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| 1. PROJECT NO. 01-17-120-489-73 | 2. PAR FOR PERIOD 02/28/74 TO 03/30/76 | 3. COUNTRY TA BUREAU | 4. PAR SERIAL NO. PD-ACL-882-61 |
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PROJECT TITLE
ON FARM WATER MANAGEMENT 8p

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| 6. PROJECT DURATION: Began FY <u>68</u> Ends FY <u>76</u> | 7. DATE LATEST PROG Oct. '73 | 8. DATE LATEST PIP N/A | 9. DATE PRIOR PAR 2/28/74 |
|---|---------------------------------|---------------------------|------------------------------|

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| 10. U.S. FUNDING | a. Cumulative Obligation Thru Prior FY: \$ <u>3,235,000</u> | b. Current FY Estimated Budget: \$ <u>565,000</u> | c. Estimated Budget to completion After Current FY: \$ <u>1,890,000</u> |
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| 11. KEY ACTION AGENTS (Contractor, Participating Agency or Voluntary Agency) | |
| a. NAME Colorado State University Fort Collins, Colorado 80522 | b. CONTRACT, PASA OR VOL. AG. NO. AID/ta-C-1100 |

I. NEW ACTIONS PROPOSED AND REQUESTED AS A RESULT OF THIS EVALUATION

| A. ACTION (X) | | | B. LIST OF ACTIONS | C. PROPOSED ACTION COMPLETION DATE |
|---------------|-------|------|---|------------------------------------|
| USAID | AID/A | HOST | | |
| | X | | 1. Prepare a project statement requesting 3-year extension. | 1 July 76 |
| | X | | 2. Distribute the review report widely especially to Missions where irrigation is important. | 1 July 76 |
| X | X | X | 3. Phase into proposed extension program prior to termination of present contract. | 1 Sept 76 |
| X | X | X | 4. Develop a detailed specific work plan to successfully accomplish the work proposed in the project statement. | 1 Feb. 77 |
| X | X | | 5. Conduct field review. | Aug. 78 |
| X | X | | 6. Conduct terminal review. | Aug. 79 |

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| D. REPLANNING REQUIRES | | | | | | E. DATE OF MISSION REVIEW | |
| REVISED OR NEW? | <input type="checkbox"/> PROP | <input type="checkbox"/> PIP | <input type="checkbox"/> PIP AC | <input type="checkbox"/> P/DT | <input type="checkbox"/> F/OTC | <input type="checkbox"/> P/OTP | |
| PROJECT MANAGER: TYPED NAME, SIGNED INITIALS AND DATE Donald L. Plucknett <i>DL</i> 05-20-76 | | | | MISSION DIRECTOR: TYPED NAME, SIGNED INITIALS AND DATE Leon F. Hesser <i>L.F.H.</i> 05/20/76 | | | |

PROJECT APPRAISAL REPORT

On-Farm Water Management
Colorado State University, AID/ta-C-1100

The Colorado State University water management research project was initiated on March 28, 1968 with funding from AID contract csd-2162. That contract was terminated on March 31, 1974 and the present contract AID/ta-C-1100 became effective on April 1, 1974. The termination date of June 30, 1976 has been extended until March 31, 1977 in order to complete a comprehensive review upon which this PAR is based.

A review panel consisting of Howard Haise, Team Leader, John Phelan, and Douglas Caton conducted a field review in Pakistan during the period January 27, 1976 - February 13, 1976 ending with discussions with USAID staff, Colorado State University team members, NE and TA Bureau personnel. Dr. Haise is a Senior Agronomist formerly with ARS/USDA; Mr. Phelan an Agricultural Engineer, formerly Director of Engineer of SCS, and Dr. Caton is Senior Agriculture Economist, AID/W.

historical

The Colorado State University water management project has had a field program in Vietnam and has an on-going field program in Pakistan. The program in Vietnam was geared towards improvement of crop production during the dry season using better water control. At the time of its termination facilities had been completed for an experiment station to be operated by faculty of Cantho University.

The field program in Pakistan was initiated in 1970, but it was not until 1972 that a significant number of faculty (4) were in the field. By 1974, an effective network of linkages with many agricultural research stations, universities, and GOP action agencies had been established. The present field party consists of seven faculty personnel.

At the outset, in 1970, there was no coordinated field program and really no linkages with host country agencies. These had to be developed. The research program now is directed at the farmer and is being conducted with the farmer. The Host Government, the USAID Mission, and the research activities are so closely connected that it is difficult to discern where the research program ends and the Government of Pakistan planning and USAID loan development program begins. This is positive since the research is itself involved with utilization, discovering how to extend known technologies, learning the constraints, and most importantly accomplishing it in the farmer environment. Most assistance programs for small farmers are directed downward from government sources -- this research project started in the farmers field, created government awareness, and is in the process of learning how best to remove farmer constraints and solve his problems.

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Issues and Problems

The review panel was asked to investigate several issues in its assessment of the project. There was concern that the project lacked focus and was developing into a series of unrelated sub-projects. There was also concern that a project whose total effort is in one country should not be centrally funded. Another issue relates to the fact that there has been practically no cooperation between AID's two centrally funded water management research projects. The panel was also asked to address several questions including: (a) when will the work be complete in Pakistan? (b) what is the rationale for continuing the work? (c) what is the utilization plan and (d) is the research directed at priority needs.

The review panel was favorably impressed with the project in total. Their report states "in the overall the project has held course, had had a single focus and each piece of work is directed toward that focus." Although the work is centered in one location, the research is confirming a set of principles which can be used as propositions for first approximations to problem identification and tentative solutions common to irrigation water management in most any arid or sub-humid area. The panel felt that the concern for more cooperation between Colorado State and Utah State Universities was somewhat unjustified. There is now some cooperation with ideas and literature interchange; but the need for extensive cooperation is not apparent.

The panel reported that there is strong economic justification for carrying the work further to full utilization in Pakistan and development of plans and specifications for use in other LDC's. A three year extension period was estimated, during which pilot test programs would be completed and several manuals prepared. The centrally funded activity would then be completed, but the process and technology developed would be in operation in other LDC's utilizing Mission funding.

Impact and Potentialities

The project has had impressive impact in water management planning in Pakistan. Water waste within the irrigation system has been quantified, by the project, to be about double the design assumptions. Farmer attitudes, constraints, and knowledge has been analyzed by carefully planned and conducted surveys. Technology packages (precise land leveling, rearrangement of farm fields, and betterment of the canal/farm watercourse) have demonstrated that losses can be halved. These

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Improvements are economical and farmers and more importantly government officials are enthusiastic.

The Government of Pakistan has allocated 300 million rupees (\$30,000,000) to development of water management studies and pilot project testing in the current 5-year plan. USAID/PAK will cooperate with a loan program (not yet approved) to extend the Colorado State University research findings to approximately 60,000 farms. The World Bank is giving assistance on development of a strategy to apply water management improvements to the entire Indus Basin, over 25 million acres.

The project import in Pakistan is impressive, but the possibility of transfer of the research methodology and findings is an exciting prospect. USAID/Egypt has developed a Project Plan essentially patterned after the Colorado State University experience in Pakistan. This was possible by utilizing field personnel from the project in Pakistan to assist with the draft PP.

Accomplishments

Government of Pakistan officials have credited this project with creating the existing awareness among Government officials and external assistance agencies of the actual watercourse losses and water losses in farmers fields. The project has reached into the on-farm situation and identified gaps and deficiencies in the cropping system, not just with respect to water, but agronomics and socio-economic factors as well.

Efficient field methods have been developed for determining the potential for physical improvement within the farmer operated irrigation system i.e., from the canal to the growing crop. Survey methods have been developed and utilized to gain valid information from farmers regarding their knowledge, constraints, and attitudes relative to water management.

Specific techniques are being developed and tested which:

- a) decrease watercourse losses at reasonable cost
- b) allow use of farmer resources to improve his irrigation efficiency, crop stands and yields.

PROJECT APPRAISAL REPORT

On-Farm Water Management
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- c) measure water adequately and evaluate crop water needs and advise farmers on water use.
- d) obtain water of optimum quantity at allowable quality from aquifers where salinity increases with depth.

In general, Colorado State University has taken a "grass roots" farmer and extension involvement in identifying farmer soil and water problems. Their research focuses attention on water management on-farms and rehabilitation of watercourses. The experiments have been conducted with farmers, in their fields, and with their support. The results thus far have pointed up the nature of technical, social and economic constraints and have brought out time as an important variable regarding development. These findings most certainly will prove applicable in many LDC's.

Conclusions

The research has evolved to the point where it can begin to document costs and benefits, and indicate payoffs. It has also reached the point where it can begin to help evolve a Pakistani institution(s) to take over the research and extension responsibilities. To gain these benefits and to document the entire research process such that it can be duplicated the research program should be continued. The results should feed more and more into development and with the proposed USAID loan program and the ongoing World Bank study there will be excellent opportunity to do this in Pakistan.

Colorado State personnel on the program have been favorably affected by the learning process connected with this project. There is truly an interdisciplinary team involved and it also extends to the campus through TDY experiences and returnees from the field. This team will be invaluable to AID in development and implementation of similar programs in the future e.g., Egypt.

It has been necessary to build experimental pilot watercourse study areas in order to test technologies and to infuse and involve host country institutions. These pilot studies need to be carried to completion in order to document problems and to learn total benefits. The training requirements for implementing and maintaining the improvements must also be carefully determined and documented.

The research project should be continued for 3 years to finish the pilot studies, to follow closely the USAID loan and World Bank programs to gain implementation knowledge, and to develop training requirements and

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On-Farm Water Management
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materials for use in other LDC's. Specifically the project should refine techniques for (a) reducing losses from watercourses, (b) farmer maintenance of watercourses, (c) farmer maintenance of leveled land, (d) bedding and furrowing to increase crop stands, (e) withdrawing ground water through skimming wells, and for (f) conducting physical and socio-economic surveys on watercourse areas.

The economic component needs to be strengthened to (a) reconstruct a cost/benefit analysis to incorporate analytical refinements based on marginal (production surface) analysis and uncertainty estimates; (b) to extend and improve upon marginal analysis estimates by "getting at" true costs, particularly to the small farmer; (c) to utilize LP cropping system models incorporating the new and traditional practices and the research water management data to compare cropping system alternatives when feasible; and (d) to make a special study of risk and uncertainty, and probability density estimates of farmer decisions with respect to these elements.

Documents which should be written during the next 3 years include:

- a. Irrigation application efficiencies and potential for their improvement in developing countries.
- b. Watercourse losses, magnitude, causes, and methods for reduction in developing countries.
- c. Role of watercourse losses and field application losses in drainage requirements and waterlogging of land. Physical and economic evaluations of coordinated management programs best suited to maintain water tables at depths conducive to optimum crop production.
- d. Watercourse design handbook for developing countries.
- e. Handbook of water management research techniques for developing countries.
- f. Organization of water user associations and their functions to achieve group action to improve water management.
- g. Survey procedures for identifying potential for improving water management and crop production.

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Actions to be Taken

Based on the comprehensive review, the project's success in Pakistan, the considerable interest the project techniques have generated, and the potential benefits indicated this project should be allowed to continue to a successful conclusion. Sufficient detail must be collected and documented such that the research processes, the technology packages, and the potential benefits can be transferred to other LDC locations.

Study by the review panel indicated that a 3-year extension would be required to finish the project. Project documentation will be prepared for approval of such an extension. The Project Statement will reflect a change from the present contract to accomplish.

- a) the preparation of the 7 documents listed above and any others deemed necessary as the project matures.
- b) the economic analyses suggested in the conclusions above.
- c) the refinement of water management technology packages involving watercourse improvement, field application effectiveness, land leveling and field design, system maintenance, and crop requirements. These will be accomplished in farmers fields on the pilot studies.
- d) a plan or methodology for transferring water management technologies and especially the development techniques so the results can be utilized elsewhere.
- e) the deliniation of LDC training requirements and techniques to accomplish the technology transfer.

This appears to be a tremendous effort for a three year period, however the project is at a point where work on these outputs can be initiated immediately. Much of the background data have already been collected.

The attached Logical Framework indicates the changes required to accomplish the results.

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 68 to FY 76
Total U.S. Funding \$3,679,000
Date Prepared: 12 May 1976

Project Title & Number: On-Farm Water Management AID/ta-C-1100

| NARRATIVE SUMMARY | OBJECTIVELY VERIFIABLE INDICATORS | MEANS OF VERIFICATION | IMPORTANT ASSUMPTIONS |
|--|---|---|---|
| <p>Program or Sector Goal: The broader objective to which this project contributes:</p> <p>Increased food production.</p> <p>Sub Goal: Elimination of water waste within irrigation systems.</p> | <p>Measures of Goal Achievement:</p> <p>Increase in per capital food production in irrigation agriculture.</p> <p>Increased acreage cropped per unit of water.</p> | <p>Production and population statistics (FAO, Foreign Agricultural Service estimates, BAPs)</p> | <p>Assumptions for achieving goal targets:</p> <p>LDC's will support increasing food production through on-farm irrigation water management of programs.</p> |
| <p>Project Purpose:</p> <p>Develop and evaluate design and implementation guidelines for technologies to identify and solve major physical, economic and institutional constraints confronting farmers in the efficient control and effective utilization of irrigation water.</p> | <p>Conditions that will indicate purpose has been achieved: End of project status.</p> <ol style="list-style-type: none"> 1. Cropping intensity increased 50 percent in pilot test areas. 2. Water wastage reduced 40 percent in pilot test areas. 3. Guidelines utilized in at least 10 watercourse areas in Pakistan. 4. Project based on the guidelines being developed in at least 2 countries. | <ol style="list-style-type: none"> 1, 2. Pakistan DAP, GOP reports, contractors annual reports. 3, 4, 5. Contractor publications and AID/W documents. | <p>Assumptions for achieving purpose:</p> <ol style="list-style-type: none"> 1. Incentives sufficient to create farmer desire to utilize developed technology. 2. Government of Pakistan will provide needed professionals. |
| <p>Outputs:</p> <ol style="list-style-type: none"> 1. Proven techniques for: a) identifying farmer physical and socio-economic constraints, b) building and maintaining effective canal/farm and on-farm water channels, c) developing and maintaining efficient on-farm irrigation systems, and d) utilizing extra water supply to increase production. 2. Methodology to integrate water management technology into social and economic environment of LDC's. 3. Trained LDC agronomists, economists and engineers. | <p>Magnitude of Outputs:</p> <ol style="list-style-type: none"> 1. Three pilot test watercourse areas with all farmers participating. 2. At least 8 "how to do" documents published. 3. At least twenty trained personnel. <p>Two training manuals indicating requirements and teaching technique.</p> | <ol style="list-style-type: none"> 1. Contractor reports. 2. Contractor reports, Mission records and reports, field reviews. 3. Contractor reports, field evaluation. | <p>Assumptions for achieving outputs:</p> <p>Project inputs required of LDC will be timely.</p> <p>Host government personnel available.</p> |
| <p>Inputs:</p> <p>LC - farmer owned land and water supply technicians (agronomists, economists, engineers) and farmers.</p> <p>SU - Professional personnel from agronomy, agri, engineering, economics, sociology, and extension. Logistic support and back-up from campus (library, administration, etc)</p> <p>D - Funding and guidance. USAID collaboration, funding, and logistic</p> | <p>Implementation Target (Type and Quantity)</p> <ol style="list-style-type: none"> 1. Three watercourse areas with at least 13 farmers and 100 acres each. 2. At least 15 technicians and all farmers in test areas. 3. Eighty-four man months in field plus campus backup. 4. Approximately \$600,000 annually, central and mission funds. 5. Annual work plan - jointly prepared by contractor and AID. | <ol style="list-style-type: none"> 1, 2. AID/W and USAID records, annual reports. 3. Field evaluation, annual reports. 4. AID/W records, field evaluation 5. AID/W records. | <p>Assumptions for providing inputs:</p> <p>Government of Pakistan will maintain present enthusiasm.</p> <p>LDC scientists willing and able to participate.</p> <p>Qualified experts will remain on CSU staff.</p> <p>AID can supply timely funding and adequate project management support</p> |