

ON-FARM WATER MANAGEMENT

A JOINT US-PAKISTAN EVALUATION

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

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N.W. FRONTIER

PESHAWAR KASH

KHYBER PASS

ISLAMABAD

RAWALPINDI

AFGHANISTAN

D.I. KHAN

JHELUM

SARGODHA

LAHORE

QUETTA

PUNJAB

CENTRAL PUNJAB

BALUCHISTAN

MULTAN

KALAT

BAHAWALPUR

SOUTHERN PUNJAB

INDIA

MIRANSHUR

SUKKUR

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SOUTHERN SIND

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INDUS

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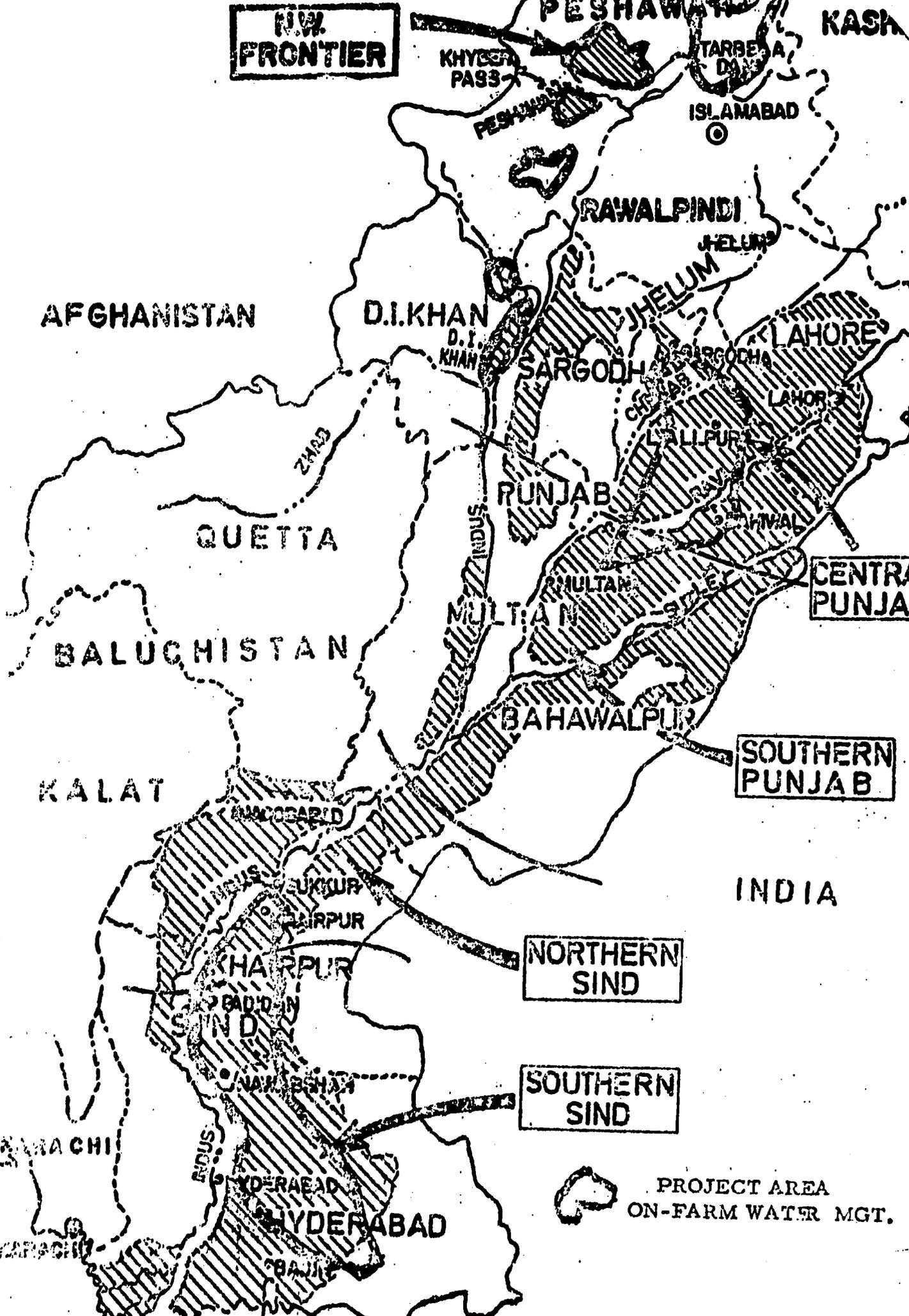
HYDERABAD



PROJECT AREA ON-FARM WATER MGT.

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INDEX

Page No.

SUMMARY

RECOMMENDATIONS

I.	Introduction	1
	Description of Project	1
	Evaluation Team Members	1
	Scope of Work	2
	Time Frame	2
II.	Progress in Major Project Areas	3
	Personnel	3
	AID Technical Assistance	3
	Pakistani Staff	5
	Training	7
	Financial Procedures	11
	GOP Budgeting Procedures	11
	AID Funding	13
	Loan Disbursement Procedures	13
	Credit Availability	18
	Private Contractors	18
	Equipment and Maintenance	21
	Technical Adequacy of Project	23
	Appropriateness of Technology for Small Farmers	23
	Technology Related to Level of Training	26
	Extension Information to Farmers	26
	Constraints in Farmers Adapting Technology	27
	Beneficiaries	28
	Water User Associations	30
III.	Assessment of Progress in Related Project Areas	32
	Project Targets	32
	Personnel	33
	Funding	33
	Water User Associations	34
	Plans for the Future	37
IV.	Additional Conclusions and Recommendations	39

APPENDIX

List of Tables

<u>Number</u>	<u>Table</u>	<u>Page</u>
2.1	Soil Conservation Service Staff Assigned to Work With Precision Land Leveling and On-Farm Water Management, (December 1973 - May 1979).	4
2.2	Colorado State University Water Management Research Project: Field Party Personnel	6
2.3	Government of Pakistan Status of Personnel Recruitment by Province (Through FY 1978).	8
2.4	Summary of Actual Vs. Planned Accomplishments On-Farm Water Management, March 31, 1973.	11
2.5	On-Farm Water Management, Government of Pakistan Funding.	12
2.6	On-Farm Water Management, USAID Contributions 1968 to 1973.	14
2.7	Annual Targets and Estimated Tractor Requirements for Precision Land Leveling.	20
2.8	Land Leveling Equipment.	22

List of Appendixes

1.	Acronyms
2.	Schedule of Work
3.	List Contacts Made
4.	USAID Grant Agreements of Precision Land Leveling and Related Research
5.	David Alverson, Field Trip Report
6.	Inspection Procedures
7.	Detailed Flow of PC-I and PC-II in Government of Pakistan
8.	Watercourses Visited by Evaluation Team
9.	Literature Reviewed

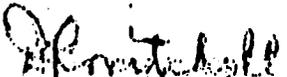
ACKNOWLEDGEMENTS

This report is the result of three weeks of intensive work by a Joint US-Pakistani evaluation team. Each of us participated, not as official representatives of our respective governments, but because our varied backgrounds and experiences would add to the evaluation. Discussions were held with numerous officials and farmers as we visited the many watercourses in the three provinces where the program is being implemented. We have attempted to summarize our findings in this report.

As leader of this evaluation team, I would like to express appreciation to Messrs S.N.A. Nasri and A. M. H. Kango for their understanding and perceptions of the program and of what is possible within the government of Pakistan. Mr. Ken Lyvers provided excellent scheduling and logistical support as well as adding materially to the report. As an experienced evaluation officer, Mr. Anthony Wirtz did much to pull information together before the team arrived and to keep the team on track. Mr. Fred Tileston brought with him an experience of having worked with irrigation in Pakistan 20 years ago. His extensive field notes and attention to detail added considerable substance to the report.

Many Pakistani officials, too numerous to name individually here, provided generous hospitality and valuable insights into the operations of the program and made suggestions for its improvement. Their names are listed in the appendix.

Finally, I would particularly like to thank Mr. Abdul Hamid Arshad, Secretary at USAID for his outstanding and tireless efforts in transcribing notes, typing the several drafts and the final report. For help in editing the report, I am grateful to Jerome Hammond, USDA who also participated in some field trips.


Donald R. Mitchell,
Team Leader

I. SUMMARY

- i. While it is too early to fully judge the success or viability of the pilot On-Farm Water Management (OFWM) program during the first phase of implementation, it is evident sound procedures have been established for assisting small farmers to improve their water courses and to level land for more efficient irrigation. The initial goals were optimistic. The start up time was under estimated and the project is about one year behind schedule in achieving planned targets.
- ii. As would be expected, the major problems occur in administrative management rather than technical areas of the project. Recruitment of qualified personnel, training them and once trained, retaining them on the teams has been difficult. The provinces are experiencing difficulty in regularizing the positions. Staff recruitment and retention is particularly acute in the Sind where only 12 percent of the positions have been regularized. It appears that morale and productive work of field team members is low because they are uncertain of their future.
- iii. The three provinces report the following work accomplishments as of March 31, 1978 :
- | | Sind | Punjab | NWFP |
|------------------------------|------|--------|------|
| Field teams | 5 | 8 | 1 |
| Water courses improved | - | 24 | 1 |
| Precision land leveling(ha.) | 861 | 1863 | 102 |
- iv. Transfer of funds to the project director for cost sharing payments has been irregular and filled with delays. The project directors receive funds to be deposited in a personal ledger account at a local treasury from which the cost share payments are made to farmers. Farmers have had trouble cashing the checks and the project directors have not recouped their funds in a timely manner. Careful attention of project leadership will be required to resolve the issues.
- v. Provinces have not been allocating the full amount budgeted in the PC-1. Present fiscal procedures of the Government of Pakistan provide the transfer of an amount of money to the provinces to cover a variety of projects. Funds are not specifically earmarked for any

individual projects. As a result, the OFWM Project is in competition with other provincial programs even though a budget was previously approved in the PC-1. Most provincial officials were not particularly concerned over this procedure and felt that all the funds in the PC-1 would be made available when and if needed. Delays encountered in the transfer of funds almost precludes the expenditure of all funds before the end of the fiscal year, at which time unused funds revert to the treasury.

vi. The technology for improvement of water courses and precision land leveling is appropriate for small farmers and has been adequately tested and demonstrated to be effective in reducing water losses and increasing crop production. Colorado State University has been doing research in this area since 1972 and Soil Conservation Services assisted in a pilot land leveling project in the Punjab and Sind in late 1973.

vii. Water User Associations are ad hoc groupings along a water course, organized for the purpose of providing labor for improvements of the water course and for later operation and maintenance. These associations do not have legal nor permanent status. Colorado State University in cooperation with the University of Agriculture, Faisalabad is conducting research in this area. Establishment of permanent Water User Associations is very important and is the key to long-term, sustained improvement in irrigation efficiency and increased crop production.

II. RECOMMENDATIONS

Institutions

- i. A permanent institutional arrangement needs to be established in order to implement the OFWM Project and to continue to provide similar services after this project terminates. In addition to the usual government agency, consideration should be given to establishing a semi-autonomous corporate entity. (2.15; 2.65;3.4)
- ii. Legal status for the Water User Associations (WUA) is very important to their establishment as permanent institutions for the operation and maintenance of the water courses and possibly for taking on other responsibilities. (2.75-8;3.10)
- iii. Responsibilities for extension and related farmer services with the WUA needs to be assigned to a new dynamic agency(s) designed to help members with organizational and agricultural problems. (2.56; 3.11)

Personnel and Training

- iv. Personnel recruitment must be given careful attention in order to select qualified persons who have a strong desire to work with farmers. Reduced academic standards combined with additional training and experience should be substituted for the presently rigid required qualifications for recruitment. The number of trainees should be increased slightly in order to compensate for drop outs and still complete the requisite teams. (2.15; 3.6)
- v. Personnel should be regularized as rapidly as possible to provide for needed job security. Otherwise, morale will suffer and personnel turn-over will impede project progress. This problem is particularly acute in the Sind and should be addressed immediately. (3.4)

Finance

- vi. District personnel should be given financial powers (Category III in Punjab) which enable them to approve estimates of water course improvements and to make cost sharing payments to farmers. Team leaders should also be given Category IV financial powers for certain specified purchases. (2. 34; 3. 8)
- vii. Project directors of all the provinces have problems in receiving funds when needed. The Finance Department in each province must be encouraged to ensure that funds are made available to the project directors in a timely manner to implement the program. It also appears that personal ledger accounts should be operated through commercial banks to ensure that farmers receive payments promptly upon completion of work. (2. 16-9; 2. 34)
- viii. In order to achieve the targets as set out, the provinces should be urged to give priority to the OFWM Project. The OFWM should not compete with other developmental projects at the time of budget allocation. One way to overcome this would be by indicating or reflecting the USAID commitment for the project in the overall Provincial Annual Development Program. (3. 7)
- ix. In order to insure that adequate rupee funds are budgeted each year to support the program there should be a direct link between the dollars released and rupees made available at the provincial level. One possible way would be to ensure that the fund advanced by USAID are placed in a non-lapsable account at the federal level each year and earmarked for the provincial programs. (3. 9)
- x. Since small farmers have little land lying fallow, and it is time consuming to level land by non-mechanical means, it is recommended that farmers be permitted to level land over a period of several years. Furthermore, FAR payments should be increased to 10 acres per farm to allow for the additional costs of technical assistance by the Government of Pakistan. (2. 31; 4. 1)

Credit

- xi. An extensive effort to provide credit for farmers to level their land should be provided in one or two Tehsils of each province. The previous guidelines provided by the Federal Government and the Banking Council should be used in establishing specific procedures for setting up a pilot effort. (2.36 -40)
- xii. The proposal by the banks of providing credit to private contractors to level land has not made much headway. These contractors have to compete with other borrowers and are not considered a good risk by the banks. Some concessions need to be extended by the banks, e. g. East Khairpur Loan Agreement with IBRD. (2.38;2.44)

Beneficiaries

- xiii. The project beneficiaries need to be more fully identified before the follow-on project paper is submitted. A better understanding is needed for defining (or identifying) a "small farmer" in Pakistan. Additionally, the issue related to large/small, owner/tenant farming patterns needs to be fully explored in order to find ways of helping those in the low income brackets. As part of this effort consideration should be given to provide cost sharing and land leveling services to tenant farmers and should be tried and studied in one tehsil of each province. These problems need immediate attention in the Sind where there are more tenants and larger land holdings than in other provinces. (2.67)
- xiv. Considerable time and expense is involved for small farmers to obtaining patwari certification of land ownerships that generally lacks credibility; it is recommended that a signed statement by the farmer, submitted through the Water User Association, be permitted in lieu of patwari certification. (2.69)

Standards and Specifications

- xv. All provinces are using slightly different designs, adapted to fit local conditions, especially for such items as diversion structures and outlets. Procedures and design criteria should be standardized to a limited extent, but adaptability to local conditions should be permissible. More research should be conducted to develop alternative designs for a variety of conditions. (4.1)

Contractors

- xvi. Private contractors should be encouraged by identifying the scope of precision land leveling work available in selected areas. Tractor owners who hire out their tractors for ploughing or transport should be encouraged to make tractors available for precision land leveling by making the rates more attractive. (2.4)

Planning

- xvii. Each of the provinces should rephrase their current programs to make them realistically coincide with the five year plan, i. e. 1978-83. This would include extension of the program by one year in the Punjab and NWFP and extension by two years in Sind (3.1; 4.1)

Publicity

- xviii. The project has not been well publicized among farmers. It is therefore recommended that a seminar be held to determine a strategy to better publicize OFWM. (4.1)
- xix. Interchange between provincial officials as well as researchers, should be encouraged as a means of spreading tested ideas. (4.1)

ON-FARM WATER MANAGEMENT PROJECT EVALUATION

I. INTRODUCTION

Description of Project

1.1 The project is a five-year pilot program to establish capability within government agencies, private contractors and farmer groups in planning and carrying out activities necessary for efficient on-farm water management. Research findings and new management procedures are being used to improve water courses, level farmer's fields and to improve their crop and water management practices.

1.2 Project activities are being carried out in three provinces with planning underway to initiate implementation in the fourth province, Baluchistan. Implementation is based on schedules appropriate to the degree of readiness of personnel, budgets and plans in each province.

1.3 By the end of the project, physical accomplishments should be :

- 1,500 improved water courses
- 425,000 acres of precisely leveled land
- improved crop and water management techniques

1.4 A \$7.5 million development loan was authorized in late FY 76. Another loan of possibly \$12 million is planned for FY 80. Two grants also support the effort, one for about \$450,000 in FY 1978 with the Soil Conservation Service (Mission funds), and the other with Colorado State University supported, to date, by AID/W.

Evaluation Team Members

1.5 The following persons served as the evaluation team :

- Mr. Donald R. Mitchell, Agriculture Advisor, ASIA/TR/ARD
AID/Washington (Team Leader)
- Mr. A. M. H. Kango, Director, Water Management, Pakistan
Ministry of Food and Agriculture, Islamabad
- Mr. S. M. A. Nasri, Deputy Chief, Water Management, Planning
Division, Pakistan Ministry of Finance,
Planning and Economic Affairs, Islamabad
- Mr. Fred M. Tileston, Water Resource Advisor, ASIA/PD
AID/Washington
- Mr. F. Ken Lyvers , OFWM/CSU Project Manager, USAID/
Islamabad
- Mr. Anthony H. Wirtz, Evaluation Officer, USAID/Islamabad

Scope of Work

1.6 The scope of work outlined in Islamabad 0970 contained the following points :

- (a) Determine current project status including :
 - (1) Provision of planned inputs
 - (2) Attaining of planned outputs

- (b) Investigate and make recommendations concerning specific issues related to :
 - (1) Project staffing
 - (2) Training
 - (3) Administrative procedures
 - (4) Financial processes (especially disbursement procedures)
 - (5) Credit availability
 - (6) Development of farmers associations and private contractors
 - (7) Technical adequacy of the project

- (c) Assess progress toward:
 - (1) Coordination of water management services within the provincial agriculture departments and the capability to adequately implement the project.
 - (2) The re-orientation of extension services to emphasize OFWM in geographic areas where irrigation is wide-spread.
 - (3) Reaching the small and medium size farmers especially with the PLL aspect of the program and promoting farmer cooperation on the water course.

- (d) Make specific recommendations concerning:
 - (1) Possible changes in project design
 - (2) Specific role of SCS for balance of project
 - (3) The input needed for the OFWM project from the CSU contract
 - (4) The timing of follow-on loan funding

Time Frame

April 16 - 27, Field investigations: Sind, NWFP & Punjab

April 28 - May 6, Draft report

May 7 - 10, Review report with Mission and GCP

II. PROGRESS IN MAJOR PROJECT AREAS

Personnel

(a) AID Technical Assistance

2.1 USAID Staff: The USAID had one direct hire project manager on the project during the time the project paper was being finalized and negotiations on the project were being conducted. The same project manager had management responsibilities until the time of his departure in June of 1977. At that time, project management responsibilities were split with one man assigned to monitor activities in NWFP and the other in Sind and Punjab. This was necessary since the Mission did not have adequate staff to provide one technician full-time for the project. In January 1978, the project monitoring responsibilities were assigned to one individual who is currently managing AID inputs to the project. He does not devote full-time to the project, however, since he has several other project responsibilities including the Colorado State University Research Contract, as well as other activities in the rural development area. The OFWM Project and CSU Contract require about 80% of the project manager's time. A local hire engineer is also assisting with the management of the project, and all of his time is currently spent in conducting inspections related to FAR payments.

2.2 SCS Team: Table 2.1 gives the man years of SCS personnel work on the project from the beginning of the project to date. The team is staffed with an Agronomist and an Engineer in each of the provinces of Punjab, Sind and NWFP.

2.3 The NWFP team has responsibility for the Baluchistan program as well, though to date only training of some personnel has occurred. Documentation is being processed in Baluchistan, however, and the program is expected to start in the province during the coming year.

2.4 The other two members of the SCS team include a team leader and an economist, located in Islamabad. After the departure of the previous team leader in December 1977, the headquarters team was moved from Lahore to Islamabad where it is now the direct counterpart to the recently established Water Management Cell of the Ministry of Food and Agriculture.

Table 2.1

Soil Conservation Service Staff Assigned to Work With Precision
Land Leveling and On-Farm Water Management
December 1973 - May 1978

Names	Post	Date of Arrival	Date of Departure	Man-Months
Murray P. Cox	Lahore	12-16-1973	12-30-1977	48
Thomas H. Dempster	Lahore	3-17-1974	5-8-1976	26
Eugen W. Shaw	Lahore	2-3-1974	HLE 6-30-78	50
Walter K. Twitty	Lahore	3-7-1974	HLE 8-29-78	49
Donald F. Jones	Lahore/ Islamabad	9-20-1976	HLE 9-21-78	19
Donald W. Haslem	Islamabad	3-8-1978	HLE 3-9-80	1
J. V. McDonald	Karachi/ Hyderabad	3-10-1974	HLE 5-13-78	49
Paul K. Koluvek	Karachi	3-24-1974	7-15-1976	28
Homer C. Moore	Hyderabad	6-15-1976	HLE 6-16-1978	22
Kermit E. Larson	Peshawar	8-3-1976	HLE 8-4-78	20
Paul Corak	Peshawar	5-15-1976	Died 4-12-77	11
Philip A. Whiting	Peshawar	11-26-1977	HLE 11-27-79	5
<u>TDY</u>				
Donald W. Haslem		11-14-1977	12-6-1977	3 weeks
John R. Long		1-16-1977	4-15-1977	3 months
Carl Anderson		10-12-1977	11-15-1977	4 weeks
Philip Whiting		7-12-1977	9-23-1977	2 months
Don Haslem		7-15-1975	10-15-1975	3 months
Kermit Larson		6-15-1975	9-15-1975	3 months

Source: SCS Staff Islamabad, Pakistan

2.5 CSU Team: The CSU Research Team is currently fully staffed with 7 members. Table 2.2 lists the CSU team members from the beginning of the project through the present.

2.6 Although the CSU Research Team has been stationed in Pakistan since 1972, the contract, because of its worldwide implications and the use of CSU staff as irrigation resource persons, has been centrally funded by DSB/AGR. In an effort to decentralize AID/W contracts, an administrative decision was made in April 1978 to transfer monitoring responsibilities from DSB to ASIA/TR until October 1978 when responsibility for managing the contract would be transferred to USAID/Pakistan. The present contract will terminate March 31, 1980 at which time the Mission is to assume the funding. To our knowledge, the contract management has not been officially transferred to ASIA/TR.

2.7 Clearances and Providing Technical Assistance: In the past, it has taken many months to secure GOP clearance of the U. S. personnel, but in recent months clearance has been obtained in about two months. Considering the number of GOP offices involved this is considered to be satisfactory by the Mission. On the USDA/SCS side there have been problems recently in obtaining replacements for the SCS team. USDA has experienced particular difficulties in finding two engineers as replacement for departing team members. At the time of writing this report over five months had lapsed before USDA nominated one of the two engineer requested for the program. Further delays in placing a man in the field are caused by the time involved in GOP clearance (2-3 months), U. S. security clearance (3-4 months) and orientation training (1 month). Hence some 4-8 months are needed to place a technician once a suitable candidate has been identified.

2.8 Much of the recruitment problem is apparently due to the present political situation in Pakistan. Many qualified people are not willing to work here. Another problem peculiar to Hyderabad is the remoteness of the location and the lack of schooling and other amenities desired by technicians.

(b) Pakistani Staff

2.9 Field Teams: An eight or nine man field team is trained and posted in each area to help farmers improve their water courses and

Table 2.2

Colorado State University Field Party Personnel
Water Management Research Project

Names	Post	Date of Arrival	Date of Departure	Man-Months
Gilbert L. Corey	Lahore/ Islamabad	July, 1970	June, 1974	48
Jerry B. Eckert	Islamabad	July, 1972	June, 1975	36
Wayne Clyma	Islamabad	Aug., 1972	Aug., 1976	47
C. J. deMooy	Islamabad	Sept., 1972	Feb., 1976	41
W. Doral Kemper	Islamabad	July, 1974	July, 1977	36
Alan C. Early	Islamabad/ Lahore	Sept., 1974	May, 1977	32
John Reuss	Lahore	Sept., 1975	-	
Sam. H. Johnson	Lahore	Oct., 1975	Sept., 1977	23
Sidney A. Bowers	Lahore	Nov., 1975	-	
Larry Nelson	Bhalwal	June, 1976	Dec., 1977	18
Tom Trout	Lahore	Sept., 1976	-	
Helmer J. Holje	Lahore	Jan., 1978	-	
Norman Illsley	Lahore	Feb., 1978	-	
Dwayne C. Westfall	Lahore	Feb., 1978	-	
Douglas J. Merrey	Faisalabad	April, 1978	-	
TDY (1968-75)				63
TDY (1976-78)				34

Source: USAID records .

precisely level their land. Each team includes a Water Management Specialist who serves as the team leader, one or two Water Course Engineers (Punjab has only one), five Land Development Officers and one Agricultural Officer. Current numbers of staff posted and/or regularized is shown in Table 2.3 along with planned staffing.

2.10 Provincial Staff: Each province has a project director and a principal staff of 6 in NWFP to 13 in Punjab to assist in the training, planning and providing administrative support to the field teams. One Area Office of two principal officers has also been established in Punjab and another is planned for the coming year. The Sind is also in the process of establishing District (Area) Office to help implement the program.

2.11 Federal: The Federal project director and staff are located in the Ministry of Food and Agriculture to provide coordination between the provinces and the appropriate agencies of the Federal Government. Seven professional positions have been established, but to date only three positions have been filled -- Project Director, Director and Accountant. None of the positions have been regularized. Positions for an Engineer, Agronomist, Researcher and Investigator are vacant.

(c) Training

2.12 Special training facilities are being established and training programs are actively underway in all the provinces with the assistance of the SCS personnel. In the Punjab an agricultural engineering workshop has been temporarily converted into an adequate training facility. In both the Sind and NWFP facilities have been rented for the provincial training programs.

2.13 The training programs in each of the provinces are similar. In the Punjab, for example, three training programs are being conducted. The main program is the three months Precision Land Leveling/Water Management course for all field personnel. This includes one month of intensive training in the class room followed by two months training in the field covering a variety of agronomic practices, techniques for Precision Land Leveling and work on water course engineering that includes a three week intensive training program on the designing and construction of water courses. The third training program for Field Assistants has been started. The three week course has been conducted

Table 2.3
Status of Government of Pakistan
Personnel Recruitment by Province
(Through FY 77-78)

Province	PC - I Number planned	Number posted	Number regular
<u>Sind</u>			
Headquarters:			
Director/Deputy	7	6	1
Assistant Director	6	6	Nil
Others	31	31	Nil
District:			
Officers	4	3	1
Others	4	4	Nil
Field team:			
Number of teams	7	6	1
Officers	63	57	6
Others	28	24	4
<u>NWFP</u>			
Headquarters:			
Director/Deputy	6	5	Nil
Assistant Director	-	-	Nil
Others	8	6	Nil
District:			
Officers	-	-	-
Others	-	-	-
Field team:			
No. of teams	2	1	-
Officer	9	9	Nil
Others	40	9	Nil
<u>Punjab</u>			
Headquarters:			
Director/Deputy	7	7	3
Assistant Director	3	2	2
Others	82	80	80
District:			
Officers	2	2	1
Others	16	16	16
Field team:			
Number of teams	10	8	8
Officers	80	74	60
Others	120	111	111

Source: OFWM records.

for only one class. These Field Assistants are the agricultural extension workers at the local level of the Government (usually one field assistant for 10 villages). Training is directed to on-farm water management techniques to update knowledge of the extension workers. The status of training in each province is shown in Table 2.4.

2.14 Each Field Team has one Water Management Extension Specialist (Agricultural Officer). The training for this Specialist is provided in a 4-1/2 month course at the University of Agriculture, Faisalabad. Eight faculty representing six departments provide interdisciplinary training in working with and organizing farmers, cleaning and maintenance of rehabilitated watercourses, and better utilization of the saved water by improved irrigation and agronomic practices. Colorado State University is providing advisory assistance in the development of curriculum and training materials. Both the first course in 1977 and the second course, which is presently underway, included participants from all four provinces.

2.15 The major training constraints are related to the recruitment of qualified personnel. All provinces have had difficulties in the recruitment of personnel resulting in inadequate numbers of personnel being trained for project implementation, while each province sets its own personnel qualifications, they are generally similar. Obtaining qualified personnel with desired levels of academic training is a problem and may require a lowering of standards. Agricultural engineers are not available in sufficient numbers for the program and more agricultural graduates are now being obtained. However they will need additional training in survey skills and with back-up assistance from qualified engineers, may be able to do much of the necessary field work. Another problem recently encountered in the Punjab and NWFP, is the requirement that agriculture personnel must have a Master's Degree. Since adequate numbers of personnel with this level of training are not available, recommendations have been recently made to change the rule so that B.S. graduate can be obtained, trained and then promoted into the higher category after several years of work in the field.

Table 2.4

Summary of Actual Vs. Planned Accomplishments
On-Farm Water Management, March 31, 1978

Activity	Sind		NWFP		Punjab		Total	
	Act- ual	Plan- ned	Act- ual	Plan- ned	Act- ual	Plan- ned	Act- ual	Plan- ned
Recruitment	67	156	16	16	76	92	159	264
Training (sessions):								
Precision land leveling	2	8	-	-	3	2	5	10
Water course improvement	1	2	2	-	3	3	6	5
Water management	1	4	-	-	2	2	3	6
Personnel trained	179	520	25	67	506	534	710	1121
Government workers	72	196	4	34	108	194	184	424
Farmers' contractors bankers	2	24	1	13	2	40	5	77
Drivers/operators(OJT)	105	300	20	20	396	300	521	620
Active field teams	5	10	1	1	8	10	14	21
Active area/district teams	1	1	-	-	1	1	2	2
Equipment pools established	5	15	4	1	8	10	17	26
Watercourse completed	-	55	1	5	24	65	55	125
Precision land leveling:								
Total(hectares)	361	15,565	102	1,700	1,863	30,000	2,025	41,25
With cost sharing(hectares)	306	-	5	-	385	-	390	-
Demonstration farms	-	15	-	-	1	1	1	16
Total allocation(million Rs.)	3.2	15.3	1.0	5.0	12.1	21.4	21.3	41.7
Total expenditure(million Rs.)	2.1	-	1.4	-	7.3	-	10.8	-

Source: On-Farm Water Management Project Reports.

Financial Procedures

(a) GOP Budgeting Procedures

2.16 Each province has a project approved in a Planning Commission Form-1 (PC-1) for a period of five years. Although draft PC-1s were prepared at the time of the AID Project Paper submission to Washington, the final PC-1s were not approved until more than six months later (more than one year later for NWFP). Based on the targets and budget noted in the PC-1, each province plans the program each year through their Annual Development Program and Budget. The provincial budget, in rupees, is made without regard to the U. S. dollar loan since the dollar funds go to the Federal Treasury. The Federal Government, however, makes the rupee funds available to the OFWM on the basis of the loan and grant agreements.

2.17 Within each province a fixed allocation is usually provided for the Agriculture Sector, which includes the OFWM project. Therefore, the magnitude of the annual OFWM budget is partially based on the PC-1 - - it is more specifically based on funds available and the demands of the Agriculture Department for other programs. The provincial OFWM budget allocation is also based on prior years' accomplishments and expenditures combined with projections of expected progress for the coming year.

2.18 The approved budget for a program is usually finalized and approved in the preceding June. The fiscal year is July 1, to June 30, and budgets releases are usually made on a quarterly basis. A mid-year review is held when a particular project and sector might receive more or less money depending on the progress and expenditures expected for that year. For a diagrammatic description of the approval process for PC-1 and PC-2 see Appendix 7.

2.19 Each of the provinces expressed difficulty in both getting the initial budget approval and disbursing funds for the project (See Table 2.5). Funds are usually released late and since they must be handled through the Treasury where pre-audit is required, considerably delay is the norm.

Table 2.5

On-Farm Water Management
Government of Pakistan Funding

Province	Status	Total Cost	(Rs. million)				Total 1973- expen- diture	1979
			1976-77		1977-78			
			ADP	Revised	ADP	Revised		
PUNJAB	Approved 10th May, 1977	190.06	5.0	2.835	10.0	9.0	11.835	3.75
SIND	Approved 10th May, 1977	92.06	1.0	0.383	7.2	N.A.	N.A.	16.22
NWFP	Approved 16th January, 78	21.21	-	-	1.0	N.A.	N.A.	N.A.

Source: Planning Division, Ministry of Finance, Government of Pakistan

(b) AID Funding

2.20 USAID funding for the precision land leveling project actually begin in 1973 and a grant to the PASA was negotiated with USDA for technical services of the Soil Conservation Service for the Precision Land Leveling Project. Table 2.6 gives the cumulative funding of the project to date, including rupee grants for specific aspects of the project. While both the loan and grant are operated as one project as depicted in the Congressional Presentation, in practice the funding is being handled separately. The Loan Agreement signed on October 26, 1976 included only loan funds of \$7.5 million. Separate project agreements are being issued each year for the grant dollar funds covering Soil Conservation Service technical services. Another related activity is the Colorado State University Research Contract which has been centrally funded.

2.21 Local cost grant funding both for the PLL and Colorado State University Research have been handled as separate project agreements and grants from the USAID mission. Since 1973, eleven different grant agreements have been initiated and are at various stages of implementation to support the precision land leveling and research aspects of the projects. These separate projects and agreements are listed in Appendix 4. While this is a fairly large number of separate activities, implementation of the Precision Land Leveling Project could not have occurred without the grant rupee funding to provide cost sharing, equipment and related aspects of the project. Likewise, much of the local cost of research done by CSU was primarily paid for through the rupee grants. Much of this research, which provided the basis for the current OFWM Project, could not have been conducted without these rupee grants.

2.22 Some problems were being experienced with funding of the SCS Team at the time of the evaluation. This was primarily because of difficulty in obligating new money. Funds have been received, however to obligate \$317,000 to carry the technical services for another six months.

(c) Loan Disbursement Procedures

2.23 Procedures: The procedures for disbursing the loan funds are nearly the same as those discussed in the Project Paper. These procedures for disbursements include advances and then Fixed Amount Reimbursement (FAR) payments for land leveled and water courses improved. As explained in Implementation Letter Number One

Table 2.6

**Funding for Land Leveling and Water Management Activities
USAID Contribution**

Project Activity	Dollars(000s)	Rupees(000s)
Precision Land Leveling		
Technical Services 1975-77	1,057	2,570
1978	317	
(204-77-1)		1,346
On-Farm Water Management(391-0413)		
1977	7,500	
Agriculture Research (296)		
1973	300	6,000
Total:	9,174	9,346
Colorado State University Research(Central)		
1969-72	2,136	
1972-74	1,820	
1975-77	2,038	
1978	900	
Punjab Water Management & Water		
Mgt. Advisory Training (391-390-73-4)		1,000
Water Management Research (204-75-3)		1,314
Water Course Improvement (204-75-4)		1,421
Water Management Survey (204-76-i)		411
Water User Associations (204-77-3)		512
Total:	6,894	4,658
Grand Total:	16,068	14,504

Source: USAID/ Islamabad

(January 18, 1977) and more specifically in Implementation Letter Number Five (June 3, 1977), USAID is advancing \$50,000 to the GOP for each team as it becomes operational in the field. The term "operational" indicates a full complement of trained team members with funds and equipment available to carry out the project activities.

2.24 The total value of advances authorized under the loan cannot exceed \$2.5 million and advanced funds must be liquidated by the GOP within one year of their receipt. As of May 1, USAID had advanced \$250,000 for five teams in the Punjab, \$150,000 for three teams in the Sind and \$50,000 for one team in NWFP. Additionally, USAID has also received a request from the GOP for an advance of \$150,000 for three more teams in Punjab. Also, the Sind Government is processing a request for another advance of \$100,000 for two more teams.

2.25 The procedures being followed for FAR payments are explained in Implementation Letter Number One (January 18, 1977) and Implementation Letter Number Seven (July 24, 1977). In summary, the "liquidation" of an advance will take place as follows: "when an FAR payment is requested, a lesser amount -- normally one-half of the eligible FAR amount -- will be disbursed to the Government; the other amount (half) will be attributed to liquidation of the applicable Advance of Funds". This percentage may vary, however, depending on progress and the requirement to fully liquidate the advance within the year provided.

2.26 The FAR payments are currently set at the rate established in the Project Paper for elements of Water Courses Improved and Land Leveled, and are noted as follows :

<u>Project Elements</u>	<u>FAR Entitlement per Unit</u> (Rupees)	
<u>Watercourse Improvements</u>		
Diversion Structures	200	each
Buffalo Wallows(Concrete)	2000	each
Concrete(<u>Pucca</u>)Lining	30.00	per running foot or
	98.43	per running meter
Engineering Cost Based on	1.00	per running foot or
Length of Watercourse	3.22	per running meter
<u>Precision Land Leveling</u>		
Earth Moving	2.25	per cubic meter or
	1.72	per cubic yard

2.27 These entitlement figures represent 100 percent of the estimated rupee cost to the GOP (excluding administrative cost) for water course improvement, and 75 percent of the estimated precision land leveling earth moving costs.

2.28 Criteria for Cost Sharing: In water course improvement the only criteria being used is that 75% of the farmers along the water course must own 25 acres or less. During the team's visit, the Sind Government officials felt this was too restrictive and should be raised to 64 acres or more since the average size farm is larger in the Sind and the banks have reportedly determined 64 acres to be an economical unit. The other two provinces are not experiencing any difficulty in selecting water courses that meet this criteria. The provincial governments pay the cost of all material and provide the technical input to improve water courses. Material is being provided for lining 5-10 percent of the water course, all water control structures, as well as related items such as buffalo wallows and silt traps. The Sind and NWFP are also providing the cost of the skilled mason, while in the Punjab program this cost is being borne by the farmers who are also constructing the water course.

2.29 During the evaluation, the team was told that certain items such as culverts were currently not being reimbursed. USAID was already aware of this and was planning to include these types of structures in the revised FAR reimbursement cost schedule. In the Sind the Team was told that the cost of diversion structures was about three times the FAR entitlement.

2.30 In the NWFP the Team was also informed that the cost of land leveling is higher than in the other provinces since the terrain is such that more earth must be moved than in other provinces. The province does allow earth moving of up to 300 cubic meters and USAID should adjust its FAR entitlements to cover this.

2.31 The current GOP cost sharing criteria for land leveling takes into account only farmers with 25 acres or less.

The Sind Government has increased this to 32 acres. The GOP is paying approximately fifty percent of the cost of leveling up to five acres per farmer. The actual cost is based on the amount of land moved and cannot exceed Rs. 1.5 per cubic meter for 200 cubic meters (\$30) per acre. Some officials in Sind and Punjab consider the 25 acre limitation too restrictive and feel that every farmer should be eligible

for cost sharing or that the ceiling should be raised to 50 acres or more. It should be pointed out that USAID does not have this limitation and is currently making payments to the Government for up to five acres for farmers who level their land.

2.32 Inspection: USAID has established fairly elaborate procedures for FAR inspection of the completed water courses and precision leveled land. For the water course inspection, it is planned that each water course during the first two years of the project (about 135 are planned) will be visually inspected by a USAID representative. Various elements of the water courses will be checked including land ownership records, structures, the length of the canal lined and the various other technical aspects of the water courses. The criteria for acceptance of water courses is discussed in detail in Appendix 6.

2.33 USAID currently has one direct hire Pakistani engineer who conducts the inspection for the Mission. It is currently planned that after inspection work increases that either additional local hire personnel will be added to the staff or a small contract team will be employed to do the inspection of the project.

2.34 Payment to Farmers: All the provinces are currently having some difficulties in making cost sharing payment to farmers. In the Sindh, for example, the team noted that at one location where the work was completed and land was leveled in January, the farmers have not yet been compensated. There have also been extensive problems with farmers cashing checks under procedures currently employed by the Government. The Project Director has a personal ledger account in the Government Treasury which requires prior pre-audit approval of all checks before they can be cashed. Thus, the farmers are likely to experience long delays in getting approval of the checks and then receiving cost sharing funds. Further, Treasury offices are usually not located in the remote areas and therefore are not easily accessible to farmers.

2.35 Intensive discussions have taken place in all the provinces and emphasis is being given to placing cost sharing payments in commercial banks where the farmers can easily cash checks. A related problem in this regard is that the Finance Department does not rapidly replenish the revolving fund in personal ledger accounts of Project Directors. This fund is to be resupplied in increments of 200,000 rupees as funds are spent. In both the Punjab and Sindh the late release of funds has caused considerable delay in project implementation.

Credit Availability

2.36 The need for adequate credit was recognized as a requirement of the project since its inception. In this regard, three specific conditions precedent (CP) to loan disbursement were made in the Loan Agreement. The first of these involved credit institution (section 3.02-e) whereby the borrower provided USAID assurance that commercial banks and other credit institutions were authorized to finance project activities.

2.37 One of the other two conditions precedent was provincial specific, and required that credit and cost sharing criteria, procedures and standard (section 3.03-e) be established. This CP included procedures which were established by the implementing agency to provide credit and cash sharing facilities for use in water course improvement, land leveling and water management and other aspects of the project. The second provincial CP was for credit and equipment to contractors (section 3.03 -f). This CP is discussed in more detail in the section on private contractors.

2.38 Although various discussions have been carried out at all levels, credit and related aspects of the project are not satisfactory to date. Although both the commercial banks and the agricultural development bank have approved the broad parameters and procedures for providing credit to farmers for land leveling, these procedures have not been fully developed and implemented in the field.

2.39 Training for bank personnel is not being adequately provided. The provincial departments are busy with training their own personnel and have not been able to fully coordinate training for bankers, nor provide the extra capacity needed for this purpose. Considerably more effort is needed to make credit available and to adequately develop this major aspect of the project.

2.40 There is also some question as to the actual need for credit for land leveling aspects of the project. Many farmers are not fully convinced that land leveling is an economic enterprise; until they are, credit requirements will not be great.

Private Contractors

2.41 As mentioned earlier, one of the specific provincial CPs to loan disbursement is that a plan to provide credit and equipment to private

contractors be evolved. (See section 3.03-f of Loan Agreement.) In meeting this CP each of the provinces provided evidence that steps were being taken to assure the following : 1) adequate number of private contractors would be available in the provinces to carry out land leveling activities; 2) the provincial government had set up procedures to provide them with necessary training if required; 3) that procedures have been set up to provide credit facilities to these contractors to procure necessary equipment, and the provincial government had established a system to assure such equipment would be available to all contractors when required. (These details are explained in Implementation Letter Number One.)

2.42 The need for establishment of private contractors for assisting with PLL aspects of the project is evident. Table 2.7 shows the annual targets and estimated tractor requirements for PLL. The table shows that 455 tractors were required for 100 days/tractor in order to reach the PLL provincial targets of 22,721 acres in 1977/78. This requirement increases to nearly 3,000 tractors to accomplish the nearly 150,000 acres of land to be leveled in 1981/82.

2.43 In NWFP the team was informed of a private contractor arrangement which has been established with three tractors provided from USAID rupee grant. Under this arrangement one of the commercial banks provides the administrative assistance and control of the funding by loaning it to three private contractors at the 2% service charges for a five year period. The farmers are required to level land 80% of the time and use the tractors for whatever other requirements they have during the remaining time. Each of the provinces is considering a similar expanded scheme to establish private contractors for the program.

2.44 The IBRD in 1976 appraisal report of the East Khairpur Tile Drainage Project, suggested to the National Bank of Pakistan the following terms for land leveling contractors :

- a) Annual interest rate of 11% minimum.
- b) Down payment by contractor of a minimum of 15% of delivered cost of equipment and vehicles, with a maximum of 25%.
- c) Security in accordance with normal requirement of banks, usually hypothecation of equipment and vehicles.

Table 2.7

Annual Targets^{1/} and Estimated Tractor Requirements for Precision Land Leveling

		<u>1977-78</u>	<u>1978-79</u>	<u>1979-80</u>	<u>1980-81</u>	<u>1981-82</u>
Punjab	(Ac)	18,000	35,000	55,000	65,000	76,000
Sind	(Ac)	3,396	12,169	23,206	40,186	65,373
NWFP	(Ac)	1,325	2,525	4,925	7,325	8,525
		<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
		22,721	49,694	83,131	112,511	149,398

Required Tractor^{2/} and Scraper Days to Level Above Acreages

Punjab	36,000	70,000	110,000	130,000	152,000
Sind	6,792	24,338	46,512	80,372	130,742
NWFP	2,650	5,050	9,850	14,650	17,050
		<hr/>	<hr/>	<hr/>	<hr/>
Total:	45,442	99,388	166,362	225,022	299,792

Total Tractor Requirement to meet Targets^{3/}

Punjab	360	700	1,100	1,300	1,520	
Sind	68	243	465	804	1,307	
NWFP	27	50	98	146	170	
		<hr/>	<hr/>	<hr/>	<hr/>	
		455	993	1,663	2,250	2,997

1/ From Provincial PC-1's.

2/ Average accomplishment rate (1/2 acre per day).

3/ Assuming 100 tractor days per year for part-time farmer-cum-contractor or village artisan-cum-contractor established under this program. Commercial contractors should have higher utilization rates.

- d) Repayment period not to exceed 5 years including maximum of 1 year gross in which interest only would be paid.
- e) National Bank of Pakistan and other approved banks to assist contractors with legal, technical and managerial advice in collaboration with land leveling staff.

2.45 USAID is also considering several alternatives to give momentum to this effort. One of these is to provide a rupee grant to each of the provincial governments which will be handled through one of the banks for establishing small private contractors. A similar arrangement is being considered to use dollar loan funds to specifically procure tractors for establishing private contractors. It is evident to the team that much work needs to be done in the entire area of the private contractors if the targets for PLL aspect of the project are to be reached in the future.

2.46 David Alverson, in a trip report of February 27, 1978 discusses the problems of developing an interest by farmers in precision land leveling, interesting contractors and providing the necessary credit to help small contractors purchase the necessary equipment. His report is attached as Appendix 5.

Equipment and Maintenance

2.47 Each team has land leveling equipment available, for rental by the day to farmers. Table 2.3 lists equipment available and generally shows its overall status. It should be noted, most of this equipment was obtained under the PLL Project and is now being used in all OFWM project areas except the Sind, where the equipment has not been moved to the project area.

2.48 Equipment engineers in each province are responsible for maintenance of equipment. While this system is working reasonably well, it is evident that more work is needed to adequately maintain and develop a replacement schedule. Each project director has funds for equipment maintenance and repair. Since land leveling equipment is manufactured locally, repair service is readily available.

Table 2.8

Land Leveling Equipment

Equipment	Operational			Total in Province		
	Sind	Punjab	NWFP	Sind	Punjab	NWFP
Land Levelers	37	71	10	72	81	30
Scrapers	-	119	15	107	123	49
Transit levelers	90	108	15	98	110	24
Tractors	6	10	3	9	10	3

Source: Provincial OFWM Reports

2.49 The suitability of the equipment supplied is generally good with most of the equipment adapted from equipment previously used in Turkey and India. There is a need, however, to further improve the equipment. Marvin Parker during a 1974 consultancy explored this problem more fully. His report is recommended for those interested in more detail.

Technical Adequacy of the Project

(a) Appropriateness of Technology for Small Farmers

2.50 The present On-Farm Water Management Project is an attempt to expand the use of knowledge gained from the WAPDA/Colorado State University research on water losses and a pilot effort in Precision Land Leveling by the Soil Conservation Service. Both projects were started in the Punjab in 1973. Technical assistance in irrigation has been a part of the USAID program since its inception in the 1950's. Among the major programs was the SCARP under the administration of WAPDA and the Washington State University contract at Lyallpur that contained a major irrigation component.

2.51 As a result of these and other efforts, the technology used in this project has been developed, tested and demonstrated to reduce water losses and make more effective use of irrigation water. While the technology is sound the true test of its appropriateness will be decided when it is put to use by the farmers. To implement the project OFWM teams of 8 or 9 technicians consisting of a Water Management Specialist as the team leader, one or two Water Course Engineers, five Land Development Officers and an Agricultural Officer are trained and assigned to an area. Each officer receives training appropriate for his special responsibilities.

2.52 Most of the technology used in the water course improvement was developed through the joint efforts of WAPDA and CSU at the Mona Reclamation Experimental Project. A vast array of water course improvements were developed and tested for their efficiency in reducing water losses, applicability in farmers fields, economy to install and freedom from pilferage. This work is continuing at Mona where various models are tested in farmers fields within the project area. Work by SCS group have indicated that water course improvement will yield net benefits of 68 rupees per acre per year.

2.53 The general procedure followed by the OFWM team is to locate a water course that meets the basic criteria of having 75 percent or more of the farmers owning less than 25 acres. Once this has been established, considerable time is spent with farmers discussing the proposed improvements, measuring water losses and finally organizing the farmers into an ad hoc water user association with the primary function of providing labor. Once it is decided to go ahead with the water course improvements, the team designs and aligns the system according to legal boundaries, providing outlets according to those prescribed by the GOP Canal and Drainage Act of 1873.

2.54 The farmers by working under the direction of project staff, receive training on how canal banks should be reconstructed and/or constructed, shaped and sized. At the same time the project officials become sensitized to the farmers' needs and it is noted particularly in some of the water courses, standard designs are revised to meet the needs of the small farmers. This does not detract from the technical adequacy of the project but rather enhances flexibility to meet the real needs of the farmers. The technical standard of the project are well within the reach of the farmers to operate and maintain.

2.55 The brick and masonry work is easily within the capability of local artisans. The most complicated part of the water course improvement is the improved outlets locally called a pucca nucca. However forms have been developed and local contractors are able to fabricate them efficiently and economically. An interesting technique was developed by CSU to cast the orifice and later cast the lid directly in the orifice. By rotating the lid while the concrete is still green, a near perfect seal can be obtained. A contractor in Chiniot is now using this method and is numbering the pieces so they can be kept together as a set. With this precast outlet, it is a simple matter for the local mason to construct the necessary foundation. We saw a number of these improved outlets in use. When properly seated, they were nearly leak-proof. Even if they did leak, a small amount of mud would easily seal them. The farmers are very pleased with the pucca nucca in terms of their convenience, labor saved in repairing the ditch bank and less leakage.

2.56 As a result of the farmers participation in the construction of the water course, they will have a good understanding of the operation and maintenance requirements. However, the key to the effective use of the system will depend on how the farmers are organized to manage and maintain the improved water course. For this purpose the Water User

Association seems the most appropriate organization. At present these associations are organized on an ad hoc basis, but we believe they should be given legal status to enable them to become permanent institutions. It would be unfortunate if this initial burst of physical activity that has brought a number of factions along a water course into a cooperative effort, is lost because the WUA cannot become a legal entity. Considerable attention is being given to this aspect of the project and a series of seminars are scheduled in June 1978 with George E. Radosovich, a Water Law Specialist with Colorado State University. The CID Water Management Technical Report No. 44 by Radosovich, entitled "Water User Organization for Improving Irrigated Agriculture: Applicability to Pakistan," provides an excellent conceptual basis for these associations.

2.57 Farmers recognize the need for leveled land in order to uniformly water their crops. But it is difficult for them to precisely level their land because in some cases they do not have appropriate equipment or adequate power, nor do they have engineering know-how.

2.58 Precision land leveling is the process of shaping the land surface precisely to planned grades for uniform application of water over the land. Efficiency of irrigation can normally be increased from 20 to 40 percent by uniform water application, thus economizing on water use and increasing crop growth over areas which were previously either over or under irrigated. Minimizing over-irrigation also reduces waterlogging and salinization.

2.59 The OFWM Project supplies the technical assistance, subsidizes the cost of leveling on up to 5 acres on a small farm by paying half the cost of moving up to 200 cubic meters/acre of soil or 300 rupees/acre where tractors are available. Scrapers and small leveling equipment are rented to farmers for a small fee.

2.60 Traditionally, farmers level their land by bullock with a wooden buckboard. While small amounts of land can be leveled by this method, it is a slow, laborious process and has not proven to be any more economical than power equipment. By conducting precision land leveling under project technical supervision and with larger and higher powered equipment, larger areas of the land can be brought more rapidly under precise level conditions than can be accomplished with traditional methods.

Unless the farmer manages his irrigation system effectively, precision land leveling and improved water course structures will not result in increased irrigation application efficiency. Measurements taken by the SCS project staff in selected areas have indicated that land leveling has raised the net benefits by 250 rupees per acre per year. All the farmers interviewed by the evaluation team wanted land leveling on their farms.

(b) Technology Related to the Level of Training

2.61 The technology used in the project is not difficult to master and the team members appear to have been adequately trained to do the work. Good training materials have been developed and the training includes practical application of the skills required. SCS advisors assist with the training and work with the OFWM teams after they are in the field to assist with technical problems as they arise. The water courses the team visited seem to be well designed and though the team did not check the engineering, they appeared to meet normal requirements. A more detailed check will be made prior to release of funds under the FAR procedures.

(c) Extension Information to Farmers

2.62 The extension of the technology developed under this project is reaching the farmers whose water courses are being improved. It is an excellent process of learning by doing. Beyond the farmers involved, the technology will spread to nearby villages and indeed other farmers are asking for assistance in improving their water courses. The same will be true of the precision land leveling as the farmers begin to see the benefits.

2.63 To provide greater publicity of the benefits of the OFWM Project it has been suggested that TV coverage would be a good way of getting the information to farmers. This was suggested in the Cind which may be a good place to test the idea. However, it may be best to wait until more OFWM teams are trained and in place so needs generated by the wider publicity could be met.

2.64 Our general impression is that the traditional extension service of the Department of Agriculture is not very effective in reaching small farmers with improved agricultural technology. Many of the extension workers simply do not know how to relate to the farmers and are a

little unsure of their skills in applying their technical knowledge. Providing a well designed water course and leveling the land are very important steps for increasing crop production, but the farmers also need to know about a vast array of improved agronomic practices, if he is to make effective use of these facilities.

2.65 The extension aspect of the project needs attention and could be the critical component to make the Water User Associations function. Either new life needs to be given the traditional extension service or the OFWM Project needs to be institutionalized with the extension functions incorporated as an adjunct to the water user associations. This should receive early attention as farmers will be most receptive after having improved the water course. Continued inputs by an "extension" officer could well be the impetus that would make the associations successful.

(d) Constraints in Farmers Adapting Technology

2.66 As discussed earlier, the technology used in this project is appropriate and within the means of most small farmers. There are, however, a number of constraints, most of them in the socio-economic arena, that may preclude the widespread adaption of the technology. These constraints are discussed more fully elsewhere, include the following :

- (i) The provincial governments may not be able to hire, train and administratively manage the teams required to do the massive job of improving water courses and land leveling. This problem is most acute in the Sind and unless the problem is resolved progress will be slow.
- (ii) Contractors to do land leveling are not currently available in most areas and until they are available, precision land leveling will be minimal. The project is based on the premise that the contractors in the private sector will become available to level land, but this may require some incentives to stimulate the private sector into action. NWFP is the only province to report availability of local contractors.

- (iii) Availability of cement may be a limitation in any rapid expansion of the project. Cement is in short supply and is in fact rationed by the government. This does not seem to be a serious problem at this time, but was mentioned in the Punjab. As a rough estimate 10 to 15 tons of cement are required per water course for lining about ten percent of the watercourse, as well as the construction of junctions and outlets.
- (iv) Legal recognition of Water User Associations could enhance this form of group action, considered so important to the improvement, operation and maintenance of the water course. At this stage the informal arrangement may be adequate, but as more water courses are improved the more critical it will become that the association be given legal recognition.

Beneficiaries

2.67 The OFWM Project is designed to give preference to the small farmers in both watercourse improvement and precision land leveling. Any attempt to develop a single criterion to assure that project benefits will accrue largely to small farmers must ignore many variations in agro-climatic conditions, cropping patterns, crop/livestock mixes, irrigation variations, socio-economic organizations and other income. Also, watercourses must be improved in their entirety and both above-average and small farmers, landlord operators and tenants are found on the same watercourse. Therefore, to deny improvement of a watercourse because of some larger sized holdings would be to the detriment of the smaller land holders and also to the tenant farmers who gain from improved production.

2.68 The determination of land ownership is a problem. Not only are land records difficult to research, but land ownership has been often divided among family members resulting in fragmentation of land. Still other land may have many owners, each with a fractional share.

2.69 It is difficult for many farmers, especially small farmers, to obtain a legal certification of land ownership from the responsible official, the patwari. OFWM team members reported that payments to the patwari plus lost time (some times many days) in obtaining certification made the cost sharing payment of little value as an

inducement for land leveling by smaller farmers. It was also the opinion of OFWM team members that a signed statement by a farmer as to his ownership of land would be more credible than the statement of a patwari.

2.70 The condition in the project that watercourses be improved only where three-quarters of the farmers have holdings under 25 acres will eliminate only those watercourses with the largest holdings, as only 18% of Pakistani farms are over 25 acres. Considering the difficulties in determining the exact beneficiaries on any watercourse, it is believed that this condition should be retained but that preference be given to improving watercourses in areas where smaller holdings are more numerous. This can be determined from available data indicating size of holdings at the tehsil (sub-district) level.

2.71 Government subsidized precision land leveling is limited to holdings under 25 acres, with cost-sharing limited to 5 acres only. Again, this eliminates only the largest land holdings and preference should be given to those areas containing smaller holdings.

2.72 A problem that has not been fully addressed in this project relates to the tenant farmer who certainly ranks among the poor majority of the country. Traditionally, the team was told, the tenant farmer in the Sind operates 16 acres, or the amount of land a man with a team of bullocks can till. The owner provides the land and certain capital inputs and half of the fertilizer and seed. The tenant provides the balance of the inputs, often on credit from the land owner, plus the labor of himself and his family along with a team of bullocks. The production is equally divided between the owner and operator. Tenants are protected by law and except for short-term contracts, eviction is difficult.

2.73 This issue was most strongly brought to the team's attention in the Sind where officials felt that the small vs large farmer should not be an issue at all, but rather that water courses should be improved regardless of the size of holding. They argue that the land owner and the tenant share equally in the increased production and therefore the benefits would accrue to the operator. Federal and Punjab officials also agreed that benefits should be extended to non-owner operators as well as land owners.

2.74 This is a rather complex issue that may well be worth further study to see if some system could be agreed upon that would assure the tenant farmers would receive most of the benefits or perhaps have a more favorable lease from the land owner. Is it fair to deny the benefits of this project to tenant simply because he is not a land owner? While it would be difficult to devise a scheme that would not benefit the land owner, it might be possible to develop a plan that would provide some cost sharing to the tenant and perhaps a more favorable long-term lease. Such a plan may skew benefits to the tenant in such a way as to make the assistance attractive.

Water User Associations

2.75 Water User Associations composed of farmers along a watercourse are essential for making improvements and providing maintenance. Although the project agreement specifies that different forms of water user associations will be tested to develop a model that can be replicated widely, little has been done in the way of experimentation. Informal associations have been formed primarily to provide labor for construction of the improved water courses and for later operation and maintenance. On the watercourses observed, the cooperation in the construction phase has been generally successful, but it is too early to gauge the willingness of the farmers to adequately maintain the watercourses.

2.76 In the Sind the farmers were required to publicly sign an agreement for providing labor for construction and subsequent maintenance, but a public gentlemen's agreement was all that was required in the Punjab. At one watercourse in the Sind, a small farmer complained that construction was slowed by the failure of larger farmers to provide labor in the quantity agreed; however generally in all provinces, the rate of construction was satisfactory. Some associations have agreed to hire ditch-tenders or khal chowkidars (paid in kind by the individual farmers) while others plan to allocate work among the members.

2.77 It is common to have two or more factions along a water course. Varying degrees of friction are reported including shootings in some instances. One water course observed had five baradaris (clans). Agreements are made between the leaders and together they formed

the executive committee of the water user association. Since water is of priority importance, it is believed that they will cooperate in water management and have done so in the water courses improved to date. Government officials expressed the hope that initial cooperation in the field of water management may lead eventually to broader cooperation.

2.78 Research on water user associations is now being conducted through a rupee grant at the University of Faisalabad with technical assistance provided under a separate contract with CSU. Seminars with farmers and government officials are planned to seek further ideas and disseminate information. Also CSU assisted training for OFWM extension personnel, conducted at the University of Faisalabad, includes courses designed to provide guidance in forming associations. A rural sociologist recently joined the CSU team to give impetus to this training and research.

III. ASSESSMENT OF PROGRESS IN RELATED PROJECT AREAS

Project Targets

3.1 Project planners did not anticipate the length of start up time and generally the project is about one year behind planned targets. Adjustments should be made in planned accomplishments to reflect current project status. Both the Sind and NWFP require a slower start up phase since they do not have the trained personnel and history of the Punjab with other predecessor irrigation activities.

3.2 Some adjustments are needed between targets used in the USAID Project Paper and those of the PC-1. It is understood, the Project Paper was written first so it is not surprising that targets are somewhat different. There were also later adjustments in targets for Sind and Punjab. The following examples will serve to illustrate the scale of differences between the two documents covering the same fiscal year :

	FY 78	FY 81
Field teams total:		
PC-1	21	56
AID/PP	27	138
Area leveled (acres):		
PC-1	33,494	122,700
AID/PP	38,205	195,270
Water course improved		
PC-1	98	471
AID/PP	135	690

3.3 It seems reasonable that USAID documentation should conform to the Pakistani PC-1 targets, but even these lower targets may be difficult to attain unless the life of the project is extended.

Personnel

3.4 The most urgent action required on the part of the Sind Government is to sort out the personnel problems related to the project. Project personnel seem very concerned about their future; that they are out of the promotion channel; some are not paid on time; funds are not released for payment of project expenses; etc. Morale is extremely low and no doubt affects performance of the project. Until the Sind government can provide some job security to project officers, project accomplishments are apt to be mediocre.

3.5 These problems are faced by other provinces, but are less acute. Project leadership on both GOP and USAID are well aware of the problems and are attempting to alleviate them.

3.6 Problems of recruitment of qualified personnel is no doubt tied to the regularization of employees. Lowering standards may help, but more attention will need to be given to training to help make up any current deficiencies and develop skills needed to do the work.

Funding

3.7 The Federal/Province relationship in so far as funding is concerned did not seem to be a problem in the minds of provincial officials. However in the Sind the project officers had not received the first 200,000 rupee revolving fund for the cost reimbursement payments. No cost share payments had been made since January 11, 1978 on one project. The Punjab has a budgetary allocation of only 90 million rupees rather than the full 190 million rupees planned in the "Large Target" PC-1. However it was felt the additional funds would be forthcoming if needed.

3.8 It is not clear how much of a constraint funding slippage is to project implementation. It would seem that the project directors must work out suitable arrangements with their provincial administrations. It is clear that the project directors need the support from the Federal Project Director and USAID Project Manager in order to keep necessary funding in the pipeline. Discussion papers, as suggested in the Sind, may be a good way of addressing the funding problems and bringing them more clearly into focus.

3.9 There are inconsistencies between the PC-1 budget estimates and the amount allocated to the project in the provinces. However, the high

level officials the team talked with did not see this as a real problem because the differences between the budgeted and allocated figures would be taken from other unobligated provincial funds. The team feels that the project directors should go ahead with their work as rapidly as possible and make their voices heard when funds are either lacking or running low. This is a problem project managers will need to give their highest priority.

Water User Associations

3.10 Water Users Associations appear to be a critical component of OFWM and will require considerable attention in order to make them work. Improvement of a water course is an excellent rallying activity to get the WUA organized. However, after the initial burst of activity, follow up will be required to maintain momentum. Some of the possible follow-on activities that requiring group action are :

- (i) Implementation of PLL involving neighboring farmers for re-alignment of land could be used to obtain optimum benefit. Additionally, a number of small land holders should be able to get a better price from a contractor than one individual for PLL activities.
- (ii) The control of pests and diseases is best undertaken by a group of farmers rather than one individual. This would be a good activity for extension workers who should be given some rather specific training in control of the most troublesome pests prior to season of normal infestation. Weed control could follow a similar pattern.
- (iii) Water course maintenance is another routine activity best undertaken by farmers under their own leadership. A measuring device seen at Mona, that indicates when the water is backing up would be a useful aid in undertaking timely maintenance.
- (iv) Hiring a khal c howkidar would be useful in providing a continuing patrol of the water course and making small

repairs to prevent leakage. Perhaps more importantly, the hiring of a khal c'howkidar requires group action by the farmers to pay his wages and may be the first important step in developing a viable WUA.

- (v) Purchase of inputs as a group could result in savings to farmers. Additionally, a loan for purchase of tractor and equipment could possibly be made to a small farmer or a local artisan with a guarantee by the WUA. The tractor and scraper could initially be used for land leveling, but also be used for primary tillage operation.
- (vi) Obtaining and possibly handling credit for inputs, tubewells, land leveling, etc., by the WUA should be considered, possibly through one of the Commercial, Cooperative or other Banks. A savings scheme like the Rural Development Program of NWFP should be introduced.
- (vii) Marketing of produce might also be done as a group to obtain higher prices. A WUA could conceivably organize production of crops for a specific market -- contract farming or perhaps schedule vegetable production for a nearby town.

3.11 As Water Users' Associations are organized there would be a need for a federation of the associations into some larger grouping - possibly at the tehsil, or simply at a market area. Radosevich suggests tying the associations to the irrigation system with the next larger grouping along a minor and the area federation being those associations along a main canal. Size of the federation should most likely be governed by a manageable size of a board of directors that should include representatives of the member associations. Organization of succeeding higher levels would most likely occur in time and as the need arises.

3.12 The strength of the WUA lies in their development at the grass-roots level; an organization growing from a need to more efficiently use a common resource - water - has a very good chance of succeeding.

3.13 The GOP can do several things in order to ensure the success of WUAs. They include :

- (i) Cost sharing and technical assistance in water course improvement as now being undertaken.

- (ii) Encouragement for financing of tractors and land leveling equipment through WUA, possibly to a local artisan or small farmers with the WUA as guarantor.
- (iii) Establishment of a legal basis for WUA.
- (iv) Provision for extension services for WUA through the traditional extension service, development of a new organization or broaden the OFWM project to include this aspect. Someone needs to work with these groups, who is dynamic and responsive to the needs of the farmers.
- (v) Provision for adequate financing for personnel, training and support to do the job.

3.14 Some of the items that could be undertaken by USAID would include the following :

- (i) Continued support of technical assistance and cost sharing for water course improvement and PLL for WUA and their members.
- (ii) Technical assistance to work with water users associations to provide guidance in their activities and development.
- (iii) Dove-tail other Mission programs particularly agricultural activities, where possible, in support of WUA.
- (iv) A major aspect of CSU research effort should be directed to problems of WUA and how to make them a viable organization. Current research should be expedited and will most likely need to be done in all provinces.
- (v) AID assistance, whether grant or loan, should be used to facilitate the evolution of viable Water Users' Associations.

Plans for the Future

3.15 The evaluation team feels that sufficient progress has been made to begin work on the follow-on loan. The Mission in the 1980 ABS, is requesting a \$12 million loan as the second phase of this project. The second loan should necessarily be contingent on satisfactory draw down of the first loan. Now that the initial staff is in place in three provinces the draw down should proceed at a faster pace. Technical assistance for the On-Farm Water Management Project through 1985 would be as follows :

3.15 SCS Team: Current Mission planning is that the SCS team would continue operations through the life of the project and provides for the SCS team at its present eight man level, to remain at post through 1983 when it would be reduced to six members and be phased out in 1985. Mission management believes technical assistance will be required as long as loan funds are being provided. This position is based on several facts including the continued requirement to train personnel and the problems with personnel recruitment. The lack of adequate qualified personnel in country to implement this expanding program is expected to place continued requirements for technical assistance. Several GOP officials expressed concern that the OFWM Project should be institutionalized and that technical assistance would be required until it was established.

3.17 CSU Team : Future plans anticipate Mission funding through March 1983, with reduced levels of personnel in the last two years of the project. The major activities of the CSU Team over the coming four years will more directly relate to the on-going OFWM Project. These activities will include the following:

(i) Mona Reclamation Experimental Project(MREP):

A proposal is currently being processed by the Government to request USAID to provide \$1.2 million equivalent in rupees to continue the research programs for the coming five years.

(ii) Activities at University of Agriculture, Faisalabad :

A proposal is being processed by the Government to request USAID funding of \$.76 million (equivalent rupees) for related water management research activities.

Another activity includes establishment of an extension training program for OFWM Project personnel as well as other extension workers. One class of 16 students completed the four and a half months course and a second class of 14 is now in training. To be effective this training program should be at least doubled to provide additional training for Extension Officers of the Agriculture Department and possibly for the trainers of the other agricultural training institutes of the Punjab as well as other provinces who provide the major extension training in the country. As a related effort, CSU is providing assistance to a recently started Water User Association research activity at Faisalabad which is planned for extension to other provinces in the near future.

(iii) Other Research :

Research will be provided to the OFWM Project directly for the development of small scale equipment, and related engineering aspects of the project. Research institutions in various parts of the country are being assisted in making consumptive use studies.

(iv) Evaluation :

WAPDA is also planning to make an evaluation of the OFWM Project and USAID has indicated interest in providing the necessary rupee funding for this evaluation. The Government at this time is processing this proposal and it appears that CSU will be an active participant in conducting this on-going in-depth evaluation of the OFWM Project. This evaluation will require continuous monitoring of selected water-courses for a four year period. Considering that the data and conclusions obtained will be used extensively by the GOP and other donors for follow-on projects, this evaluation may be considered to also fulfill the purpose of feasibility studies.

IV. ADDITIONAL CONCLUSIONS AND RECOMMENDATIONS

4.1 In addition to the major recommendations pointed out in the beginning of this report the following additional conclusions and recommendations should be brought to the attention of project implementors :

- (i) There is greater need of coordination between the Irrigation and Agriculture Departments regarding efficient use of water.**
- (ii) Different agencies working on research related to water management should pool their knowledge and disseminate it through the Federal Ministry of Agriculture.**
- (iii) CSU should expand its efforts to disseminate water management research results to provinces other than the Punjab. This should include wide dissemination of abstracts of research conducted in the past and wider use of all research information in the future.**
- (iv) The target for the Punjab needs to be decided immediately. There is still an argument as to which PC-1 is being utilized, i. e. 550 water courses versus 900 water courses to be improved (Rs. nine crore versus nineteen crore PC-1). It will not be possible to improve 1500 water courses and to level 425,000 acres under USAID funding (covered in the loan agreement) unless the larger program is accepted in Punjab.**
- (v) USAID should also be encouraged to experiment with land leveling as one of the pilot grant credit project being prepared for the future dollar credit loan.**
- (vi) Consideration should also be given to increase the amount of dollar advance for the program.**
- (vii) Revise the FAR payments to include such items as culverts, which are not being reimbursed at this time.**

- (viii) Larger FAR payment per acre of PLL should be authorized for NWFP to allow for the greater gradients in that province.**
- (ix) It is evident to the Team that there needs to be more standardization of various elements of the program and that different FAR entitlement per unit might be required for each province, based on local cost.**
- (x) A large number (175) of tractor drivers have been trained in Sind yet there are no private contractors. This is all the more obvious when the progress of PLL is observed against targets (1085 acres against 3396).**
- (xi) Field teams in reporting accomplishments, could more accurately reflect their work by including length rather than just the number of water courses improved. Water courses vary in size and simple numbers do not adequately describe the size of the task. One suggestion is to use an index number such as "1" to equal 5,000 feet of water course. A 10,000 foot water course would be equal to "2" units. Such a numbering system could be keyed to a targeted amount of work each reporting period.**

APPENDICES

Appendix 1

ACRONYMS AND ABBREVIATIONS

AID/W	Agency for International Development/Washington
ACS	Additional Chief Secretary
AD	Agriculture Department
AG	Accountant General
ARC	Agriculture Research Council
CSU	Colorado State University
DG	Director General
DWM	Director Water Management
EAD	Economic Affairs Division
FAR	Fixed Amount Reimbursement
GOP	Government of Pakistan
LDO	Land Development Officer
NWFP	Northwest Frontier Province
OFWM	On-Farm Water Management'
PC-1	Project Counsel No. 1
P&D	Planning and Development Board
PLA	Personal Ledger Accounts
SCARP	Salinity Control And Reclamation Project
RPO	Regional Planning Organization
SCS	Soil Conservation Service
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
WAPDA	Water And Power Development Authority
WC	Water Course
WMC	Water Management Coordinator
WM	Water Management
WUA	Water User Association
ACS	Assistant Chief Secretary

Appendix 2

SCHEDULE OF WORK

12 April 1978	1100	Arrive at Islamabad
	1200	Meeting with Messrs Headrick, Lyvers & Wirtz
	1500	Meeting with Mr. Don Jones and study of OFWM materials
13 April 1978	0830	Meeting with Messrs Handly, Wirtz, Lyvers, Headrick, Lezin
	1000	Messrs Kango and Nasri joined the meeting
	1100	Meeting with Messrs Wirtz, Kango and Lyvers
	1300	Review and study of CSU materials and OFWM Project
14 April 1978		Study of materials
		Dinner with staff of baran agricultural activities
15 April 1978	0800	Meeting with Amir Mohammad, Chief Agricultural Advisor to CMLA and Nazim Hussain Rana Joint Secretary Agriculture, and Messrs Kango, Headrick, Wirtz, and Lyvers
	1000	Meeting with Messrs Kango, Headrick, Wirtz, and Lyvers
	1300	Review and study of materials
16 April 1978	1000	Meeting with Messrs Tennant, Jones, Haslem, Lyvers, Kango, Hassan, Wirtz, and Khalil
16 April 1978	1500	Meeting with Plunkett, Wirtz, Lyvers
	1730	Plane for Karachi did not arrive and was delayed until following morning.
17 April 1978	0530	Depart for Karachi
	0930	Depart for Hyderabad via Govt. Car
	1230	Meeting in Hyderabad with Messrs Ashraf Arain (DDA Soil Chemist), Akhtar Mogho (DDA Agronomist), Irfan Naqvi (DDA-WC Engineer), Wirtz, Haslem, Lyvers, Nasri, McDonald, and Moore

	1430	Depart for water course activity near Tandojam
18 April 1978	0800	Depart for Nawabshah
	1000	Meeting with Messrs S. Azfar Hussain, Asst. Water Mgt. Specialist, Sandar Baluch, W. C. Leader, Nasri, Wirtz, Lyvers, Kango & Haslem
	1100	Depart for W. C. activity site IAL Dhoro More DEH87 located about 12 miles east of Nawabshah
	1600	Depart for Karachi and visited PLL site lying about 7 miles south west of Nawabshah
19 April 1978	0930	Meeting with Messrs A. G. Pirzada, Chief Agric. P&D Dept., Haslem, Lyvers, Kango, Nasri, Moore, Mohd Ashraf Arian, Deputy Dir. Agric. (Soils), CFWM, Irfan A. Naqvi, Deputy Director Eng. (WCD), OFWM
	1030	Meeting in Karachi with Messrs S. Hazrat Pasha, Chief Economist, P&D Dept., A. G. Pirzada, Chief Agric. P&D Dept., Mohd Ashraf Arian, Deputy Director Agric. (Soils), OFWM, Sind, Irfan A. Naqvi, Deputy Director Engr. (WCD), OFWM, Haslem, Lyvers, Kango, Nasri, Moore
	1200	Meeting with MKamal-Ud-Din Qureshi, Additional Secretary of Agric., Sind, Dodani, Deputy Secy. for Development Agric., Sind, Nasri, Kango, Pirzada, Haslem, and Lyvers
	1430	Depart for Peshawar
April 20, 1978	0800	Meeting with Messrs Sheikh Dost Mohd, Project Director, OFWM, NWFP, Mian Mahboob Gul, Dy. Director Agri. Engineer (PLL), Mohd Yousaf, Dy. Director (T.L.), Wirtz, Lyvers, Nasri, Kango, Haslem
	0930	Depart for W. C. and PLL activity sites
	1400	Lunched at local barbague kebab restaurant on return to Peshawar
	1600	Meeting of group to assign work to be carried out by individual members of panel.
	1830	Depart Peshawar for Islamabad

April 22, 1978	0700	Prepared notes of tour of Sind and NWFP
April 23, 1978	0800	Worked on notes from Sind and NWFP
	1300	Depart for Mona via Government car
	1730	Meeting with Messrs Mohd Munir Chaudhry, Project Director, Ghulam Haider, Supd. Research Officer, Ghulam Hussain, Soil Sci., Bashir Ahmed Sapie, Senior Research Officer, Agronomy, Mohd Iqbal, Junior Research Officer, Mona Reclamation Exp. Proj., WAPDA, Bhalwal Sargodha; John Reuss and Galord Skogerboe, CSU
April 24, 1978	0700	Toured the Mona experimental water course sites and the WAPDA Phullarwan experimental farm, and skimming well project located on the farm.
April 25, 1978	0800	Depart for Chiniot arriving at 1000 hours where we met with Messrs Sadiq Cheema, Project Dir., Punjab OFWM Project, Mohd Shafi Moughal, W.M.C. , M. Ashraf Akhtar, Research Officer (Water Resources Section, P&D; Haslem, Skogerboe, Reuss, Wirtz, Shaw, Hammond
	1030	Toured OFWM Project activity sites in Chiniot area arriving in Faisalabad 1300 hours
April 26, 1978	0830	Met with Messrs Mian M. Aslam, Chr. Farm Mgt. Dept. , OFWM, Chaudhry Mohd, Economics Dir. Village Dey. Coord. , Mohd Aslam, Dir. Research, Qurban Ali, Tariq & Drainage Ishfaq Mirza, Rural Sociologist, Dean Saeed of Faculty of Agric. , all of faculty of Agric. Univ. of Faisalabad, and Westfall, Hammond, Kango, Cheema, Moughal, Skogerboe, Ashraf, Wirtz, Haslem, Shaw, Reuss.
	1000	Toured OFWM Project activity sites in Faisalabad area arriving in Lahore 2030 hours

April 27, 1978	0800	Met with Messrs Cheema, Project Director, Punjab OFWM Project, Twitty, Nasri, Kango, Lyvers, Haslem, Hammond, Wirtz, and Mushtaq Gil (Deputy Director Training, Punjab, OFWM Project)
	0900	Visited OFWM Project Training Center, Lahore
	1030	Met again in Cheema's office with Mohd Naseem, Secretary of Agriculture, Punjab and with people as listed in 0800 hours meeting
	1230	Met with Messrs Mueen Afzal, Additional Secretary(Development), Punjab, Noor Ahmed, AC(Agriculture), Mohd Rafique Ahmed AC (ECA), Zaka-Ud-Din, Irrigation Engr., seconded to P&D Punjab, and Nasri, Cheema, Kango, Lyvers, Haslem, Hammond, Wirtz, Gil, and Shaw
	1400	Met with Messrs John Reuss, Helmer Holje , Sidney Bowers, Norman Illsley, Tom Trout, D. Westfall, Gaylord Skogerboe, all of CSU team and Kango, Nasri, Lyvers, Haslem, Wirtz, and Ashraf
	1810	Depart Islamabad
April 28 - May 8, 1978		Prepare and summarize trip reports and assist evaluation report of OFWM Project and review of CSU contract relating to OFWM activities.

Appendix 3

CONTACTS MADE

Prior to Departure - Principal Contacts

- Dr. Gilbert Cory - DS/AGR/AID/WASH.
- Mr. Murry Cox - Formerly Project Leader, OFWM Project, USDA/PASA/SCS

Islamabad, USAID

- Mr. Everett L. Headrick, AD/AP
- Mr. Francis Ken Lyvers, O/AP
- Mr. Anthony H. Wirtz, PRC
- Mr. Don Jones, SCS
- Mr. Arthur M. Handly, Acting Director, AID
- Mr. Arthur S. Lezin, PRO
- Mr. Hugh S. Plunkett, DEA
- Mr. John A. Tennant, PDM
- Mr. Don Haslem, SCS
- Mr. Khalil-Ur-Rehman, Agri. Engineer, O/AP
- Mr. Sayed Anwar-Ul-Hassan, PDM

Karachi, USAID

- Mr. Khawaja S. Ahmed, Deputy Liaison Officer

Hyderabad, USAID

- Mr. Homer Moore, Irrigation Engineer, SCS, CFWM Project
- Mr. J. V. McDonald, Irrigation Agronomist, SCS, CFWM Project

Peshawar, NWFP

- Mr. Kermit Larson, Agronomist, SCS, OFWM Project
- Mr. Philip Whiting, Irrigation Engineer, SCS, OFWM Project

Government of Pakistan (OFWM)

Islamabad, Pakistan Govt.

- Dr. Amir Mohammad, Chief Agricultural Advisor to CMLA
- Mr. Itikhar Ahmed Shah, Chief, Water Resource Section,
Planning Division
- Mr. Nazim Hussain Rana, Joint Secretary of Agriculture
- Mr. A. M. H. Kango, Director of Water Management
- Mr. S. N. A. Nasri, Deputy Chief/Deputy Secretary (Water
Resources Section), Planning Division
- Mr. Ashraf Akhtar, Research Officer, (Water Resources
Section, P&D Division)

Karachi, Sind Govt.

- Mr. S. Hazarat Pasha, Joint Chief Economist, P&D Dept.
- Mr. A. G. Pirzada, Chief (Agric.), P&D Dept.
- Mr. Kamaluddin Qureshi, Additional Secretary Agriculture
- Mr. Karamchand Dodani, Deputy Secretary (Development),
Agriculture Department

Hyderabad OFWM Sind

- Mr. Mohd Ashraf Arain, Deputy Director Agric. (Soils)
- Mr. Irfan A. Naqvi, Deputy Director, Agric. Engineer (WCD)

Nawabshah OFWM Sind

- Mr. Sarfraz Hussain, Asst. Water Management Specialist
- Mr. Sandar Baluch, Agricultural Engineer

Peshawar OFWM NWFP

- Mr. Sheikh Dost Mohd, Project Director
- Mr. Mian Mahboob Gul, Deputy Director, Asst. Engg. (PLL)
- Mr. Mohd Yousaf, Deputy Director (T.L.)

Mona, Punjab Mona Project, WAPDA

- Mr. Mohd Munir Chaudhry, Project Director, Mona Reclamation
Exp. Project WAPDA, Bhalwal(Sargodha)
- Dr. Ghulam Haider, Superintending Research Officer, Mona,
WAPDA, Bhalwal
- Mr. Ghulam Hussain, Soil Scientist, Mona, WAPDA, Bhalwal
- Mr. Bashir Ahmad Sahie, Senior Research Officer, Agronomy
- Mr. Mohd Iqbal, Junior Research Officer, Agronomy
- Mr. Malik Mohd Nawaz, Farmer on W. C. Exp.
- Mr. Mohammad Munir Bhatta, J. A. E.
- Mr. Tahir Ahmed Pracha, J. A. E.
- Mr. Khalid Mohd, J. A. E.
- Mr. Bashir Ahmad, Field Assistant
- Mr. Mohd Wasim, Field Assistant
- Mr. Mohd Arshad Malik, Sub. Engineer
- Mr. Jehangir, Junior Hydrologist (Skimming Well Project)

Chiniot, OFWM, Punjab

- Mr. Salim Arshad, Team Leader, OFWM Specialist
- Mr. Zahir Aslam, Land Development Officer

Faisalabad, OFWM, Punjab

- Mr. Zafar Abbas, Water Course Development Officer
- Mr. Safdar Ali Cheema, Land Development Officer
- Mr. Bashir Ahmed Bajwa, Water Management Specialist
- Mr. Mumtaz Ahmed Awan, Agricultural Officer Field Team

Faisalabad University, Agricultural Faculty

- Dean Sayeed, Faculty of Agricultural Economics and Rural Sociolog
- Dr. Mohd Aslam, Director of Research
- Dr. Chaudhry Mohd Ali, Economist, Director Village Development
Coordination
- Dr. Mian M. Aslam, Chairman, Dept. of Farm Mgt. Planning
- Mr. Qurban Ali Awan, Irrigation and Drainage Engr.
- Mr. Ashfaq Mirza, Dept. of Rural Sociology

Sammundri, OFWM, Punjab

- Mr. Bashir Ahmed, Water Management Specialist
- Mr. Abdul Ghani, Land Development Officer
- Mr. Safdar Ali, Land Development Officer
-

Jaranwala, OFWM, Punjab

- Mr. Abdul Ghani, Land Development Officer
- Mr. Abdul Majid, Water Management Specialist
- Mr. Khadim Hussain, Water Course Development Officer

Lahore, OFWM, Punjab

- Mr. Sadiq Cheema, Project Director
- Mr. Mushtaq Gill, Deputy Director(Training)
- Mr. Mohd Shafi Moughal, W.M.C.
- Mr. Mohd Shafiq, Soil Scientist, Training Center

Lahore, Punjab Government

- Mr. Mohd Naseem, Secretary of Agriculture
- Mr. Mueen Afzal, Additional Secretary for Dev.
- Mr. Noor Ahmed, A.C.S. (Agric.)
- Mr. Zaka-Ud-Din, Irrigation Engineer, Irrigation Dept.,
seconded to P&D

Lahore, Punjab (CSU Group)

- Dr. John Reuss, Party Chief
- Prof. Gaylord V. Skogerboe, Campus Coordinator
- Dr. Douglas Merrey, Anthropologist
- Dr. Helmer Holje, Economist
- Dr. Sidney A. Bowers, Soil Scientist
- Mr. Norman Illsley, Equipment Specialist
- Mr. Tom Trout, Irrigation Engineer
- Dr. Dwayne Westfall, Extension Agronomist

Appendix 4
Rupee Grant Projects for Operation
and Research for Water Management

Projects		Date started	Project Cost (Rs. 000)	Status
Number	Title			
391-17-110-296 (75-12)	Agricultural Research PLL	6/25/73	6,000	Nearly completed
391-17-120-397 (74-2)	Specification of tubewells	12/26/73	197	Completed
204-75-3	Water Management Research (Mona)	5/30/75	1,314	Nearly completed
204-75-4	Watercourses Implementation (Mona)	5/30/75		Nearly completed
381-17-120-0401 (75-2)	Precision Land Leveling (Water Management)	10/22/74	2,500	Nearly completed
204-76-1	Water Management Survey	11/7/75	411	Nearly completed
204-77-1	OFWM (NWFP)	12/29/76	1,346	Recently amended, will be completed in 1978-79.
391-17-110-390	Precision Land Leveling		684	Recently amended to be completed in 1978-79.
204-77-3	Water User Association	6/9/77	512	Recently started.
391-6441 (78-2)	Water Management Research	Unknown	12,505	Approved by CDWP. Expected to start in early, 1978.
391-0442	Water Management Training and Development Research (Faisalabad)	Unknown	7,600	Approval expected in May and will start in early 1978.
Unknown	Evaluation and Monitoring Program (OFWM)	Unknown	16,120	Being processed, expected to start in early 78.

Appendix 5

David Alverson's Field Trip Report

To: See Distribution

February 27, 1978

From: David Alverson, C/AF

Subject: Field Trip Regarding Private Contractors for Precision Land Leveling, February 5-11, 1978

The purpose of the trip was to investigate why progress in developing private contractors to do Precision Land Leveling (PLL) under the On-Farm Water Management (OFWM) Project has been unsatisfactory. I visited Project areas in NWFP (near Peshawar) and in Punjab (Faisalabad, Jaranwala, Toba Tek Singh, and Sahiwal). There I talked to the OFWM Project staff (including field personnel), SCG advisors, and farmers. In NWFP I also interviewed one private contractor. In Punjab I was assisted by Messrs Chughtai and Qayyum. Observations and recommendations based on our discussions follow.

Current Demand for PLL

The potential for recruiting and retaining individuals or firms as contractors for custom land leveling depends on the profitability of the enterprise. Currently, profitability is limited by low demand for the service, particularly in areas covered by the project which are intensively cropped and where holdings are small. What demand does exist comes mainly from wealthy farmers. Even this demand, however, is generally not being met by private contractors. In the Project areas of Punjab, farmers do the earth moving almost exclusively with their own tractors and PLL equipment (scrapers, land planes) rented from the Project. They receive technical advice from the Land Development Officers (LDO's) as well as, of course, cost sharing payments. The situation is similar in NWFP, but here some PLL work is also being done by the three private contractors recruited by the Project. We do not yet know whether these contractors have leveled land for any small farmers, although the private contractor in the Peshawar area said he thought the average size of the 14 or 15 farms where he has done PLL in the past year was about 15 acres.

There appear to be several reasons for the present concentration of (the limited) demand for PLL among large farmers. First, the Project field staff are focusing their attention on these farmers, probably because a) the LDO's consider large farmers more "progressive", b) the LDO's are rewarded by the total number of acres they get leveled rather than the number of small farmers served, c) large farmers, unlike small farmers, have the tractors to do the work, and d) large farmers, in contrast to small farmers, provide the LDO's in some cases "extras" such as meals and lodging.

Second, large farmers appear to be more convinced that PLL is an attractive investment than small farmers. They see, for example, the opportunity not only to increase yields, but to bring into production substantial amounts of land that had previously lain fallow for lack of water.^{1/} Small farmers, on the other hand, usually have little fallow land in any season and could not increase cultivated acreage very much after PLL. They also have apparently not been convinced that PLL results in much leveled land or better yields than are attainable with traditional land leveling techniques.

Third, large farmers can more readily bear the risk of the innovation (PLL) and, more than small farmers, have the liquidity to pay the out-of-pocket costs for tractor operation (or hire) and equipment rental not covered by the subsidy. And fourth, large farmers are, for some of the reasons already mentioned, in a better position than small farmers to capture subsidies for PLL. Although in theory no farmer is entitled to cost sharing on more than 5 acres, in practice most large farmers (or at least their families) can and do get subsidies for much more land. (The average was 14.9 acres (range 3-25 acres) for the nine participating farmers we interviewed in Punjab). This is possible because eligibility for cost sharing is based on land owned rather than land operated. To take a hypothetical (but realistic) example, a farmer managing a 60 acre farm may own only 10 acres, the remaining 50 acres, consisting of five 10 acre units, being registered in the names of two brothers employed off the farm and three school age children. This farmer and his household could legally qualify for

^{1/} After PLL the time required to irrigate a field is considerably reduced. As a result, the farmer can irrigate more area within his irrigation turn.

subsidies under the Project on as much as 25 acres of land. In cash terms the subsidy could be worth as much as Rs. 11,250.

Increasing the Demand for PLL

Project accomplishments in terms of acres of land precision leveled have so far fallen far short of expectations. As noted earlier, this has been in large part the result of a low level of demand for the service. If, however, the economic returns are as favorable as suggested in several research papers ^{1/} there should be considerable scope for increasing the demand for the service, especially in areas where the natural slope of the land is substantial, fields operated by a single farmer are large, and water is scarce relative to land (cropping intensity is low). How can this be done? First, more emphasis needs to be placed on publicizing and properly demonstrating the benefits of PLL. Although the project design calls for publicity through the farm radio programs and other mass media, there apparently has been little effort in this direction so far. Neither has there been much emphasis placed on demonstration plots or field days. It would appear, therefore, that the project staff have not yet exploited the full arsenal of standard extension tools. In addition, some LDO's and their supervisors have not given adequate attention to ensuring that land leveled under the project meets design specifications. While this probably has resulted from an understandable desire to meet project targets, poorly executed work can only serve to hinder efforts to encourage farmers -- particularly small farmers -- to invest in PLL ^{2/}

Second, the banks should be more actively called on to take part in the project. Although the Project Agreement provides that institutional

1/ See for example "The Economics of Precision Land Leveling in Pakistan" by Johnson, Hussain, Khan, and Ali.

2/ In one village we visited (no OFWM personnel were present) several farmers remarked that precision land leveling of one large plot of land had been improperly done. We were in no position to judge whether this was true or not, but the important point is that these farmers had a poor opinion of PLL as the result of seeing the plot.

lenders will make loans both to farmers for PLL and to private contractors for tractors and equipment, absolutely no loans for these purposes have been made. And while it is true that lending procedures have been established by the National Banking Council, the National Bank of Pakistan, and the Agricultural Development Bank of Pakistan, there has so far been little action on the part of either the OFWM project staff or the banking community to involve the banks in the project.

It seems that the first step in "getting the ball rolling" is for the Project Directors in each province to request the heads of banks operating in the Project areas to make available staff to work on the credit aspects of PLL. As already specified in the procedures agreed to by the National Banking Council, each loan officer (who should be an agriculture graduate) should first be trained by the Project staff in PLL and then work closely and on a continuing basis with the OFWM team to which he is assigned. At the minimum the training should enable the loan officer a) to determine that land leveling financed in part by the bank has been done properly and b) to act as a salesman for PLL, complementing the efforts of the OFWM staff in generating demand for the service. The Project Directors should inform the banking officials as soon as possible specifically when and where training courses will be held and what topics will be covered in the course.

Third, more research is needed to determine the technical feasibility and profitability of PLL on small farms. If the Project is to succeed in benefiting small as well as large farmers, more needs to be known about constraints to small farmer adoption of PLL. For example :

1. How does the benefit-cost ratio for leveling small plots of land compare with that for large plots? If less, is PLL of small plots still competitive with alternative investments such as increased fertilizer use?
2. Is it technically possible for a farmer using his own bullocks and leveling equipment (e. g. karah) to level his land to project design specifications? If so, can it be done in a period short enough to avoid loss of a crop on the land being leveled.
3. What would be the comparative cost of leveling by bullock and traditional equipment versus leveling by tractor and scraper?

4. How crucial is provision of institutional credit as an inducement to small farmer adoption of PLL?

These and other questions need to be studied and the findings used to develop strategies, if justified, for promoting PLL on small farms. For example, if bullock leveling proves feasible, LDC's should set up demonstrations of bullock leveled land.

Private Contractor Development

As noted earlier, there is now little demand for PLL. The source of what demand exists is large farmers, most of whom use their own tractors for leveling their land. Given this situation, prospects for attracting private businessmen into the custom land leveling business do not seem too bright. However, this outlook could change assuming that a) PLL is as profitable to the farmer as advertised, b) farmers become convinced through discussions with other farmers or PLL staff, observing demonstration plots on precisely leveled fields, etc. that PLL is at least as attractive as alternative investments, c) farmers have sufficient liquidity or can borrow enough to pay for the one-half of the cost not covered by the subsidy, and d) farmers prefer to have their land leveled by a private contractor rather than doing the job with their own power source (tractor or bullock) and owned or rented equipment.

If these assumptions are realistic and a favorable climate emerges for custom PLL, it appears that the best short-term strategy for promoting private contractor development is to work through farmers already owning tractors who have used these tractors to level their own land. Advantages of such an approach are that: a) these farmers (or their tractor drivers) have developed some skill in doing PLL, b) they already have the tractors to do the work (scrapers and other PLL equipment can be rented from the project), and c) they can quote from their own experience in describing the benefits of PLL to potential clients.

There are some important questions about such a strategy, however. Although 11 of the 12 tractor owners we interviewed in Punjab said they would be interested in doing custom work for their neighbors, most of these farmers had not previously given much thought to the

idea and none had actually done any of this work.^{1/} Furthermore, they had some serious reservations about becoming private contractors :

1. There was nearly universal agreement that pulling the scraper would harm the tractor and reduce its useful life.^{2/}
2. Two tractor owners said they would consider becoming contractors only if the Project arranged payment from their clients. (This view was apparently the result of these farmers' previous difficulties in recovering payment for other types of custom services, e.g. ploughing. One farmer suggested that small farmers or village artisans would be better suited to becoming private contractors because, unlike wealthy farmers, they could actively pursue nonpaying clients without losing face in the community.)
3. Two said they would need an additional tractor to do PLL, one because his tractor was too old to do heavy work and the other because his tractor was fully utilized in other work.

Despite such reservations and expressed problems, some of these tractor owners would probably be willing to do custom PLL on a part-time basis if it is profitable for them to do so. It is likely that PLL work would be most attractive to them when a) more lucrative uses of their tractor are not available, e.g. when sugarcane is not being hauled to the mill, b) they do not need their tractor for use on their own farm, and c) between crop seasons when considerable land in the immediately surrounding area is fallow, as after wheat harvest and before planting of the kharif is fallow, as after wheat harvest and before planting of the kharif crop. Unless the OFWM Project staff make more efforts to bring the potential private contractor and potential nontractor-owning

1 / However, one farmer did rent out his tractor to his uncle for PLL at Rs. 40 per hour. Another provided his tractor and driver to a relative for PLL at Rs. 120 per day, excluding fuel.

2 / The farmer who said he was not interested in doing custom PLL gave this as his reason.

clients together, however, there is little chance that small farmers will be able to participate in the Project. As the system now operates and for reasons already mentioned, the Project field staff have no incentives for working with and selling PLL to small non-tractor owning farmers. The incentive structure needs a thorough review and appropriate changes made, e.g. special bonuses to LDO's for land leveled on small farms by private contractors, if the benefits of PLL are to be skewed more towards small farmers.

The project design assumes that much of the land leveling, particularly on small farms, will be performed by village artisans and small farmers having insufficient land to fully utilize a tractor on their own land. To date the conditions have not been established to make this possible. ^{1/} To do so will require the concerted efforts of both the OFW Project staff and the banking community. Such actions as the following are required :

1. Project Staff

- Contact small farmers and artisans in villages where the Project is operating and inform them about the opportunities of becoming private contractors.
- Tell potential small contractors how they should proceed in order to get training in PLL^{2/} and credit to purchase tractors.
- Help interested small farmers and artisans make contact with loan officers assigned by banks to the Project.

2. Banks

- Provide for training of loan officers in PLL and subsequent assignment of these officers to Project teams.

^{1/} The three private contractors in NWFP are large farmers who were given a large subsidy as an incentive to do custom PLL. In return for the opportunity to get credit for purchase of a tractor at only 2% interest, these farmers agreed to do land leveling for the Project. Such a scheme might have some "demonstration effect" but would not be applicable on the scale needed to make this project work.

^{2/} Training should equip contractors to operate with minimum of technical assistance from project staff.

- **Actively solicit applications from small farmers and artisans for loans to purchase tractors and PLL equipment.**

In addition, steps should be taken to ensure that not only tractors but scrapers, land planes, etc. are also available for purchase by private contractors on credit. Where, by whom, and at what cost will this equipment be fabricated and serviced?

As a final observation, it seems clear that unless major issues and problems we have discussed are given attention, project objectives relating to acreage targets for precision leveling, small farmer participation, and development of private contractors will not be achieved.

Appendix 6 Inspection Procedures

USAID has established fairly elaborate procedures for FAR inspection of the completed water courses and precision leveled land. For the water course inspection, it is planned that each water course during the first two years of the project -- about 135 are planned -- will be visually inspected by a USAID representative. Various elements of the water courses will be checked including land ownership records, structures, the length of the canal lined and the various other technical aspects of the water courses. The criteria for acceptance of water courses includes the following: for structures there will be no deviation from "as built" in excess of 3 cm in any cross sectional measurement; only minor deviation are allowed in the length of the water courses and other aspects such as buffalo wallows; along the earthen water course section the bottom elevation will not deviate in excess of ± 2 cm and bottom width in excess of -2 cm or + 4 cm.

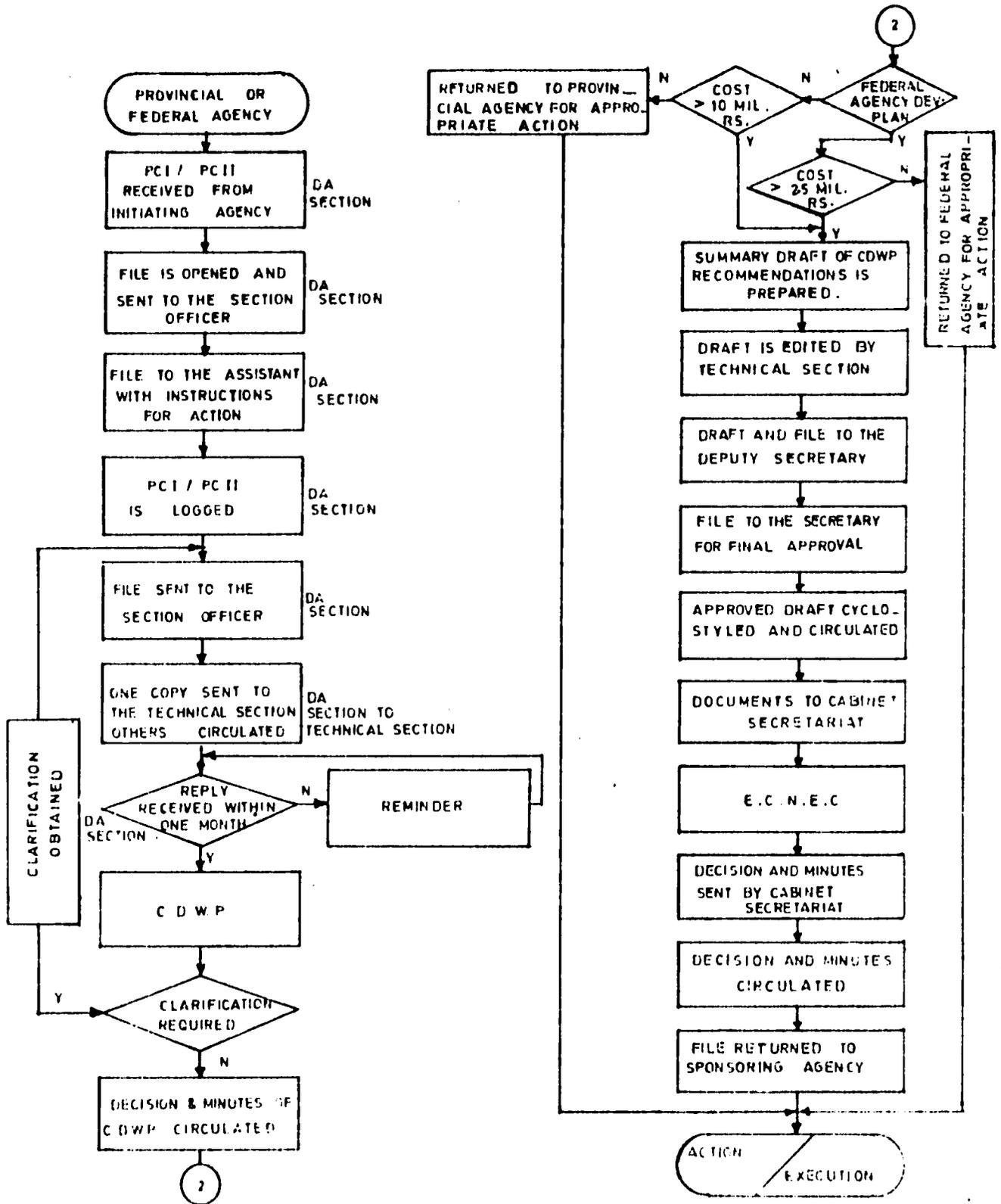
A fairly detailed sampling procedure is being used for land leveling. The precision leveled fields submitted for reimbursement in each water course command area and nearby vicinity (i. e. in each sampling stratum) will be numbered. Then a random sequential sampling procedure will be used to select a sample of levelled fields for inspection. Initially 5 percent, but not less than ten fields of those submitted from a given team area at any one time will be selected for inspection. Selection will be by the use of a random number table. The selected acres will first have their ownership or other titles checked for conformance to the land tenure conditions of reimbursement, and then their physical condition and contours will be checked for conformance to the precision land leveling standards.

If the proportion of acceptable acres of those submitted in the initial sample is not less than 0.3 or not more than 0.2 the proportion of the sample which qualifies will be accepted as an accurate estimate of the proportion in the entire submission from that team or stratum acceptable for payment at that time. If the proportion is between 0.2 and 0.3, additional acreage will be chosen at random and checked. Two additional plots will be selected at a time. This procedure will continue until either (1) the proportion of acceptable acres is 0.3 or better (2) 0.2 or less, or (3) the size of the sample has been doubled.

The proportion of qualifying plots in the sample will be considered the best available estimate of the proportion eligible in the whole submission from the team area. After the samples have been obtained, ownership of the land will be verified. The area itself will be verified and if within 10 percent of specific acreage, will be accepted. Then an actual survey of physical checking of the land will be done. With a surveying instrument a minimum of 4 shots per acre on a double line cross pattern will be taken. No line shall be any closer than 20 meters of the field boundary. When 80 percent of the rod readings are within a 4 cm (6 cm in Sind) range, the field will be accepted. When over 20 percent of the readings are beyond the 4cm (6cm in Sind) range, the field will be resurveyed on a 20 meter grid. If on resurveying, 80 percent of the readings are within 4cm (6cm in Sind) the field will be accepted.

USAID currently has one direct hire Pakistani engineer who conducts the inspection for the Mission. It is currently planned that after inspection work increases that either additional local hire personnel will be added to the staff or a small contract team will be employed to do the inspection of the project.

DETAIL FLOW OF PCI AND PCII



Appendix 9

Watercourses Visited by Evaluation
Team (April, 1978)

Items	Sind	NWFP	Mona Experimental Area			
	1	2	3	4	5	6
Water course number	14-L Daeboro 27-AN		TW-78	T-56	TW-91	No. 68
Length(meters)	6,640	3,720	671	610	3,340	3,236
Commanded area(acres)	-	447	1,524	380	325	-
Number of farmers	32	-	-	31	20	-
Designed discharge(liters)	-	-	428	-	-	-
Head discharge "	-	-	-	-	-	-
Discharge at tail end "	-	-	-	-	-	-
Length improved(meters)	3,640	-	-	-	-	-
Brick lining(meters)	234	-	-	-	-	-
Structures installed (No.)	1	1	-	-	-	-
Culverts installed (No.)	1	-	-	-	-	-

PUNJAB

	7	8	9	10	11	12	13	14	15
Watercourse number	34668-R	6465/L	51143/R	3226/R	23636/ 56/ R	Bha- 407 R wali GB	4699/R		
Length (meters)	2600	5250	5025	4693	6948	6800	463	2937	6343
Commanded area(acres)	290	375	400	300	507	724	178	600	525
Number of farmers	26	49	104	53	55	107	42	-	68
Designed discharge(liters)	100	50	70	85	60	100	-	-	49.0
Head discharge(liters)	85	43	-	-	-	-	-	-	27.3
Discharge at tail end(liters)	-	24	59.5	-	-	-	-	-	-
Length improved(meters)	-	-	-	-	5034	3577	-	-	-
Brick lining(meters)	363	60	-	503	150	230	-	-	-
Structures installed(No.)	34	60	-	41	29	37	50	-	-
Culverts installed (No.)	5	8	-	10	1	-	4	-	-

Source: Evaluation Team records.

Appendix 9

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