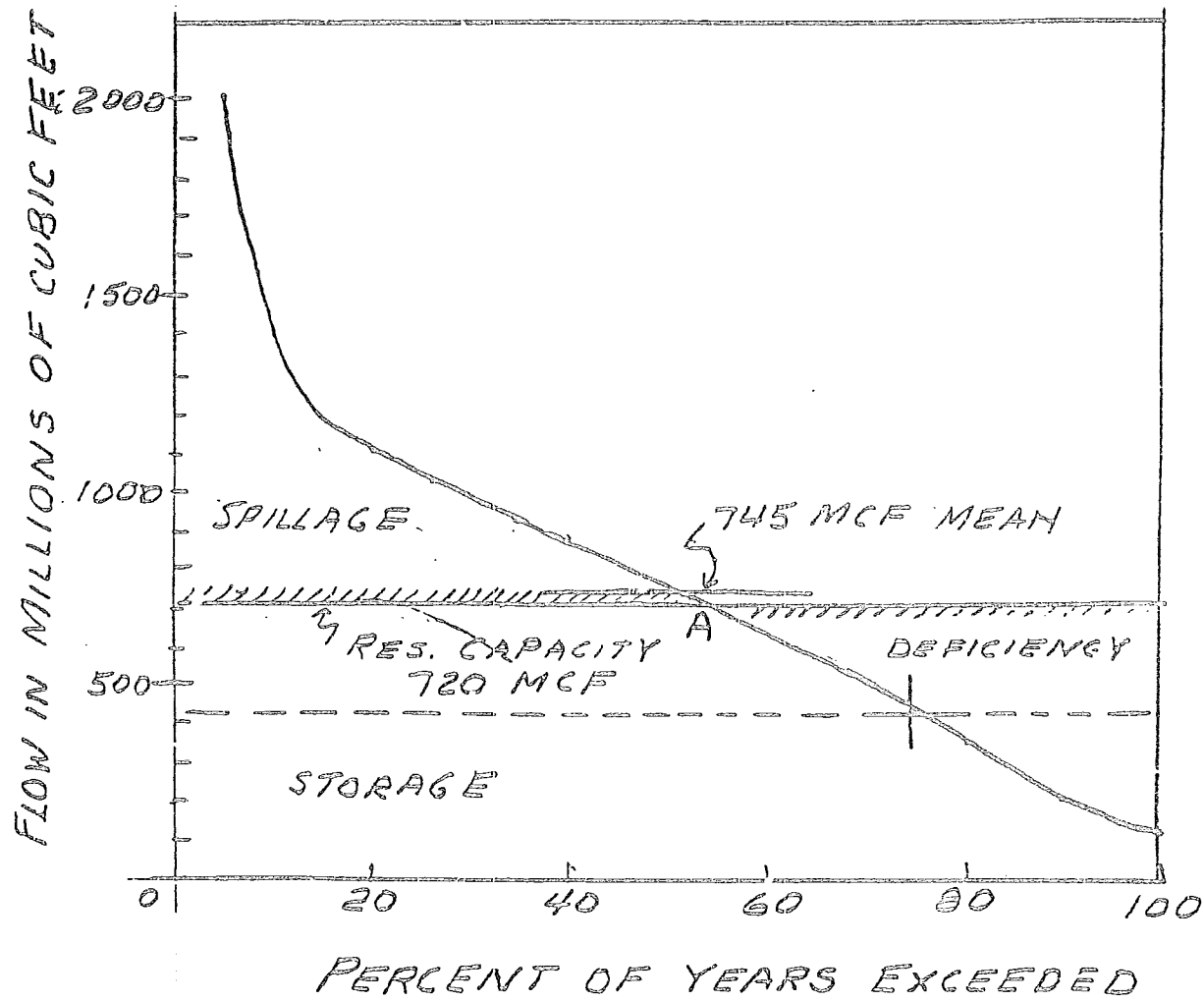


Fig. 1 SIZE VS. RELIABILITY OF RESERVOIRS

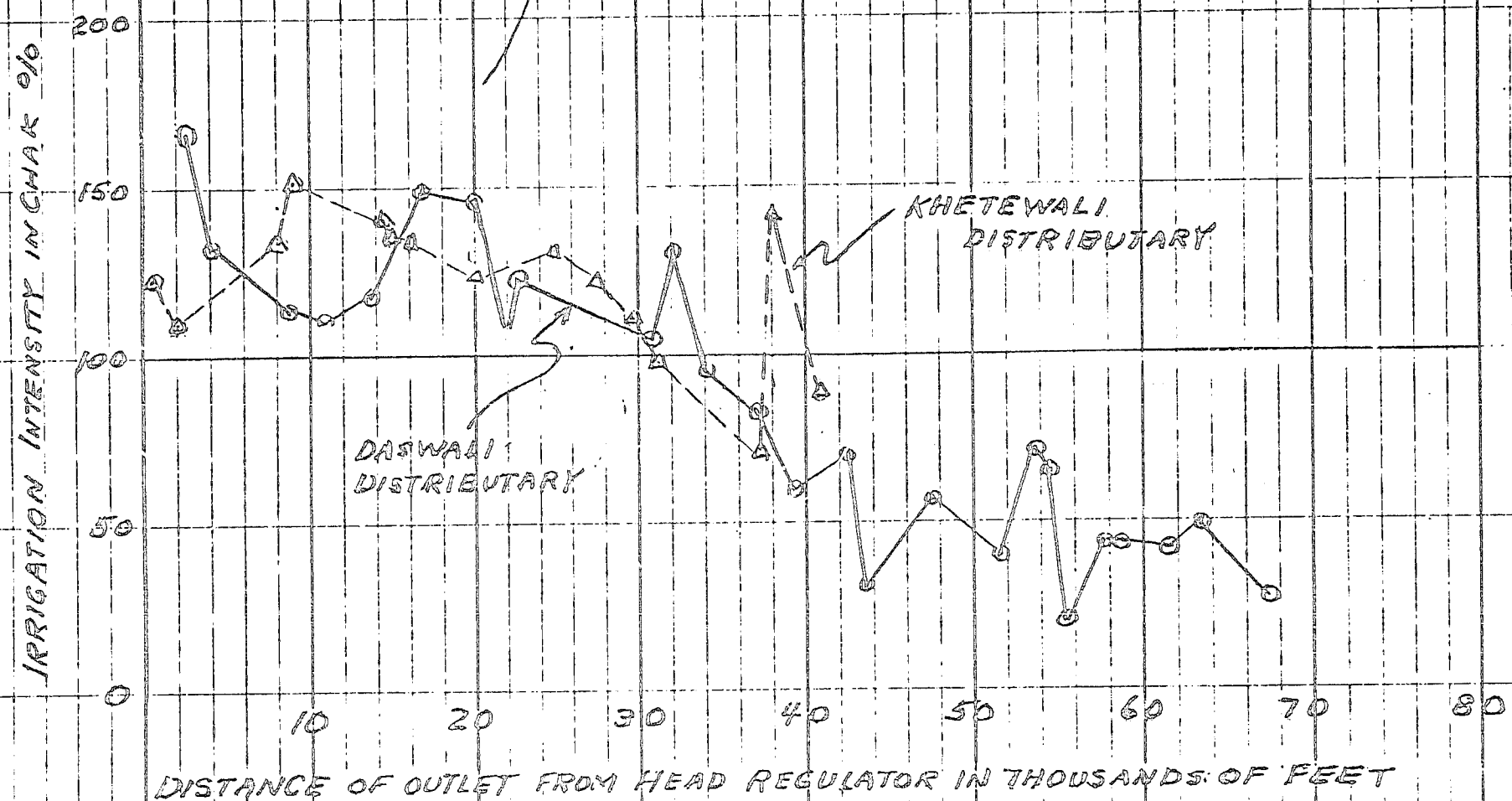


Fig. 2 RELATIONSHIP BETWEEN CHAK INTENSITY AND DISTANCE ALONG CANAL

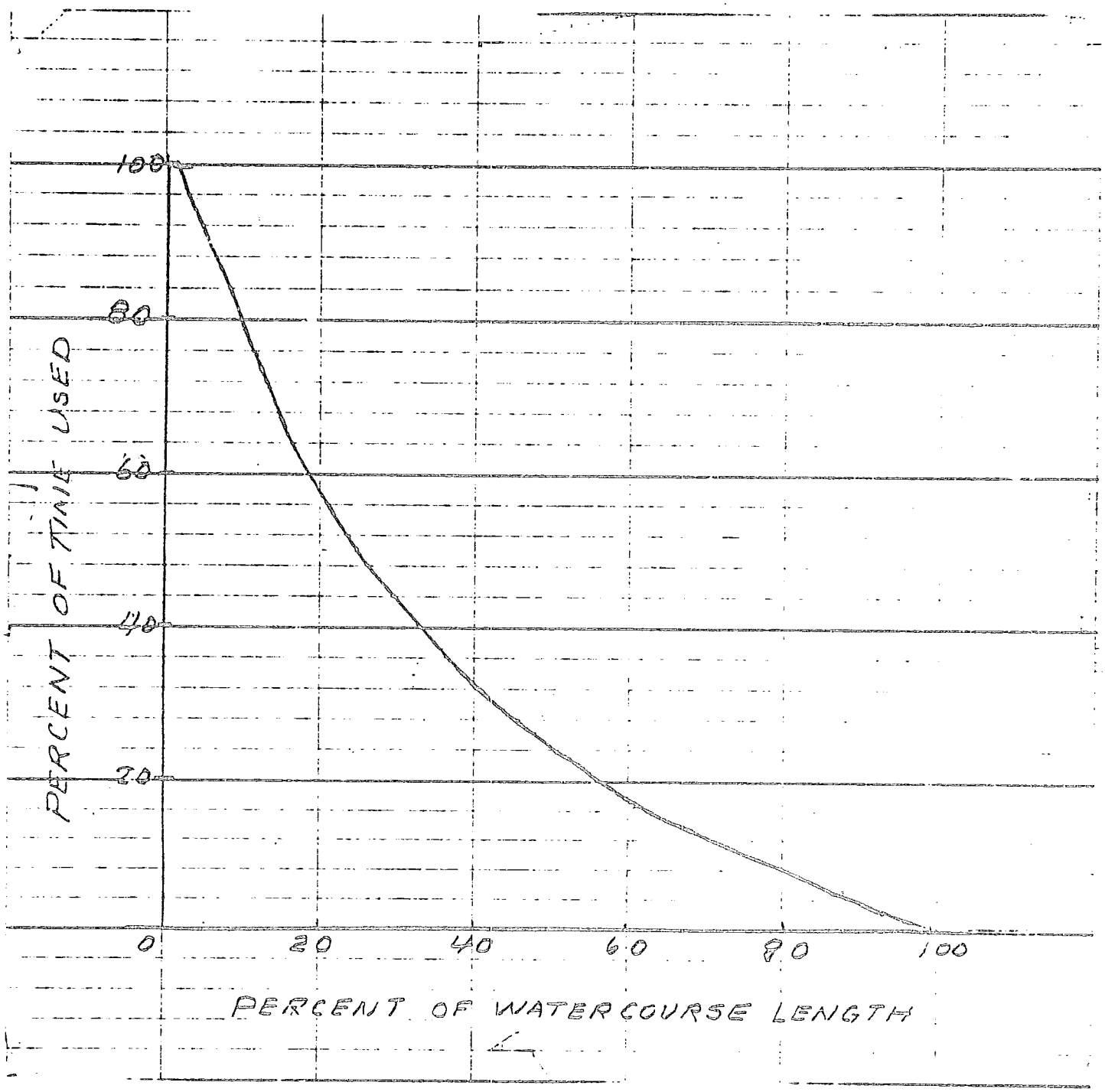


Figure 3 - Percent of Use Compared to Percent of Total Length of Watercourses. Rajasthan Canal Study. (From Kapoor, et al).

GRAPH SHOWING % SAVING OF LOSSES IN WATER COURSE AND % LENGTH OF WATER COURSE LINED FOR CHAK I & IV OF MINOR NO. I OF GALWA. CHAK II & IV OF MALIKHERA MINOR OF MEJA PROJECT.

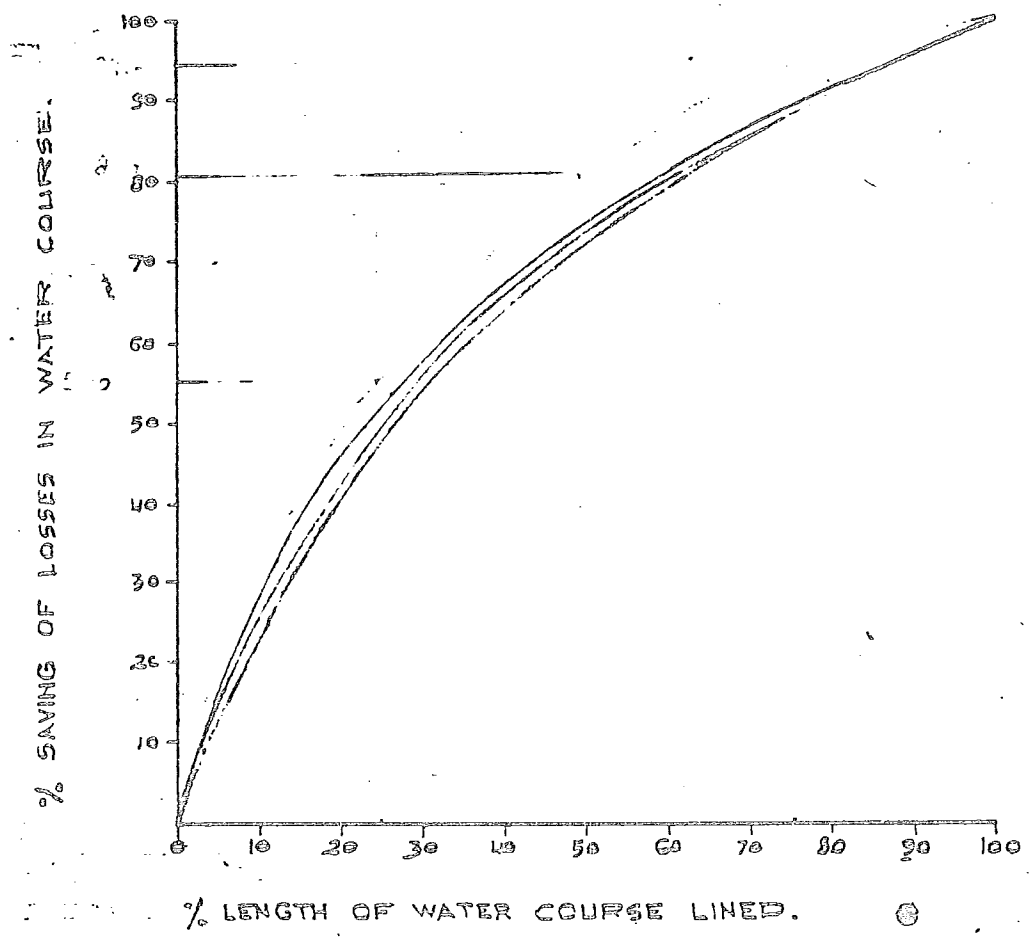


Fig. 4 RELATIONSHIP OF WATER SAVED TO WATERCOURSE LINED

TABLE 1 ESTIMATED RUNOFF AND RESERVOIR STORAGE AT HINDLOT MIP SITE IN MILLIONS OF CUBIC FEET (MCF)

Year	Total Yield	Estimated Live Storage	% of Capacity
1954	454.27	374.27	52.0
1955	855.96	720.00	100.0
1956	1190.09	720.00	100.0
1957	855.96	720.00	100.0
1958	1190.09	720.00	100.0
1959	1072.28	720.00	100.0
1960	792.12	720.00	100.0
1961	1190.09	720.00	100.0
1962	792.12	720.00	100.0
1963	454.27	430.27	59.8
1964	418.66	394.66	54.8
1965	179.38	155.38	21.6
1966	229.96	205.96	28.6
1967	963.42	720.00	100.0
1968	229.96	205.96	28.6
1969	662.27	638.27	87.3
1970	753.85	720.00	100.0
1971	1014.37	720.00	100.0
1972	113.45	89.65	13.7
1973	1793.79	720.00	100.0
1974	575.00	551.08	76.5
1975	910.20	720.00	100.0
1976	454.27	430.27	59.8

TABLE 2

RABI AND KHARIF WATER ALLOCATIONS IN STUDY SAMPLE OF MIPS

Project	CCA	Actual Kharif	Actual Rabi	Kharif	Rabi	% supply non-rabi crops
Morel	21,600	1,964	15,065	5,042	13,722	3.8 4/
Jaisamand	22,600	557 1/	5,205	2,045	9,354	12.2
Gosunda	13,669			1,740 2/	6,291 2/	8.7 5/
Gudha	10,860			1,466	9,231	23.2
Chappi	9,336			1,394 3/	5,655 3/	8.7
Bhimsagar	9,990			2,297	5,594	
Hindlot						4.7 5/
Sabi						8.4 5/
Namani						7.8 4/
Orai						3.3 4/

1/ Zaid season. The crop is moong.

2/ 1,071 hectares of maize are post-kharif irrigation. Remainder are long season crops; cotton, sugarcane and are also included in rabi. Total irrigation 7,362 ha.

3/ Includes 319 hectares long season crops, 6730 ha total.

4/ Estimated by Appraisal Team of existing projects

5/ From project reports reviewed by appraisal team.

TABLE 3 SELECTED SEEPAGE LOSS MEASUREMENTS

	Loss Rate CFS/MSF
1979 Morel Project Chandrilla Minor	23.7 - 6.7

Recent preliminary measurements in Maharashtra

Project/Canal	Loss Rate CFS/MSF	Soil Type
Girna/Jambda LBC	11	Black
Mula/RBC	25	Red Gravelly, rock cut
Mula/RBS	24	Black
Nira/RBS	6	Unknown (Black?) 1/
Purna/Basmath Br	15	Black
Mula Sanai Dr.	9	Rocky
	19	Red gravelly

1/ Canal built in 1930. Well silted and settled

Measurements on Nagajunasagar Project

Left Main	30	Red gravelly, rock cut
Left Main	23	Red gravelly
Mulkal Kalva Minor	32	Red gravelly
Right Main Canal	21	Black
Daida Major	19	Heavy Black
Gohimukka Minor	19	Heavy Black

Canals in Madhya Pradesh

Chambal RMC	6	Clayey, filling
Chambal RMC	34	Sandy, filling
Chambal LMC	13	Sandy, partial cutting
Chambal LMC	48	Sandy, partial cutting and filling

Estimates for unlined canals

	Etcheverry and Harding	PWD Gujarat
Impervious Clay loam	3-4	4.0
Medium Clay loam	4-6	6.5
Ordinary silty clay loam	6-9	9.5
Gravelly or sandy clay loam	9-12	---
Sandy loam	12-17	17.0
Loose sandy soil	17-20	---
Gravelly sandy soil	23-29	---
Porous gravelly soils	20-35	35.0
Very gravelly soils	35-70	---

TABLE 4 AUTHORIZED AND ACTUALLY MEASURED DISCHARGES THROUGH OUTLETS IN CFS

	Khetewali Distributary			Daswali Distributary		
	Auth. Disch.	Act. Disch.	% Diff	Auth. Disch.	Act. Disch.	% Diff
1	0.82	1.29	(+)57	1.20	1.68	(+)49
2	1.56	2.09	(+)34	0.96	1.60	(+)67
3	2.82	4.08	(+)45	1.20	1.71	(+)43
4	0.29	1.38	(+)376	0.74	1.50	(+)102
5	3.28	3.83	(+)17	1.34	1.62	(+)21
6	2.66	2.32	(-)11	1.28	1.54	(+)20
7	2.46	2.26	(-) 8	0.81	1.34	(+)65
8	2.12	2.48	(+)17	1.35	1.31	(-)3
9	2.37	3.02	(+)27	1.94	2.33	(+)20
10	2.48	2.41	(-) 3	1.72	1.36	(-)21
11	1.75	2.26	(+)29	1.49	2.19	(+)47
12	2.17	2.69	(+)24	1.85	2.06	(+)11
13	3.23	3.75	(-)16	2.24	1.93	(-)14
14	1.50	1.81	(+)21	1.70	1.54	(-)9
15	1.54	2.74	(+)13	1.95	1.06	(-)45
16	2.39	2.09	(-)12.5	1.00	1.19	(+)19
17	2.71	2.33	(-)14	1.45	0.76	(-)48
18				1.67	1.11	(-)41
19				1.30	1.37	(-) 9
20				1.39	1.26	(-)21
21				---	1.09	---
22				3.36	4.51	(+)34
23				1.96	0.88	(-)55
24				1.44	1.03	(-)28
25				1.83	2.61	(+)18
26				1.08	1.09	---
27				1.57	1.03	(-)34
28				1.59	0.88	(-)45
29				1.47	1.06	(-)28
30				1.55	0.80	(-)48
31				2.16	1.26	(-)42

ANNEX A - WATER BALANCE CALCULATIONS

Water losses in irrigation systems can be classified as (a) operational losses, (b) reservoir evaporation and seepage, (c) seepage from canals and watercourses and (d) losses on farmers fields. Operational losses include releases resulting in water deliveries either at times when farmers do not require water or in amounts greater than needed, in filling and emptying channels, and from poor farm irrigation practices. They are inherent in canal systems and cannot be eliminated fully, but they can be reduced by improving canals and water courses. After deducting reservoir losses, operational losses may be calculated as a percentage of the net reservoir water supply even though they may occur throughout the distribution system. Information on operational losses are variable from different sources. World Bank for Maharashtra II gave the following values:

Unlined Systems, 40 ha outlets	25%
Main Canals & Branches lined, 40 ha outlets	24%
Lined down to 40 ha outlets	22%
Lined down to 8 ha outlets	20%

For Gujarat, these were estimated at 20% for completely unlined systems and 15% for systems fully lined to 8 has.

For unlined canals and watercourses, losses should be calculated by applying measured or estimated seepage rates to the wetted perimeter; for lined canals and watercourses, the rate can be taken as 2 CFS/MSF. Field requirements should be calculated by deducting residual soil moisture and/or effective rainfall from evapotranspiration requirements and allowing for field losses, which can be taken as 20%.

The example which follows assumes a 10,000 hectare CCA project with live storage capacity of 2,000 MCF averaging 1,750 MCF annually. Operational losses are taken as 20 percent for a fully unlined system, 16 percent for a system lined to 40 has, and 15% for a system with modernized watercourses, one-third of them lined. Estimated wetted perimeter for canals and distributaries is taken at 90 M^3/ha, and for water courses 97.5 M^3/ha. Operating time is taken at 100 days. The full canal wetted perimeter is assumed subject to 70 percent coverage under actual operations. Watercourse losses are calculated on the basis of 31 percent equivalent use time assuming that lining one-third of them will save 64 percent of the total watercourse losses. Losses in unlined channels are taken at 10 CFS/MSF; lined channels at 2 CFS/MSF.

Crop requirements (evapotranspiration less rainfall) are calculated

as 10 acre inches per acre and field efficiency as 80 percent thus requiring (10) (43560)/(12 (.80) = 45375 CF/A delivery at the field. Three cases are examined: I, no lining: II, canals and minor lined to 40 ha; III canals and minor lined to 40 ha and one-third of water courses lined. This is meant as an example although values used are reasonable. Appropriate values based on field measurements or the best available information from similar MIPs should be used in actual analyses.

		I	II	III
1.	Average Reservoir Live Storage	1,750 MCF	1,750 MCF	1,750 MCF
2.	Reservoir Evaporation	125 "	125 "	125 "
3.	Available at Canal Head	1,625 "	1,625 "	1,625 "
4.	Operational Losses	325	260	244
5.	Canal and distribution system seepage losses	585 "	117 "	117 "
6.	Watercourse seepage losses	281 "	281 "	101 "
7.	Water available at field	434 "	967 "	1,163 "
8.	System Efficiency a/	24.8	55.3	66.4
9.	Conveyance Efficiency b/	26.7	59.5	71.6
10.	Overall Irrigation Efficiency c/	19.8	44.2	53.1
11.	Water requirement, per acre	.04537	.04537	.04537
12.	Irrigated Area, acres	9,565	21,311	25,634
13.	Irrigated Area, hectares	3,872	8,628	10,378

a/ (Line 7) (Line 1)
b/ (Line 7) (Line 2)
c/ (Line 8) (0.8)

ANNEX B - VALUE OF WATER SAVED BY LINING

1. Value of Water Saved by Watercourse Lining

The amount of water saved, assuming there are no leaks through banks or outlets and that the wetted area is not enlarged by animals or by seepage into low places, depends on the wetted perimeter of the standard cross section, the seepage rate per unit of wetted perimeter (WP) and the time that the watercourse reach is in service each year. The following computations are based on 100 days of service. Results may be adjusted proportionately for longer or shorter periods.

Loss for Earthen Watercourse

Assume cross-sectional wetted perimeter in earth is 1.3 meters.
Wetted area per km = 1,300 square meters = $(1300)\ (3.28)^2$ = 13,984
say 14,000 sq ft/km

Loss for one CFS/MSF (cusec per million sq. ft)

$$(1.4 \times 10^4)\ (10^{-6}) = 1.4 \times 10^{-2} \text{ CFS/km}$$

Loss for 100 days: $(1.4 \times 10^{-2})\ (100) = 1.4$ CFS days =
$(1.4)\ (86{,}400) = 120{,}960$ CF/km

Loss for Lined Watercourse

Assume cross section WP = 1 m; seepage loss is 2 CFS/MSF

Loss for 100 days: 2 (120,900)/1.3 = 186,092 CF/km

TABLE 1 Savings for Various Seepage Rates

Loss Rate Unlined	Loss unlined CF/km	Less Loss Lined	Savings cf/km
2 CFS/MSF	241,920	186,092	55,828
3	362,880	"	176,788
4	483,840	"	297,748
6	725,760	"	539,662
8	967,680	"	781,588
10	1,209,600	"	1,023,508
12	1,451,520	"	1,265,428

Estimated Value

Assume that 16" or 1.33 acre feet per acre is to be delivered at the field. Table 2 shows cost of additional irrigation potential created based on 100 days operation of reach of watercourse. To find cost for other periods multiply by D/100 where D is the actual operating time in days.

Table 2 Value of Water Saved as Cost of New Irrigation Potential by Lining 1 km of Watercourse

Seepage Rate CFS/MSF	Savings CF/km	Add'l Area Irrig. Pot. ha	Cost of Add'l Area Rs/ha Lining Cost Rs/SM 25 Rs	30 Rs	35 Rs
2	55,828	0.39	64,102	76,923	----
3	176,788	1.24	20,161	24,193	----
4	297,748	2.08	12,019	14,423	16,827
6	539,662	3.77	6,631	7,957	9,284
8	781,588	5.46	4,579	5,495	6,410
10	1,023,508	7.15	3,496	4,195	4,895
12	1,265,428	8.84	2,828	3,394	3,959

Example

A medium irrigation project has fully lined canals, minors and distributaries. Modernized watercourses in earth are provided to 8 hectares. Project cost is 12,000 Rs/ha. Watercourses are operated 90 days, estimated seepage loss is 8 CFS/MCF. Cost of watercourse lining is 30 Rs/SM. For 90 day use cost (from Table 2) is 5495/0.9 = 6106 Rs/km. Loan criteria provide that watercourses shall be lined if benefits equal 80 percent of alternative sources. Eighty percent of 6106 is 4884 Rs/ha. Dividing 4884/12000 = 0.407. All watercourses used 40.7 percent or more of the time should be lined. From Figure 3, this would be about 26 percent of the total watercourse length.

2. Value of Water Saved by Lining Minors and Distributaries

Assumptions

Unlined: Q = 10 CFS, A = 5 SF, WP = 7 ft. Time of operation = 100 days

Lined: A = 2.5 SF WP = 5' Seepage loss = 2 CFS/MSF

Water Delivery at Field: 16 inches or 143,500 CF/ha

Cost of Lining: Rs 3/SF

Unlined Case for Seepage Loss = 1 CFS/MSF

(100) (1) (1000) (7) = 0.7 CFS/1000 Ft.

Lined Case

(100) (2) (5) (1000) = 1 CFS/1000 Ft.

Cost = 3(5) (1000) = Rs 15,000/1000 Ft.

Table 1 Cost of Water Saved

Seepage Rate (CFS/MSF)	Loss Unlined (CFS-Days)	Loss Lined (CFS-Days)	Savings (CFS-Days)	Cost Rs/MCF	Cost Rs/ha
2	1.4	1.0	0.4	424,000	62,250
4	2.8	1.0	1.8	96,450	13,836
6	4.2	1.0	3.2	54,253	7,782
8	5.6	1.0	4.6	37,740	5,414
10	7.0	1.0	6.0	28,935	4,150
12	8.4	1.0	7.4	23,460	3,365

Since the average cost of additional irrigation potential in this Project is Rs. 11,000 - Rs. 12,000/ha, and the above assumptions are conservative lining of all minors and distributarties is economical.

3. Economics of Watercourse Lining - Morel Modernization Project

ESTIMATED COSTS

Item	Estimated Cost (Rs. Millions)
1. Raising dam	16.200
2. Lining canals	25.000
3. Other canal modernization	1.200
4. Drainage	1.000
5. Construction of roads	.075
6. Compensation of lands	.500
7. Provision of special T & P	.600
8. Extension of Irrigation to 7000 a	5.250
Sub Total	49.835 2/
9. Lining all watercourses	43.000

Raising the dam will increase reservoir storage from an average of 1,930 to 2,746 or add 816 MCF. Evaporation losses are estimated at 270 MCF for the new average reservoir level, 237 MCF for the existing, thus reducing the average additional water at the reservoir to 759 MCF. Lining will reduce canal losses from 862 to 112 MCF, assuming full canals all the time. About 70 percent of the wetted perimeter is covered under operational conditions so the estimates may be reduced to 603 and 78 MCF.

In this example, watercourse loss estimates are based on the assumption that 33% of the length is wet at one time. They are reduced by lining the entire length from 333 MCF to 27

For comparison of alternatives, unit cost at the field must be used. Evaporation, operational and seepage losses must be deducted for each alternative. Studies 3/ show that lining the most used 25 percent of the watercourse savings about 55 percent of the seepage; 50 percent saves 81 percent and 75 percent saves 94 percent. Each alternative is considered incrementally. Operational losses are taken at 20 percent for unlined canals, at 16 percent with lined canals and 15 percent with canals and 25 percent or more watercourses lined.

Table 1 compares the water delivered to the field under each alternative. Present losses (Line 1) are estimated using the same conveyance efficiency as Alternative 2.

Separating the proposed new cost for dams and canals (49.8 million) rupees) between additional water saved and modernizing and extending the canals is difficult because the additional water cannot be delivered unless present canal capacities are increased. If lining were not done, canal size would have to be increased at an additional cost. For the present analysis, all of the new costs except lining are attributed arbitrarily to the cost of storage. Table 2 (columns 3 and 4) shows cost of an additional MCF of water at the field under the various alternatives; Columns 5 and 6 show equivalent per hectare costs

---

1/ Draft Report on Morel Project, 1979

2/ Total of these numbers shown in report (p. 75) is reported as 582.5 lacs. Reason for the discrepancy is not known. Possibly an allocation has been added for escalation. For this analysis the unescalated unit costs will be used.

3/ Kapoor, A.S., V. K. Sharma and S. K. Magliani. A Study to Determine the Optimum Length to be Lined in a Watercourse. CAD Rajasthan Canal Project. Office of the Chief Engineer, Command Area Development, R.C.P., Bikaner, July, 1976. See also Figure 4, this Appendix.

assuming 16 inches is to be applied to the field.

Watercourses are to be lined if benefits equal 80 percent of the cost of alternative sources. By interpolation, from Table 2, this criteria is satisfied when 27 percent of the watercourses are lined; however lining up to about one-third of the watercourses has little effect on water costs at the field. Water costing 55,000 Rs/MCF translates to a cost of 7,870 Rs/ha for new irrigation.

TABLE 1

WATER DELIVERED TO FIELD UNDER VARIOUS ALTERNATIVES IN MCF

MOREL PROJECT

Alternative	Water at[a] Reservoir	Operational Losses	Canal Losses	Water-course Losses	To Field	Conveyance Efficiency	Increment Added	Add'l Water to Field
1. Present System	1,717	---	---	---	727	42.4	---	---
2. Add Storage	2,476	495	603	333	1045	42.4	318	318
3. Add Canal Lining	2,476	396	78	333	1669	67.0	624	942
4. Add 25% WC Lining	2,476	371	78	155	1872	75.6	203	1145
5. Add 35% WC Lining	2,476	371	78	119	1908	76.9	36	1181
6. Add 50% WC Lining	2,476	371	78	86	1941	78.4	33	1214

a/ After evaporation

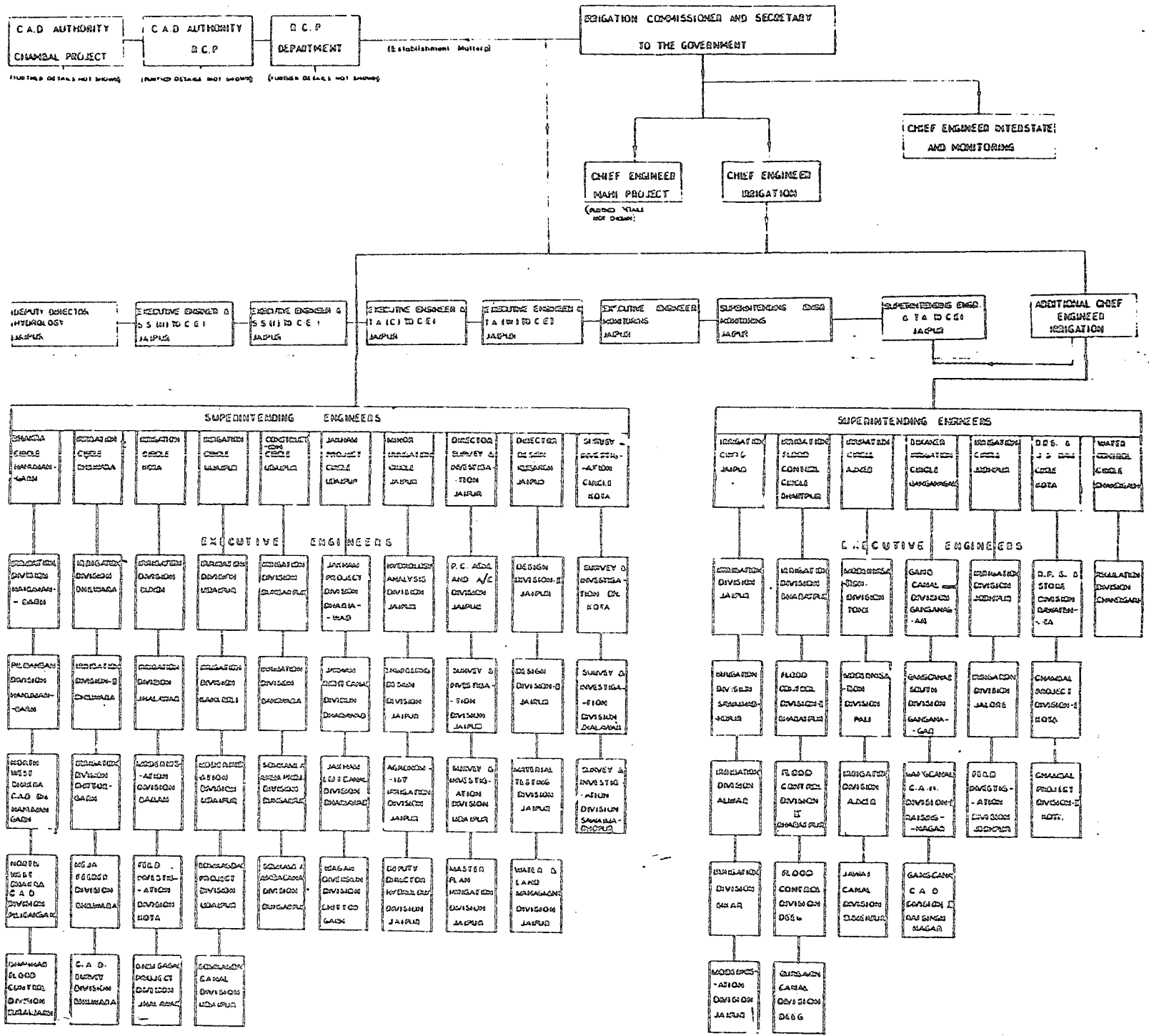
TABLE 2

UNIT COSTS OF WATER AT THE FIELD

	Cost (lacs)		New Water Unit Costs Rs/MCF		Equivalent Cost per Hectare, Rs.[a]		
	(1) Incremental	(2) Total	(3) Incremental	(4) Total	(5) Incremental	(6) 80% of Incremental	(7) Total
Add Storage, etc.	248	248	78,990	78,990	11,303	N.A.	11,303
Line Canals	250	498	40,070	52,870	5,734	N.A.	7,566
Line 25% w.c.s.	108	606	53,220	52,400	7,616	6,093	7,498
Line 35% w.c.s.	43	649	119,170	54,950	17,053	13,642	7,863
Line 50% w.c.s.	64	713	193,940	58,730	27,753	22,202	8,404

a/ Assuming delivery of 16" at the field.

RAJASTHAN IRRIGATION DEPARTMENT ORGANISATION



386-0467

LIMITED SCOPE GRANT PROJECT AGREEMENT

Between the United States of America, acting through the Agency for International Development (AID)

AND

The President of India

(Grantee)

1. Project Title	2. AID Project Number
RAJASTHAN MEDIUM IRRIGATION PROJECT	386-0467

The above-named parties hereby mutually agree to carry out the Project described in this Agreement in accordance with (1) the terms of this Agreement, including any annexes attached hereto, and (2) any general agreement between the two governments regarding economic or technical cooperation.

3. Amount of AID Grant	4. Grantee Contribution to the Project	5. Project Assistance Completion Date
$ 500,000 1/	$ 1/	June 30, 1985

6. This Agreement consists of this title page, Project Agreement Annex A Project Description and Project Agreement PROAG Standard Provisions Annex.

7. For the Grantee	8. For the Agency for International Development
Typed Name: Yogesh Chandra	Typed Name: Priscilla M. Boughton
Signature: -/Sd./-	Signature: -/Sd./-
Title: Joint Secretary, Department of Economic Affairs, Ministry of Finance	Title: Director
Date: August 21, 1980	Date: August 21, 1980

1/ The total cost of the project is estimated at $58 million to be funded jointly by AID and the Grantee. See Project Loan Agreement No. 386-T-228 executed between AID and the Grantee showing the details of the funding arrangements.

(CONFORMED COPY)

PROJECT AGREEMENT

Annex A

PROJECT DESCRIPTION

1. Project Title	2. AID Project Number
RAJASTHAN MEDIUM IRRIGATION PROJECT	386-0467

3. This Project consists of a grant for training and special studies as described below. This Project is complementary to AID Loan No.386-T-228 which provides funds to assist in the financing of the construction of new, on-going, and modernization of existing medium irrigation projects in the State of Rajasthan.

(1) Short term training will be provided for engineers responsible for design, appraisal, construction, evaluation and/or operations and for GOR/GOI officers responsible for economic analysis, to review and study practices and participate in special courses in the United States. In-service training will be provided for project design officers. Development of training modules and special courses and training activities in water management for use by GOR Irrigation and Agricultural Departments will be supported.

(2) Studies will include: (a) base-line socio-economic surveys, (b) water management studies, (c) organization studies and (d) evaluation. The content and timing of studies will be mutually agreed upon between GOI/GOR and USAID. The Grant will provide technical assistance and special equipment, if necessary, for these studies.

(3) The Grant may provide for additional training and studies as mutually agreed to by the Parties herein.

4. Special Provisions

PROJECT AGREEMENT

PROAG STANDARD PROVISIONS ANNEX

A. Reference to 'this Agreement' means the original Project Agreement as modified by any revisions which have entered into effect. Reference to 'cooperating country' means the country or territory of the Grantee.

B. (1) AID will make available the amount specified in Block 3 of this Agreement, as necessary for the Project, as may be further described in Annex A.

(2) The Grantee will make available the amount specified in Block 4 of this Agreement, as necessary for the Project, as may further be described in Annex A. The Grantee will also make, or arrange to have made, additional contributions of property, services, facilities and funds required for carrying out the Project as specified in Annex A.

C. AID and the Grantee may obtain the assistance of other public and private agencies in carrying out their respective obligations under this Agreement. The two parties may agree to accept contributions of property, services, facilities and funds for purposes of this Agreement from other public and private agencies, and may agree upon the participation of any such third party in carrying out activities under this Agreement.

D. Except as otherwise specified herein or subsequently agreed by the parties, all contributions of the parties pursuant to this Agreement shall be made on or before the Project Assistance Completion Date, or amended date. A contribution of goods or services shall be considered to have been made when the services have been performed and the goods furnished as contemplated in this Agreement. Disbursement of funds may take place after final contributions have been made, but AID shall not be required to disburse funds hereunder after the expiration of nine months following the estimated Project Assistance Completion Date (Block 5 of this Agreement) or any amended Project Assistance Completion Date specified.

E. The procurement of commodities and services to be financed in whole or in part by AID may (where so required by AID procedures) be undertaken only pursuant to Project Implementation Orders (PIOs) issued by AID.

F. Unless otherwise specified in the applicable PIO or Project Implementation Letter (PIL), the procurement of commodities imported specifically for the Project and financed with the AID contribution referred to in Block 3 of this Agreement shall be subject to the provisions of AID Regulation 1.

G. Unless otherwise agreed by the parties or otherwise specified in the applicable PIO, title to all property procured through financing by AID pursuant to Block 3 of this Agreement shall be in the Grantee, or such public or private agency as it may authorize.

H. (1) Any property furnished to either party through financing by the other party pursuant to this Agreement shall, unless otherwise agreed by the party which financed the procurement, be used effectively for the purposes of the Project in accordance with this Agreement, and upon completion of the Project, will be used so as to further the objectives sought in carrying out the Project. Either party shall offer to return to the other, or to reimburse the other for, any property which it obtains through

financing by the other party pursuant to this Agreement which is not used in accordance with the preceding sentence.

(2) Any funds provided to either party pursuant to this Agreement which are not used in accordance with this Agreement, shall be refunded to the party providing the funds.

(3) Any interest or other earnings on funds provided by AID to the Grantee under this Agreement will be returned to AID by the Grantee.

I. (1) If AID and any public or private organization furnishing commodities through AID financing for operations hereunder in the cooperating country, is, under the laws, regulations or administrative procedures of the cooperating country, liable for customs, duties and import taxes on commodities imported into the cooperating country for purposes of carrying out this Agreement, the Grantee will pay such duties and taxes unless exemption is otherwise provided by any applicable international agreement .

(2) If any personnel (other than citizens and residents of the cooperating country), whether United States Government employees, or employees of public or private organizations under contract with, or individuals under contract with AID, the Grantee or any agency authorized by the Grantee, who are present in the cooperating country to provide services which AID has agreed to furnish or finance under this Agreement, are under the laws, regulations or administrative procedures of the cooperative country, liable for income and social security taxes with respect to income which they are obligated to pay income or social security taxes to the Government of the United States of America, for property taxes on personal property intended for their own use, or for the payment of any tariff or duty upon personal or household goods brought into the cooperating country for the personal use of themselves and members of their families (not including such personal or household goods as may be sold by any such personnel in the cooperating country) or if any firm, not normally resident in the cooperating country, is liable for income, receipts, or other taxes on work financed by AID hereunder, the grantee will pay such taxes, tariff, or duty unless exemption is otherwise provided by any applicable international agreement.

J. If funds provided by AID are introduced into the cooperating country by AID or any public or private agency for purposes of carrying out obligations of AID hereunder, the Grantee will make such arrangements as may be necessary so that such funds shall be convertible into currency of the cooperating country at the highest rate which, at the time the conversion is made, is not unlawful in the cooperating country.

K. AID shall expend funds and carry on operations pursuant to this Agreement only in accordance with the applicable laws and regulations of the United States Government.

L. The two parties shall have the right at any time to observe operations carried out under this Agreement. Either party during the term of the Project and for three years after the completion of the Project shall further have the right (1) to examine any property procured through financing by that party under this Agreement, wherever such property is located, and (2) to inspect and audit any records and accounts with respect to funds provided by, or any properties and contract services procured through financing by, that party under this Agreement, wherever such records may be located and maintained. Each party, in arranging for any disposition of any property procured through financing by the other party under this Agreement, shall assure that the rights of examination, inspection and audit described in the preceding sentence are reserved to the party which did the financing.

M. AID and the Grantee shall each furnish the other with such information as may be needed to determine the nature and scope of operations under this Agreement and to evaluate the effectiveness of such operations.

N. The present Agreement shall enter into force when signed. Either party may terminate this Agreement by giving the other party thirty (30) days written notice of intention to terminate it. Termination of this Agreement shall terminate any obligations of the two parties to make contributions pursuant to Blocks 3 and 4 of this Agreement, except for payments which they are committed to make pursuant to noncancellable commitments entered into with third parties prior to the termination of the Agreement. It is expressly understood that the obligations under paragraph H relating to the use of property or funds shall remain in force after such termination. In addition, upon such termination AID may, at AID's expense, direct that title to goods financed under the Grant be transferred to AID if the goods are from a source outside the Grantee's country, are in a deliverable state and have not been offloaded in ports of entry of the Grantee's country.

O. To assist in the implementation of the Project, AID from time to time, may issue PILs that will furnish additional information about matters stated in this Agreement. The parties may also use jointly agreed-upon PILs to confirm and record their mutual understanding on aspects of the implementation of this Agreement.

P. The Grantee agrees, upon request, to execute an assignment to AID of any cause of action which may accrue to the Grantee in connection with or arising out of the contractual performance or breach of performance by a party to a direct U.S. Dollar contract with AID financed in whole or in part out of funds granted by AID under this Agreement.

Q. This Agreement is prepared in both English and Hindi. In the event of ambiguity or conflict between the two versions, the English language version will be used for final interpretation.

BEST AVAILABLE