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IMPLEMENTATION COMPLETION REPORT

PAKISTAN

THIRD ON-FARM WATER MANAGEMENT PROJECT

(CR. 2245-PAK and Loan 3327-PAK)

June 3, 1997

Agriculture and Natural Resources Operations Division
Country Department I
South Asia Region

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CURRENCY EQUIVALENTS

Currency Unit = Pakistan Rupees (Rs)
 SAR (May 1991) Rs22.00 = US\$ 1.00
 Completion Year (December 1996) Rs 40.00 = US\$ 1.00

WEIGHTS AND MEASURES

(Metric System)

FISCAL YEAR OF BORROWER

July 1 to June 30

ABBREVIATIONS AND ACRONYMS

AED	= Agriculture Extension Department
CCA	= Culturable Command Area
DC	= Demonstration Center
DOA	= Development Credit Agreement
DOA	= Department of Agriculture
FATA	= Federally Administered Tribal Areas
FANA	= Federally Administered Northern Areas
FCU	= Federal Coordination Unit
FO	= Farmers' Organization
FTC	= Farmer Training Center
GOP	= Government of Pakistan
IAT	= Irrigation Agronomy Team
IBRD	= International Bank for Reconstruction and Development
ICB	= International Competitive Bidding
IDA	= International Development Association
LCB	= Local Competitive Bidding
MinFAC	= Ministry of Food, Agriculture and Cooperatives
M&E	= Monitoring and Evaluation
NWFP	= North West Frontier Province
O&M	= Operation and Maintenance
OECF	= Overseas Economic Cooperation Fund of Japan
OFWM	= On-Farm Water Management
OFWMD	= On-Farm Water Management Directorates
OFWM I	= First IDA assisted OFWM Project (Cr. 1163-PAK)
OFWM II	= Second IDA assisted OFWM Project (Cr. 1603-PAK)
PC-I	= Planing Commission's Proforma Number I, Government's Project Approval Document
PLL	= Precision land leveling
RD	= Revenue Department
SAR	= Staff Appraisal Report
WAPDA	= Water and Power Development Authority
WMED	= Watercourse Monitoring and Evaluation Directorate
WUA	= Water Users' Association

GLOSSARY

barani	= rainfed area with some interspersed small irrigation schemes
chak	= tertiary irrigation command (watercourse command)
sailaba	= irrigation using flood waters
warabandi	= weekly rotational schedule of irrigation deliveries to farmers on a watercourse
watercourse	= irrigation distribution channel with a chak

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PAKISTAN

**THIRD ON-FARM WATER MANAGEMENT PROJECT
(Cr. 2245/Ln. 3327-PAK)**

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MAPs: IBRD 22652, IBRD 22653, IBRD 22654, IBRD 22655, IBRD 22656

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IMPLEMENTATION COMPLETION REPORT

PAKISTAN

THIRD ON-FARM WATER MANAGEMENT PROJECT (Cr. 2245/Ln. 3327-PAK)

Preface

This is the Implementation Completion Report (ICR) for the Third On-Farm Water Management Project in Pakistan for which Credit 2245-PAK in the amount of SDR33.4 million (US\$47.9 million equivalent) and Loan 3327-PAK in the amount US\$36.3 million were approved on July 31, 1991 and made effective on May 14, 1992. The IDA Credit and IBRD Loan closed on December 31, 1996, following a one-year extension. The Credit was fully disbursed on September 30, 1995, and the IBRD loan on May 28, 1997.

The ICR was prepared by an FAO/World Bank Cooperative Program mission^{1/} which visited Pakistan in February/March, 1997 and revised by the Agriculture and Natural Resources Operations Division, Country Department I, South Asia Region. Preparation was based on review of the project files, Staff Appraisal Report (No. 9142-PAK) dated May 2, 1991, field investigations and discussions with staff of the World Bank, Federal Coordination Unit (FCU) of the Ministry of Food, Agriculture and Cooperatives (MinFAC), the On-Farm Water Management Directorates (OFWMD) of provincial Departments of Agriculture, the Federally Administered Tribal Areas (FATA) and the Watercourse Monitoring and Evaluation Directorate (WMED) of the Water and Power Development Authority (WAPDA) and with farmers benefiting from the project. Additional information was obtained from comments on the mission's Aide-Memoire. The Government of Pakistan prepared its evaluation of the project which is included as Appendix B. The Government also contributed to the preparation of the ICR by commenting on mission's aide-memoire, arranging field visits and discussions with project staff and farmers, and providing relevant data on project performance.

^{1/}

Messrs. D. A. Ivory (Mission Leader), R. G. Paterson (Irrigation Engineer) and T. Lohavisavapanich (Economist).

IMPLEMENTATION COMPLETION REPORT

PAKISTAN

THIRD ON-FARM WATER MANAGEMENT PROJECT (Cr. 2245/Ln. 3327-PAK)

Evaluation Summary

Introduction

1. The positive impact of two previous International Development Association (IDA) assisted On-Farm Water Management Projects (OFWM I, Cr. 1163-PAK; and OFWM II, Cr. 1603-PAK) and the strong demand from farmers for continued OFWM activities, led to the Government of Pakistan (GOP) requesting the Bank Group to finance a third OFWM project (OFWM III).

Project Objectives

2. The objectives of the project were: (a) to increase agricultural production through effective use of irrigation water saved by improved OFWM practices and a strengthened irrigation agronomy program; (b) to improve the capability of the implementing agencies to carry out an expanding OFWM program and facilitate their coordination with the extension directorates; (c) to provide for increased farmer participation in water users' associations (WUAs) and strengthening these organizations to improve water and non-water input management and ensure efficient operation and maintenance (O&M) of installed facilities; and (d) to reduce government's financial obligations by increasing cost recovery and encouraging WUAs to assume O&M responsibilities within smaller irrigation commands. Approximately 1,000,000 ha of irrigated land involving about 250,000 farm families or about 2 million people were expected to benefit from the project.

3. The project objectives were clear, and in line with the Government's sector policies and the Bank's assistance strategy for Pakistan which supported growth objectives by focusing on structural reforms, improving the enabling environment for the private sector, strengthening inadequate basic infrastructure, reducing constraints on agricultural productivity, and protecting natural resources. Pakistan's development plans acknowledged that huge investments made in irrigation infrastructure must be accompanied by measures to strengthen agriculture input and support services and the role of the private sector, if efficient agricultural production is to be achieved. The project was to address one important part of this agenda, namely the management of a key input, water, at the farm level.

4. The physical targets included the renovation of 7,685 watercourses, precision land leveling (PLL) on 55,000 ha, the construction of 515 water tanks, the rehabilitation of 35 flood irrigation (*sailaba*) schemes in Balochistan and the provision of 10 hydra ram pumps and higher efficiency irrigation systems. Construction of hill torrent control structures for one seasonal river was added to the project during its one year extension.

5. A number of loan covenants were aimed at enhancing farmers participation and sustainability of the program by implementing specified levels of cost recovery, both under this and the

previous OFWM projects. The cost recovery levels were enhanced further during the project implementation. The implementing agencies had sufficient experience in the project implementation, a flexible implementation program was adopted and the project works were tailored to suit the local needs.

Implementation Experience and Results

6. **Achievement of objectives.** The project increased the production of the major grain crops, cotton, fodder and fruits. However, for the major grain crops the increase was less than estimated at appraisal. The production of sugarcane declined because of a shift towards more water efficient crops in improved watercourses and reduction in area planted under sugarcane. Increased production was mainly due to increased crop area and yields as a result of water saved by watercourse improvements and precision land leveling, particularly the lining of watercourses.

7. Physical targets were achieved for the main components (watercourse improvement - 101% of target; and tanks - 188%), but fell short for sailaba (74%) and PLL (72%). Hydra ram pumps and higher efficiency irrigation were not taken up by farmers, probably due to the low (20%) subsidy offered. Construction of hill torrent control structures for one seasonal river was completed but their effectiveness has not yet been tested by a flood in the river.

8. The capability of OFWM Directorates was enhanced substantially in implementing the OFWM program. However, the irrigation agronomy program was not as successful as expected at the appraisal, especially in establishing linkage with provincial Agriculture Extension Directorates (AEDS). The number of irrigation agronomy teams was increased slightly compared to previous OFWM projects to advise farmers on effective use of saved water. This did not lead to the expected increase in efficiency of use of saved water for agricultural production, because a large proportion of the teams' time was involved in forming WUAs, leaving inadequate time available to continue post-improvement support to farmers through repeated farm visits. The involvement of provincial AEDs staff in the project was negligible.

9. WUAs were organized according to provincial laws as a prerequisite to watercourse improvements. Pilot projects were undertaken for experimenting with their involvement at the higher level of the irrigation system. The capital cost recovery levels were increased substantially by introducing upfront recovery.

10. **Project sustainability.** The benefits of the investments made under the project are likely to be sustained. Farmers will continue to maintain the watercourses constructed under the project. However, the efficiency gains made when they were first renovated may decrease over time. The WUAs formed under the project are most active during the watercourse renovations. Their activities reduce after completion of works and some WUAs fail to continue to function. Fortunately, this does not mean that maintenance is not done. Instead it is carried out through informal arrangements.

11. Towards sustaining the OFWM program, the GOP and provincial governments are committed to continuing the process of renovation of farm watercourses under future projects. Presently, the program is heavily dependent on continuing donor funds. However, during the project and in subsequent projects the Government has enhanced levels of cost recovery/sharing by the beneficiaries. With this approach it is likely that the program would continue to cover more watercourses.

12. **Project costs, financing arrangements and implementation timetable.** Following a one-year extension to Credit/Loan closing to December 31, 1996, the actual total project expenditures amounted to US\$158.7 million, 102% of the total project costs of US\$155.5 million estimated at appraisal. Due to higher local inflation than anticipated, the cost in rupees was 4,929 million, including farmers' cash and labor contribution of Rs1,140 million, Rs80 million for PLL and Rs176 million for the Vidore Hill Torrent control, representing a cost overrun of about 44% over the total project costs of Rs3,422 million estimated at appraisal. However, these increases were balanced by depreciation of rupee required to accommodate the higher local inflation rate. The IDA Credit of SDR33.4 million (US\$47.9 million equivalent) was fully disbursed on September 30, 1995 and the IBRD Loan of US\$36.3 million, was totally disbursed as of May 28, 1997.

13. Recovery of farmer's share of capital cost for watercourse improvements and other project works was initially through repayment by installments. As required under the legal covenants, Punjab and Sindh provinces achieved target recovery level of 90 percent of amount due from farmers by June 30, 1992 and December 31, 1993, respectively. However, the recovery rate in these provinces declined thereafter, until upfront cost sharing was implemented from July 1995. Full recovery of the amount due from beneficiaries was achieved by Balochistan, NWFP and FATA by December 31, 1996. Because of the cumulative arrears from low recoveries between 1993 and 1995, overall recovery remained low at 68% in Punjab and slightly higher at 80% in Sindh.

14. **Key factors affecting achievement of major objectives.** The considerable experience gained by provincial governments in previous OFWM projects was a major factor enabling most of the physical targets to be achieved satisfactorily. However, delays in establishing Federal Coordination Unit (FCU), approval of project PC-I by the Government, meeting conditions of disbursements, procurement and delivery of vehicles and field equipment, and shortages of counterpart funds, change in cost recovery methods, and inadequacy of the irrigation agronomy component during project implementation, all contributed to the need for a one-year extension of the project and lower than expected increase in agricultural production.

15. **Bank and Borrower performance.** The Bank performance during project preparation and appraisal was satisfactory. Bank provided adequate resources for project processing. However, would have been preferable if a more detailed design/plan had been prepared and agreed with the borrower about the irrigation agronomy and farmers training components. The Bank supervision was satisfactory but was less successful in directing watercourse improvements towards farmers with small landholdings, encouraging the use of less costly lining, and developing proposals to improve the performance of the agronomy groups. The borrower generally performed satisfactorily except with respect to procurement of vehicles and equipment, cost recovery from farmers for their share of the costs of civil works and fostering strong linkages with the extension services. Performance on cost recovery improved in last year of the project with introduction of upfront cost recovery.

16. **Project outcome.** The overall outcome of the project is satisfactory. However, the increase in crop production and the re-estimated ERR for the whole project (23%) were both lower than expected at appraisal.

Summary of Findings, Future Operations and Lessons Learned

17. **Important findings.** Improvement of watercourses increased water availability by about 20% and reduced the time spent by farmers on O&M of watercourses and on applying irrigation water to their fields. Construction of water storage tanks, which is often only necessary because of the unreliability of the electricity supply to pumps, was very popular with farmers, particularly in Balochistan. The results from PLL are reported to be good with most of the benefits expected in the SAR being obtained. The resulting improvements in on-farm water supply and distribution were not, however, translated into expected increases in agricultural production due to inadequate functioning of the irrigation agronomy component.

18. **Plans for future operation and sustainability.** The general plan for future improvement of watercourse, tanks and sailaba irrigation will continue as at present, there being no need for any changed plan of operation.

19. **Key lessons learned.** The key lessons learned from this project which could improve future OFWM operations are: (a) the irrigation agronomy program should be improved by establishing a better linkage with provincial AEDs which, if needed, could be strengthened with subject matter specialists in efficient water use; (b) external and internal monitoring programs should be strengthened; (c) farmer participation in the irrigation management should be strengthened by establishing farmers' organizations at the distributary/minor level and transferring to them responsibility for distribution of water to their members, collection of water charges, and maintenance. Watercourse level WUAs should be formed as part of the distributor/minor level organization; (d) up-front cost sharing of the capital costs at current levels is generally accepted by the beneficiaries. Upfront contribution by the farmers towards the capital cost improves the cost recovery and significantly reduces government's financial obligations. However, too high levels of up-front cost recovery would adversely affect the participation of small farmers in the program due to cash flow problems. Assessment of farmers' financial capacity to meet costs of watercourse improvements should be undertaken prior to introducing further increases in the up-front recovery; (e) farmers training should be emphasized and these costs should be funded from the credit.

IMPLEMENTATION COMPLETION REPORT

PAKISTAN

THIRD ON-FARM WATER MANAGEMENT PROJECT (Cr. 2245/Loan 3327-PAK)

PART I: PROJECT IMPLEMENTATION ASSESSMENT

A. STATEMENT/EVALUATION OF OBJECTIVES

1. The principal goal of the Third On-Farm Water Management Project (OFWM III) was to raise farmers' incomes and agricultural production through the improvement of the supply and application efficiency of on-farm irrigation water. The stated objectives of the project were to: (a) increase agricultural production through effective use of irrigation water saved by improved on-farm water management (OFWM) practices and a strengthened irrigation agronomy program; (b) improve the capabilities of the implementing agencies in the four provinces, the Federally Administered Tribal Areas (FATA) and Northern Areas (FANA) to carry out an expanding OFWM program and to facilitate their coordination-ordination with the Agricultural Extension Directorates; (c) provide for increased farmer participation in Water Users' Associations (WUAs) and to strengthen these organizations to improve water and non-water input management and to ensure efficient operation and maintenance (O&M) of installed facilities; and (d) reduce government's financial obligations through increased cost recovery and to encourage WUAs to assume O&M responsibilities within smaller irrigation commands.
2. The project objectives were clear, and in line with the Government's sector policies and the Bank's assistance strategy for Pakistan which supported growth objectives by focusing on structural reforms, improving the enabling environment for the private sector, strengthening inadequate basic infrastructure, reducing constraints on agricultural productivity, and protecting natural resources. Pakistan's development plans acknowledged that huge investments made in irrigation infrastructure must be accompanied by measures to strengthen agriculture input and support services and the role of the private sector, if efficient agricultural production is to be achieved. The project was to address one important part of this agenda, namely the management of a key input, water, at the farm level.
3. Significant water savings resulted from project works. The number of irrigation agronomy teams was increased slightly compared to previous OFWM projects to advise farmers on use of saved water. However, this led to less than expected increases in efficiency of use of saved water and agricultural production because a large proportion of the teams' time was involved in forming WUAs, leaving inadequate time available to continue post-improvement support to farmers through repeated farm visits.
4. The objective of reducing the government's financial obligations and thereby inducing financial sustainability, was reasonable. In line with this objective, the amounts to be recovered from water users were further increased during the project. The project physical targets were straightforward and well within the capabilities of the implementing agencies. No serious risks were identified at appraisal.

B. ACHIEVEMENT OF OBJECTIVES

Efficient Use of Irrigation Water for Agricultural Production

5. **Watercourse renovation.** This was the largest component of the project, contributing over 85 percent of the civil works costs. About 7,781 watercourses (101% of the SAR target), including 264 in Fordwah Eastern Sadiqia Project (Cr. 2410-PAK), with a total culturable command area (CCA) of 885,827 ha (86% of the area estimated in the SAR) were improved. Targets for number of watercourses were exceeded in NWFP and Punjab, but fell short in Balochistan, Sindh and FANA. In FATA the target was met. The reason for the shortfall in Sindh (68% of target in canal areas and 61% of the target in rainfed--*barani*) was a lack of WUAs willing to meet the financial requirement to pay 25% of the cost of materials upfront, despite this having been reduced during the project from 30% (10% upfront and 20% in installments).

6. A criterion specified in the SAR that watercourses to be improved should be operated predominantly by low-income farmers with small landholdings was not always observed. Supervision missions reported that in Punjab and NWFP preference was given to watercourses serving farmers with small landholding but that it was difficult to achieve this in Sindh. One reason for this is that such farmers could not easily pay the required upfront cost. But a more basic reason is the pervasive tenancy arrangements with a large percentage of the land farmed by landless tenants, who are often resource starved as well as indifferent to making capital investment for land improvement. In FATA and NWFP, farmers have provided sand and gravel but in most other places this was insufficient to meet the required amount of the beneficiary contribution. In FATA it seems that the minimum contribution was relaxed in some cases.

7. Most watercourses were built of "double brick" walls on brick or concrete beds. Lower cost alternatives proposed in the SAR such as single brick walls, concrete walls, or three-piece concrete precast slabs were rarely used. In Balochistan, however, *in situ* concrete and pre-cast pipes were preferred. The quality of construction was generally satisfactory with mortar-faced brickwork in good condition, sometimes after ten or more years for watercourses improved under earlier Bank projects. On average the length of lining was about 780 m per watercourse or about 7 m per ha of CCA, representing about 24% of the total length improved. Culverts were generally built where needed. The maximum number of culverts provided on a watercourse were 22. However, the average was about one per watercourse as compared with the original provision of four per watercourse. The average length of earthen channel improved was about 2,400m per watercourse or about 22 m/ha of command area. The average cost of materials and skilled labor per meter lined was Rs 347/m. Unskilled labor provided by the WUA, if priced at market rates, would add about 25% to the cost of lining.

8. **Improved water availability.** Improving watercourses, including lining, increases efficiency by reducing seepage, evaporation (due to increased water velocity and reduced water surface area with narrower lined sections), spillage and operating losses. The Watercourse Monitoring and Evaluation Directorate (WMED) of the Water and Power Development Authority (WAPDA) was employed under the project to measure watercourse irrigation efficiency before and after improvement of the watercourses. On the basis of the measurements by WMED for this project^{1/}, the amount of water delivered to farms has

^{1/}

A draft of Chapter 3 of their final report discusses their results of measurements on 13 watercourses: 6 in the Punjab, 3 in Sindh, 2 in Balochistan and one each in NWFP and in FATA.

increased by an average of 26 percent (weighted average). The high benefit achieved was mainly a function of the strategy used of lining the head end of the watercourse, which is the most effective strategy where a rotational (*warabandi*) water distribution system is used. Other benefits of lining watercourses are saving in time in farmer operation in irrigating farm fields and in lower maintenance requirements of the watercourses. Farmers reported that they saved about 50% of the labor originally needed for irrigation and as much as a further 10 days/ha/year on maintenance. The construction of washing places and lining watercourses through villages gave additional public health benefits.

9. **Water storage tanks.** Some 969 water storage tanks were constructed, about 88% more than estimated in the SAR. There were no tanks proposed for Sindh; all other provinces and areas met or exceeded the targets, particularly in Balochistan, where the target was exceeded by 116%. Water storage tanks are built where the supply of water is unreliable or intermittent, such as from a spring with a low flow or, most commonly, where the electricity supply to an electric pump for a tubewell or dug well is unreliable. The tanks are usually constructed from brick with a cement mortar rendering and are commonly about 12 m square and 1.2 m deep. Although there was no limit on the allowable size of tank given in the SAR, where farmers wanted larger tanks (usually by about 30 to 35%) they were required^{1/} to meet the additional costs themselves. This happened for about 25% of the tanks constructed.

10. **Other Facilities.** Some 26 sailaba subprojects (74% of the SAR target of 35) were constructed between June 1993 and June 1996 in Balochistan with an estimated command area of 415 ha. The cost of materials was about Rs4.5 million or about Rs11,000/ha (roughly US\$300/ha). There has been no monitoring of the benefits of these works. The project included provisions for installation of hydra-ram pumps for pumping from perennial streams in Punjab province and the provision of higher efficiency irrigation technologies (sprinkler and drip irrigation systems). These were not taken up by farmers due to the low subsidy offered (20%) for relatively expensive systems.

11. **Vidore hill torrent scheme.** This subproject was added to the project and constructed in 1996 at a cost of about Rs176 million (US\$4.5 million) to redistribute flows more equitably in the three branches of the Vidore river in accordance with long-standing water rights and to spread water over an estimated cropped area of about 10,600 ha at a cost of about US\$425/ha. According to the feasibility study the runoff from a storm with a return period of two years, which corresponds to runoff of about 27 mm from the whole of the 770 km² catchment, would provide about 200 mm (less losses) of irrigation to the cropped area. A storm with a five year return period would provide about 300 mm. The feasibility study estimated that the subproject would increase the cropping intensity from 30% to 93% and avoid damage to the D.G.Khan canal and the town of D.G.Khan. Commencement of construction of the main gabion diversion structures was delayed until August 1996, due to slow release of funds and slow preparation of design documents, but was commendably completed by December 1996. However, the OFWM structures planned to divert flood waters to farmers fields were not commenced due to a decision of the Government of Punjab to delay this work until after the primary diversion structures were completed. The functionality and benefits of the system have not yet been tested by any substantial floodwater flow.

12. **Precision land leveling (PLL).** The area of land leveling is reported to be about 40,000 ha, about 72% of the SAR target. Other than in Punjab, where about 4,000 ha were leveled using laser controlled equipment, the use of lasers for PLL has been slight: about 550 ha in Balochistan and roughly 1,000 ha in NWFP. No lasers were used in Sindh, FATA or FANA due to the delayed procurement of the laser

^{1/}

Following a decision of the December 1993 supervision mission for equity and efficiency reasons.

equipment, inability of the project staff to operate the equipment until recently and, to a lesser extent, to the reluctance of the farmers to pay the fairly modest hire charges (normally less than the rate for hiring a tractor). The results from laser land leveling are reported to be good with most of the benefits expected in the SAR being obtained.

13. **Engineering and irrigation agronomy field teams.** Two significant changes were proposed to field team operation in this project as compared with OFWM II: (i) an increased number of teams to carry the extra workload; and (ii) posting of separate engineering and irrigation agronomy teams (IATs). The establishment of separate IATs was aimed at achieving greater project emphasis on increasing agricultural production from saved water and thus ensure sustainability of benefits. In fact, in all provinces and federal areas the engineering and irrigation agronomy personnel were contained in single operational teams, deployment of agronomists started very late in several instances, and there were frequent transfers and numerous vacancies in the agronomy cadres.

14. The performance of the engineering group of the field teams was satisfactory with watercourse improvements mostly meeting targets and work completed to satisfactory design and quality standards. However, a review^{1/} of the irrigation agronomy groups of the field teams deemed their performance unsatisfactory, as assistance to farmers to improve efficiency of use of saved water and improve agricultural production was judged as being limited. The sub-optimal performance of IATs to obtain the necessary improvement in water management and agricultural production was partially due also to basic design flaws for this component. The project design was unrealistic in expecting these small teams to be able to: (i) organize WUAs; (ii) set up demonstration plots (centers) each year in newly improved watercourses as well as maintain a proper "after-care" service to these demonstration centers in subsequent years; and (iii) provide information, training and technical support to farmers in all aspects of water management. The expectation was that the Agriculture Extension Directorate (AEDs) would provide support to IATs which was not materialized. Strengthening of AEDs was expected from other projects, therefore, funds were not provided under the project. The operational cooperation between AEDs and OFWM Directorates was minimum except for providing training of extension agents at the Water Management Training Institutes.

15. **Demonstration centers.** Deficiencies in utility and impact of demonstration plots in earlier OFWM projects led to the proposal for Demonstration Centers (DCs) to be established on suitable areas of land (up to 2 ha in size) in one of every 6-8 watercourses improved in this project. The intention was for these DCs to be operated through project completion and demonstrate a full range of water management practices and irrigation agronomy techniques to farmers for the main crops grown in local areas. The project was expected to provide technical assistance for the planning and design of the water management improvements, additional agricultural inputs and PLL. In reality, the DCs still remained as demonstration plots, were mostly established for only one year (two crop seasons) and did not provide crop production inputs. A random survey by WMED^{2/} of 10 demonstration centers in all provinces and FATA found that dissemination of information to neighboring farmers in all but two centers was limited and adoption of practices demonstrated was limited because farmers lacked resources and modern equipment, despite demonstration farmers using higher levels of crop production inputs, improved cultural practices and having increased net income.

^{1/} "Impact assessment of post-training activities of irrigation agronomy field teams and farmers", Sheladia Associates Inc., National Engineering Services Pakistan (Pvt) Ltd, June 1995.

^{2/} Draft final report of WMED, February 1997.

16. **Increased agricultural production.** As a result of improvements to water supply systems and consequent overall increase in on-farm water supplies of 26%, cropping intensities increased by 1%-17%, crop yields increased by 9% for rice, 4%-63% for wheat, 5%-10% for seed cotton, 14%-21% for sugarcane, 4% for fruits and 6%-46% for fodders (Appendix C). While changes in areas of wheat, rice and sugarcane varied, depending on locality or groundwater quality, cotton, maize and orchard areas increased throughout the project area.

17. It is concluded that the objective of increasing agricultural production as a consequence of increased water supply due to improvements was satisfactorily achieved. The increase in agricultural production was mainly due to increase in water supply, and efficiency gains as a consequence of improved OFWM practices attributable to the strengthened irrigation agronomy program were minimum.

Institutional Development

18. **Offices and residences.** Because of earlier OFWM programs, there was little need for additional buildings. Provision was only made for five offices and houses to be constructed for field teams in more remote locations in Balochistan province in order to complete such facilities for all 17 teams deployed in the province. These were constructed.

19. **Equipment and vehicles.** Laser land leveling equipment, and office and survey equipment were provided for under the project. Laser land leveling equipment was also received from non-project sources in all provinces. However, equipment and vehicles supply from the federal source was very much delayed. Less than half of the 70 pick-ups, 52 jeeps, 9 cars, 236 motorcycles and 210 bicycles scheduled for the project were purchased, mainly through the FCU but also directly by the provinces (less costly items in particular). Considerable delays were experienced in delivery of vehicles to provincial agencies, mostly because of the time consuming purchasing procedures used in ICB at the Federal level.

20. **Training of OFWM staff.** Information provided by provinces indicated some 3,490 professional and 1,558 non-professional staff were trained during the project. These numbers are obviously much larger than those OFWM staff deployed as it includes field staff from other line departments (extension services, for instance) and non-government organizations (NGOs). No training was given in Balochistan because new teams were not recruited; the teams trained under the first two OFWM projects continued to operate for OFWM III. Other training included the training of social organizers and irrigation agronomy teams in the development of sustainable WUAs. A series of workshops was conducted by Bank and Overseas Economic Cooperation Fund of Japan (OECF) consultants to introduce concepts of OFWM. These were followed by a comprehensive in-service training program.

21. **Farmer Training Centers and Training Institutes.** Limited support was to be provided under the project for strengthening Provincial Training Institutes in Balochistan and Sindh. Little support was given in Sindh and a hostel was constructed late in the project in Balochistan. Of the proposed five Farmer Training Centers (FTCs) in Punjab province to provide farmer training in improved on-farm water management, only three centers were established. It is estimated that about 20,000 farmers were given training. Further consideration needs to be given to how farmer training could be expanded. This should include an assessment of the required number of FTCs (for common use by all directorates of DOAs) to provide adequate formal training for farmers as well as the possible establishment of Farmer Training Schools for more direct informal training in farmers' fields.

22. In conclusion, while the capability of the provincial OFWM directorates to carry out watercourse improvements to improve water supply has been further strengthened by the project, the capability of their staff to carry out and/or to expand demonstration programs has remained limited. Training of farmers and extension agents in improved OFWM practices has been carried out, while their linkages and coordination with extension directorates has been less than satisfactory.

Strengthening of Water Users' Associations (WUAs)

23. WUAs were organized by OFWM-irrigation agronomists, according to enacted provincial laws as a prerequisite to watercourse improvement. Enactment of new WUA Ordinances were required in FATA and FANA as a condition for inclusion in the project. The sustainability of the WUAs involvement as an association, which was expected to be improved in this third project phase, does not appear any greater^{1/}. The activity and enthusiasm of the WUAs still remain greatest during watercourse renovation and within one year most WUAs revert to informal alliances. This does not appear to be dependent on the way they were organized or the fault of farmers, but rather a function of the narrowly defined charter of WUA activities.

24. It is concluded that while WUAs were satisfactorily formed as a prerequisite to improvement of watercourses and there is a more efficient O&M of improved watercourses, the majority of WUAs have become inactive within two years following watercourse improvement. The WUAs can only stay active if they have continuous and essential role in irrigation management. This consists of distribution of water to the users and collection of water charges. Since both of these functions continued to be performed by the Government after improvement of watercourses, the WUAs become inactive. In Pakistan's irrigation system the water supply is controlled at the distributary/minor head (above mogha). Therefore, formation of farmers organization at the distributary/minor level with responsibility for distribution of water and collection of revenue is essential for effective participation of farmers in managing the irrigation system. The distributary/minor also covers a sufficiently large area to support the operation of farmers organization through professionals.

Cost Recovery from Beneficiaries

25. In order to reduce the financial burden of the government and to ensure the sustainability of OFWM programs, the GOP implemented partial capital cost recovery from farmers for project works. Punjab and Sindh provinces achieved the target recovery rate of 90% of amount due from the farmers by June 30, 1992 and December 31, 1993, respectively. However, the recovery rate in these provinces declined thereafter, until upfront cost recovery was implemented from July, 1995. During the project's extended implementation period, the provincial governments (except in Balochistan initially) agreed that all cost sharing would be by advance payments and supply of materials and labor in place of the previous system of cost recovery partly in advance and partly in installments^{2/}. Farmers in many improved watercourses visited by the ICR mission, particularly in Punjab and Sindh, reported that they had

^{1/} "Sustainability of Water User Associations and their working as formal organizations", Chapter 5, Draft Report of WMED, February, 1997.

^{2/} The cost sharing with beneficiaries was: Punjab - 30% of material costs and farmers also provide 100% of the cost of sand, labor and masons; and for Sindh and NWFP - 25%. There was no change in the cost sharing of 20% in FATA and FANA. In Balochistan, 15% of the cost of materials was paid upfront and 15% was recovered in six biannual installments

difficulties in paying the upfront cost sharing, while many farmers in unimproved water courses reported that they did not have sufficient incomes to meet the upfront cost sharing. Analysis of the financial impact of capital cost sharing, however, shows that payments due are in most cases a small proportion of annual net farm income and at an acceptable level for farmers in improved watercourses (Appendix C). Present level of upfront contribution required from beneficiaries could be too high in Balochistan fruit zone where the project works serve a limited number of farmers (only one in some cases). Considering that a maximum number of farmers should benefit from the limited project resources, such schemes serving only a few farmers should be given low priority.

26. Full recovery of amount due from the beneficiaries was obtained in Balochistan, NWFP and FATA by December 31, 1996. Although the upfront cost sharing was implemented from July 1995, because of the cumulative arrears from low recoveries between 1993-95, cost recovery remained low at 68% in Punjab and slightly higher at 80% in Sindh. The low recovery rate was due to: (i) difficulties in collection by OFWM staff who had the responsibilities to undertake OFWM works and at the same time act as collection agents for the Revenue Department (RD); (ii) unsatisfactory performance of RD staff after the collection responsibilities were delegated to them, although OFWM staff were required to continue providing assistance to the RD; and (iii) suspension or postponement of collection due to natural calamities (floods, drought, etc.). It appears that involvement of beneficiaries (who are the joint owners of watercourses and have joint financial liability and other responsibilities to develop and sustain the watercourses) in arrears collection would have helped to overcome the low collection rates.

27. It is concluded that, while there were earlier problems with the partial recovery of the costs of civil works associated with watercourse and water tanks improvements, these have been solved with the later introduction of upfront payments from farmers, which has resulted in a significant reduction in the government's financial obligations.

28. **Pilot Project.** It was agreed during project implementation that the original proposal to finance a study on "Possible role of WUAs in the distribution of irrigation water within watercourses and minor canals" (to be completed by June 30, 1993) would be canceled and instead a "Pilot Project for Farmers' Participation in Irrigation Management" would be established in NWF and Punjab provinces. It was initially planned for 18 months, but it was recognized that this would be a very short time for such a pilot project. The Pilot Project in NWFP commenced in November 1994 on two minors (Surazai and Pabbi), but was greatly delayed in Punjab (commenced April 1996). Considerable technical assistance, particularly from sociologists, was given in supporting the activities in these pilot areas. As the objectives of the pilot project were only partially achieved by Credit closure, external support has been continued under the OECF-funded OFWM project.

29. In NWFP, the project activities have been centered on formation of WUAs, their executive committee and numerous sub-committees (for by-laws, Survey, Cost Recovery, Construction and Mobilization). There has been a considerable investment in project staff time to support these activities. However, at present WUAs have not yet been established at all watercourses in the two minors. With regard to establishing a Federation of WUAs, while preliminary activities on completion and approval of by-laws, and awareness programs with farmers on federation and election of representatives from WUAs have been undertaken, a Federation has not yet been registered.

Technical Assistance

30. **Supervisory consultants.** About 108 staff-years (141% of the appraisal target of 76.7 staff-years) of locally recruited consultants were provided to assist the implementing agencies in reviewing plans and designs, supervising and monitoring progress and quality of the civil works program and preparing reports. This assistance has been satisfactory.

31. **Technical consultants.** About 11.55 staff years (160% of the appraisal estimate of 7.2 staff years) of internationally recruited technical experts were provided. Their duties and responsibilities were well covered in the contract. However, their interaction with the many implementing agencies remained limited. Contrary to original estimates, the team spent less than 50% of its time in the field. Most of their activities were associated with the Pilot Project and the Vidore Hill Torrent subproject and with preparation of resource materials and reviews. Achievements claimed in the consultants' final report^{1/} include the updating of OFWM field manuals (in English) in conjunction with the supervisory consultants and OECF international consultants, construction management of the Vidore hill torrent subproject, recommendations for alternative materials and technologies for watercourse and canal lining, the design and conduct of training for OFWM staff, social organizers and farmers and assistance to WMED to improved M&E and cost/benefit analysis of watercourse improvement

Project Costs

32. **Project Costs and Disbursements.** Project costs, in US dollar equivalent were close to appraisal estimates. By the Credit/Loan closing date on December 31, 1996, the actual total project expenditures amounted to US\$158.7 million (102% of the total project costs of US\$155.5 million estimated at appraisal). Due to higher local inflation than anticipated the costs in Rupees was 4,929 million, including farmers' cash and labor contribution of Rs1,140 million, Rs80 million for PLL and Rs176 million for the Vidore Hill Torrent control, representing a cost overrun of about 44% over the total project costs of Rs3,422 million estimated at appraisal^{1/}. However, these increases were balanced by depreciation of the Rupee required to accommodate the higher local inflation rate. The IDA Credit of SDR33.4 million (US\$47.9 million equivalent) was fully disbursed on September 30, 1995. The IBRD Loan of US\$36.3 million was fully disbursed as of May 28, 1997.

Project Benefits

33. **External project M&E.** The WMED of WAPDA was commissioned to provide external M&E of the project performance and impact. Detailed objectives, activities and methodologies were defined for this subcomponent in Annex 7 of the SAR. Regular reporting was required and WMED was expected to develop and implement a computerized database system for managing the data regularly collected by field and headquarters staff for analytical evaluation studies. About 125 staff-years of professional services were to be provided at a cost of US\$1.4 million. It was proposed to monitor: (i) 16 watercourses in fresh and saline groundwater areas that would be renovated under OFWM III; and (ii) an additional 8 watercourses to be selected each year which had been renovated under previous OFWM projects.

^{1/} Consultant's Final Report, Sheladiah Associates Inc., World Bank funded On Farm Water Management III, December 1996, Sheladiah Associates, Inc., Islamabad, Pakistan.

^{2/} Excluding the expenditures of the Vidore Hill Torrent control in D.G.Khan, the cost overrun was 39%.

34. The M&E was not very satisfactory due to: (i) sample size (number of watercourses) not being large enough to provide an accurate perspective of project performance and impact on the major crop production systems recognized in Pakistan; (ii) lack of regular reporting of M&E; (iii) high average cost and high professional staff input of M&E (about Rs2.6 million and 1.15 staff years per watercourse); and (iv) lack of timely and regular reporting. Fourteen newly renovated watercourses under OFWM III have been intensively surveyed, and four watercourses from each of OFWM I and OFWM II. Within these watercourses intensive sampling has been conducted on 15 farms, but only in two years (baseline survey in 1992-93 and post-improvement survey in 1995-96). Although the extensive data collection for baseline and the post-evaluation surveys was carried out satisfactorily by WMED, the sample size represented only 0.2% of total watercourses renovated under the project and is considered inadequate to develop a reliable estimate of the changes in overall cropping patterns and productivity of major cropping systems in each province following watercourse improvement. In any M&E of future projects a larger number of watercourses should be sampled, but with a lesser number of farms sampled in head, middle and tail locations of the watercourse.

35. **Internal project M&E.** It is surprising that the provincial OFWM Directorates and FATA and FANA did not regularly collect data to undertake their own evaluation of project performance and impact. The ICR mission requested each OFWM field team to conduct a short survey on two improved watercourses in order to collect additional information on pre- and post- improvement water losses, conveyance efficiency, cropping pattern, cropping intensities, yields of crops, etc., for the reassessment of project impact. Analysis of this data showed much greater improvements to crop production than the WMED surveys, yields were much higher than provincial averages, but in many instances data were incomplete. Therefore these data have only been used to supplement the WMED survey data. M&E is an important activity that provides vital feedback to management and is also extremely useful to justify activities to higher authorities when an M&E system is set up to systematically and objectively monitor and evaluate project implementation and impact.

36. **Project impact.** The reduction in water losses and increases in conveyance efficiency resulting from improvements to water supply systems allowed farmers to bring additional land under cultivation, increased the yield and production of many crops as a result of increased water supply and PLL, reduced time and labor required for irrigation and the maintenance of watercourses and significantly increased farm incomes (Appendix C). The project also had a significant impact on the acceptance of the principle of cost sharing by beneficiaries for physical improvements to water supply systems and their responsibility for O&M at the tertiary level.

37. **Economic rate of return.** The re-estimation of the ERR for the project has been based on limited crop production data from post-evaluation surveys conducted by the WMED Directorate in 13 watercourses, with some adjustments made by the ICR mission where appropriate based on secondary information. Given the small sample size and only one cropping year (two seasons) covered in the M&E surveys, the outcomes of the economic analyses should be treated with some caution. The ERRs have been re-estimated at 23% for the whole project, compared with the SAR estimate of 26%, and they range between 14% and 32% for the provinces and federal areas. The original and revised ERRs are based on all investment costs calculated at constant FY91 and FY96 values, respectively. Higher crop yields and substantial increases in areas of high value crops (vegetables, fruits, etc.) were factors contributing to higher than expected ERRs for Balochistan (31%), NWFP (32%), FATA (30%), FANA (14%) and Sindh (27%), while substantial cost overrun and lower incremental crop yields and reduced command areas of improved watercourses were factors contributing to lower than expected ERRs for Punjab (19%).

C. MAJOR FACTORS AFFECTING THE PROJECT

Factors not Generally Subject to Government Control

38. Social discordance and lack of cash and credit for small farmers in some watercourses resulted in their not qualifying (could not form a WUA and meet cost recovery payments) for watercourse improvement, although a number of farmers wished to participate. A strike by brick-kiln owners in Sindh and some civil unrest in the 1992-94 period in a number of areas hampered project implementation.

Factors Generally Subject to Government Control

39. Problems with cost recovery from OFWM II in Sindh delayed project disbursements. Staff indiscipline and misuse of vehicles due to political interference was a problem in some cases. All provinces would have preferred independent purchasing of equipment and vehicles; there were long delays caused by central ICB procedures at the Federal Government level. Most components were delayed at one time or another within one of the several implementing agencies, resulting from shortage and delays in release of counterpart funding from the provincial governments.

Factors Generally Subject to Implementing Agency Control

40. The provincial OFWM Directorates were able to implement the civil works program successfully because of their long experience in watercourse improvement. The quality of the agronomy program was adversely affected by the deployment of combined engineering and agronomy teams, which was at variance with the SAR, as well as general failure to resolve several implementation issues (lack of mobility, high staff vacancy rate, rapid staff turn-over) faced by such teams, which reduced the effectiveness of the agronomy teams. Some OFWM Directorates had problems in filling vacancies in field teams and appointing irrigation agronomy staff with adequate qualifications.

D. PROJECT SUSTAINABILITY

41. The benefits of the investments made under the project are likely to be sustained. Farmers will continue to maintain the watercourses constructed under the project. However, the efficiency gains made when they were first renovated may decrease over time. The WUAs formed under the project are most active during the watercourse renovations. Their activities reduce after completion of works and some fail to continue to function. Fortunately, this does not mean that maintenance is not done. Instead it is carried out through informal arrangements.

42. Towards sustaining the OFWM program, the GOP and provincial governments are committed to continuing the process of renovation of farm watercourses under future projects. Presently, the program is heavily dependent on continuing donor funds. However, during the project and in subsequent projects the Government has enhanced levels of cost recovery/sharing by the beneficiaries. With this approach it is likely that the program would continue to cover remaining watercourses

E. BANK PERFORMANCE

43. Bank performance during project preparation and appraisal was generally satisfactory. Bank provided adequate resources for project processing. However, it would have been preferable if a more

detailed design/plan about the irrigation agronomy and farmers training component, and M&E had been prepared and agreed with the Borrower during preparation/appraisal. Bank supervision was generally satisfactory. The supervision missions were regular and reports prepared indicate that the missions undertook detailed reviews of implementation progress of the project and, while indicating deficiencies in implementation, gave helpful and constructive advice to overcome such problems. However, they were less successful in directing the improvement of watercourse towards farmers with small landholdings, encouraging the use of less costly lining, and developing proposals to improve the performance of the agronomy teams.

F. BORROWER PERFORMANCE

44. The federal agency and provincial OFWM Directorates generally performed satisfactorily. However, some issues of delays in procurement and staffing and slow release of counterpart funds (mentioned above) should be noted. Initially, OFWM Directorates were very slow in meeting completion targets for watercourse improvement, particularly in FATA, FANA and Sindh, but subsequently they improved their performances. During much of the project period the collection of repayments from farmers as a proportion of the costs of civil works was generally unsatisfactory. There was considerable improvement during the later years of the project, particularly after changing the collection method in July 1995 to introduce upfront cost sharing. The OFWM directorates failed to obtain the necessary cooperation and involvement of the AEDs in project irrigation agronomy program. The FCU performed adequately except in procurement and in deployment and use of technical assistance.

G. ASSESSMENT OF OUTCOME

45. The outcome of the project is assessed as satisfactory in that most of the targets were obtained or exceeded and the project objectives were generally achieved. The project had a positive impact in increasing the income of beneficiaries. The capability of provincial OFWM Directorates was enhanced significantly in implementing the OFWM program. The project also had a significant impact on acceptance of the principles of cost sharing by beneficiaries for physical improvements to water supply systems and their responsibility for O&M at the tertiary level. With introduction of upfront contributions by farmers towards capital costs the sustainability of the program has improved while reducing government's financial obligations.

H. FUTURE OPERATION

46. The irrigation systems will continue to be operated as at present by the farmers involved, generally using a rotational (*warabandi*) system, and there is no reason to suppose that this will not continue satisfactorily. There is no need for any changed plan of operation for watercourses and tanks. In the Vidore Hill Torrent subproject, OFWM works will have to be introduced and normal regular maintenance will be needed for the hill torrent control structures. The OFWM program is extremely beneficial and essential for the sustainability of irrigation system. Participation of the beneficiaries in planning and construction and sharing capital cost is an indicator that these investments are valuable. Their participation could be enhanced if the farmers' organizations have continuous crucial role in O&M of the system. They should be given responsibility for distribution of water and collection of revenue resulting from water charges. In Pakistan's irrigation system, this could be achieved by forming FOs at the secondary canal level i.e. distributaries/minors.

I. LESSONS LEARNED

47. The main lessons learned from implementation of this project which are relevant for future OFWM operations are:

- a) Provincial OFWM Directorates are organized, staffed and mandated to give major support to engineering aspects of irrigation (watercourses and *sailabas*). They have little capability of providing the support for efficient use of water and other agronomic practices in an integrated manner required to improve agricultural production. The intention under the irrigation agronomy component was to strengthen their capacity in this area by introducing irrigation agronomy teams. This approach was not very successful. It would have been better to design the irrigation agronomy component by fostering better linkage with the provincial AEDs which, if needed, could be strengthened with subject matter specialists in efficient water use.
- b) The external and internal M&E program should be improved. The external M&E should be more independent. In any future project it is critical that appropriate (adequate) M&E systems are set up for both external and internal on-going and final evaluation of project performance.
- c) For long term sustainability of the irrigation system, participation of farmers in irrigation management is necessary. Their participation could be enhanced if the farmers' organizations have continuous crucial role in O&M of the system. They should be responsible for distribution of water and collection of revenue resulting from water charges. In Pakistan's irrigation system, this could be achieved by forming FOs at the secondary canal level i.e. distributaries/minors.
- d) There has been a systematic increase in the amount recovered from beneficiaries for investments made in watercourse improvement through several phases of OFWM projects. Improvements have also been made in the system of cost recovery. The recent move to introduce complete up-front payment of the beneficiaries' share has become generally accepted by farmers and removes the problems faced by government in cost recovery. Upfront contribution by the farmers for capital costs also significantly reduces Government's financial obligations. However, too high levels of up-front cost recovery would adversely affect poor farmers with small land holdings from participating in this scheme unless their access to financial markets is made easy and trouble free. Assessment of farmers' financial capacity to meet costs of watercourse improvement is required prior to the introduction of any further increases in the amount of capital cost recovery.
- e) The training component was insufficiently emphasized, particularly the farmer training. Because funding was solely from Government's share of project financing, this created a problem for OFWM directorates in financing such activities due to shortage of counterpart funds. Bank/IDA sharing of financing for such activities might have resulted in their being given higher priority. In any future projects more emphasis should be given to providing appropriate facilities and establishing a suitable modality for farmer training.

PART II: STATISTICAL TABLES**Table 1: Summary of Assessments**

<u>A. Achievement of objectives</u>	<u>Substantial</u> (✓) <input type="checkbox"/>	<u>Partial</u> (✓) <input type="checkbox"/>	<u>Negligible</u> (✓) <input type="checkbox"/>	<u>Not Applicable</u> (✓) <input checked="" type="checkbox"/>
Macro policies				
Sector policies	✓ <input checked="" type="checkbox"/>			
Financial objectives	✓ <input checked="" type="checkbox"/>			
Institutional development		✓ <input checked="" type="checkbox"/>		
Physical objectives	✓ <input checked="" type="checkbox"/>			
Poverty reduction		✓ <input checked="" type="checkbox"/>		
Gender issues				✓ <input checked="" type="checkbox"/>
Other social objectives				✓ <input checked="" type="checkbox"/>
Environmental objectives	✓ <input checked="" type="checkbox"/>			
Public sector management		✓ <input checked="" type="checkbox"/>		
Private sector development		✓ <input checked="" type="checkbox"/>		
Other (specify)				
<u>B. Project sustainability</u>	<u>Likely</u> (✓) <input checked="" type="checkbox"/>	<u>Unlikely</u> (✓) <input type="checkbox"/>	<u>Uncertain</u> (✓) <input type="checkbox"/>	
	<u>Highly</u> <u>satisfactory</u> (✓) <input type="checkbox"/>	<u>Satisfactory</u> (✓) <input checked="" type="checkbox"/>	<u>Deficient</u> (✓) <input type="checkbox"/>	
<u>C. Bank performance</u>				
Identification		✓ <input checked="" type="checkbox"/>		
Preparation assistance		✓ <input checked="" type="checkbox"/>		
Appraisal		✓ <input checked="" type="checkbox"/>		
Supervision		✓ <input checked="" type="checkbox"/>		

D. Borrower performance	<u>Highly satisfactory</u> <input checked="" type="checkbox"/> (✓)	<u>Satisfactory</u> <input checked="" type="checkbox"/> (✓)	<u>Deficient</u> <input checked="" type="checkbox"/> (✓)
Preparation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Implementation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Covenant compliance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Operation (if applicable)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

E. Assessment of outcome	<u>Highly satisfactory</u> <input type="checkbox"/> (✓)	<u>Satisfactory</u> <input checked="" type="checkbox"/> (✓)	<u>Unsatisfactory</u> <input type="checkbox"/> (✓)	<u>Highly unsatisfactory</u> <input type="checkbox"/> (✓)
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Table 2: Related Bank Loans/Credits

Loan/credit title	Purpose	Year of approval	Status
<i>Preceding operations ^{a/}</i>			
1. Khairpur Tile Drainage Project (Cr. 648-PAK)	To improve drainage and reclaim soil (included OFWM).	1978	Completed
2. SCARP Mardan (Cr. 877-PAK)	To improve drainage and reclaim soil (included OFWM)	1979	Completed
3. On-Farm Water Management Project (Cr. 1163-PAK)	To increase agricultural production through (i) improved utilization of irrigation water saved through improved OFWM, (ii) strengthening provincial OFWM Directorates and Federal Water Management Cell, (iii) organisation of farmers into Water User Associations, and (iv) facilitating coordination and cooperation between OFWM Directorates and Extension Services in provincial DOAs.	1981	Closed on December 31, 1985
4. Irrigation Systems Rehabilitation I Project (ISRP-I)(Cr. 1239-PAK)	To improve irrigation system	1982	Completed
5. Balochistan Minor Irrigation & Agric. Development Project (Cr. 1243-PAK)	To construct minor irrigation channels and develop agriculture	1982	Completed
6. Fourth Drainage Project (Cr. 1375-PAK)	To improve drainage and reclaim soil	1983	Completed
7. Command Water Management Project (Cr. 1487-PAK)	To improve irrigation system and OFWM	1984	Completed
8. Left Bank Outfall Drain Project (Cr. 1532-PAK)	To improve drainage/irrigation and OFWM	1985	On-going
9. Second On-Farm Water Management Project (Cr. 1603-PAK)	To increase agricultural production through (i) improved utilization of irrigation water saved through improved OFWM, (ii) improved capability of provincial OFWM directorates to plan and implement an expanding OFWM programme, (iii) facilitating coordination and cooperation between provincial OFWM and Extension Directorates, and (iv) strengthening farmer participation in WUAs.	1985	Closed on December 31, 1991

Table 2: Contd.....

10. SCARP Transition Pilot Project (Cr. 1693-PAK)	To improve irrigation and drainage	1986	Completed
11. ISRP-II (Cr. 1888-PAK)	To improve irrigation system	1988	Completed
12. Private Tubewell Development Project (Cr. 2004-PAK)	To test viability of integrated tubewell development for increasing agricultural production	1989	Completed
<i>Following operations</i>			
1. Second SCARP Transition Project (Cr. 1239-PAK)	To increase agricultural productivity through improved provision of supplementary irrigation water	1991	On-going
2. Fordwah Eastern Sadiqia Project (Cr. 2410-PAK)	To increase agricultural productivity by improving irrigation channels and drainage	1993	On-going
3. Balochistan Community Irrigation & Agri. Development Project (Cr. 2780-PAK)	To develop sustainable farmer organizations to own, and efficiently operate and maintain irrigation systems	1996	On-going
4. Punjab Private Sector Groundwater Development Project (Cr. 2901-PAK)	To increase the scope and productivity of Punjab's irrigation and drainage sub-sector	1997	On-going

Table 3: Project Timetable

Steps in project cycle	Date planned	Date actual/ latest estimate
Identification (Executive Project Summary)		August 1988
Preparation		February/March 1990
Appraisal	October 1989	May/June 1990
Negotiations	March 1990	25-29 March, 1991
Letter of development policy (if applicable)	NA	NA
Board presentation	July 1990	21 May, 1991
Signing	October 1990	31 July, 1991
Effectiveness	29 October, 1991	14 May, 1992
First tranche release (if applicable)	NA	NA
Midterm review (if applicable)	NA	NA
Second (and third) tranche release (if applicable)	NA	NA
Project completion	30 June, 1995	30 June, 1996
Loan closing	31 December, 1995	31 December, 1996

**Table 4: Loan/Credit Disbursements: Cumulative Estimates and Actual
(US\$ millions)**

	FY92	FY93	FY94	FY95	FY96	FY97
Bank Group Disbursements						
Appraisal estimate ^{1/}	19.0	37.5	58.0	79.0	83.6	-
Actual						
IDA Credit	4.1	17.9	33.2	45.1	47.9	47.9
IBRD Loan	0.0	0.0	0.0	10.0	27.1	36.3
Total	4.1	17.9	33.2	55.1	75.0	84.2
Actual as % of estimate	21.6	47.7	57.2	69.7	89.7	100.7
Date of final disbursement		May 28, 1997				

^{1/} IDA Credit of SDR 33.4 million (US\$47.3 million equivalent), and IBRD Loan of US\$36.3 million.

Table 5: Key Indicators for Project Implementation

I. Key implementation indicators in SAR	Province/Agency	Estimated	Revised	Actual	Percent Estimated
Irrigation Infrastructure					
a. Watercourse Renovation (No.) (canal + barani) ^{1/}	Balochistan	920	827	717	78
	NWFP	1010	1364	1326	131
	Punjab	3975	4995	4546	114
	Sindh	1650	1542	1121	60
	FATA	65	56	63	97
	FANA	65	34	8	12
	Total	7685	8818	7781	101
b. Water Storage Tanks (No.)	Balochistan	350	764	756	216
	NWFP	100	137	140	140
	Punjab	45	79	50	111
	Sindh	0	0	0	-
	FATA	10	11	10	100
	FANA	10	7	8	80
	Total	515	998	969	188
c. Sailaba Irrigation Rehabilitation (No.)	Balochistan	35		26	74
d. Hydra Ram Pumps (No.)	Punjab	10	0	0	0
e. Higher Efficiency Irrigation (No.)	Punjab	10	0	0	0
f. Area Benefited (ha) ^{2/}	NWFP	55,350		48,454	88
	Punjab	599,625		643,887	107
	Barani (NWFP & Punjab)	71,388		(60523) ^{3/}	83
	Subtotal (NWFP & Punjab)	726,363		692,471	95
	Balochistan:				
	-Fruit			(21,902)	
	-Mixed			(7,981)	
	-Subtotal	31,100		29,820	96
	Sindh	267,250		161,616	60
	FATA	1,196		1,767	148
	FANA	256		153	60
	Total	1,026,165		885,827	86
g. Precision Land Levelling (ha)	Balochistan	2500	2073	2769	111
	NWFP	5000	5813	5054	101
	Punjab	38000	19308	21889	58
	Sindh	9000	9971	9935	110
	FATA	250	130	110	44
	FANA	250	145	0	0
	Total	55000	37440	39757	72

Demonstration Centres (No.)	Balochistan NWFP Punjab Sindh FATA FANA Total	150 150 500 250 5 5 1060	138 159 776 274 6 4 1357	155 148 724 266 5 2 1300	103 99 145 106 100 40 123
Facilities (No. units)					
Offices and Residences	Balochistan	5		5	100
Training Institutes	Balochistan	1		1	100
Farmer Training Centres	Sindh Punjab	1 5		1 3	100 60
Vehicles (No. units)					
Pickups		70		31	44
Jeeps		52		25	48
Cars		9		0	0
Motorcycles		236		0	0
Bicycles		210		0	0
Staff, Field Teams (No.)					
a. Engineering	Balochistan NWFP Punjab Sindh FATA FANA Total		17 13 57 25 1 1 114	17 13 57 25 1 1 114	100 100 100 100 100 100 100
b. Irrigation Agronomy	Balochistan NWFP Punjab Sindh FATA FANA Total		17 13 57 25 1 1 114	0 13 57 25 1 0 96	0 100 100 100 100 0 84
Technical Assistance (Staff Years)					
Supervisory Consultants		76.7		108.00	141
Technical Experts		7.2		11.55	160
Training (Number)					
Government Staff				5048	
Farmers				19316	

^{1/} Includes 264 watercourses in Fordwah East Sadiqia Project financed by OFWM III

^{2/} The "actual" figures for area benefited were given to the ICR mission. Subsequently, NWFP and Balochistan submitted revised figures totalling 946,350 ha (92% Of SAR). The mission was unable to verify these figures.

^{3/} The actual benefited barani areas are not separated but included in the total figures for NWFP and Punjab

Table 6: Key Indicators for Project Operation

(This table is not applicable to this project)

Table 7: Studies Included in Project

Study	Purpose as defined at appraisal/redefined	Status	Impact of study
1. Possible role of Water User Associations in the distribution of irrigation water within watercourses and minor canal commands.		Not under- taken	Study replaced by Pilot Projects in NWFP and Punjab

Table 8A: Project Costs

Item	Appraisal estimate ^{1/}		Actual/latest estimate	
	Rs M	US\$ M	Rs M	US\$ M
Civil Works	1,792.00	81.45	2,902.30	93.45
Equipment	116.16	5.28	99.52	3.20
Technical Assistance	126.28	5.74	94.02	3.03
Training	15.18	0.69	NA	NA
Monitoring & Evaluation	35.42	1.61	32.20	1.04
Supervision & Administration	379.06	17.23	811.01 ^{2/}	26.11 ^{2/}
Total Cash Cost	2,465.00	112.00	3,939.05	126.83
Farmers Labour Contribution	957.00	43.50	989.56	31.86
TOTAL	3,422.00	155.50	4,928.61	158.69

^{1/} Including price contingencies.^{2/} Including training.**Table 8B: Project Financing**

	Appraisal Estimates	Actual/ICR Estimate
Source		
IDA	47.3	47.9
IBRD	36.3	36.3
Government of Pakistan	22.4	37.8
Farmers (cash)	6.0	4.8
Total Cash Cost	112.0	126.8
Farmers Labour Contribution	43.5	31.9
TOTAL	155.5	158.7

Table 9: Economic Costs and Benefits**A. Direct Benefits**

	Appraisal Estimates	ICR Estimates
No. Beneficiaries	250,000	197,170
Benefited Areas (ha)	1,026,165	885,827
Incremental Production (tons):		
Paddy	46,300	23,000
Wheat	104,100	60,400
Seed Cotton	25,900	65,000
Sugarcane	122,900	-35,000
Fodder	928,000	29,000
Fruits	37,500	91,900

B. Economic Benefits

	Appraisal Estimates (ERR %)	ICR Estimates (ERR %)
Provinces/Federal Areas		
Balochistan	19	31
NWFP	25	32
Punjab	28	19
Sindh	24	27
FATA	14	30
FANA	14	14
Whole Project	26	23
Assumptions		
Project Life (years)	20	20
Incremental cropping intensity (%)	4-12	2-17
Incremental crop yields (%)	5-13	4-28
SCF	0.90	0.90

C. Financial Impact

	Appraisal Estimates	ICR Estimates
Net project costs to GOP as % of total project costs ^{1/}	58	87
Net Project Costs to GOP after Cost Recovery as % of total project costs ^{1/}	48	78

^{1/} Discounted at 10% over 20 years.

Table 10: Status of Legal Covenants

Agreement	Section	Covenant type ^{a/}	Present status ^{b/}	Original fulfillment date	Revised fulfillment date	Description of covenant	Comments
DCA	4.01	1	C	3/31 each year		FCU and MINKA (FATA) to maintain records and accounts, have them audited each fiscal year, and furnish audit reports to IDA	
Project Agrmt (PA)	3.01	1	C	3/31 each year		The Provinces and FATA to maintain records and accounts, have them audited each fiscal year, and furnish audit reports to IDA	Audit reports were submitted with general delays
DCA	4.02	2	C	7/1/91		Implement in FATA and FANA a policy to recover (a) 20% of the cost of construction materials for watercourses renovation and water storage tanks as a lump sum advance, and (b) 80% of the cost of installing hydra ram lifting/other high efficiency irrigation devices from farmers as a lumpsum advance	
DCA	4.03	12	CD	6/30/93	12/31/96	Carry out a study on WUAs role in the distribution of water in minor canal and watercourse commands, and implement recommendations of such study as agreed with IDA	Pilot projects instead of the study have been implemented in NWFP and Punjab
DCA	Schedule 1, subpara b & c	12	C			Reimbursements for expenditures made by FANA and FATA not to commence unless WUA Legislation for FANA and FATA satisfactory to IDA enacted	
DCA	Schedule 1, subpara d	2	C			Reimbursements for expenditures made by Sindh not to commence unless it has reached a recovery level of 25% for amounts outstanding from farmers under OFWM II project	
DCA	Schedule 4, Part A.1.a	5	C			Project coordination at the federal level shall be assigned to FCU established in MinFAC with staffing and reporting arrangements satisfactory to IDA	
DCA	Schedule 4, Part A.1.b	9	C	4/1 each year, annual & quarterly reports within 60 days		FCU to prepare, inter alia, annual work plans based on inputs from implementing agencies; prepare consolidated quarterly and annual reports; procure equipment through ICB; appoint supervisory consultants and technical experts; and to conclude M&E contract with WAPDA	
DCA	Schedule 4, Part A.2.b	9	C	3/1 each year, annual & quarterly reports within 30 days		Each Provincial OFWM Directorate, inter alia, prepare annual work plans as input to ADP and to consolidate project work plan; submit annual and quarterly progress reports to FCU; organize, register, train, and assist WUAs; and procure local equipment/materials	
DCA	Schedule 4, Part A.5.e	5	CD	9/30/91	9/30/93	Provinces, FATA, and MINKA shall prepare and furnish to IDA for review operational action plans for their respective irrigation agronomy field teams	
DCA	Schedule 4, Part C 10	5	CD	9/30/91; 6/30/91 as revised date for technical experts	6/30/92	Supervisory consultants and technical experts shall be appointed in accordance with Bank guidelines	
DCA	Schedule 4, Part C 11	5	CD	9/30/91	9/30/93	A training programme shall be prepared on the basis of requirements from Provincial OFWM Directorates, MINKA, and FATA and furnished to IDA through FCU	
DCA	Schedule 4, Part C 13	9	CD	9/30/91	6/30/92	MINFAC, through FCU, shall enter into an inter-agency agreement with WAPDA under terms and conditions satisfactory to IDA for carrying out the impact evaluation of the Project	
PA	2.01 (a)	4	C			The Provinces and FATA shall carry out activities under the project with due diligence	

Agreement	Section	Covenant type ^a	Present status ^b	Original fulfillment date	Revised fulfillment date	Description of covenant	Comments
PA	2.01 (c)	1	C			and efficiency ..., and shall provide ... the funds, facilities, services and other resources required for their activites under the Project The Provinces shall open and maintain in dollars special accounts in the National Bank of Pakista, on terms and conditions satisfactory to IDA	
PA	3.02 (a)	2	C	7/1/91		The Provinces shall implement a policy of cost recovery from farmers the cost of construction materials to be provided under the future OFWM project, including the Project, in respect of renovation of watercourses and construction of water storage tanks, as follows: <u>Punjab</u> : 30% cost recovery in 6 equal instalments over 3 years with no grace period; <u>Sindh</u> : 30% cost recovery, 10% as a lump sum advance and 20% in 10 equal instalments over 5 years with no grace period; <u>NWFP</u> : 20% cost recovery as a lump advance ; and <u>Balochistan</u> : 25% costrecovery, 10% as a lumpsum advance and 15% in10 equal instalments over 5 years with no grace period	In July, 1995 cost recovery arrangements were revised as following: Punjab: farmers paid 30% of the material cost upfront and provided sand, and skilled (masons) and unskilled labor; Sindh and NWFP: 25 percent of the cost upfront. Balochitan: 15% of cost upfront and another 15% recovered in six biannual installments.
PA	3.02 (b)	2	C	7/1/91		The Provinces shall implement a policy to recover from farmers 80% of the cost, as a lumpsum advance, in respect of installation of hydra ram lifting and other high efficiency irrigation technology devices to be provided under the future OFWM projects, including the Project (OFWM III)	
PA	3.03 (a)	2	CP	6/30/92		Punjab shall take measures to recover the cost of construction materials provided to farmers under OFWM II Project so as to reach a recovery level of 70% by December 31, 1991, 85% by March 31, 1992, and 90% by June 30, 1992	90% achieved by June,92 but not maintained thereafter. Recovery status as of 31 December 1996 was 65% in Punjab
PA	3.03 (a)	2	CP	12/31/93		Sindh shall take measures to recover the cost of construction materials provided to farmers under OFWM II Project so as to reach a recovery level of 45% by June 30, 1992, 70% by December, 1992, and 90% by December 31, 1993	90% achieved by December, 1993 but not maintained thereafter. Recovery status as of 31 December 1996 was 76% in Sindh

^a **Covenant Type:** 1 - Accounts/audit; 2 - Financial performance; 3 - Flow and utilization of project funds; 4 - Counterpart funding; 5 - Management aspects of the project; 6 - Environmental covenants; 7 - Involuntary resettlement; 8 - Indigenous people; 9 - Monitoring, review and reporting; 10 - Implementation; 11 - Resource allocation; 12 - Regulatory/institutional action; and 13 - Other

^b **Status:** C - Complied with; CD - Compliance after delay; CP - Complied with partially; SOON - Compliance expected in reasonable time; NYD - Not yet due; and NC - Not complied with.

Table 11: Compliance with Operational Manual Statements

Statement number and title	Describe and comment on lack of compliance
1. No deviations from applicable operational manual statements were noted	

Table 12: Bank Resources: Staff Inputs

Stage of project cycle	Planned ^{1/}		Revised ^{1/}		Actual ^{2/}	
	Weeks	US\$	Weeks	US\$	Weeks	US\$ (000) ^{3/}
Preparation to appraisal	-	-	-	-	38.4	76.7
Appraisal	-	-	-	-	63.9	124.5
Negotiations through Board approval	-	-	-	-	24.9	50.6
Supervision	-	-	-	-	109.5	172.4
Completion	-	-	-	-	-	-
TOTAL					236.7	424.2

^{1/} Estimates for original and revised staff weeks and dollar budgeting only introduced in FY95 and therefore total original and revised staff weeks and costs cannot be computed.

^{2/} Data from World Bank MIS.

^{3/} Includes US\$300 for Grade 18-21; US\$37,600 for Grade 22-23; US\$6,000 for Grade 24-25; US\$241,000 for unidentified grades; US\$110,400 for consultants and US\$28,800 for all other staff.

Table 13: Bank Resources: Missions

Stage of project cycle	Month/ year	Number of persons	Days in field	Specialized staff skills represented ^{a/}	Performance rating ^{b/}		Types of problems ^{c/}
					Implementation status	Development objectives	
Through appraisal	May/June 1990	5	27	Ec(2),Ag,W M,IE	—	—	—
Appraisal through Board approval					—	—	—
Supervision	April/May 1993	3	14	IE,Ag,So	2	2	F,M
	Dec./Jan. 1993-94	2	19	IE,Ag	2	2	F,M
	June/July 1994	4	29	IE,Ag,IS,So	S	S	F,M
	Jan./Feb. 1995	2	12	IE,Ag	S	S	
	April 1996 ⁱ	2	13	IE,Ag	S	S	
Completion	Feb/Mar 1997	3	22	Ag,IE,E	—	—	—

^{a/} Staff specialisations: Ag-Agriculturist; RS-Research Specialist; Ar-Architect; Ec-Economist; Ho-Horticulturist; IS-Institutions Specialist; and PS-Procurement Specialist.

^{b/} Performance ratings based on IBRD and IDA - Implementation Summary Form 590

^{c/} Types of problems: T-Technical; M-Managerial; and F-Financial.

ⁱ Informal supervision and implementation assistance was provided by the Bank staff in between long supervision intervals.

IMPLEMENTATION COMPLETION REPORT

PAKISTAN

**THIRD ON-FARM WATER MANAGEMENT PROJECT
(Cr. 2245/Ln. 3327-PAK)**

Appendix A: Mission's Aide-Memoire

**PAKISTAN: Third On-Farm Water Management Project
(Loan 3327/Credit 2245-PAK)**

**FAO/World Bank Cooperative Program ICR Mission
12 February to 6 March 1997**

Mission Aide-Memoire

A. INTRODUCTION

1. At the request of the World Bank, an FAO/CP Mission^{1/} visited Pakistan from 12 February to 6 March 1997 to meet with officials of the Federal Coordination Unit (FCU) of the Ministry of Food, Agriculture and Cooperatives (MinFA), the On-Farm Water Management Directorates (OFWMD) of provincial Departments of Agriculture, the Federally Administered Tribal Areas (FATA) and the Watercourse Monitoring and Evaluation Directorate (WMED) of the Water and Power Authority Development Authority (WAPDA) to obtain relevant information for the preparation of the Implementation Completion Report (ICR) for this project. Field visits were made to a number of centers in Balochistan, Northwest Frontier, Punjab and Sindh provinces and FATA. Irrigation water distribution systems constructed and renovated under the project were inspected. Meetings were held with staff of local units of the provincial OFWMDs and farmers to discuss project activities and benefits obtained from project interventions. The mission briefed the Secretary of Agriculture in each province.

2. The mission wishes to thank all staff of the FCU and units of the provincial OFWMDs and farmers visited for their kind hospitality and the information and assistance given with arranging meetings and field visits and in preparation of the ICR for this project. The preliminary findings and views presented in this draft Aide-Memoire reflect those of the mission, based on discussions with staff of OFWMDs and farmers visited in project areas and from prior consultation of project documents at the World Bank. The Aide-Memoire has been amended to take into account many points raised in a final wrap-up meeting, chaired by the Additional Secretary of MinFA, Government of Pakistan (GOP) on March 6, 1997. Additional points raised will be covered in the ICR.

B. THE PROJECT

3. The GOP requested the International Development Association (IDA) and International Bank for Reconstruction and Development (IBRD) to finance the Third On-Farm Water Management Project (OFWMP III) because of the positive impact of the first two IDA assisted OFWMPs (OFWM I, Cr. 1163-PAK; and OFWM II, Cr. 1603-PAK) and the strong demand from farmers.

4. The project was prepared during February/March 1990 by a team of national consultants and appraised by an IDA mission in May/June 1990. Project effectiveness was delayed due to several postponements of negotiations of the loan and credit agreements and slow progress of provincial governments in effecting agreed cost recoveries from the previous OFWMPs prior to project commencement.

^{1/} Messrs. D. A. Ivory (Mission Leader), R. G. Paterson (Irrigation Engineer) and T. Lohavisavapanich (Economist)

5. The rationale for the project was to support GOP policy to reinforce the huge investments made in irrigation infrastructure by improving the efficiency of water delivery and use and to continue Bank assistance to Pakistan's OFWM program, by providing external financial and technical assistance to continue the renovation of the remaining 89,300 unimproved watercourses. The objectives^{1/} of the project were (i) to increase agricultural production through improved on-farm water management (OFWM) practices; (ii) to enhance the capabilities of OFWM agencies to enable them to carry out an expanding OFWM program and to facilitate their coordination with the extension agencies; (iii) to strengthen Water User Associations and to increase farmer participation in them so as to improve water and non-water input management and to ensure efficient operations and management (O&M) of installed facilities; and (iv) to reduce the Borrower's financial obligations in respect of OFWM works through increased cost recovery and encouragement of WUAs to assume O&M responsibilities.

C. MISSION FINDINGS

Project Implementation Record and Major Factors Affecting the Project

6. The original five-year project was approved on July 31, 1991, but only became effective on May 14, 1992 and closed on December 31, 1996, following a one-year extension to Credit closure. The OFWMP III has a national perspective and has provided assistance to each of the four provincial OFWMDs, the FATA and the Federally Administered Northern Areas (FANA). An additional component (Vidore Hill Torrent Scheme) was introduced to control and utilize flood waters for agricultural purposes in barani areas in D.G.Khan area of Punjab province, as part of the extension phase. The project achieved most of its physical targets but was less successful in achieving its main objectives, as indicated in subsequent sections.

Project Costs

7. **Total project costs.** By the Credit/Loan closing date on 31 December 1996, the actual total project expenditures amounted to Rs4,929 million, including farmers' cash and labour contribution of Rs1,140 million, Rs80 million for precision land leveling (PLL) and Rs176 million for the Vidore Hill Torrent control, representing a cost overrun of about 44% over the total project costs of Rs3,422 million estimated at appraisal^{1/}. The main contributing factors were the substantial increases in the unit costs of civil works and a 114% increase in the costs of project supervision and administration, both of the provincial OFWM III offices and the supervisory consultants. However, due to the substantial depreciation of the rupee against US dollar, the actual total project expenditures amounted to US\$158.7 million, 102% of the total project costs of US\$155.5 million estimated at appraisal.

8. **Disbursements.** The IDA Credit of SDR33.4 million (US\$47.9 million equivalent) was fully disbursed on 30 September 1995. For the IBRD Loan of US\$36.3 million, total disbursement as of 11 February 1997 stood at US\$34.9 million (96%). As the amount of expenditures incurred during October to December 1996 were substantial, amounting to about US\$5.0 million, the balance of the IBRD Loan of US\$ 1.4 million is expected to be fully disbursed by 30 April 1997.

^{2/} As described in Schedule 2 of the Development Credit Agreement.

^{3/} Excluding the expenditures of the Vidore Hill Torrent control in D.G.Khan, the cost overrun was 39%.

9. **Capital cost recovery.** In order to reduce the financial burden of GOP and also to ensure the sustainability of the OFWM Program, the GOP agreed to implement partial capital cost recovery from farmers for water course renovation, construction of water storage tanks, Sailaba irrigation, precision land leveling, installation of hydra ram pumps and higher efficiency irrigation schemes, and to increase the collection efficiency. After considerable delay, Punjab and Sindh provinces satisfactorily complied with the legal covenants in implementing the above capital cost recovery, to achieve a targeted recovery rate of 90% by June 30, 1992. During the project's extended implementation period, the provincial governments agreed to implement upfront cost sharing^{1/} (except in Balochistan) by collecting a lump sum advance payment from farmers prior to construction in place of the cost recovery in installments. Farmers in many improved water courses visited by the ICR mission, particularly in Punjab and Sindh, reported that they had difficulties in paying the upfront cost sharing, while many farmers in unimproved water courses reported that they did not have sufficient incomes to meet the upfront cost sharing. During the preparation of ICR, the mission would reassess the financial impact on farm income from the water course renovation as well as the farmers' financial capacity to meet costs associated with the above methods of capital cost recovery, taking into account the strong views expressed by the provincial authorities at the wrap-up meeting against reintroducing installment financing.

10. Although the upfront cost sharing was implemented from July 1995, because of the cumulative arrears from low recoveries between 1993-95, overall recovery as of 31 December 1996 remained low at 65% in Punjab, 76% in Sindh and slightly higher at 80% in Balochistan. The low recovery rate was due to: (i) difficulties in collection by OFWM staff who had the responsibilities to undertake OFWM works and at the same time act as collection agents for the Revenue Department (RD); (ii) unsatisfactory performance of RD staff after the collection responsibilities had been handed over to them, with OFWM staff required to continue assistance to the RD; and (iii) suspension or postponement of collection due to natural calamities (floods, drought, etc.). It appears that involvement of beneficiaries (who are the joint owners of watercourses and have joint financial liability and other responsibilities to develop and sustain the watercourses) in arrears collection would have helped to overcome the low collection rates.

Irrigation System Improvement

11. **Watercourse renovation.** About 7,781 watercourses (101% of the SAR target), including 264 in Fordwah Eastern Sadiqia Project, with a total culturable command area (CCA) of about 846,000 ha (80% of the area assumed in the SAR) were improved. Targets for number of watercourses were exceeded in NWFP and Punjab, but fell short in Balochistan, Sindh and FANA. In FATA the target was met. The reason for the shortfall in Sindh (68% of target in canal areas and 61% of the target in barani) was a lack of Water Users' Associations (WUAs) able to meet the financial requirement to pay 25% of the cost of materials in advance, despite this being reduced during the project from 30% (10% advance and 20% in installments). The criterion in the SAR that watercourses to be improved should be operated predominantly by low-income farmers with small landholdings has not always been observed largely because such farmers cannot easily find the necessary deposit.

^{4/} The proposed cost sharing with beneficiaries was: Punjab 30% of material costs as cost sharing and farmers also provide 100% of the cost of sand and masons; and Sindh 25%. There was no change in the cost sharing of 20% in NWFP, FATA and FANA. In Balochistan, 15% of the cost of materials as advances and 15% recovered in six biannual installments

12. Most watercourses were built of "double brick" walls on brick or concrete beds. The less costly "single brick" suggested by the SAR was not adopted. In Balochistan, in particular, *in situ* concrete and pre-cast pipes were preferred. The quality of construction seen by the mission was generally satisfactory with mortar-faced brickwork in good condition, sometimes after ten or more years for watercourses improved under earlier Bank projects. On average the length of lining was about 780 m per watercourse or about 7 m per ha of CCA, representing about 24% of the total length improved. The mission found no evidence that the computer program prepared by the international consultants was used to determine the length to be improved. The SAR stipulation that the maximum number of culverts would be four per watercourse seems to have been, quite sensibly, ignored and culverts have generally been built where needed: one watercourse is reported to have 22; the average is about one per watercourse. The average length of earth channel reported as being improved was about 2,400m per watercourse or about 22 m/ha of command area. The improvement of farm branches and field ditches does not on the basis of the missions observations appear to have resulted in lasting improvements to earth channels. The average cost of materials and skilled labour per meter lined was Rs 347/m. Unskilled labour provided by the WUA, if priced at market rates, would add about 25% to the cost of lining.

13. **Improved water availability.** Improving watercourses, including lining, increases efficiency by reducing seepage, evaporation, spillage and operating losses. The Watercourse Monitoring and Evaluation Directorate (WMED) of the Water and Power Development Authority (WAPDA) was employed under the project to measure watercourse irrigation efficiency before and after improvement of the watercourses. On the basis of the measurements by WMED for this project^{1/}, the amount of water delivered to farms has increased by an average, weighted according to the number of watercourses improved, of 26%. These results are comparable with other reported increases including 34% by Punjab Economic Research Institute (PERI) in 1985 for evaluation of OFWM in Punjab, 27% by WAPDA in 1984 for M&E of USAID OFWM and 38.5 % in 1979 by OFWM Training Institute^{1/}. Other benefits of lining watercourses are saving in operation of the irrigation and in maintenance of the watercourses. Farmers reported to the mission that they saved about 50% of the labour originally needed for irrigation and as much as a further 10 days/ha/year on maintenance. The construction of washing places and lining watercourses through villages gives additional public health benefits.

14. **Use of incremental water.** Increased delivery of water does not seem to be translated into comparable increases in cropping intensities. Reasons for this include reduction in tubewell pumping to compensate for the increased supply in the watercourse, more water being applied to the same area of crop and a shift to thirstier crops.

15. **Water storage tanks.** Some 969 water storage tanks were constructed, about 88% more than estimated in the SAR. There were no tanks proposed for Sindh; all other provinces and areas met or exceeded the targets, particularly in Balochistan, where the target was exceeded by 116%. Water storage tanks are built where the supply of water is unreliable or intermittent, such as from a spring

^{5/} A draft of Chapter 3 of their report discusses their results of measurements on 13 watercourses: 6 in the Punjab, 3 in Sindh, 2 in Balochistan and one each in North-West Frontier Province (NWFP) and in Federally Administered Tribal Areas (FATA).

^{6/} Draft PCR of OFWM III by DG Agriculture (Water Management), Punjab, February 15 1997, pages 9 and 10.

with a low flow or, most commonly, where the electricity supply to an electric pump for a tubewell or dug well is unreliable. The tanks are usually constructed from brick with a cement mortar rendering and are commonly about 12 m square and 1.2 m deep. Many farmers (maybe 25%) paid the excess cost of building larger tanks (by 30-35%). These were allowed under the project.

16. **Precision land leveling (PLL).** The area of land leveling is reported to be about 40,000 ha, about 72% of the SAR target. Other than in Punjab, where about 4,000 ha were leveled using laser controlled equipment, the use of lasers for PLL has been slight: about 550 ha in Balochistan and roughly 1,000 ha in NWFP. No lasers were used in Sindh, FATA or FANA due to the delayed procurement of the laser equipment, inability of the project staff to operate the equipment and, to a lesser extent, to the reluctance of the farmers to pay the fairly modest hire charges (normally less than the rate for hiring a tractor). The results from laser land leveling are reported to be good with most of the benefits expected in the SAR being obtained.

17. **Sailaba Irrigation.** Some 26 sailaba subprojects (74% of the SAR target of 35) were constructed between June 1993 and June 1996 in Balochistan with an estimated command area of 415 ha. The cost of materials was about Rs4.5 million or about Rs11,000/ha (roughly US\$300/ha). There has been no monitoring of the benefits of these works.

18. **Hydra ram lifting devices and higher efficiency irrigation technology.** The project was to have included the supply of hydra-ram pumps for pumping from perennial streams in Punjab province and for the provision of higher efficiency irrigation technologies. These were not taken up by farmers due to the low subsidy proposed (20%).

19. **Vidore hill torrent scheme.** This subcomponent was added to the project and constructed in 1996 at a cost of about Rs176 million (US\$4.5 million) to redistribute flows more equitably in the three branches of the Vidore river in accordance with long-standing water rights and to spread water over an estimated cropped area of about 10,600 ha at a cost of about US\$425/ha. According to the feasibility study the runoff from a storm with a return period of two years, which corresponds to runoff of about 27 mm from the whole of the 770 km² catchment, would provide about 200 mm (less losses) of irrigation to the cropped area. The storm with a five year return period would provide about 300 mm. The feasibility study estimated that the subproject would increase the cropping intensity from 30% to 93% and avoid damage to the D.G.Khan canal and the town of D.G.Khan. Commencement of construction of the main gabion diversion structures was delayed until August 1996, due to slow release of funds and slow preparation of design documents, but was completed by December 1996. The OFWM structures to divert flood waters to farmers fields was not commenced due to a decision of the Government of Punjab to delay this work until after the primary diversion structures were completed. The functionality and benefits of the system have not yet been tested by any substantial floodwater flow.

Institutional Development

20. **Offices and residences.** Five offices and houses were constructed for field teams in more remote locations in Balochistan province in order to complete such facilities for all 17 teams deployed in the province.

21. **Equipment and vehicles.** Laser land leveling equipment and office and survey equipment was to be purchased under the project. Laser land leveling equipment was not received from project sources in all provinces and that received was very much delayed. Some laser land leveling equipment was sourced from other Federal projects. In Sindh this equipment was never used to level farmer fields because of technical difficulties experienced in commissioning the equipment. Most of the 70 pick-ups, 52 jeeps, 9 cars, 236 motorcycles and 210 bicycles scheduled for the project were purchased. Considerable delays were experienced in delivery of vehicles to provincial agencies, mostly because of the time consuming purchasing procedures used in ICB at the Federal level. Provincial authorities indicated that independent purchase by them would be both cheaper and quicker. The amount paid in taxes and duties alone exceeded the unit cost of comparable vehicles procured locally.

22. **Engineering and irrigation agronomy field teams.** Two significant changes were proposed to field team operation in this project as compared with OFWM II, *viz*: (i) an increased number of teams to carry the extra workload; and (ii) posting of separate engineering and irrigation agronomy teams (IATs). The establishment of separate IATs was aimed at achieving greater project emphasis on increasing agricultural production from saved water and thus ensure sustainability of benefits. In fact, in all provinces and federal agencies the engineering and irrigation agronomy personnel were contained in single operational teams.

23. The performance of the engineering group of the field teams was satisfactory with watercourse improvements mostly meeting targets and work completed to satisfactory design and quality standard. However, a review^{1/} of the irrigation agronomy groups of the field teams deemed their performance unsatisfactory, as assistance to farmers to improve efficiency of use of saved water and improve agricultural production was judged as being limited. However, the mission considered the failure to obtain the necessary improvement in water management and agricultural production was due to a serious basic design flaw for this component, both logically and conceptually. The project design was unrealistic in expecting this team to (i) organize WUAs (refer also paras 27-28), (ii) setup demonstration plots (centers) each year in newly improved watercourses as well as maintain a proper "after-sales" service to these demonstration centers in subsequent years (refer para. 26), and (iii) provide information, training and technical support to farmers in all aspects of water management. Furthermore, the conceptual flaw was exacerbated by the expectation that somehow the Agricultural Extension Directorates of the provincial DOAs would be strengthened and they would provide advice on agronomic practices, without any budgeted activity included in this project. There was no evidence of any operational cooperation or involvement of provincial Agricultural Extension Directorates with OFWM Directorates.

24. **Training of OFWMD staff.** Information provided by provinces indicated some 3,490 professional and 1,558 non-professional staff were trained during the project. These numbers should, however, be treated with skepticism, since, for example, the number of professional OFWM staff in NWFP associated with this project was less than 104, yet the number claimed to have been trained is 1,892. No training was given in Balochistan because new teams were not recruited: the teams trained under the first two OFWM projects continued to operate for OFWM III. Training included the training of social organizers and irrigation agronomy teams in the development of sustainable WUAs. A series

^{1/}

"Impact assessment of post-training activities of irrigation agronomy field teams and farmers", Sheladia Associates Inc., National Engineering Services Pakistan (Pvt) Ltd, June 1995.

of workshops was conducted by Bank and OECF consultants to introduce concepts of OFWM. These were followed by a comprehensive in-service training program.

25. **Farmer Training Centers and Training Institutes.** Limited support was to be provided under the project for strengthening Provincial Training Institutes in Balochistan and Sindh. Little support was given in Sindh and a hostel was constructed late in the project in Balochistan. It was also proposed to establish five Farmer Training Centers (FTCs) in Punjab province to provide farmer training in improved on-farm water management. Only three centers were established. The training of farmers generally received insufficient emphasis in this project. Further consideration needs to be given to how farmer training could be expanded. This should include an assessment of the required number of FTCs (for use by all directorates of DOAs) to provide adequate formal training for farmers as well as the possible establishment of Farmer Training Schools for informal training in farmers' fields.

Support to Farmers in Agricultural Development

26. **Demonstration centers.** Deficiencies in utility and impact of demonstration plots in earlier OFWMPs led to the proposal for Demonstration Centers (DCs) to be established on suitable areas of land (up to 2 ha in size) in one of every 6-8 watercourses improved in this project. The intention was for these DCs to be operated through project completion and demonstrate a full range of water management practices and irrigation agronomy techniques to farmers for the main crops grown in local areas. The project was expected to provide technical assistance for the planning and design of the water management improvements, additional agricultural inputs and PLL. In reality, the DCs still remained as demonstration plots, were mostly established for only one year (two crop seasons) and did not provide crop production inputs. A random survey by WMED of 10 demonstration centers in all provinces and FATA found that dissemination of information to neighboring farmers in all but two centers was limited and adoption of practices demonstrated was limited because farmers lacked resources and modern equipment, despite demonstration farmers using higher levels of crop production inputs, improved cultural practices and having increased net income.

27. **Water User Associations (WUAs).** WUAs were organized by OFWM-irrigation agronomists, according to enacted provincial ordinances as a prerequisite to watercourse improvement. The ordinances provided authority for assessment of members for improvements and services they receive and for their subsequent organization into federations along minors, distributaries and canals. Enactment of new WUA ordinances were required in FATA and FANA as a condition for inclusion in the project. They also provide sanctions if individual members or the Association fail to adequately maintain communal watercourses.

28. WUAs were formed according to the above conditions in all watercourses to be improved. However, the formation of a WUA, as presently conceived, only has relevance to communal use of public water resources, not privately owned tubewell systems. Farmer participation remains an essential cornerstone to operations and maintenance of watercourses (and eventually, it is proposed, minors). However, the sustainability of their involvement as an association, which was expected to be improved in this third project phase, does not appear any greater^{1/}. The activity and enthusiasm of the WUAs still remains greatest during watercourse renovation and within one year reverts to an informal

^{1/} "Sustainability of Water User Associations and their working as formal organizations", Chapter 5, Draft Report of WMED, February, 1997.

alliance. This does not appear to be dependent on the way they were organized, but rather that the purpose of the WUA has been too narrowly defined. The WUA should have been seen as an essential vehicle through which all agricultural services (training, technical information, input supplies, credit facilities, etc.) could be funneled, to maximize utilization of on-farm water. The role of sociologists in formation of WUAs also has to be examined further (refer paras 29 and 30).

29. **Pilot Project.** It was agreed during project implementation that the original proposal to finance a study on "Possible role of WUAs in the distribution of irrigation water within watercourses and minor canals" (to be completed by June 30, 1993) would be canceled and a "Pilot Project for Farmers' Participation in Irrigation Management" established in NWFP and Punjab provinces. It was initially planned for 18 months, but recognized that this would be a very short time for such a pilot project. The Pilot Project in NWFP commenced in November 1994 on two minors (Surazai and Pabbi), but was greatly delayed in Punjab (commenced April 1996). Considerable technical assistance, particularly from sociologists, was given in supporting the activities in these pilot areas (refer para. 32). As the objectives of the pilot project were only partially achieved by Credit closure, external support has been continued under the OECF-funded OFWM project.

30. In NWFP, the project activities have been centered on formation of WUAs, their executive committee and numerous sub-committees (for By-Laws, Survey, Cost Recovery, Construction and Mobilization). There has been a considerable investment in staff time to support these activities. However, at present WUAs have not yet been established in all watercourses in the two minors in the study area in NWFP. With regard to establishing a Federation of WUAs, while preliminary activities on completion and approval of By-Laws, awareness programs with farmers on federation and election of representatives from WUAs have been undertaken, a Federation has not yet been registered. There remain serious questions as to the effectiveness and cost of this approach to the formation of WUAs and Federations and the basic concept of the role of such farmer associations. A rigorous review of this pilot project is required before proceeding further with this approach.

Technical Assistance

31. **Supervisory consultants.** About 108 staff-years (141% of the appraisal target of 76.7 staff-years) of locally recruited consultants were provided to assist the implementing agencies in reviewing plans and designs, supervising and monitoring progress and quality of the civil works program and preparing reports. This assistance has been satisfactory.

32. **Technical consultants.** About 11.55 staff years (160% of the appraisal estimate of 7.2 staff years) of internationally recruited technical experts were provided. Their duties and responsibilities were inadequately defined in the staff appraisal report. As a consequence, many aspects of the project with which they were to have been associated have been unsuccessful, including support to agronomy field teams, M&E activities of WMED and introduction of hydra ram pumps and higher efficiency irrigation technology. All provincial directors commented that they had received limited useful input from the international consultants. It seems that the team did not spend over 50% of its time in the field (as was expected in the SAR). Most of their activities have seemingly been associated with the Pilot Project and the Vidore Hill Torrent subproject and with preparation of resource materials

and reviews. Achievements claimed in the consultants' final report^{1/} include the updating of OFWM field manuals (in English) in conjunction with NESPAK and OECF international consultants, construction management of the Vidore hill torrent subproject, recommendations for alternative materials and technologies for watercourse and canal lining (the mission found no evidence that this had been used), the design and conduct of training for OFWM staff, social organizers and farmers and assistance to WMED to improved M&E and cost/benefit analysis of watercourse improvement. The major assistance actually required, but not given, was for "hands-on" work with the field teams, demonstrations and farmers to ensure that the savings in water from improved field irrigation were translated into increased agricultural production and household incomes. This does not seem to have been adequately provided.

Monitoring and Evaluation

33. **External project M&E.** The Watercourse Monitoring and Evaluation Directorate (WMED) of WAPDA was commissioned to provide external M&E of the project performance and impact. Detailed objectives, activities and methodologies were defined for this subcomponent in Annex 7 of the SAR. Regular reporting was required and WMED was expected to develop and implement a computerized database system for managing the data regularly collected by field and headquarters staff for analytical evaluation studies. About 125 staff-years of professional services were to be provided at a cost of US\$1.4 million. In this program it was proposed that two chak samples would be monitored: (i) 16 watercourses in fresh and saline groundwater areas that would be renovated under OFWM III; and (ii) an additional 8 watercourses to be selected each year which had been renovated under previous OFWM projects.

34. The M&E undertaken is considered unsatisfactory, on the basis of (i) watercourse sample size being too small to provide an accurate perspective of project performance and impact on the major crop production systems recognized in Pakistan, (ii) lack of regular reporting of M&E, and (iii) high average cost and high professional staff input of M&E (about Rs2.6 million and 1.15 staff years per watercourse). Fourteen newly renovated watercourses under OFWM III have been intensively studied during only one year (two crop seasons in 1994-95). They should have been studied every year in order to remove seasonal variation and obtain reliable changes in production. Four watercourses from each of OFWM I and OFWM II were sampled in two years. Within these watercourses intensive sampling has been conducted on 15 farms. It is suggested that the original sampling design was inadequate and in any M&E of future projects a larger number of watercourses should be sampled in consecutive years, but with a lesser number of farms sampled in head, middle and tail locations of the watercourse.

35. **Internal project M&E.** It is surprising that the provincial OFWM directorates and FATA and FANA did not regularly collect data to undertake their own evaluation of project performance and impact. M&E is an important activity that provides vital feedback to management and also is extremely useful to justify activities to higher authorities.

^{1/} Consultant's Final Report, Sheladia Associates Inc., World Bank funded On Farm Water Management III, December 1996, Sheladia Associates, Inc., Islamabad, Pakistan.

Major Factors Affecting Project Implementation

36. Undoubtedly, the greatest factor contributing to the success of the project in achieving most of the civil works targets was the engineering experience gained by provincial governments in previous OFWM projects. However, several factors impeded project implementation. Project effectiveness was delayed by nearly one year, principally due to considerable delays in some provinces (Sindh particularly) meeting the conditionality imposed by the Bank on cost recovery from previous OFWM projects. This has led some provinces to suggest that a future project should not be national in scope but be a provincial project. A number of other factors also subsequently hampered implementation, such as shortage of counterpart funds, delays in procurement and delivery of vehicles and PLL equipment, change in cost recovery methods and strike by brick makers in Sindh. This led to the need for a one-year extension of the project to achieve the original targets set.

Project Benefits

37. **Project impact.** Although the extensive data collection for baseline and the post-evaluation surveys was carried out satisfactorily by WMED, the sample size represented only 0.2% of total watercourses renovated under the project and the surveys were conducted only for one cropping year. Therefore, the sample size and results of the surveys are inadequate to provide an accurate basis for the assessment of project impact. Therefore, the ICR mission requested each OFWM field team to conduct a short survey for two water courses in order to collect additional information on pre- and post- improvement water losses, conveyance efficiency, cropping pattern, cropping intensities, yields of crops, etc, for the reassessment of project impact. The data have been received and will be analyzed subsequently. At this stage, only qualitative benefits can be identified. These include: (i) reduction in water losses and increases in conveyance efficiency resulting in the increase in water supply to bring additional land under cultivation that could not be farmed before improvement; (ii) increases in yield of crops resulting from PLL and improved water management; and (iii) reduced time and labour required for irrigation and the maintenance of watercourses.

38. **Economic rate of return.** Assuming increases between 5-13% in crop yields and 4-12% in cropping intensities (as estimated at appraisal), with a project cost overrun of about 39% and a reduction in project command area of about 20%, the ERR of the whole project would be substantially lower than the appraisal estimate.

Project Sustainability

39. The benefits of the investments made in watercourse lining are likely to be sustained. Farmers will continue to maintain the increased efficiency of water distribution on-farm, but probably at a lower level than when watercourses were first renovated. The GOP and provincial governments are committed to continuing the process of renovation of farm watercourses under future projects. However, this process is heavily dependent on continuing donor funds. When donor financial support ceases, provincial governments do not provide additional budget to continue this program and experienced field staff, which are on the development budget (temporary staff), are redeployed to other activities. Both factors adversely affect the sustainability of the program of watercourse improvement.

Bank and Borrower Performance

40. **Bank Performance.** Some serious deficiencies were apparent in project design and project start-up which the Bank should have corrected. Firstly, the project objectives were not altogether clear (three different versions appear in the SAR and the DCA). Secondly, the design of the irrigation agronomy component is considered to be conceptually and logically unrealistic. Thirdly, the expectation that the linkage between the directorates of OFWM and Agricultural Extension would be strengthened without any prescribed joint field activities and budget was naive. Fourthly, the Bank failed to ensure that the PC-1s drawn up for the provincial governments ensured the project would be implemented exactly as planned (for example, separate engineering and field teams were not present, M&E was not as prescribed, etc.). Furthermore, the introduction of upfront cost sharing was simply to increase collection rate, but failed to assess its impact on the farmers' financial capacity. By contrast, Bank supervision missions were regular and reports prepared indicate that the missions undertook detailed reviews of implementation progress of the project and while indicating deficiencies in implementation gave helpful and constructive advice to overcome such problems.

41. **Borrower Performance.** The provincial directorates of OFWM were able to implement the civil works program successfully because of their long experience in watercourse improvement. In most provinces, retrospective cost recovery for irrigation canal works was problematic. Staff indiscipline and misuse of vehicles due to political interference was a problem in Balochistan. All provinces would have preferred independence in purchasing of equipment and vehicles due to the long delays caused by central ICB procedures and heavy duty payments required. Some components were delayed in implementation resulting from shortage and delays in release of counterpart funding from the provincial governments. Other than in procurement, the FCU performed adequately. It has been suggested that better coordination and performance would have been obtained from the technical assistance component by bringing the technical and supervisory consulting groups under a single level of control, as has happened in other projects.

Future Operational Plans

42. The GOP has not yet prepared their assessment of the project as required by the Bank or their plans for future improvement of watercourses beyond project completion, except for those associated with uncompleted projects with other donors. The mission has provided guidelines to the GOP for preparation of their completion report (Appendix A).

Lessons Learned

43. The project was a third phase of assistance by World Bank in improving OFWM in Pakistan in which some changes in project design were introduced to improve project effectiveness. The main lessons learned from implementation of this project which are relevant to any further assistance include:

- (a) Provincial OFWM Directorates are organized, staffed and mandated to give major support to engineering aspects of **off-farm** irrigation (watercourses, tanks and sailabas). They are organizationally not capable of providing the necessary integrated support to the management and use of on-farm water and other agronomic support required to advance agricultural production. The project

should have included a component that would have provided the necessary operational integration of Agricultural Extension with OFWM services.

- (b) The assessment of project impact by external monitoring and evaluation (M&E) was unsatisfactory and internal M&E by provincial OFWM Directorates was non-existent. In any future project it is critical that appropriate (adequate) M&E systems are set up for both external and internal on-going and final evaluation.
- (c) WUAs provide a natural grouping of farmers with common agricultural interests and problems. Therefore their future role should be changed to include, not only an association for operations and maintenance of tertiary and farm irrigation systems, but a farmers' group through which support (technical, training, demonstrations, etc.) for all aspects of efficient use of crop production inputs (water, fertilizers, credit, etc.) and improved crop husbandry practices can be provided by government and non-government services.
- (d) There has been a systematic increase in the amount and system of cost recovery from beneficiaries for investments made in watercourse improvement through several phases of OFWM projects. The recent move to introduce complete up-front payment of the beneficiaries' share of materials has become generally accepted by farmers and removes the problems faced by government in cost recovery. However, higher levels of up-front cost recovery will adversely affect poor farmers with small land holdings from participating in this scheme. Assessment of farmers' financial capacity to meet costs of watercourse improvement is required prior to the introduction of any further increases in the amount of capital cost recovery.
- (e) The training component was insufficiently emphasized, particularly farmer training, and because funding was to be solely from counterpart funding, created a problem for OFWM directorates in financing such activities. It is suggested that in any further projects considerably more emphasis be given to establishing appropriate facilities and establishing a suitable modality for farmer training.

E. FOLLOW-UP

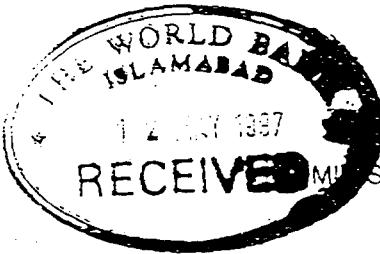
44. The mission will complete the preparation of the ICR for this project for submission to World Bank by early April, 1997. The GOP must prepare their final assessment of the project according to the guidelines provided by the mission (refer para. 42). The amended Aide-Memoire will be attached to the ICR prepared by the mission for submission to the World Bank.

IMPLEMENTATION COMPLETION REPORT

PAKISTAN

**THIRD ON-FARM WATER MANAGEMENT PROJECT
(Cr. 2245/Ln. 3327-PAK)**

Appendix B: Borrowers' Evaluation and Comments



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D. O. No. 3/85-Plan(WM)
GOVERNMENT OF PAKISTAN
MINISTRY OF FOOD, AGRICULTURE AND LIVE STOCK
(Federal Water Management Cell)
14-N (Riaz Plaza) Al-Markaz, F-8.

From: DR BAZ MUHAMMAD KHAN
Director General (WM)

Islamabad, the May 10, 1997

Subject: ON-FARM WATER MANAGEMENT (CR. 2245-PAK/Ln.
3327 PAK) IMPLEMENTATION COMPLETION REPORT:

My dear Qamar Sahib.

Kindly refer to World Bank's letter dated 26 April 1997 addressed to the Secretary (F&A). Government of Pakistan. on above noted subject. The comments, Evaluation Report and a plan for the operational on the draft ICR are enclosed herewith which have been prepared in consultation with the Provincial Governments and Federal Water Management Cell

With kind regards.

Yours Sincerely

(Dr. Baz Muhammad Khan)
Director General (WM)

Mr. Usman Qamar
Senior Project Advisor.
World Bank Resident Mission,
Sector G-5,
ISLAMABAD:

COMMENTS ON
DRAFT ICR OF ON FARM WATER
MANAGEMENT -III PROJECT
(CR. 2245-PAK/LN. 3327-PAK)

Draft Implementation Completion Report (ICR) of IDA assisted On Farm Water Management-III Project, prepared by a mission from the Food and Agriculture Organisation (FAO) World Bank Co-operative Programme, has been circulated amongst the implementing agencies for comments. The Government of Pakistan & provincial governments have reviewed and generally agree with the findings of ICR.

BORROWER'S EVALUATION OF THE PROJECT ON-FARM WATER MANAGEMENT III

PHYSICAL ACHIEVEMENTS OF PROJECT.

The targets in terms of main project activities have been completely met whereby, (I) 7,781 watercourses have been renovated against originally envisaged target of 7,685, (ii) 969 water storage tanks have been constructed against a target of 515, (iii) 39,757 hectares of land have been precisely levelled against target of 55,000, (iv) 1,300 demonstration centres have been laid out against original target of 1,060, and (v) some 3,490 professional and 1,558 non-professional staff were imparted training in improved OFWM practices etc.

ASSESSMENT OF PROJECT OBJECTIVES.

The Economic Rate of Return (ERR) as worked out by the ICR Mission comes out to be 22% against the SAR estimates of 26%. The report also mentions that as a result of improvements of water supply system and consequent overall increase in water supplies at farm level by 26%, cropping intensities have been increased upto 17%, crop yields by 9% for rice, 4% - 63% for wheat, 5%-10% for seed cotton, 14%-21% for sugarcane, 4% for fruits and upto 46% for fodder.

The report concludes that the objectives of increasing agricultural production as a result of increased water supplier was satisfactorily achieved. It, however, points out that improvements to agricultural production, as a consequence of improved OFWM practices, would have been far greater, had the irrigation agronomy program functioned as envisaged under the project.

Above mentioned finding of the report regarding lesser translation of saved water into increased production than its potential is mainly because of flaws in project design. It is

pointed out that Irrigation Agronomy Field Teams (IAFTs) were established to ensure increased agricultural production through saved water and thus sustenance of benefits accrued. IAFTs were also entrusted with the responsibility to (I) organise WAUs, (ii) set-up demonstration plots each year in newly improved watercourses as well as provide a proper “after-sales” services to the demonstration centres in subsequent years, and (iii) provide information, training, and technical support to farmers in all aspects of water management, apart from implementation issues. It is, however, mentioned that the IAFTs were merely created by bifurcating the then prevailing Field Teams wherein, both the engineering and agriculture staff were working together. One set of staff comprising of an Agricultural Officer, two Field Assistants and some support staff was designated to form an Irrigation Agronomy Field Team. No mechanism was described and even no funds were provided enabling the IAFTs to function and operate separately and independently. Creation of separate IAFTs and their functioning as envisaged appears to be over ambitious. Assigning too many responsibilities to these teams without provision of adequate resources and absence of a proper design to undertake envisaged tasks was, therefore, one of the major project design flaws.

EVALUATION OF BORROWER'S OWN PERFORMANCE.

The borrower's performance during implementation of the project remained quite satisfactory which has duly been acknowledged in the evaluation report. This is evident from the fact that all the physical targets envisaged under the project were substantially met, despite of the fact that it took late start by about fourteen months. moreover, there have been frequent strikes by brick kilns and a shift was made from post improvement recovery of material costs to up-front cost sharing.

The performance of Irrigation Agronomy Field Team has, however, remained less satisfactory than intended due to inadequate provision of resources and improper design to undertake assigned/envisioned function. Furthermore, since no mechanism to ensure co-ordination between Agriculture Extension and Water Management Directorates was

delineated in the project design, co-ordination remained limited to sporadic training of extension staff at the Water Management Institutions. It has correctly been pointed out in the report that project implementation suffered adverse affects due to shortage and delays in release of counterpart funding from the provincial governments. in fact, timely release of funds is sometimes beyond the control of provincial governments. It is, thereof, proposed that instead of making the Governments of Provinces to contribute a certain percentages of each category, it would be better if they are made to bear the 100% cost (equal to the total share of the respective government) of one or more of the project categories such as salary, operating cost etc. The remaining components may be fully financed by the donor e.g. civil works, consulting services, equipment etc.

Payment of salary/allowances of employees can not be denied by the government. Delayed release of funds will, therefore, not affect the physical project activities as experienced under previous OFWM projects.

EVALUATION OF THE PERFORMANCE OF THE WORLD BANK.

BANK PERFORMANCE.

Bank performance remained substantially satisfactory during the project implementation. Certain project covenants introduced by the Bank, however, hampered the project implementation. For example, effectiveness of loan was linked with achieving 90% recovery level of the due amounts under OFMW-II project whereby, most of the staff available for project implementation could not commence their activities on time. Likewise, it was envisaged in the original project to carry out a study on farmer's management of irrigation system at minor/distributary level but its scope was later on altered to a level of pilot project and was made one of the pre-conditions for one year's extension of the project. Similarly, rate and mode of payment of farmers share towards material costs was changed altogether and beneficiaries were made to make up-front contributing as their share of project costs. The Bank was highly inflexible in considering any alternate proposal and borrower was left with no option except to accept this change as it was also

a conditionally for project extension enabling the government to avail the already committed credit/loan. This fundamental alteration in project implementation adversely affect watercourse improvement activity as majority of the farmers under the revised cost sharing mechanism were not in a position to bear the burden of up-front payments due to their poor financial positions. Accordingly, they could not join the programme or resorted to curtail actual requisite lining length according to their paying capacities. The reduction in lining length have ultimately resulted in less benefits of watercourses improvement program than potential.

It is, therefore, suggested that major changes or introduction of new covenants for undertaking already envisaged targets of the project should be avoided.

RELATIONSHIP BETWEEN THE WORLD BANK AND THE BORROWER.

Relationship between the Bank and the borrower remained satisfactory during project implementation period.

LESSONS LEARNT.

MAKING WUAs VIABLE.

Participation rates world-wide in community base common interest groups are surprisingly low, such that both expectations and the approach adopted to support future irrigation system investments and management needs to be carefully based on local realities and not dictated by a board master plan and physical implementation targets. The sustainability of Water Users Associations (WUAs) formed under the project, therefore, needs to be ensured and investigated in order to continue beneficial use of these institutions as in case of watercourse improvement. it has been observed that WUAs have no further significant task/role to continue their existence. As such, their enthusiastic response observed during improvement of watercourse is not seen in the post improvement period. It is, accordingly, required that possibility for making such provisions be investigated whereby, WUAs or Farmers Organisation may be made a

pivotal point for all agricultural services like training , technical assistance, input supply, credit facilities etc. The arrangements will not only make WUAs/FOs more viable but will also help in harnessing the positive impacts of On-Farm Water Management interventions alongwith other activities.

The deficiency of social organisation input in Field Teams of IDA assisted OFWM-III has been compensated by the introduction of Community Development Officer in each of the OFWM Field Team under World Bank assisted Punjab Private Sector Groundwater Development Project. it is anticipated that community mobilisation activity under new scheme may help to achieve the requisite results.

Furthermore, now Farmer Organisations are being considered to assume greater role to take over operation and management of irrigation at minor/distributry/canal level. There is, accordingly, a need of proper legislation to Federate Associations at different levels and cater with other responsibilities i.e. assessment and collection of water rates (abiana), water distribution etc.

AFFECT OF ENHANCED COST RECOVERY.

Upfront sharing of 30 percent cost of materials in cash or kind, is conceptually a good attempt toward sustainability of OFWM Program, but the same has been observed to have its adverse affect also. Majority of farmers under the project area did not possess the requisite financial capability to afford up-front payments. Accordingly, they either did not come forward for improvement of their watercourse altogether or carried out lesser improvements than there required, to the extent they could mobilise resources. It is obvious from the fact that lining lengths have drastically been reduced by almost 60 percent i.e. average lined length per watercourse has been educed from 812 meters before introduction of upfront cost sharing mechanism to only 328 meters after its introduction. The reduction in lining length would ultimately result in lesser benefits of watercourses improvement program than potential. moreover, greater number of visits and meetings with farmers had to be organised by the OFWM staff to convince them to adopt this new

mode of cost sharing which has, resulted in additional expenses on travelling, P.O.L, T.As etc. on project staff. It is, therefore, imperative to consider affordability of the farmers to share up-front cost while designing future projects.

RECRUITMENT OF STAFF AND PROCUREMENT OF EQUIPMENT.

Requirements of staff and equipment are always very carefully worked out while preparing development projects. If vital inputs are not timely made available to the project, its implementation is adversely affected. It is learnt from the past experience that ban on recruitment of new staff and procurement of equipment/vehicles subsequently imposed by the government affects the project execution very seriously. It is, therefore, proposed to give coverage to approved positions of staff and equipment/vehicles and exempt them from such bans imposed by the government during project implementation.

MONITORING AND EVALUATION.

The assessments of external as well as internal Monitoring and Evaluation arrangements made under IDA assisted OFWM-III project have been identified as less satisfactory in the project Implementation Completion Report. In order to rectify this defect, it is proposed that in-built M&E model being followed under OECF funded OFWM-III Project with some improvements be adopted for future projects wherein, staff can be utilised, at no extra cost, to collect required input data. There could be a limited consultancy input to ensure validity/quality of the data so collected and for its processing/analyses, and preparation of reports.

OPERATION PLAN
ON FARM WATER MANAGEMENT III PROJECT
(CR.2245-PAK/LN.3327-PAK)

Under the WUA ordinance the Water users farmers are responsible for the operation and maintenance of watercourses below the mogha. The field observations show that farmers are discharging their duty with due diligence.

However, under the ordinance if farmers fail to fulfil their obligation the department may rehabilitate the watercourses at farmers cost. The department plans to carry out spot checking of the watercourses improved under the program to ensues its compliance.

IMPLEMENTATION COMPLETION REPORT

PAKISTAN

THIRD ON-FARM WATER MANAGEMENT PROJECT
(Cr. 2245/Ln. 3327-PAK)

Appendix C: Financial and Economic Analysis

IMPLEMENTATION COMPLETION REPORT

PAKISTAN

THIRD ON-FARM WATER MANAGEMENT PROJECT (Cr. 2245/Ln. 3327-PAK)

Appendix C: Financial and Economic Analysis

A. Production Impact

1. At appraisal, it was proposed that renovation of watercourses and construction of water storage tanks would provide additional on-farm water supply, and when combined with other project improvements (PLL, demonstration centres, improved water management), would result in increased crop yields and cropping intensities. Additional water supply would be used to: (i) intensify cultivation on the same areas cropped before improvement; (ii) bring additional new land under cultivation; or (iii) a combination of (i) and (ii). Eight cropping systems, covering a total command area of about 1,026,165 ha, were chosen to represent the project area, as shown below:

Expected Changes in Cropping Intensities under the Project^{1/}

Cropping Systems	CCA (ha)	Cropping Intensity (%)		
		Present, WOP ^{2/}	WP ^{2/}	Incremental (%)
Balochistan-Fruit Zone	31,100	95	102	7
NWFP-Mixed Cropping	55,350	145	151	6
Punjab:Cotton-Wheat (FGW)	239,850	124	130	6
Punjab: Cotton-Wheat (SGW)	119,925	93	101	8
Punjab: Rice-Wheat	239,850	126	130	4
Sindh: Cotton-Wheat	120,250	105	111	6
Sindh: Rice-Wheat	147,000	100	107	7
Barani Areas	72,840	60	72	12
Total	1,026,165			

^{1/} SAR

^{2/} WOP:without project; WP: with project

2. It was estimated that the project interventions would increase cropping intensities by 4%-12% and crop yields by 5%-13%. As a result, incremental annual production at full development was estimated to reach 46,300 tons of paddy, 104,100 tons of wheat, 25,900 tons of seed cotton, 122,900 tons of sugarcane, 37,500 tons of fruits and 928,000 tons of fodder.

3. The re-assessment of production impact for the ICR has been based on the limited production data of the FY92/93 baseline and the FY95/96 post-evaluation surveys conducted in 13 watercourses^{1/} by the Watercourse M&E Directorate, with some adjustments made by the ICR mission, where appropriate, based on other secondary information^{1/}. Because of the small sample size and only one cropping year (two seasons) of the M&E surveys, separate cropping systems (cotton-wheat, rice-wheat) in Punjab and Sindh have not been prepared, but the overall cropping systems for each of the entire provinces, have been used in the analysis. It should be noted that as the M&E surveys do not provide a sufficiently rigorous and accurate representation of the whole project, the outcomes of the farm incomes and economic analyses should be treated as indicative results only.

4. The M&E surveys show that as a result of improvements to water supply systems and consequent increases in on-farm water supplies, cropping intensities increased by 2%-17%, as summarized below:

Command Area and Cropping Intensity

Cropping Systems	CCA (ha)	Cropping Intensity (%)		
		WOP	WP	Incremental
Balochistan-Fruit Zone	21,902	118	120	2
Balochistan-Mixed Cropping	7,918	82	87	5
Subtotal	29,820	106	109	3
Punjab a/	643,887	168	170	2
Sindh	161,616	118	128	4
NWFP a/	48,584	180	197	17
FATA a/	1,767	186	198	12
FANA a/ b/	153	186	198	12
Total	885,827			

a/ Including *barani* areas

b/ Assumed to be the same as FATA.

^{1/} Six watercourses in Punjab, four watercourses in Sindh, two water courses in Balochistan, and one watercourse each in NWFP and FATA.

^{2/} Pakistan Statistical Yearbook, 1994; OECF reports; and requested rapid survey by provincial and federal agencies.

5. Overall crop yields in Punjab and Sindh, which comprise 95% of total command area, increased by 9%-13% for paddy, 4%-11% for wheat, 5%-12% for seed cotton, 83% for maize, 14%-28% for sugarcane, 8% for fodder and 4% for fruits as shown below:

Crop Yields in Punjab and Sindh (t/ha)

Crops	WOP	WP	Incremental (%)
Paddy	2.47-2.56	2.70-2.90	9-13
Wheat	1.80-2.08	2.00-2.16	4-11
Seed Cotton	0.86-1.02	0.96-1.07	5-12
Sugarcane	43-65	55-74	14-28
Maize	2.03	3.71	83
Fodder	26-49	26-53	8
Fruits	12.0	12.5	4

6. Based on the above cropping intensities and crop yields and the total command area of 885,827 ha, incremental annual production at full development has been re-estimated at 23,000 tons of paddy, 60,400 tons of wheat, 65,000 tons of seed cotton, 79,900 tons of maize, 29,000 tons of fodder and 91,900 tons of fruits. Because of the reduction in WP cropped area, annual production of sugarcane is estimated to be 35,000 tons lower at full development.

B. Farm Incomes

7. At appraisal, the impact of the project on farm financial incomes was assessed for eight farm models, representing different cropping systems and farm sizes. The size of the model farms was taken to be 5 ha for canal command areas in Punjab and Sindh, and 2 ha in Balochistan, NWFP, FATA, FANA and barani areas of Punjab. Re-stated in FY95/96 constant prices, the WP annual net farm incomes would be expected to be Rs27,520 for Sindh rice-wheat farms, Rs65,280 for Punjab cotton-wheat farms, Rs28,400 for barani farms and Rs69,000 for Balochistan fruit farms. Incremental annual net farm incomes were estimated to be about 9%-14% higher than WOP net farm incomes for Balochistan fruit farms, NWFP mixed farms, Punjab and Sindh rice-wheat and cotton-wheat and mixed farms, and 11% higher for barani farms.

8. Re-estimation of farm financial incomes for the ICR for those farms with improved water supply systems (WP) indicate that net farm incomes at full development would range from Rs35,000 for Balochistan mixed farms to Rs126,135 for Sindh mixed farms and Rs208,000 for Balochistan fruit farms, representing 8-177% increases of net farm incomes, compared with unimproved areas (WOP), as shown below:

Annual Net Farm Incomes (Rs)

Cropping Systems	Farm Size (ha)	ICR Estimates			
		WOP	WP	Incremental	
		Rs	Rs	Rs	%
Balochistan-fruit	2	115,630	208,000	92,370	80
Balochistan-mixed Cropping	2	12,650	35,000	22,350	177
Punjab-mixed cropping	5	80,150	86,920	6,770	8
Sindh-mixed cropping	5	117,065	126,135	9,070	8
NWFP-mixed cropping	2	63,110	72,360	9,250	15
FATA/FANA-barani	2	64,240	78,110	13,870	22

C. Capital Cost Recovery

9. **Capital cost recovery.** In order to reduce the financial burden to the GOP and also to ensure the sustainability of the OFWM Programme, the GOP agreed to: (i) implement a system of capital cost recovery from users (farmers) for watercourse renovation, water storage tank construction, and installation of hydra ram pumps and higher efficiency irrigation schemes - the costs of PLL were to be fully borne by farmers; and (ii) increase monetary collection efficiency. Under the project, besides the donated labour, plus the costs of masons which were to be paid by farmers in Punjab, the costs of material for watercourse renovation and water storage tank construction were to be recovered as follows: Punjab-30% in six biannual instalments; Sindh-30% (10% in lump sum advance and 20% in ten biannual instalments); Balochistan-25% (10% in lump sum advance and 15% in ten biannual instalments); and NWFP, FATA and FANA-20% in lump sum advance. For the installation of lift pumps and higher efficiency irrigation technology, 80% of the costs were to be recovered in lump sum advance payment. In addition to the implementation of the above capital cost recovery, collection was to be increased to 90% by 31 June, 1992 in Punjab province and 31 December, 1993 in Sindh province.

10. With considerable delays, Punjab and Sindh OFWM offices had satisfactorily complied with the legal covenants of the DCA in implementing the above capital cost recovery, and in achieving the targeted recovery rate of 90% by 30 June, 1993. However, because of difficulties in the collection of instalments (see para. 11), the cost recovery method in Punjab and Sindh was amended on 1 July, 1995 by replacing the cost recovery in instalments with the cost sharing by "upfront" advance payment. The cost sharing was: Punjab - 30% of the costs of material (excluding sand), plus farmers providing the costs of masons and sand; and Sindh - 25% of the cost of materials. In Balochistan, 15% of the cost of materials was to be by advance payment, and the remaining 15% to be recovered in six biannual instalments. The upfront cost sharing of 20% of the cost of materials in NWFP, FATA and FANA, remained unchanged. The cost recovery was further revised on 1 July, 1996: Sindh - 25% cost

sharing plus farmers paying the cost of masons; and Balochistan - 15% cost sharing plus farmers paying the cost of masons.

11. **Recovery rate.** The recovery rates in FY93 were 90% in Punjab and 100% in Sindh, but dropped to about 63% and 75%, respectively, in FY95 (Table 11). With the exception of NWFP and FATA (100% recovery rate), collection rates in the remaining provinces were low in FY93 but improved substantially towards FY95: Balochistan- 6% in FY93 and 99% in FY95; and FANA - 94% in FY95. Although the upfront cost sharing was implemented from July 1995, because of the cumulative arrears, overall cost recovery as of 31 December 1996 remained low at 68% in Punjab and 80% in Sindh, but full recovery was achieved in Balochistan. The low recovery rate was due to: (i) difficulties in collection by OFWM staff who already had responsibilities to undertake the OFWM works and at the same time act as collection agents for the Revenue Department (RD); (ii) unsatisfactory performance of RD staff after collection responsibilities were handed over to them, even though OFWM staff continued to provide a lot of assistance to the RD staff; and (iii) suspension or postponement of collection due to natural calamities (floods, drought, etc.). It appears that involvement of beneficiaries, who are the joint owners of watercourses and have joint financial liability and other responsibilities to develop and sustain the watercourses, would help to enhance the present low collection rate. This was evident from ICR mission discussions with the chairmen of many WUAs who have successfully acted as collection agents for the RD. Staff of the International Irrigation Management Institute (IIMI) and OECF consultants are currently working with WUAs in pilot projects in many provinces with the aim of forming Federations of WUAs who would take the responsibility for maintaining watercourses, minor and distributary canals as well as water charge collection. If the pilot projects prove successful, the system could be replicated on a nationwide basis.

12. **Cost recovery and farmers' financial ability to meet payments.** Although upfront cost sharing was implemented during the one-year extension to the project, its impact on financial capacity of the participating beneficiaries to meet payments, particularly small farmers, was not assessed. Farmers in many improved watercourses visited by the ICR mission, particularly in Punjab and Sindh provinces, reported that they had difficulties in paying the upfront cost sharing and many farmers had to seek informal loans, while many farmers in unimproved watercourses reported that they did not have sufficient incomes to meet the upfront cost sharing.

13. At appraisal, the proposed cost recovery of 15%-30% of the costs of materials for watercourse improvement, to be paid in six to ten biannual instalments in Punjab, Sindh and Balochistan, was estimated to comprise about 1%-9% of annual net farm incomes following project improvement, which was considered to be affordable to farmers. Based on re-estimated annual net farm incomes, the amount of advance required to meet cost sharing payments would comprise about 4%-39.5% of the re-estimated WOP annual net farm incomes for Balochistan fruit farms, and 1.8%-10.6% of the WOP annual net farm incomes for Punjab, Sindh, NWFP, FATA and FANA mixed farms (Tables 12 and 13). The amount required from farmers to participate in cost sharing appears to be affordable in all provinces except Balochistan, where the amount of cost sharing appears to be too heavy for farmers. In terms of recovery in six biannual instalments, annual instalment would comprise only 1.4%-8.6% of the WP annual net farm incomes of Balochistan fruit farms, and 0.5%-3.3% of the WP annual net farm incomes of mixed farms. This indicates that farmers' financial capacity would gradually improve and they would more easily be able to pay for partial recovery of project costs as annual net farm incomes gradually rise after watercourse renovation.

14. **Financial impact.** At appraisal, farmers were expected to contribute cash for masons and donate unskilled labour and assume full responsibility for PLL and full O&M costs of completed works. In addition, farmers were to repay a share of the costs of construction materials and installation of works, and water charges. In present value terms (discounted at 10% over 20 years), the net cost to the GOP, net of farmers' contribution to project investment cost and incremental O&M cost and capital costs and water charges recoveries, is estimated at 48% of total project costs.

15. Using the appraisal assumptions and the project's actual expenditures (re-stated in FY96 constant prices), the net cost to the GOP, net of farmers' contributions to project investment cost and incremental O&M costs and capital cost and water charges recoveries, has been re-estimated at 78% of total project costs as shown below:

**Present Values of Project Costs and Recoveries
(FY96 constant prices)**

	Rs Million
Total Investment Costs	3,730.8
Incremental Watercourse and Water Storage Tank O&M costs	-531.2
Total Costs	3,199.6
Farmers' Contribution:	
Investment costs	931.7
O&M costs 1/	-531.2
Net cost to GOP	2,799.1
Cost recoveries	265.7
Incremental water charges	43.9
Total direct recoveries	309.6
Cost to GOP after recoveries	2,489.5

1/ savings in O&M of watercourses in WP (see para. 17).

D. Economic Rate of Return

16. At appraisal, ERRs were calculated separately for six sub-project areas and the whole project. ERRs were estimated to range from 14% for FATA and FANA to 28% for Punjab, and 26% for the whole project. The following main assumptions were used in the economic analysis:

- (i) All costs and benefits were expressed in FY91 constant values;
- (ii) Project life was assumed for 20 years, with full development reached in project year 10, five years after completion of works;

- (iii) All investment costs, net of taxes and duties, and incremental crop production costs were taken into account in the analysis. The costs of FCU, technical assistance and M&E were distributed proportionately among the six sub-projects.
- (iv) O&M costs for improved watercourses were estimated at 1% of the investment costs;
- (v) Economic farm gate prices of traded goods were based on export parity prices for cotton, rice and sugarcane, and import parity prices for wheat, maize and fertilizers. For non-traded goods and unskilled labour, their domestic prices prevailing in the project areas were adjusted by a standard Conversion Factor (SCF) of 0.90; and
- (vi) Build-up of cropping intensities would take four years post watercourse improvement, and that of yields would require five years for each batch of improvements;

17. The economic analysis undertaken to re-estimate the ERRs for the individual sub-projects and the whole project (Table 14), follow the assumptions used at appraisal, except that:

- (i) All costs and benefits have been expressed in FY96 constant values; actual expenditures have been re-stated in FY95/96 constant prices by using the wholesale price and MUV indices. Local costs and unskilled labour were further adjusted to border prices by SCF of 0.90; and
- (ii) O&M costs have been estimated as follows:

O&M Costs

	Balochistan	Punjab	Sindh	NWFP	FATA/FANA
Watercourse (labour days/ha)					
WOP	7.2	3.8	2.4	12.0	12.7
WP	3.8	2.3	1.4	7.1	7.7
Water Storage Tanks (Rs//ha)					
WP a/	66	47	75	86	38

a/ 1% of investment costs.

18. Based on the above assumptions, ERRs have been re-estimated at 23.4% for the whole project and between 14.4% and 31.7% for the individual sub-projects (Tables 16-22), as shown below:

Economic Rates of Return (%)

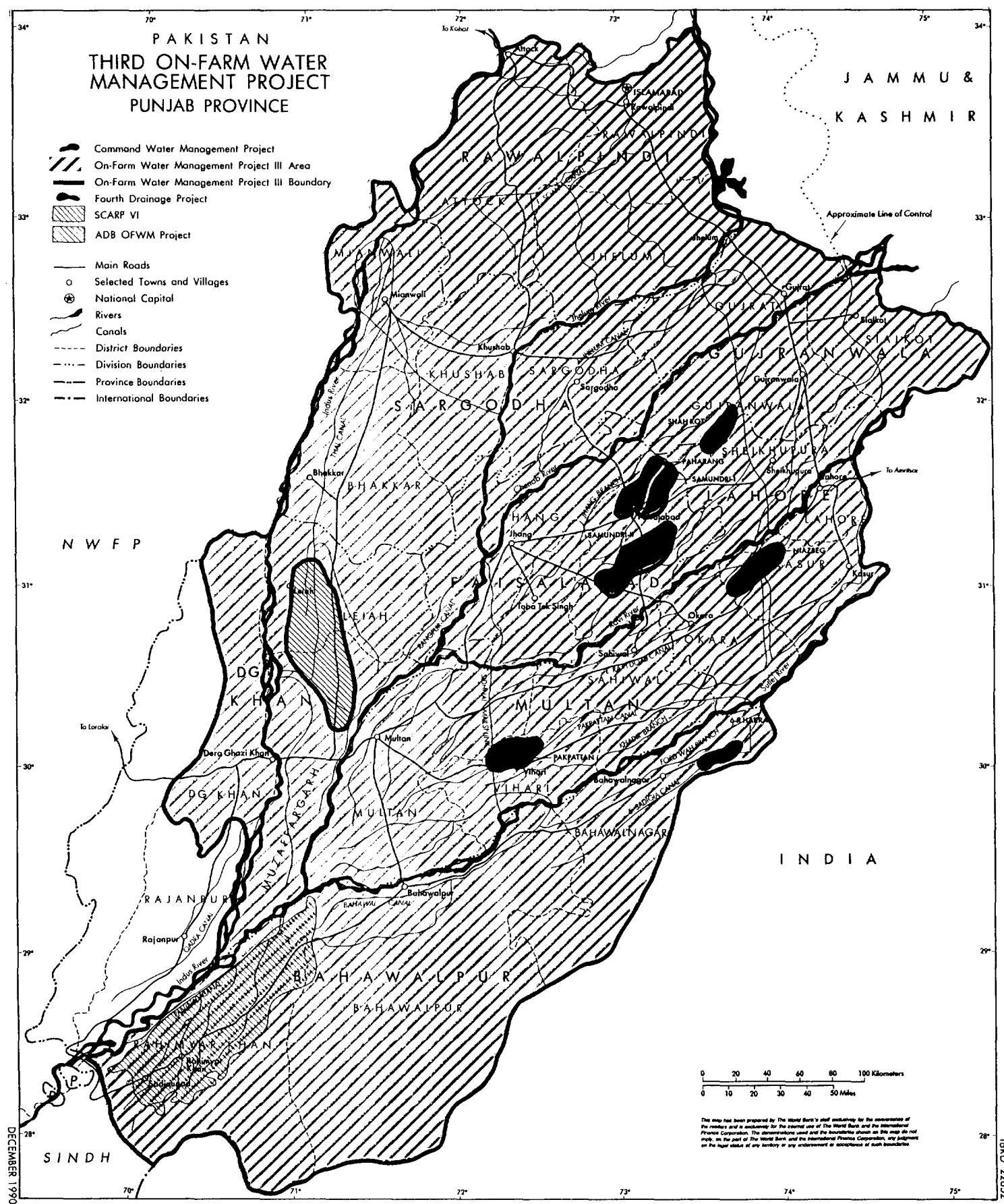
Provinces/Federal Areas	Appraisal estimate	ICR Estimate
Balochistan	19	30.8
Punjab	28	19.2
Sindh	24	27.2
NWFP	25	31.7
FATA	14	30.4
FANA	14	14.4
Whole project	26	23.4

19. Higher crop yields and substantial increases in areas of high value crops (vegetables, fruits, etc) were factors contributing to higher ERRs for Balochistan, FATA, NWFP and Sindh, while substantial cost overrun and lower incremental cropping intensities and yields in improved watercourses were factors contributing to lower ERRs for Punjab.

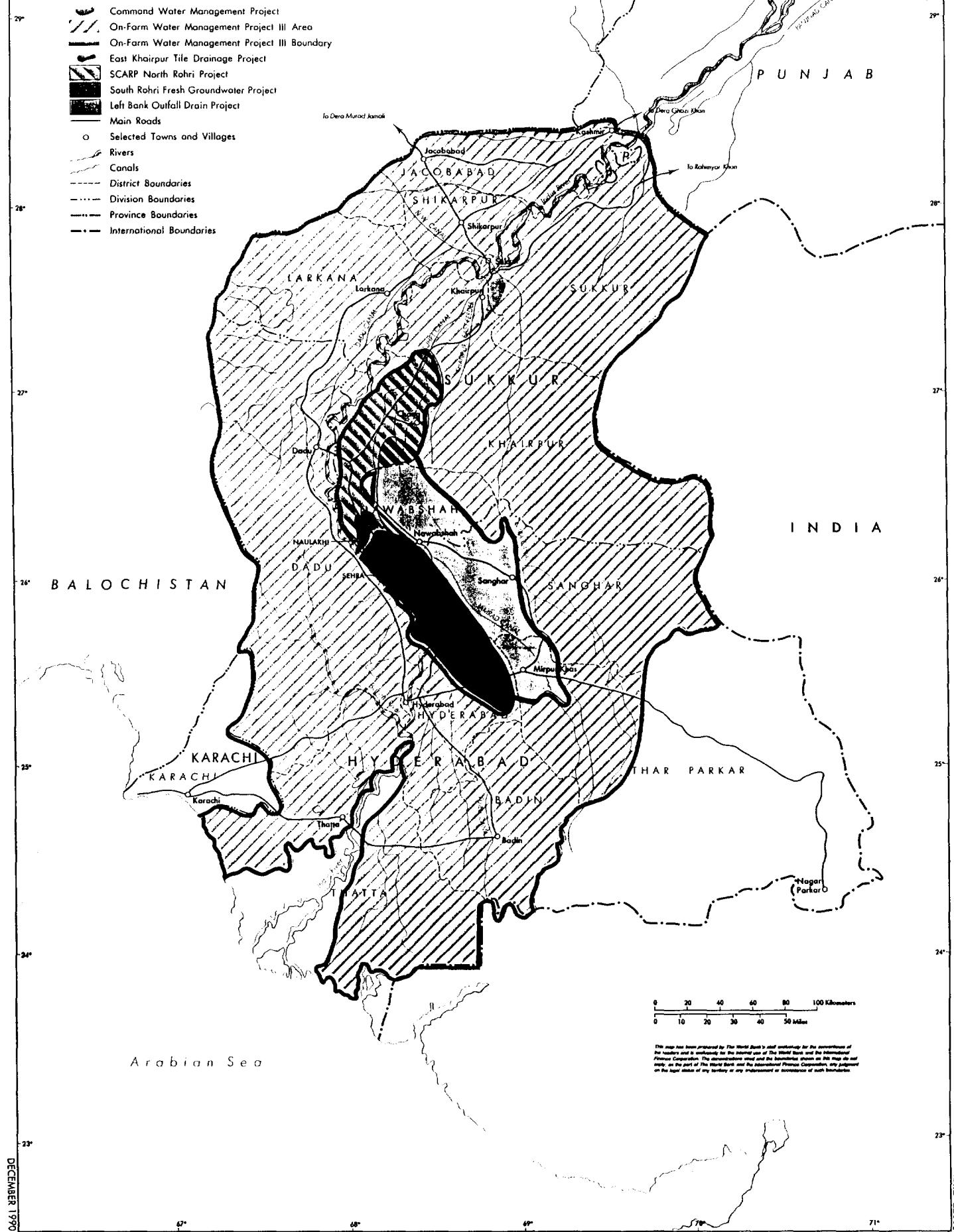
PAKISTAN
**THIRD ON-FARM WATER
MANAGEMENT PROJECT**
PUNJAB PROVINCE

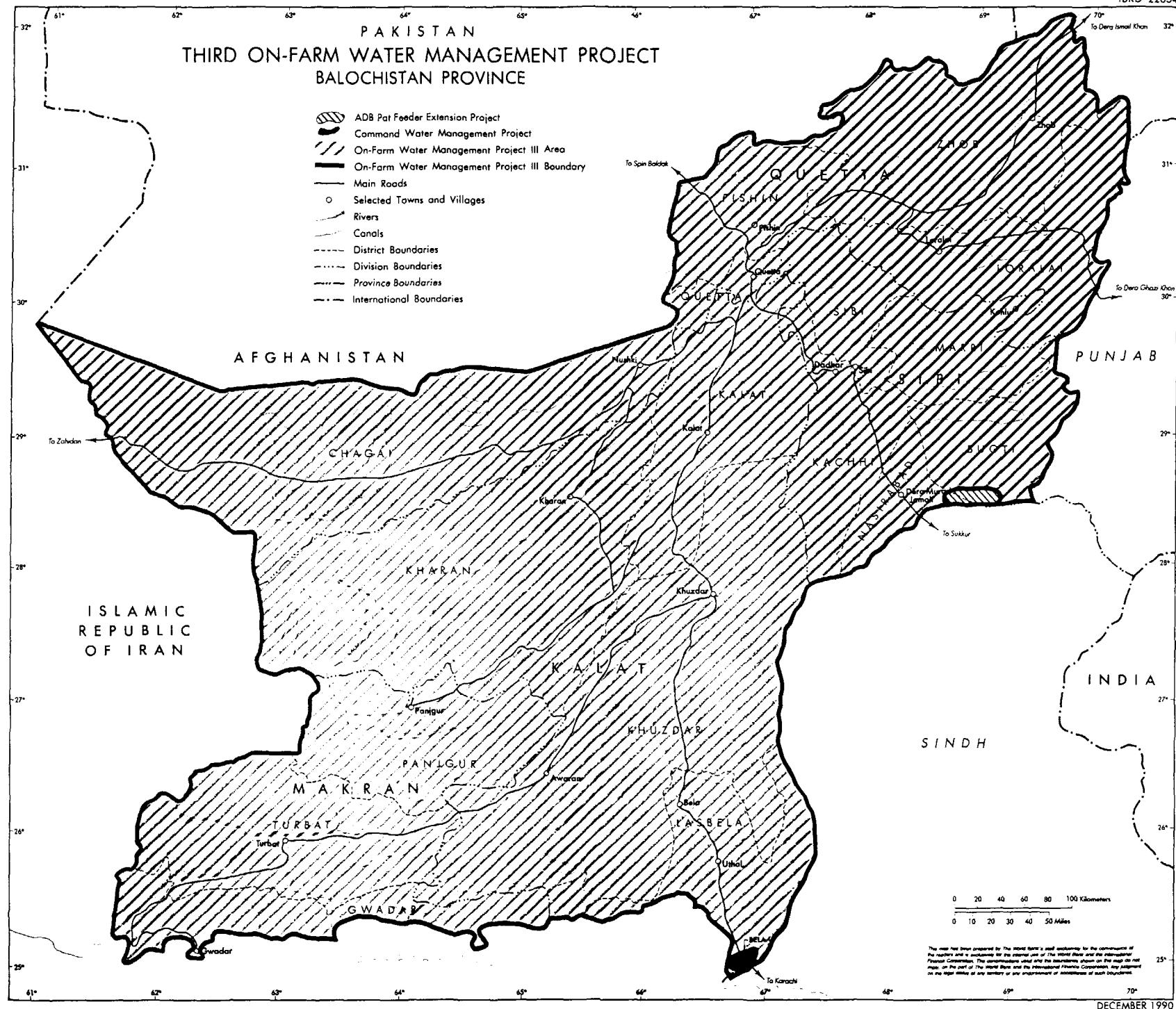
-  Command Water Management Project
-  On-Farm Water Management Project III Area
-  On-Farm Water Management Project III Boundary
-  Fourth Drainage Project
-  SCARP VI
-  ADB OFWM Project

-  Main Roads
-  Selected Towns and Villages
-  National Capital
-  Rivers
-  Canals
-  District Boundaries
-  Division Boundaries
-  Province Boundaries
-  International Boundaries



PAKISTAN
THIRD ON-FARM WATER MANAGEMENT PROJECT
SINDH PROVINCE

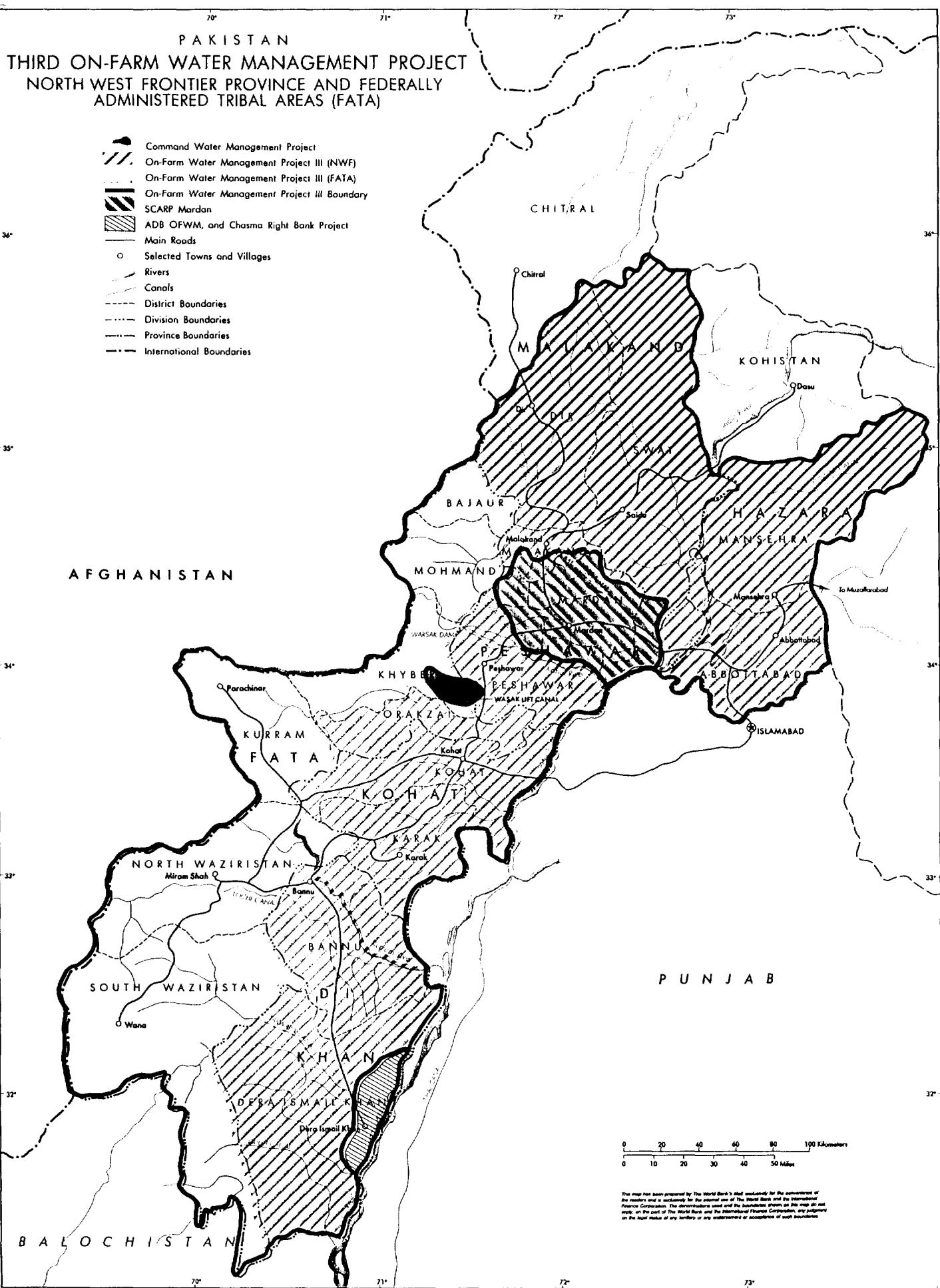




PAKISTAN

THIRD ON-FARM WATER MANAGEMENT PROJECT
NORTH WEST FRONTIER PROVINCE AND FEDERALLY
ADMINISTERED TRIBAL AREAS (FATA)

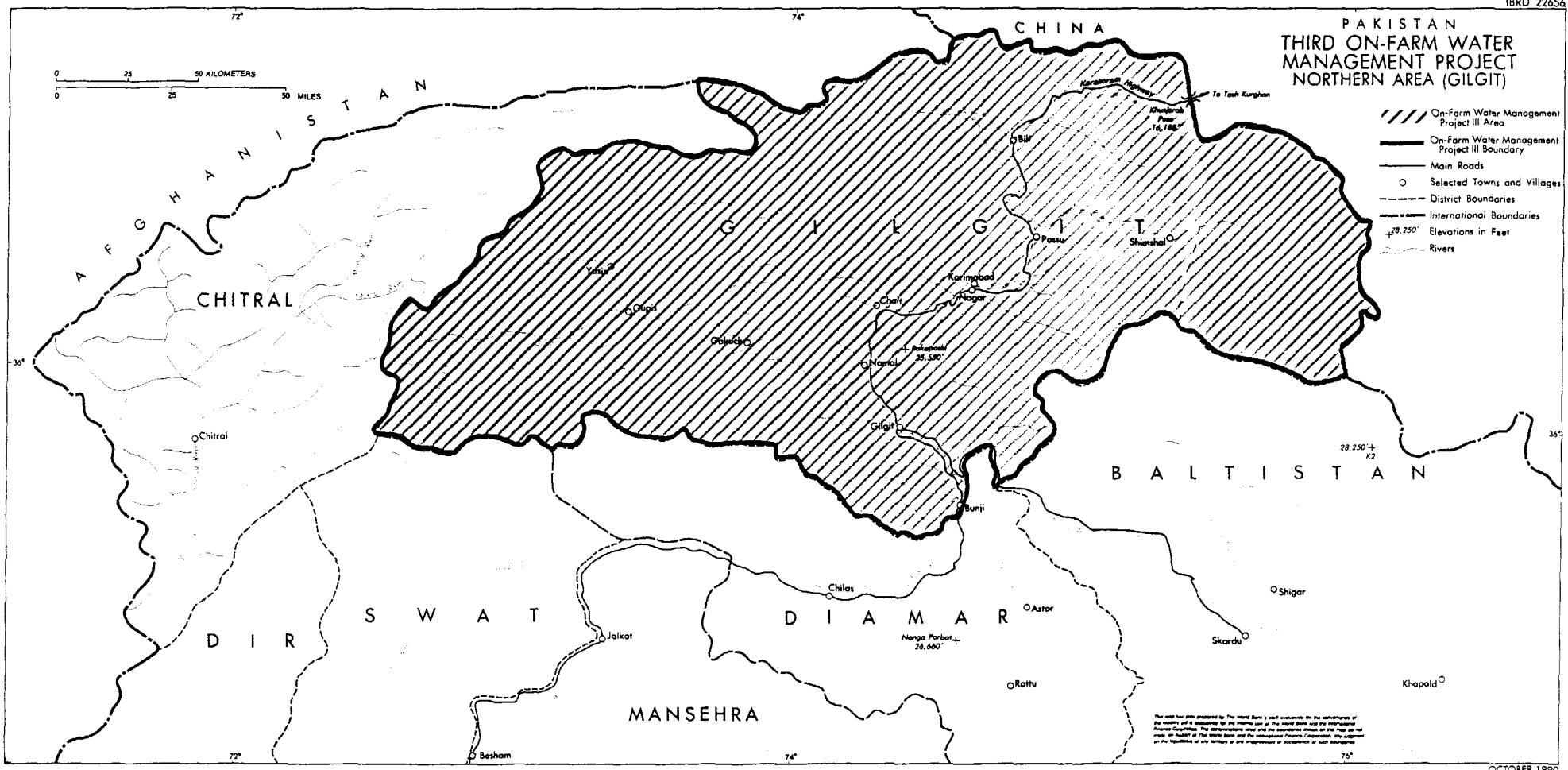
-  Command Water Management Project
-  On-Farm Water Management Project III (NWF)
-  On-Farm Water Management Project III (FATA)
-  On-Farm Water Management Project III Boundary
-  SCARP Mardan
-  ADB OFWM, and Chasma Right Bank Project
-  Main Roads
-  Selected Towns and Villages
-  Rivers
-  Canals
-  District Boundaries
-  Division Boundaries
-  Province Boundaries
-  International Boundaries



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**PAKISTAN
THIRD ON-FARM WATER
MANAGEMENT PROJECT
NORTHERN AREA (GILGIT)**



IMAGING

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