MID-PROJECT EVALUATION

OF THE

EGYPT WATER USE AND MANAGEMENT PROJECT

BY

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USAID/CAIRO

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1. COREY AGREES WITH THE BASIC CONTENT OF MOST OF THE EVALUATION REPORT AS WRITTEN. THERE ARE MINOR ERRORS WHICH ARE NOT SIGNIFICANT; SUCH AS USING CSU IN PLACE OF CID IN SEVERAL INSTANCES.

2. COREY, HOWEVER, DOES NOT PRECISELY AGREE WITH THE REPORTS SUGGESTIONS FOR PROJECT COMPLETION. IN FACT, THE REPORT IS VAGUE AND NOT HELPFUL IN THIS AREA. COREY'S SUGGESTIONS ARE:

A) MOI, EWUP, AND USAID, WITHIN THE NEXT FEW WEEKS, SHOULD DETERMINE EXACTLY WHAT STUDIES WILL BE DONE TO COMPLETE THE PROJECTS. WHETHER THEY ARE CALLED PILOT STUDIES OR CANAL STUDIES IS IMMATERIAL. THE IMPORTANT THING IS THAT THEY SHOULD PROVIDE DATA AND INFORMATION SO THAT GOE CAN MAKE SENSIBLE INVESTMENTS IN IRRIGATION IMPROVEMENT. THESE (STUDIES) COULD BE THE ONES SUGGESTED BY THE EVALUATION REPORT OR THEY COULD BE ANOTHER COMBINATION OF TECHNOLOGIES. IN ANY CASE, THEY SHOULD BE LIMITED TO WHAT IS ACHIEVEABLE WITHIN A TWO TO THREE YEAR TIME FRAME.

B) NEXT A DETAILED WORK PLAN SHOULD BE DEVELOPED TO ACCOMPLISH THESE STUDIES. THE PROJECT SHOULD THEN BE EXTENDED TO WHATEVER DATE IS NECESSARY FOR COMPLETION. COREY BELIEVES THIS PROJECT HAS ACCOMPLISHED FAR TOO MUCH TO DATE TO NOT CONTINUE TO COMPLETION. ITS FINAL STAGE SHOULD BE ESPECIALLY HELPFUL TO MOI AND USAID. IT DOES NEED A CHANGE OF DIRECTION TO A MORE FOCUSED PRACTICAL APPROACH OF DETERMINATING WHAT IRRIGATION INTERVENTIONS MAKE SENSE IN EGYPT IF IN FACT ANY DO.

C) THE IRRIGATION ADVISORY SERVICE AND THE FARMER ORGANIZATION "RESEARCH" SHOULD BE LIMITED TO WORKING WITH FARMERS AND GOE TO THE EXTENT NECESSARY TO DETERMINE CONSTRAINTS AND METHODS ASSOCIATED ONLY WITH THE IRRIGATION

TECHNOLOGIES BEING TESTED. TO STUDY THESE IN ISOLATION USUALLY BECOMES AN ACADEMIC EXERCISE WHICH LEADS TO NOTHING PRACTICAL.

3. WATER SAVINGS SHOULD BE STRESSED AS A BENEFIT. THE MOI IS EXTREMELY INTERESTED IN THIS AND ITS POTENTIAL FOR HORIZONTAL EXPANSION AND ALLEVIATION OF DRAINAGE PROBLEMS MAKE IT POTENTIALLY VERY ATTRACTIVE.

4. COREY DISAGREES WITH PARAGRAPH 6.27 WATER IS NOT AN AGRICULTURAL INPUT LIKE FERTILIZER AND SEED. THIS MINDSET IS ONE OF THE REASONS WATER MANAGEMENT HAS LAGGED BEHIND MANAGEMENT OF OTHER INPUTS EVERYWHERE IN THE WORLD. IT IS TRUE THAT A SEPARATE EXTENSION IS NOT NEEDED FOR WATER; HOWEVER, SPECIAL ATTENTION MUST BE GIVEN TO WATER MANAGEMENT IN EXTENSION OR IT WILL BE NEGLECTED ENTIRELY. EVERY COUNTRY WITH IRRIGATION HAS PROOF OF THIS.

5. IT IS UNFORTUNATE THAT THE EVALUATION TEAM COULD NOT REVIEW EACH REPORT (DRAFT) BEFORE IT BECOMES FINAL. COREY HAS NO OBJECTION TO MISSION REPRODUCING AND DISTRIBUTING REPORT. HOWEVER, HE WOULD PREFER THAT THIS CABLE BECOME A PART OF IT. MUSKIE

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ABSTRACT

It took quite a while for the project to get its toes in the water. The personnel had to get in the swim of things, and to realize by interdisciplinary training that they are all in the same boat. For a long time the project seemed to be treading water and wallowing hip-deep in the mud. The project choice of research priorities does not hold water, and consequently much valuable time went down the drain. Its information dissemination system, too, seems all wet. However, all that is now water over the dam. With its pilot program the project has dived off the deep end, and now it must sink or swim. Consequently, although the project seems to just be holding its head above water, it would decidedly not be advisable to change horses in midstream.

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Annex A: Egypt Water Use and Management Project — Logical Framework

Annex B: Problems Identified by the Project

Annex C: Pilot Programs Proposed by EWUP

ABBREVIATIONS

EWUP — Egypt Water Use and Management Project

MAG — Ministry of Agriculture

MOI — Ministry of Irrigation

PP — Project Paper

SP — Staff Paper

TR — Technical Report

ARABIC TERMS

marwah — farm ditch within the farmer's property

mes/ah — water course (a lateral supplying water from the last MOI-maintained canal to a group of farmers)

sa/iyah — water wheel

tambour — Archimedes' screw

1. INTRODUCTION

1.1 Background: The Water Use and Management project (263-0017) in Egypt is an AID-financed applied research program. It was initiated in FY 76 with the signing of the grant agreement in June of that year. The project, however, did not get fully underway until January 1978, when a full contract team was placed in the field. The project was designed to run five years and with extensions the contract is now scheduled to terminate on July 30, 1982.

1.2 Process of evaluation: The project plan as well as the contract calls for an in-depth evaluation at mid-point in the project. Dr. Itil Asmon, private consultant, and Dr. Gilbert Corey, Water Management Specialist, DS/AGR-AID/W, were asked by USAID/Cairo to comprehensively review the project past performance and future plans. Dr. Corey stayed in Egypt from 10/27/80 to 11/15/80 and submitted upon departure a separate report, as envisioned in the evaluation plan.[1/] Dr. Asmon worked on the evaluation from 10/29/80 to 11/27/80 and synthesized the findings of both team members into the present report.

1/ G. L. Corey, "Water Use and Management Project Mid-Project Review," USAID/Cairo, 11/15/80.

1.3 Inputs to evaluation: The Team reviewed all project background material (Project Paper, Contract, Work Plans, past evaluations). Some 70 publications, articles, staff papers, and reports were read to determine project output and stage of development. The field sites at Kafr El Sheikh, Gizah (Mansouriyah), and El Minya were visited with project staff. Discussions were held with officials from the Ministries of Irrigation and Agriculture, GOE and contractor project personnel, and USAID.

2. PROJECT DESCRIPTION

2.1 Project start: The project was developed in early 1976 and the grant agreement with GOE was signed in September 1976. The contract to provide the technical assistance, however, was not signed until May 1977. The Consortium for International Development (CID) was selected as the contractor. The first team members did not arrive in Egypt until October 1977 and a full contract team was not available until January 1978. Thus the project essentially started either 16 or 8 months behind schedule, depending on which date one considers as project initiation. The contract is now scheduled to terminate on July 30, 1982, or approximately 5 years after the technical assistance contract was signed.

2.2 Project purpose, as stated in the Project Paper, is to (a) develop and demonstrate replicable improved irrigation water management and associated practices that increase agricultural production, and (b) increase institutional capacity to develop and sustain an improved on-farm water management capacity. In summary, the project is to develop and implement an applied research and management program for improving the management of irrigation water.

2.3 Institutional framework: The project is being conducted by the Water Research Center in the Ministry of Irrigation. There is close cooperation with the Agricultural Research Center. In fact, agricultural scientists from that Center are assigned to the project. The contract with CID provides for procurement of necessary professional services, equipment, and commodities for the project.

2.4 There is an Egyptian Project Director who is assisted by a U.S. Technical Project Director. The principal project activities are carried out in three pilot areas in Mansouriyah, Kafr El Sheikh and Minya. The U.S. team consists of five professionals in the main office and one each at the field sites, for a total of eight U.S. technicians stationed in Egypt.

2.5 Project summary: The contract between AID and CID presents a clear description of the project concept and its implementation methodology. The following description is summarized from that document.

2.6 The final product from the project will be an action program, tested and proven as to technical applicability, farmer acceptability, and organizational replicability, that could be expanded to regional and/or national programs. An applied research and extension program is to be conducted with farmers in three pilot areas to:

(a) identify major constraints to improved on-farm water management and optimal water delivery system operation;

(b) determine and establish the use of optimal irrigation practices at the farm level in pilot areas;

(c) establish improved water control practices for the water delivery and drainage systems in project areas;

(d) develop plans for organization and implementation of expanded future programs, based on results in the project areas; and

(e) develop and/or train qualified scientists and technicians for the conduct of project activities.

2.7 Project components: In each of the pilot areas, project activities are to be implemented in three overlapping and interrelated components, which are:

A. Conduct on-farm surveys designed to improve the data base concerning existing farm production and to determine the type of additional research required.

B. Develop and improve a similar data base concerning quality and quantity of water entering and leaving each irrigation area.

C. Conduct studies in two stages where:

Stage (1) involves an on-farm research program based on components A & B and on results from other agricultural research in Egypt. Research the improvement of farm application systems. Develop optimum combinations of such factors as flow rate, field configuration, infiltration, field leveling, all of which will lead to higher efficiencies.

Studies also to be done on replenishment of soil moisture and control of waterlogging and salinity.

Stage (2) : Design and implement a pilot program in each of the three areas to test the accptability and rate of adoption by farmers of improved practices. Of equal importance will be the determination of the most efficient organizational approach or approaches, the technical competence of personnel required, and the costs and benefits involved in the successful conduct of such programs.

2.8 Supposedly the project is now at the beginning of stage (2), i.e. ready to initiate pilot programs. The evaluation, of which this report is a part, was designed to be conducted at this time to provide USAID and the contractor an independent assessment of the elements and organizational arrangements required for the pilot demonstration/production activities to be conducted during the last one and one half project years.

3. PROGRESS TO DATE

3.1 Much progress has been made on the project during the initial three-year period. Certain key elements are lagging, however, and now that the pilot stage is imminent a careful review of current status is in order.

Status of Project Activities

3.2 The project activities A, B and C (para 2.7) represent a well-planned and comprehensive approach to improvement of any irrigation system anywhere. All activities are essential to success. Activities A and B are necessary for building a reliable on-farm testing program, C stage 1. All three, in turn, are essential before entering the implementation of the pilot program (C stage 2).

3.3 Activity A, the on-farm surveys, has been developed and is functioning well. The data from these surveys are excellent and will be especially valuable not only to future programs in irrigation, but also for any other agricultural development program. Much information regarding the existing farmer practices, his constraints, and how he copes with them is revealed in these analyses. They should definitely be continued on into the pilot phase and beyond, if expansion programs finally develop from this project.

3.4 Activity B, the monitoring of the water situation, is not as well established. This could be due to a variety of reasons, the most important of which is undoubtedly the degree of difficulty encountered in accomplishing it. It is, however, essential to success in water management improvement programs to know how the water is presently being managed and where the water goes. This activity is especially difficult under Egyptian conditions because so much of the delivery system is below land surface and is essentially connected with the underground water system which lies just below the surface on most of the agricultural land, so that groundwater flow in and out of the canals and drains is hard to estimate. Possible improvements in the water budget studies are discussed in para 2.19 - 6.20.

3.5 Activity C, the on-farm research and the pilot testing, is in the planning stage. It will be analyzed below after reviewing the status of inputs, outputs and end-of-project status (EOPS). The inputs, outputs and EOPS originally planned in the Project Paper are shown in Annex A.

Inputs

3.6 Project progress has not been constrained by lack of inputs. Project facilities are quite satisfactory. In fact, in some cases it appears that over-abundance of inputs has caused diversion from priority problems. Specifically, the unusual amount of TDY technical assistance must at times surely hamper the productivity of the permanent staff (para 3.10). Also, some of the equipment was

inappropriate (e.g. laboratory trailers which are unused, slip-form lining machine which was too large and the accompanying concrete mixer which was too small, a current meter without a user's manual, etc.), showing less than sufficient care in procurement.

3.7 Startup delays: The full contract team was not in the field until 8 months after contract signature, and 16 months after signing the grant agreement (para 2.1). This, regrettably, is not especially unusual; often AID does not find contracts who can field large teams immediately after contracts are signed, and this should be programmed into the work plans, although the time lag in this case does seem excessive. The main point is that the contractor has only 4½ years from the time of arrival of the full team (January 1978) until contract termination (June 1982). This must be taken into account when evaluating progress and making future plans.

3.8 Expatriate personnel: The number of expatriate advisors is as contracted, with a full contingent of eight persons in the field team. They are stationed as called for and have the required disciplines. The advisors seem to work well as a team and to be individually hard-working, motivated and interested in making the project a success. However, over time there might have been what the Egyptian side perceives as a reduction in the quality of the U.S. team. Several of the recently-arrived team members are

more junior in age and experience than the persons they replaced, and inevitably suffer in the comparison. Nevertheless, there is much appreciation on the Egyptian side of the work of the U.S. team, and relations between the two teams are excellent.

3.9 The Egyptian counterpart team is also at full strength and appears highly motivated. The training activity has actually over-fulfilled its targets, as 178 person-months of training have been completed so far (not counting four persons presently on eight-month training), compared with 120 person-months planned in the PP for the entire project. The training has been exceptional in building enthusiasm and a team spirit in the Egyptian staff (para 3.16). The only staffing problem is the shortage of civil engineers in relation with project requirements, owing to the high demand for this profession in the private sector at much higher salaries; this shortage undoubtedly slowed the project construction work.

3.10 Short-term advisors: In the nearly three years since the project started, there has been a total of approximately eight person-years of short-term assistance furnished under the contract. Six person-years were provided in the technical areas; the other two in administration and training. It is questionable that such a large quantity of short-term help can be efficient and effective, especially as it was provided through a total of 54 persons. Some of the short-termers were apparently graduate students, whose stay

in Egypt was of more benefit to their own dissertations than to project progress, and other academic persons interested in visiting Egypt; some national team members estimated that more than half of the short-termers were not useful to the project. In addition, a significant amount of time of the Egyptian and the permanent U.S. staff was spent in programming and accompanying the short-termers. It may be noted that engineering discipline accounts for more than one-half of the short-term technical assistance; yet it is apparent, as will be discussed below, that this discipline lags behind the others in accomplishments.

3.11 Financial inputs appear to be sufficient and on schedule. Overall the input situation is as planned.

Project Outputs to Date

3.12 Project outputs required by the PP may be divided into two types:

(a) external objectives — what has been achieved, i.e. project findings which are usable for future irrigation planning, and

(b) internal objectives — how it has been achieved, i.e. the capabilities developed in Egyptian individuals and institutions, which will be useful for generating more research findings in the future.

3.13 Specifically, the external objectives were (Annex A):

1. identification of the major constraints to on-farm water management and optimal delivery system operation;

2. established optimal water practices available for use at the farm level in project areas;

3. improved water control practices for the delivery system in the project areas established; and

4. plans for organization and implementation of future program expansion developed.

3.14 The required internal objective was:

5. Experienced scientists and technicians in place.

3.15 The achievements of outputs to date, and perspectives for full outputs achievement by project end, are discussed in the following.

3.16 Achievement of the internal objective (output 5): Starting with the good news, the success of the project in creating an Egyptian water management study team is impressive. The Egyptian project agronomists, engineers, economists and sociologists have an outstanding grasp of the totality of irrigation water management in all of its social, economic, institutional and technical aspects. They are reputed to spend more time in the field with the farmers than any other Egyptian professionals. They are confident in dealing with the farmers and seem to enjoy the exchange. The farmers, in turn, have not been alienated from the project but actively seek the advice of the professionals. Moreover, farmers were observed to actually talk back to professionals on specific subjects, showing the degree of confidence which has been built up.

The different professionals work together as a team to achieve common objectives; some have even trained each other to do each other's routine work (e.g. taking flow measurements), so that the temporary absence of one will not harm the work. The shortfalls of the project in meeting specific output targets, discussed below, must be seen in this perspective. A critical mass with a high momentum has been created, which under a leadership that sets well-focused objectives is capable of remarkable achievements.

3.17 Legitimization of on-farm research: An associated internal output, not specifically mentioned in the PP but implied in the other outputs, has also been achieved by the project, namely: acceptance by the Egyptian research community of the idea that bona fide agricultural research can be done on the farmers' fields and with their cooperation. This is an enormous departure from the usual attitude in most countries that agricultural research is "that which is done in an agricultural research station," with the results transmitted (sometimes) to the extension service to divulge to the farmers, e.g. via demonstration plots. Apparently the project is performing the only on-farm research going on in Egypt; it has been successful in demonstrating and gaining acceptance for the idea that research work (variety trials, fertilizer and water response, etc.) can be done on actual farms so that the results are relevant under the farmer's conditions. Along with the creation of an Egyptian multidisciplinary field research team (para 3.16), this is the most significant project accomplishment to date. The following paragraphs discuss the project advance towards its external objectives.

3.18 Output 1 — the identification of major constraints has been implemented in Mansouriyah from late 1977 to the end of 1978, in Kafr El Sheikh from mid-1978 to late 1979, and in Minya from early 1979 to early 1980; it is now essentially complete. Within this stage, the project has performed the farm outlet studies, village soil testing and on-farm socio-economic/irrigation practices surveys.[1] The planned and actual timing of these studies in the three areas is shown in Fig. 1, 2 and 3. The results of the studies are given in TR (technical report) 1, TR 2, TR3 and TR 4 for Mansouriyah and in TR 6 for Kafr El Sheikh. The problem identification report and soil survey for Minya should be ready by March 1981.

3.19 This stage could perhaps be better termed "quantification of major constraints." When reading the list of problems identified (Annex B) it is evident that most of them were well known before the project; the Egyptian project team is also of this opinion.[2] On the other hand, this is the first time that these factors have been systematically measured under field conditions. The information thus gathered forms a solid basis for future interventions to break these constraints. On the other hand, the PP states that "some problems may be so obvious that practical solutions will be attempted early in the on-farm studies." This has not been done. When the list of proposed interventions (Annex C) is examined, we submit that

1/ As a prelude to these studies, a library research was conducted on all relevant precedent studies in Egypt.

2/ Although some problems were unsuspected, e.g. the apparent over-fertilization in Mansouriyah.

most of them could have been started a year or two ago.

3.20 Although the problem-identification stage is formally complete, problem identification and quantification is in reality a never-ending process; as some constraints are removed, others become the limiting factors and must be more closely measured. Thus, rather than stating that the problem-identification stage has ended, it would be more accurate to say that the solution-testing stage has begun.

3.21 The water budget studies are an ongoing activity which was meant to start with the on-farm problem identification studies and continue throughout the project. Figure 1 shows that the water budget study in Mansouriyah started on time (taking January, 1978, time of arrival of the full team, as the practical starting date in Mansouriyah, July 1978 as the planned starting date in Kafr El Sheikh and January 1979 in Minya). In Kafr El Sheikh the water budget study started six months behind schedule (Figure 2) and in Minya nine months behind schedule (Figure 3), apparently because the project management did not want to start them before the problem identification stage was finished in order to avoid a possible bias in its results. The drainage evaluations started six months late in Mansouriyah and Kafr El Sheikh and twelve months late in Minya.

3.22 Output 2 — established optimal water practices available for use at the farm level: Experiments leading to optimal farm-level practices will be referred to in the following as field trials,

to conveniently distinguish them from experiments leading to improved delivery systems (output C), referred to as canal trials. The main field trials implemented by the project were the establishment of precision land leveling and long furrows. The field trials started three months behind schedule in Mansouriyah, three months ahead of schedule in Kafr El Sheikh and nine months behind schedule in Minya. A start has been made on farm-level irrigation practices; in each of the three sites several fields have been leveled and field trials are proceeding.

3.23 Crop management experiments are an integral part of the farm-level optimal water practices. Figures 1, 2 and 3 show that crop management experiments started three months behind schedule in Mansouriyah, on time in Kafr El Sheikh and three months late in Minya. In Mansouriyah initially the agronomic experiments were totally divorced from water practices and dealt with pest control, zinc application and other purely agronomic practices without studying their interrelationship with irrigation. These experiments have produced the most remarkable results of the project to date (para 4.5 and 4.6). However, except for building up confidence of the farmers in the project team and helping to train the Egyptian professionals in field methods, they were basically irrelevant to the project objective. However, this situation was corrected, and at present most experiments in the three sites are done in four variations: (a) traditional practices, (b) improved irrigation practices only, (c) improved agronomic practices only, and

(d) both improved irrigation and agronomic practices. As will be discussed later (para 3.34), this methodology is essential for separating the benefits of the irrigation and the agronomic interventions.

3.24 Output 3 — improved water control practices for the delivery system: The major shortfall of the project lies in the fact that to date no start has been made on this output, i.e. on the improvement of delivery canals and mes/ahs (henceforth referred to as canal trials). EWUP tries to paper over this shortfall by confusing the canal trials with the pilot projects to create the impression that, with the so-called pilot projects (para 3.27) about to start in early 1981, the EWUP is basically on schedule. As will be analyzed at some length in section 6, the fact that no start has been made on canal trials in the three past years makes it impossible for the project to fully reach its outputs by June 1982, and constitutes the chief shortcoming of the project.

3.25 Output 4 — plans for future program expansion developed: This output should come about at the end of the project, and is expected to occur on schedule.

End-of-Project Status (EOPS)

3.26 The End-of-Project Status (Annex A) is worth examining at this stage, because a cursory review might lead one to conclude that most EOPS criteria have been met and the project is already successful. This is certainly not the case, especially in light

of the fact that most outputs are yet to be developed. The EOPS remaining to be accomplished are vitally important to project success, and it would be misleading to assume that the overall project is a success without at least a degree of completion of EOPS 1b and 1c. A brief review of all EOPS follows:

1 a. Three pilot areas established: The sites have been established, with working teams assigned and functioning. Soil and farming practice surveys and area water balance have delineated many boundary conditions. The degree to which operation of the farm water management system is known within each area varies considerably. Much more is known in this regard about the Monsouriyah site than about the other two.

1 b. Farmers are practicing recommendations derived from the project: Farmers appear especially cooperative and work well with project staff. However, farmer acceptance can only be fairly evaluated at project termination, when pilot testing of recommendations should be complete.

1 c. Yields have increased significantly over non-profit areas: Some significant yield increases have been achieved, especially from agronomic practices. Yield increases strictly from water management changes have not yet been demonstrated. Evaluation of this must also await project termination.

2 a. Government approval exists for program expansion: The Government of Egypt views the program with great anticipation. Once viable programs for expansion can be demonstrated, not only with a delineation of the technology but also of the means to implement it, the government will respond. Both the Ministry of Agriculture and the Ministry of Irrigation look to this project to provide guidance on design of programs to increase agricultural production.

2 b. Farm problem feedback mechanism exists: The farm survey mechanism provides excellent feedback on agronomic, social and economic status. These surveys should continue throughout the life of the project. Feedback from the irrigation system operation is weak. The overall water budget for each entire area is good, but the manipulation of the water within the system is not sufficiently monitored. In fact, it is not yet well known (para 6.19 to 6.21).

2 c. An evaluation program exists for the research: Here again the farm survey mechanism provides an excellent tool to monitor changes caused by research. It is undoubtedly sufficient unless the sole objective of a specific item of research should turn out to be saving water, developing procedures or anything other than increasing farm production or farmer income.

2 d. Interministry and interdisciplinary approach accepted: Without question this condition has been fully met.

2 e. Farmers' views understood and incorporated in planning: Undoubtedly this has been accomplished to a great extent. Certainly the farmer's views have been sought (e.g. SP 24, SP 32) and research programs have been molded to take them into account. However, it is not readily apparent that his views are completely understood regarding operation of the irrigation system along each mes/ah or among the mes/ahs along the branch canals. His perceptions and suggestions regarding farmer organization also needs further attention.

Plans for Upcoming Activities

3.27 Tentative plans have been made by EWUP for what it terms the pilot testing phase at each of the project sites. These are attached in Annex C. The basic activities proposed are:

(a) Mansouriyah:

i. development of an advisory service to assist farmers with irrigation scheduling, distribution, system maintenance, pest control and improved agricultural practices;

ii. development of farmer organizations to facilitate scheduling of water, ditch maintenance, and other community efforts;

iii. improvement of mes/ah 6 at its present level;

iv. elevation of mes/ah 10 for gravity irrigation;

v. replacement of El Hammami canal by a buried pipeline;

vi. replacement of El Hammami mes/ah 2 by buried pipeline; and

vii. development of a land leveling program.

(b) Minya:

i. elevation of mes/ah 26 and pumping into it (a simulated gravity system) with land leveling, farmer organization, irrigation scheduling, micro-nutrients, farmer advisory service; and

ii. elevation of the entire Abueha canal (1120 fd) for gravity irrigation, with the same interventions as above.

(c) Kafr El Sheikh

i. Hammad and Manshiyah mes/ahs: Improving two sa/iya areas on each mes/ah with land leveling, elimination of field drains to save land, reshaping of canals and drains, farmers' organization and advisory service, and improved agronomic practices.

3.28 In addition to the pilot testing described above, project personnel have listed 7 items still needing further problem identification and research. These include:

(a) Field drains at Kafr El Sheikh

(b) Plant population density

(c) Sweet corn production

(d) Farmer acceptance of new technology

(e) Irrigation law

(f) Relationship between farmers and support institutions

(g) Role of livestock in agriculture.

3.29 Perspectives for accomplishment of the proposed EWUP action program: The EWUP action plan is scheduled to run from January, 1981 to December 1982, so it does not even claim to have anything more than progress reports by project end in June 1982. Moreover, it is expected that construction of the El Hammami buried pipe will take at least a year, so that it will be finished at best at the end of 1981, with only six months left in the contract to observe the impact on yields and to organize the farmers (since meaningful organization can take place only after the physical intervention). Thus only very preliminary results could be had by June 1982 regarding the success of these activities. The same holds, to a lesser extent, for the other proposed interventions: 1½ years are simply too short a period to implement and observe the effect. In this respect, the experience of the Beni Magdoul canal is disconcerting. This canal had been lined by the MOI in 1977, before the project started. Far from regarding this as an opportunity, the project considered that this had spoiled the purity of the experimental situation, as no previous farm data was available to make a before/after comparison. An alternative would have been to compare crops with those on the command area of a neighboring canal, but although the project has been collecting detailed farm budget data in Beni Magdoul for three years, no economic analysis of the benefits of canal lining has been performed,[1] nor is the project planning to do one, although this is one of the major MOI

1/ Except for a six-page preliminary study (SP 29).

expectations from the project (para 5.6). In light of this performance, it is expected that the most likely results by June 1982 will be number of improved canals and buried pipes constructed without conclusive evidence regarding their economic feasibility, a number of semi-organized farmer groups, and a request for a five-year contract renewal. Project achievements will be sufficient to meet the letter of the contract, but not to provide the MOI with the information it expects from the project to rationally determine its irrigation investments in the coming years.

3.30 Definition of a pilot project: Before recommending that the project proceed to the pilot project phase, it is legitimate to ask what is meant by a pilot project. The PP is very specific on this point:

> "At the end of the initial program of solutions to the major problems, a number of high-benefit technologies will be defined. With this technologies identified, an integrated package of technologies will be offered as a pilot program on an outlet or lateral basis for adoption by farmers. Such a program would then be initiated on a pilot basis to test its acceptability by farmers and their rate of adoption." (PP Section II.B.3.3.7) (underlining added).

3.31 It is clear that the PP meant the pilot phase to be a larger-scale package application of certain techniques after they have been individually tested and proven advantageous. This is further illustrated by such statements as:

> "After testing various practices in on-farm experiments, a package of practices will be offered as a pilot program." (PP Section IV.C.1.), or

> "Farmers taking part in the pilot projects will benefit... with somewhat more certainty, since the experimental work is intended to filter out problems of on-farm implementation." (FP Section III.D.3.).

3.32 By the above definition, in no way can the proposed project interventions (mes/ah elevating for gravity irrigation, buried pipeline, etc.) be termed pilot projects, since they are not techniques which the project has already tried and can confidently offer to the farmers on a larger scale. Rather, they are canal and mes/ah trials. As such, they should have been started a year or two ago, immediately after ending the problem-identification phase or even before that date, since most of the proposed interventions are well-known ideas and none of the information developed by problem quantification was necessary for their implementation. Instead, the project spent much effort on topics irrelevant to project purpose[1/], and no start was made on the all-important canal trials. The difference is far more than semantic. Referring to the upcoming canal trials as "pilot projects" has two undesirable effects:

(a) it masks the fact that the canal trials have not been started on time, and as a result there is no chance of achieving meaningful results by project end (June 1982); and

(b) it encourages the researchers to apply a package including different interventions (from land leveling to zinc application) which in general will be applied separately,

1/ Ranging from SP (staff paper) 35 on "Agricultural Pests and their General Control Concepts" to SP 9 on "Honey (!) Production at Kafr El Sheikh."

so that the canal trials will not be in position to separate the benefits of the main intervention (e.g. buried pipeline).

3.33 In this connection, it is noteworthy that the EWUP team consistently refers to the present (post-problem-identification) stage of the project by the somewhat vague term "searching for solutions," whereas the PP defined this stage by the more specific term "testing of solutions." Practically all of the activities which have been proposed in Annex C for the upcoming phase of the project (with the partial exception of large basins and long furrows) belong to this category of testing solutions which are new to Egypt and which have yet to prove their economic and organizational feasibility.

3.34 Agronomic vs. irrigation effects: As noted in para 3.32 (b), a main danger with regarding the upcoming canal trials as pilot projects is that it encourages the team to mix in these trials low-investment, high-benefit agronomic interventions (zinc application, pest control) with high-investment, low-benefit irrigation interventions (elevated canals, buried pipes). This is likely to mask the effect of the irrigation interventions and prevent the canal trials from giving unequivocal answers as to whether the irrigation interventions by themselves are economically feasible. To avoid this problem, the canal trials should collect data on four situations (as was done for leveling trials in Kafr El Sheikh):

(a) farmer's practices, (b) irrigation improvements only, (c) agronomic improvements only, and (d) both irrigation and agricultural improvements. Where resources do not permit this, only farmers' practices and improved irrigation practices should be tried.

3.35 The action program which is recommended by the present evaluation will be discussed in Section 7, after reviewing the interventions which have the highest potential (Section 4) and which are of highest interest to the GOE (Section 5), and analyzing the project performance (Section 6).

4. POSSIBLE PROJECT INTERVENTIONS

4.1 To optimize the usefulness of the one and one-half years remaining in the project, one must consider the alternative possibilities for action in light of the knowledge gathered so far and concentrate on those activities which promise the highest payoff and potential for replicability. The present section gives some bases for such planning.

4.2 Possible lines of action: The following interventions have been suggested by the project team (based on the problem identification results), the GOE agencies concerned, USAID and IBRD specialists. They are listed in their approximate order of priority for application, as discussed in the following.

(a) Agronomic interventions:

i. zinc application,

ii. pest control,

iii. improved cultural practices,

iv. soil mapping for fertilizer application,

v. increased plant population,

vi. improved varieties.

(b) Irrigation interventions:

i. improving canal gates and shifting to continuous flow,

ii. mechanical clearing of mes/ahs,

iii. improvement of water-lifting equipment,

iv. conjunctive use of canal and drain water,

v. supplementary well irrigation,

vi. lining canals and mes/ahs in place,

vii. raising canals and mes/ahs and organizing the farmers for gravity irrigation,

viii. replacement of canals and mes/ahs by buried pipe and organizing the farmers for gravity irrigation,

ix. precision land leveling.

4.3 The above interventions may be rated according to the following parameters:

(a) investment per feddan,

(b) yield increase,

(c) water saving,

(d) labor saving,

(e) reduction of other costs,

(f) land saving,

(g) complexity of organization required,

(h) farmer acceptance,

(i) GOE willingness to apply, and the resulting

(j) potential for replicability.

4.4 The rating of each of the possible interventions along each of the above dimensions is discussed in the following. Where no other source is given, the rating is strictly the evaluation team's opinion and may be open to debate. It should be borne in mind, however, that had the testing-of-solutions stage really been finished at present, as claimed, there would have been hard data on most of these subjects. Since the most significant results of EWUP to date are the agronomic ones, these are discussed first, in their approximate order of priority for application.

Agronomic Interventions

4.5 Zinc application: SP (Staff Paper) 38 shows that in Delta soils, under farmer conditions, zinc application increased rice yield by 67% (!), wheat yield by 14% and flax yield by 23%. In Abueha (Minya), zinc application increased corn grain yield by 14% (SP 10) and apparently doubled wheat yields.[1/] These results were achieved without changes in water management or other practices. Zinc application by itself thus has the potential for significant to dramatic yield increases. The investment (sprayers) is low, and so are the additional labor and other costs involved (zinc sulphate), as well as the organizational complexity. Water consumption is unchanged. Farmer acceptance and GOE interest are high, and the potential for wide replicability very good. Thus large-scale zinc application seems a priority item. However, this is a strictly

1/ Note however that in Mansouriyah (SP 20), wheat did not respond to zinc treatment.

agronomic subject and as such not appropriate to EWUP. Unless the subject is adequately covered by the Major Cereals Project or another project, pilot-scale and large-scale zinc application (including the necessary soil mapping, input provision, extension effort, etc.) should be a priority subject for an agricultural project.

4.6 Pest control: In the Mansouriyah area, SP 15 shows that EWUP on-farm experiments increased squash yields from 0.5 to 4.2 MT/fd. SP 16 shows tomato yield increases from 4.16 to 10.4 MT/fd. SP 17 shows squash yield increases from 0.3 to 4.2 MT/fd(!). SP 19 shows cabbage yield increases of 88%. These increases were due mostly to pest control, combined with improved seedbed preparation and fertilization. These results show that pest control in vegetables can increase yields dramatically. The investments (sprayers), additional labor and other costs (pesticides) are low in comparison with the value of the increased yield. Organizational complexity of application is low. Farmer acceptance on the project is high and so is probably GOE interest. Thus the potential for replicability in the vegetable areas of Egypt is good. Again, this is an agricultural subject only minimally related to water management, and could be a priority subject for an agricultural project.

4.7 Improved cultural practices: SP 7 found that rice transplanting by mechanical transplanter improved grain yields by 24% while reducing water consumption by 12% and variable costs by 14%. After some more

field trials, this technique should be ready for pilot application. Investment in the transplanter is medium (18.4 LE/fd if used to capacity on 75 fd); organizational complexity should be medium (there is a need for repair shops), and so are likely to be farmer acceptance and GOE interest. Thus this is a promising subject for trials on a larger scale.

4.8 Soil mapping for fertilizer application: At present MAG fertilizer recommendations are uniform for entire governorates or larger regions. SP 34 shows that farmers in Mansouriyah apply phosphorous and nitrogen fertilizers in greatly varying quantities, which usually exceed the recommended doses. SP 43 found that phosphorous application can increase yields by 10% - 15% and that each crop basin should be sampled separately for a phosphorous fertilizer recommendation. Recent results from Mansouriyah indicated that increasing nitrogen fertilizer from 50 Kg N/fd to 60, 75 and 100 Kg N/fd lowered yields by 8%, 8% and 16% respectively. These admittedly very preliminary results indicate that yields may be increased and costs of fertilizer reduced by a program of soil testing for fertilizer, combined with farmer plot trials to test fertilizer response. Yield increases, cost reduction, organizational complexity, farmer acceptance and GOE interest are likely to be medium. Thus this subject could be replicated in a pilot area, say on a governorate level.

4.9 Increased plant population and improved varieties: There is a potential for a medium increase in yields at a low cost by these interventions. Thus in Mansouriyah, improved corn variety with other cultural practices showed a yield increase of 17%. In Minya the project expects a 25% yield increase in cotton and beans through

higher plant density and correct fertilization (including micronutrients). The organizational complexity is medium (a research and extension effort is required), and there is a medium to good farmer acceptance and GOE interest.

Irrigation Interventions

4.10 The possible irrigation interventions during the remaining one and one-half years of the project are discussed below with respect to the parameters listed in para 4.3, again according to what the evaluation team considers the order of priorities for highest payoff and potential for replicability.

4.11 Improving canal gates and changing from rotation to continuous flow: The investment per feddan is minimal. There should be a small yield increase. The change will enable farmers to irrigate on the basis of crop requirements.
The main rationale for the change is water saving: SP 18 cites a previous research in which the continuous-flow system caused water savings of about 9%. At Beni Magdoul (SP 18), shifting to a rotation system plus lining, gate rehabilitation and operating the gate according to demand caused the water consumed per feddan to be only 54% of that in a neighboring traditional canal. The degree of organization is low, necessitating only more attention on the part of present MOI personnel. EWUP studies in Mansouriyah showed most farmers to be in favor of rotation. MOI interest in rehabilitating the gates is high. If the MOI is also interested in changing to a continuous flow system, the possibilities for replication are high.

4.12 Mechanical clearing of mes/ahs: This is at present a subject of high interest in Egypt, primarily owing to its potential for saving canal-clearing labor, which is becoming very scarce. The potential for yield increase (through better water distribution) is medium, and a small to medium water saving is possible through weed elimination. Some land would also be saved by reducing the cross sections. The investment per feddan is medium, and so is the organizational complexity (a governorate-level company for operation of canal-clearing equipment is recommended). Farmer acceptance is high, and so is GOE interest (such equipment is now being tested at several locations). However, there are indications that the equipment used at present is not the most appropriate (backhoes carve out a cross-section too wide for mes/ahs, while ditchers are not being used in the Nile Valley lands). Project experience in clearing mes/ahs with ditchers and measuring the costs, water savings and yield increases would require relatively small effort and promises high payoff and potential for replicability.

4.13 Improvement of water-lifting equipment: The project plans to spend much of its resources (para 3.27) on changing the present lift irrigation system to gravity irrigation. For the reasons discussed below (para 4.18), the evaluation team submits that this approach is of very limited acceptability and replicability. On the other hand, the team believes that the costs of water lifting could be considerably reduced by a few simple design changes in the pumping equipment, which should have wide acceptability and

replicability, to wit:

(a) The metal sa/iyas (water wheels) used throughout Egypt represent a great improvement over the wooden sa/iyas which they replaced, but their efficiency could be considerably improved by the simple expedient of setting the axles on ball bearings, with consequent less animal labor resulting in greater milk production.

(b) The centrifugal irrigation pumps being introduced are grossly energy-inefficient, as they lift the water about one meter above ground and jet it forward, all of which is dissipated energy; SP 23 estimates that for a net lift of 1.0 m a diesel or electrical pump must work against a 3.5 m head. A low-lift, large-diameter helical pump, which lifts the water no more than is necessary, should both bring about energy savings and require a smaller, cheaper motor.[1/]

(c) Finally, the tambour (Archimedes' screw) is quite an inefficient water-lifting machine, since it uses only the hand muscles which are much weaker than the thigh muscles. Introduction of the IRRI (International Rice Research Institute) diaphragm pump (which is operated by the farmer standing on it and shifting his weight from one leg to another), as well as fashioning a simple metal frame which

1/ MOI engineers at the 30,000-fd San el Hagar reclamation area coupled 17-HP motors with oversize sa/iyas to lift water for irrigating 200 fd each at a present cost of LE 2200 each, i.e. an investment of eleven pounds per feddan. This shows the benefits possible from simple design changes in existing equipment.

would enable the tambour to be turned by a bicycle, would greatly reduce farmer hand labor without demanding any other changes in the system.

4.14 The pump improvements suggested above would require minimal investments per feddan and would result in considerable savings of labor, fuel and animal energy. The organization required is minimal. Once the devices have proven their worth, their spread could happen even without GOE intervention (as was the case with metal sa/iyas and motor pumps). Thus a small effort of the project in introducing prototypes of low-lift helical pumps, ball-bearing-mounted sa/iyas, diaphragm foot pumps and bicycle-operated tambours should have a high payoff and wide replicability. Such prototypes might be developed by the project through a contract with the MOI hydraulics laboratory, which has apparently been working on such innovations.

4.15 Conjunctive use of canal and drain water: Much of the agricultural drainage water is of sufficient quality to be reused for irrigation even by itself (many farmers are pumping drain water onto their fields), and more so when mixed with fresh canal water. Conjunctive use of drain and canal water could save considerable amounts of drain water now flowing into the Mediterranean. The investment per feddan would be medium, as areas irrigated with mixed canal and drain waters are likely to require a good drainage network to avoid salinization. The chief advantage of conjunctive use is

the saving of water, to be applied on new lands. Conjunctive use does not imply yield increases or labor and cost savings. Little organization will be required beyond MOI operation of drain pumps and monitoring of water quality and effect on the soils. GOE interest and farmer acceptance are good. Thus this method has a good potential for replicability. The feasibility of conjunctive water use can only be determined by investigating its effect on the soils and its drainage requirements through EWUP-type field research.

4.16 Supplementary well irrigation: In certain regions of Egypt farmers located at the end of canals and mes/ahs suffer from seasonal water shortages which lower production both through yield reduction and through motivating the farmers to plant lower-value but more drought-resistant crops. The extent of the "tailender problem" is still a subject of discussion. Where the soil is porous, this problem may be solved by sinking wells for supplementary irrigation during peak periods. Some farmers in the El Hammami area of Mansouriyah have done so by their own means, showing that they find this activity economical. The investment per feddan is high (89 to 250 LE/fd — TR 5). The yield increases should be medium (TR 5 estimates increases of 9% to 23% in maize). The complexity of organization is low, as a farmer may operate a well individually or rent its use to neighbors. Farmer acceptance is high, at least in the vegetable belts of urban areas (e.g. Mansouriyah). GOE interest is low since the MOI sees its function as the provision

of surface water. In sum, replicability should be good in well-defined areas (vegetable belts with light soils).

4.17 Lining canals and mes/ahs in place: This measure would have fairly high costs per feddan (SP 29 records a cost of 47 LE/fd for the Beni Magdoul canal and 43 LE/fd for a branch canal in 1977; present costs are considerably higher). In sandy soils (on the Nile Valley fringes) lining should cause considerable local water savings. SP 36 measured losses of 1.34% to 3.93% per km in different reaches of the Mansouriyah Canal, and cited overall losses of 10% to 40% in other canals in Egypt. Lining should bring about small yield increases owing to better water availability. It will also reduce maintenance costs and free some land for planting. It requires either a high degree of organization (an irrigators' association) or substantial MOI budgets for regular maintenance of the lining. Farmer acceptance should be high if the MOI finances the lining, slow otherwise. MOI is interested in this solution. Owing to the investment costs, the potential for replicability is low to medium.

4.18 Raising canals and mes/ahs and organizing the farmers for gravity irrigation: The Egyptian irrigation system is designed to provide an abundant quantity of water to each irrigated acre. The water is supplied in a conveyance system located below field level, and it is usually reduced or cut off in the branch canals during the nighttime hours. Each farmer must therefore lift his water 1 - 2 feet to spread it on his crops. He does this by various hand, animal, and mechanical-powered pumps. Such a system acts as a long

reservoir where water is essentially stored before use. With such a system the farmer has some flexibility on when he irrigates. In other words, the water will not run off if it is not immediately used. The branch canals and all mes/ahs connected to them have a rather large storage capacity.

4.19 When this system is placed above ground a different situation obtains. The water will flow by gravity and it is much more important to develop a rotational system of use among farmers. When the system is flowing it must be used or spilled into a drainageway. This is not to say that the tertiary system should not be elevated. In the interest of energy savings alone it is surely worth testing. This is to point out that there are some advantages to the below-ground system. It is probable that one can come nearer to scheduling water strictly according to crop demand with the below-ground system.

4.20 The investment per feddan in elevating canals and mes/ahs for gravity irrigation should be medium to high, depending on whether the elevated canal is lined or not. It is doubtful that this technique would show yield increases. Egyptian engineers maintain that allowing gravity irrigation would cause the farmer to use more water than at present; common sense would indicate that this is the case, and there is no data to support the CSU team's position to the contrary (the water budget study data for the Abueha canal in Minya has not yet been analyzed so as to make possible a comparison between water consumption on gravity-irrigated and lift-irrigated farms). The benefit of the system is in elimination of farmer hand labor for turning tambours (estimated in Minya at roughly 60 LE/fd/yr) and of

animal or motor pumping costs (estimated by EWUP at 30 LE/fd/yr — SP 23). The organizational complexity is high, as the farmers on each mes/ah must be organized in an irrigators' association to schedule and practice turns in water use; this runs counter to the desire of the first farmers on each mes/ah to take water whenever and as much as they want, so that such organization is problematic. In addition, the MOI will have to control not only the canal gates as at present but also the mes/ah inlets. Farmer acceptance is high for gravity irrigation,[1/] but low for the self-restraint which irrigation by turns requires from the upper-end water users. GOE willingness to apply is negative, as it is a strongly felt MOI policy that farmers must be obliged to pump in order to save water. Senior MOI officials commented that they would accept canal elevating only as a part of a complete water management system (including precision leveling, lining, etc.)—a condition not likely to be fulfilled to a significant extent except on new-lands projects. For these reasons it is concluded that the potential for replication of canal elevating is low.

4.21 Replacement of canals and mes/ahs by buried pipe and organizing the farmers for gravity irrigation: The cost per feddan of this method should be high. Water savings would result from elimination of canal seepage, but these might be annulled by the probable tendency of the farmer to use more water when it is provided without effort. Reduction of hand labor, animal and motor pumping

1/ Which is colloquially known as "rayy be raaha" — "irrigation in comfort."

costs would result, as for elevated canals (para 4.18), but would be partially or wholly offset by the energy costs of supplying pressure to the pipe. An important advantage of buried pipes is the freeing for cultivation of land presently occupied by canals. The complexity of organization is high, as the farmers must conform to an irrigation schedule and the MOI must be in position to adequately operate and maintain the pumps which are necessary for supplying water through a buried pipe. Paradoxically, although buried pipes supply water to the users without an effort on their part just like gravity irrigation, MOI interest in buried pipes is high. However, owing to the investment and organization required, as well as to the permanent shortages of asbestos-cement pipe in Egypt, replicability of this system appears limited.

4.22 Precision land leveling: The investment per feddan is medium. The yield increases are expected to be small and difficult to isolate from those caused by other factors. Water savings may be high—preliminary results for wheat irrigation in Kafr el Sheikh show an average increase in field application efficiency from 38% to 62% due to EWUP practices (leveling, long furrows and marwah improvements). There is a significant saving in irrigation labor (reportedly reduced in EWUP trials in Kafr el Sheikh by about 40%). The large basins or long furrows made possible by land leveling save about 10% of the agricultural area presently occupied by marwahs and bunds. On the other hand, precision leveling in the Nile Valley lands presents considerable technical, organizational

and sociological problems, to wit:

(a) because of the cropping intensity, the land is free for leveling only a few weeks per year;

(b) roads for access of the leveling equipment to the small farms are often lacking, and it is also difficult to maneouver the relatively large machines within the small fields;

(c) for efficient leveling, all farmers on a given mes/ah must organize to have their land free at the same time;

(d) experienced equipment operators and surveyors are in short supply;

(e) no Egyptian public agency is charged with leveling small farms in the Old Lands; 1/ and

(f) most farmers simply do not have a perceived need for better leveling.2/

4.23 The main constraints for large-scale precision leveling are (a), (e) and (f) above. Leveled lands must be releveled about once every four years. Thus a leveling of say 1,000,000 fd would signify a need to relevel 250,000 fd per year in a few weeks — a very unlikely achievement. Thus the perspectives for large-scale replication of precision leveling on small farms in Egypt are quite limited.

1/ The Executive Authority for Land Improvement Projects is engaged mostly in soil improvement through drain excavation, leaching, subsoiling and gypsum addition; it performs land leveling only on the Delta Sugar Company lands in the El Hamoul sector of Kafr El Sheikh.

2/ In the sociological study of the project sites (SP 32), 75% of the farmers interviewed believed that their fields are already as level as they should be for good irrigation.

5. GOE EXPECTATIONS FROM THE PROJECT

5.1 EWUP does not operate in a vacuum; it is designed to support the activities of the Egyptian agencies engaged in water use and management, and it will be of no use unless its results are applied by them; therefore it must respond to their perceived needs. A review of potential project users discovered that they are almost entirely concentrated in the Ministry of Irrigation. In particular, the potential users of project results are:

(a) the top decision-makers (Minister and Vice-Minister);

(b) the Irrigation Division and the MOI governorate-level agencies (responsible for water distribution);

(c) the Projects and Expansion Division;

(d) the Water Master Plan; and

(e) the Drainage Research Institute.

5.2 The evaluation team consulted senior officials of the above entities, as well as of other institutions presently or potentially concerned with the project (the MAG Agricultural Research Center, Executive Authority for Land Improvement Projects, and General Directorate for Agricultural Extension), regarding their expectations from the project. These are discussed in the following.

5.3 Possible objectives for an irrigation improvement program may be one or several of the following:

(a) water savings,

(b) yield increases,

(c) land savings,

(d) labor savings,

(e) reduction of other irrigation costs, and/or

(f) bilharzia control.

5.4 MOI objective: Numerous interviews with high MOI officials and review of the Ministry development plans 1/ indicated that the most important MOI objective by far is reduction of water losses in order to save water for horizontal expansion of the irrigated area without reducing current yields. Yield improvement ("vertical expansion") which does not entail water savings (e.g. through organizing or policing the farmers to distribute more equally a given quantity of water) seems to hold very little interest. Land savings and bilharzia control were mentioned mostly as beneficial side effects of otherwise desired interventions (e.g. replacement of canals by buried pipes); while savings of labor and other farmer costs is actually regarded by the MOI as undesirable — there is a consensus in the MOI that the farmers should spend effort and incur expenses for lifting water, so that they will have an incentive to save it. The philosophy of obliging the farmer to save water runs as a common thread through MOI thinking.

1/ "Irrigation Development in Egypt," MOI, 1979 (in Arabic).

5.5 MOI priority interventions: In order to accomplish the objective of water saving, MOI officials think most often in terms of the following interventions (roughly in this order of priorities):

(a) rehabilitate gates to reduce leakage losses;

(b) line secondary and tertiary canals, especially in light soils;

(c) lower canals, changing existing gravity to lift systems, to cause farmers effort in lifting water;

(d) replace canals by buried pipelines;

(e) correct mes/ah inlets to supply the correct discharges; and

(f) guide farmers to save water (e.g. by night irrigation).

5.6 MOI expectations from the project: MOI expects the project to help it achieve its objectives by providing information and experience on the following topics (again — roughly in the order of priorities):

(a) buried pipelines: technology, water savings, costs and benefits;

(b) lining of mes/ahs and marwahs: water savings, costs and benefits;

(c) effect of improved water management on water consumption and on drainage — in particular, whether it offers possibilities to do without field drains;

(d) improved gates (e.g. Nyrpic gates) and canal tail escapes: technology, water savings and costs;

(e) reduction in the water consumption of sugar cane;

(f) land leveling: technology, water savings, costs and benefits;

(g) the economy of lift pumping at the national level.

5.7 Time pressure: MOI is interested in the above information as soon as possible in order to help it plan its upcoming rehabilitation activities, such as the 40,000-fd. Zefnah pilot project in Gharbiyah. MOI is more interested in prototypes functioning in the field than in research papers.

5.8 The project task: Project scope need not be limited by the above demands. Some promising activities such as improving pumps to reduce lift costs (para 4.13) or sinking of wells for sumplementary irrigation (para 4.15), which are not of priority interest for the MOI at present, might also be investigated by the project. However, unless the project supplies by June 1982 at least preliminary answers on the topics listed in para 5.6 it will be considered by the MOI as a disappointment — regardless of whether it has conformed to the letter of the CID contract — with potentially serious consequences not only to project continuation but to USAID credibility in Egypt.

6. ASSESSMENT AND ANALYSIS

6.1 The present section discusses a variety of topics concerning the project design, complementation, technical and organizational aspects.

The Project Design

6.2 The project concept and design are exceptionally good. The evaluation team does not feel that with the benefit of 20/20 hindsight it could have been significantly improved upon. The process of learning how the present system functions before testing or implementing solutions is sound and logical. Too often one finds, in development projects, solutions to non-problems or assumed problems being implemented without the vaguest notion of how to be successful. This is true especially in irrigation system improvement, which is a complicated mix of society, water, land and cropping systems. And the Egyptian water delivery system is so complex that it is virtually impossible to understand it without systematic data collection.

6.3 This project provides time for that difficult and time-consuming phase of data collection, to understand the system and identify the problems. The project is undoubtedly providing the

best farm agricultural data available in Egypt. These data are needed by several ministries in the Government of Egypt and by donor agencies involved with assistance to them. It is noted that the recent USAID scope report on the "Nile River System - Redesign, Rehabilitation and Improvement Program" suggests that the following alternatives should be investigated in developing the feasibility for a command area irrigation project:

(a) install a gravity system on an entire area;

(b) change from a rotation to a demand system of water delivery;

(c) reduce the size of the mes/ah command area;

(d) develop operation and maintenance plans;

(e) develop conjunctive use of water; and

(f) investigate land leveling and use of fill to raise mes/ahs.

6.4 The feasibility of each of these alternatives cannot be assessed without a great deal of basic information and research. The Water Use and Management Project, in its final phase, should provide exactly the type of information needed on all of these technologies.

6.5 The project, then, is timely. Its output is needed now. Among government officials one feels a sense of anticipation and expectancy for information which will define a workable large-scale program to increase agricultural production. It is especially important that the project focus full attention in the upcoming implementation phase on providing this needed information.

Assessment of Project Design

6.6 Interpretation of the project scope: In spite of a very lucid Project Paper, a point of potentially major misunderstanding remains, namely: what is meant by "on-farm"? Does it mean "upon entering the farmer's property" or "upon passing the last control of the Ministry of Irrigation"? As discussed in para 3.22 and 3.24, if the former (limited) definition is adhered to then the project is on schedule, while according to the latter (expanded) definition the project is seriously lagging, since no interventions have yet been made in the no-man's-land between the last MOI control and the farm gate. The statements and actions of the contractor (e.g. planning to do mes/ah raising and lining) show that the contractor adopts the expanded definition, as does USAID. However, at present the contract (para 2.7)does not specifically include the non-farm, non-MOI irrigation and drainage system, and this may cause uncertainty during the final evaluation as to whether or not the contractor has fulfilled his obligations. To avoid misunderstanding it is recommended that USAID will formally establish, in a letter to the contractor, that for the purposes of this project "on-farm" means "all fields, canals and drains between the last MOI control gate and the drains regularly maintained by the MOI."

6.7 Agronomic practices: Another point of divergence is that the PP included "testing of agricultural procedures" with the intention of testing them in interrelation with irrigation practices,

to determine for example the correct timing of fertilization and pesticide applications in relation to the irrigation schedule. At the start of implementation this was not followed, as purely agronomic experiments moved alone and ahead of the irrigation experiments. This situation has been improved, but it is still present in the ongoing trials and in future planning.

6.8 The basic design decisions such as the make-up of the technical assistance team seems to have been quite correct (except for the omission of a project administrator — para 6.9). The selection of the Water Research Center as the principal counterpart agency, with cooperation from the Agricultural Research Center, seems an optimal institutional framework for the project. Location of the project office in Cairo was logical in view of the availability of facilities and senior Egyptian staff, proximity to the points of decision-making, and central position with respect to the field sites. However, the expatriate subject-matter specialists (agronomist, engineer, sociologist and economist) should spend about one-half of their time in the field — doing much of their report-writing at the Kafr El Sheikh and Minya sites — since daily contact with their counterparts is one of the chief benefits of their presence.

6.9 Lack of a project administrator: Many of the project delays and deviations from its purpose (para 3.21 - 3.24) may be ascribed to the fact that the PP did not provide for an expatriate project

administrator, and the contractor did not or could not change the design in this respect. As a result, the large majority of the technical director's time was taken up in administrative matters such as housing, salaries and correspondence, and he was not able to devote his full attention to the true management function of keeping the project outputs on course. Hiring a national administrative assistant apparently did not give the desired results. The lesson here seems to be that a team this size must be provided with a full-time administrator.

6.10 Assumptions: All major assumptions essential to project progress (Annex A) held true and did not limit project progress. In particular, the separation of the former Ministry of Agriculture and Irrigation into two did not prove an obstacle to the project. However, some unstated input assumptions were only partially fulfilled, and undoubtedly had some slowing effect. The shortage of civil engineers on the project has already been noted (para 3.9). The willingness of older Egyptian staff to change from office to field work has also been overestimated, and in retrospect it would have been better to concentrate the field training on the younger staff.

6.11 A major implicit assumption was that the Egyptian staff will be properly motivated. Motivation of the Egyptian staff, which devotes to the project efforts that are unusual in the Egyptian public service, critically depends on the incentives provided by

the project. USAID financing of these incentives is scheduled to terminate at the end of 1980. Unless a source of financing is found for continuing these incentives, Egyptian staff motivation is likely to suffer precipitously, with a serious detrimental effect on the achievement of project outputs.

Management of Project Implementation

6.12 Lack of a sufficiently results-oriented attitude lies at the base of many of the output shortfalls to date discussed in para 3.21 - 3.24. A case can be made for this phenomenon being associated with the university background of the contractor. The academic attitude — which has the advantage of contributing a broad knowledge of the subject matter and a scientific approach to problem analysis — has also had its drawbacks, manifested in a consuming interest in long-term problems (such as an eventual future national water scarcity, rise of salinity or introduction of farm machinery), at the expense of focusing on producing the information needed to make intelligent investments in the Egypt irrigation system for the next few years. The lack of a results-oriented attitude is apparent in cases such as:

(a) The Beni Magdoul canal and several of its mes/ahs, lined in 1977, were not used to make a definitive study (through a comparison with neighboring unlined canals) of the economic return on lining and lowering a canal, as the MOI plans to do on a large scale (para 5.5);

(b) The MOI policy of supplying water below field level, which EWUP contests, is based on the assumption that farms will use more water if supplied by gravity — an assumption which the contractor challenges. Although the project collected in Minya water use data from farmers irrigating by gravity and by lift on upstream and downstream reaches of the same mes/ahs, the data was not analyzed to resolve the issue of which system consumes more water; in fact, it is not known whether the data was collected so that it can serve for this purpose.

(c) The project technical manager took a conscious decision — over the protests of other team members — not to start interventions or even water budget studies until the problem identification stage was complete, in order to avoid a possible bias (para 3.23); scientific accuracy was preferred over timeliness.

(d) The farm budget study, on which a considerable effort was expended, is based on a stratified random sample of farms selected without any specific data use (or a number of specific uses) in mind. Thus there is no assurance that a sufficient number of the sample farms are located near a lined mes/ah or a well, for example, to make possible an economic evaluation of such interventions.

(e) A start on implementation of the Hammami buried pipeline was apparently delayed by nearly a year because of the project

shortage of civil engineers to perform the design and specifications (para 3.9). Evidently the expedient of relegating this work to a local engineering consulting firm has not been utilized.

(f) The number of articles written (seventy) versus the paucity of irrigation interventions (to date, only several leveled fields and measuring flumes are visible at the sites) seem to indicate a greater interest in research than in execution.

(g) Although more than a year was spent in identifying and quantifying the on-farm water use problems, this work was not brought to a conclusion in prioritization of those problems and of the most promising solutions through an exercise similar to that of Section 4 but with firmer numbers. Instead, the irrigation interventions selected for application by EWUP (precision leveling, gravity irrigation, water users' associations, irrigation advisory service) constitute an adaptation of U.S. irrigation practices.

(h) Most seriously, comparison of project interventions to date (para 3.22) and future plans (para 3.27) with the list of possible irrigation interventions in the order of their potential for replicability (para 4.2 and the following discussion) shows a predilection of the project management to focus on those interventions (e.g. precision land leveling,

water delivery by gravity) which for various reasons have the lowest replicability potential. This can only be ascribed to a questionable sense of priorities.

6.13 The above remarks must be tempered with the observation that all too often the vice of technical assistance projects has been to rush into application of U.S. solutions without sufficient comprehension of the local problems. All of the shortcomings noted in para 6.12 are corrigible, and to date the project has not made any serious error. In a research project like EWUP, it is better to sin on the side of taking more time than planned but to reach the correct solutions.

6.14 Dissemination of project findings: In this regard it suffices to note that, although the most important applicable results of the project to date have been in the field of agronomy, the MAG General Directorate for Agricultural Extension has not yet received a single publication from the project; while the Deputy General Supervisor of the Agricultural Research Center, who is a member of the project direction committee, has so far received two articles out of the seventy published by the project.

6.15 The lack of distribution to national agencies of the project findings (which are, after all, the raison d'etre of the project) is not due to mere neglect but to project policy. A review of the seventy project publications shows that the whole publication system seems oriented to serve (a) project personnel, (b) USAID evaluations

and other donors, and (c) international publications and conferences, rather than to be of use to those MOI and MAG departments which are in position to apply the project results (para 5.1 - 5.2). Thus in the ten-part mid-project report, Volume I (Project Summary, Conclusions and Recommended Pilot Projects) and Volume II (Project Technical Reports) are in a form useful mostly for project evaluation; of the 15 articles of Volume IV (Technical Articles), at least ten are concerned with general topics such as "farm systems management" or "irrigation system improvement concepts," which in no way incorporate project findings. Practically all of the project results are located in the 47 Staff Papers (Volume III), which are "not for quotation" and meant only for internal distribution. One result of this policy was that the General Directorate for Agricultural Extension has recently ordered for distribution 1000 tons of zinc sulphate on the basis of its experiment-station results only, while the outstanding EWUP field results on the subject were not made available to it.

Analysis of Technical Aspects

6.16 Water management among and on farms: The Egyptian irrigation system is unique. The principal reason for this is the delivery of water to each farmer in a channel which is below the land surface. Most irrigation systems involve government management of the system down to a tertiary system which is managed by the farmers. In Egypt, the tertiary system is the mes/ahs and it is true that the farmers manage the water beyond the mes/ah inlet. However, the Egyptian

system offers another major difference. Just as the farmers on a mes/ah are mutually concerned about the water in that channel, so are the farmers located on different mes/ahs on a branch canal. There are no control gates on the mes/ahs, so that the quantity of water available to every farmer is affected not only by the consumption of his neighbors on the same mes/ah, but by the behavior of farmers on other mes/ahs as well. This added dimension greatly complicates the water use pattern among farmers as well as the organization required. It certainly cannot be ignored, however, in any program dealing with improved farm water management.

6.17 The comprehensiveness of project research directed at on-farm water use: Of the seventy papers and articles published so far by the project, 51% concerned water use, 30% dealt with agronomy and agricultural economics, 11% concerned pest control and 8% sociology and extension. This in itself is not an unreasonable distribution of effort. The problem, as noted above (para 6.7), has been that most of the agronomy and pest control work proceeded without much connection with the water use research. This problem is now being corrected.

6.18 The appropriateness of considering on-farm water management apart from off-farm water management: This should certainly not be the case, and the project has not done so. It is true that all project interventions to date have been on-farm (para 3.22); but project personnel is well aware of the intricate connection between

on-farm, off-farm and policy. In Egypt this is especially important because the farms are small, water is delivered below field level, there are no control gates on the tertiary channels, the secondary channels are regulated twice daily, and there is a high water table throughout most of the country. Obviously one cannot isolate water management on farms in such a system. The water management system in Egypt is undoubtedly the most complicated one in the world. This need not be discouraging, because it also undoubtedly has the possibility of being one of the best-managed large systems in the world. However, it has not yet approached that potential.

6.19 Mes/ah-level water budgets: At present the water budgets are made at the level of an entire branch canal (subsidiary canal regulated by the MOI). In each of the three sites the canal inflow is measured by a flume, the groundwater level is monitored through observation wells, the consumptive use is estimated by evapotranspiration equations and the outflow is estimated (albeit with some difficulty owing to the low velocities in some drains). This program is important and should be continued. However, an activity which is lacking at present is the monitoring of water movement into and along individual mes/ahs. Without such mes/ah -level measurements one cannot estimate the water savings caused by mes/ah improvements (elevating, lining, etc.), nor even know whether there is maldistribution of water between the first and

last irrigators on each mes/ah (the "tailender problem"). These observations would require a great deal of dedication and certainly overtime, since farmers might be irrigating at ny time of the day or night.

6.20 Mes/ah-level water measurements should be initiated early in the coming stage of mes/ah trials. This could be done by establishing several mes/ah inlets (at the beginning, middle and end of each branch canal) as gaging stations with recorders. The water management along the mes/ah need only be accomplished on representative mes/ahs, much in the same manner as the farm survey data are gathered. Some of this information has been accomplished, especially at Mansouriyah, but more needs to be done.

6.21 The tailender problem: The extent to which farmers at the far ends of canals and mes/ahs are not obtaining enough water has not yet been determined. In the sandy soils of El Hammami, EWUP investigations (TR 5) have shown that farmers at the lower end of the canal have more idle land, grow fewer crops per year, have a smaller percentage of their land in vegetables and use more pumps, all of which decreases farm income. In Minya and Kafr El Sheikh, visual evidence of crop water deficiencies at the end of mes/ahs is harder to find; however, in the sociological survey (SP 32) 38% of the tail-end farmers in Kafr El Sheikh and 20% of those in Minya stated that they "never get sufficient water," while none of the upper-end farmers said so. One would expect this perceived water deficiency

to have an effect on productivity, though its extent is yet to be determined.

6.22 The drainage problem: Because of the flat Delta terrain, its low elevation, and the abundance of water in the irrigation system throughout most of the year, there is a relatively high water table under most of Egypt's agricultural land. The irrigation water supply has a very low salt content; to date the salinity problems have been minimal and most of the groundwater is not especially saline. In fact, most of it is usable as irrigation water.

6.23 One might logically predict that the present situation cannot continue without serious detrimental effects being created by the high water table and salt condition. After all, the post-Aswan irrigation system is not really old. This is undoubtedly the reason the government has implemented a tile drainage program, as well as a program of open drain lines in the lower Delta agricultural lands.

6.24 Certainly any water management improvement program must take into consideration the drainage problem. The effects of alterations in the irrigation system on efficiency of use, reduction of waterlogging, salinity and alkalinity must be carefully monitored. Where drainage and ground water is relatively salt-free, a program of conjunctive use of canal and drain water might prove especially valuable in maintaining a lower water table. The open drains act

as skimming wells and would be an excellent source of water, should water use efficiency become a serious concern of the government.

Organizational Considerations

6.25 Farmer organization figures prominently among the actions proposed by the EWUP (para3.27). The evaluation team considers that farmers can be successfully organized only around a new technology which promises benefits to all participants. We believe that farmers have defined, through generations of trial and error, the optimal degree of cooperation for maximizing their benefits under existing conditions. This implies that it would be futile to try to organize farmers on the basis of the existing technology, e.g. "get all the farmers to work together to hand-clean the mes/ah and schedule water deliveries." 1/ If this is true, then the project should form irrigators' associations only around a new technology which necessitates such organization, e.g. for joint operation of a pump for an entire raised mes/ah.

6.26 Irrigation extension service: Project agents should evidently organize the farmers for the optimal operation of the new systems created by the project (e.g. scheduling of irrigation along a gravity canal). A different matter altogether is laying the foundations for an entity to provide an irrigation extension service, as the EWUP plans (Annex C) seem to imply. The evaluation team is

1/ In such an intervention the "new technology" is in fact the presence of a project agent, and things are likely to revert to the traditional way once he is withdrawn.

much less sanguine than the contractor about the potential of such an organization. One would expect it to share all the problems of the MAG extension service, which has not been noted for its success, with the difference that the MAG extension service at least has at its disposal some high-payoff technologies (fertilizers, micro-nutrients, pesticides, improved varieties) to extend to the farmers, while no such high-payoff technology has yet been developed by EWUP.

6.27 Water is only one of the agricultural inputs, and in Nile Valley conditions it is not the limiting one. Creating an "irrigation extension service" would be as logical as creating a separate "fertilizer extension service," "pest control extension service," "zinc application extension service" and so forth. Insofar as new irrigation techniques which require more farmer organization (e.g. elevated canals) prove their worth, it seems more effective to add them to the repertoire of the agricultural extension service, <u>and</u> give it the means for applying them adequately.

7. THE PROPOSED ACTION PROGRAM

7.1 The pilot project is about to enter a new phase consisting mainly of canal and mes/ah trials, which may be regarded as the establishment of prototypes of an elevated mes/ah, a buried pipeline, etc. Although it would be premature to call these "pilot projects" (para 3.37), they will be of a considerably larger size than the field trials undertaken so far. It is important that this phase be carefully planned to insure that information derived from it will not only be useful to the GOE but will also be in a form usable by them.

7.2 It will be especially important to manage personnel and time carefully; otherwise the program can become fragmented and unfocused, resulting in the loss of its true purpose and the production of something other than planned. This cannot be overemphasized. The very nature of the program results in a rather thorough understanding of the on-farm agricultural situation. Armed with such knowledge, project personnel will think of many possibilities for further study and research which are outside the project bounds. Most of them could be viable and worthwhile endeavors; however, with limited time the project must remain focused on specific

objectives. Otherwise it will continue indefinitely on the brink of producing something useful for operational agencies but never quite getting it all together. This is a common failing among agricultural researchers. It is much more attractive and easier to pursue unknowns than it is to develop an implementation methodology for an improvement technology that has been identified. Yet the project must do exactly that if it is to accomplish its purpose. This is a challenge project leadership must constantly deal with.

7.3 The project is at a stage where canal trials are long overdue. There is no reason for not launching them now. However, implementation plans and target outputs need to be very clear to all participants. To date they are not. The present plans are too diffuse and non-specific. It is not apparent that an analysis of time and technician constraints was made before deciding on the scope of the studies. These need to be narrowed to technologies which have a high probability of being useful to Egypt in the near term. They also need to be focused, because the technologies not only need to be applied and tested but the implementation must be monitored with sufficient care so that a development plan can be designed from the pilot tests. This means that the reasons for successes and failures must be quantitied. The implementation and operation of each prototype must also be accomplished in a manner such that the institutional requirements for its establishment are quantified and delineated. This always means more time than if

project staff accomplish the entire process by themselves. Egypt cannot improve its irrigation system through a research project; EWUP can only develop an economically and technically feasible plan for such improvement. The remainder of the project life should be devoted solely to that purpose.

Conditions for a Successful Action Program

7.4 To assure that the last phase of the project concludes in results useful to the operational agencies, it should follow the conditions discussed in the following paragraphs.

7.5 Every trial should be made as specific as possible, so that the effect of the various factors can be disaggregated. Every trial should include four variations: (a) farmer practices, (b) Improved irrigation only, (c) improved agronomic practices only, and (d) both improved agriculture and irrigation. This must be done in order to separate the costs and benefits of the agronomic and the irrigation interventions, since these are largely separable, have different potential for payoff and replicability, and in practice will be applied by different ministries and most probably in different regions and at different rates. Where staff and time limitations do not allow this, only improved irrigation practices should be tested, always in comparison with current practices. Largely separable techniques in the irrigation package (e.g. land leveling and farmer organization) should be tested separately.

7.6 Every trial should have a complete analysis of its costs, benefits and the conditions under which it can be successful. For construction (e.g. of an elevated mes/ah or a buried pipeline), an estimate should be made of the costs when these interventions are applied on a larger scale.

7.7 The conditions obtaining during large-scale application of the techniques tried must be visualized and duplicated as clearly as possible. The project should not furnish inputs which are unavailable on a larger scale or, if it does, should analyze and recommend how they would be made available when the techniques are applied on a national basis.

7.8 Specific responsibilities must be assigned to every Egyptian and American project member. Time is too short to have every professional advising on every project. Every trial must be put in the charge of a specific person, and sufficient authority delegated to that person so that the work can proceed expeditiously.

7.9 The experiences involved in designing and conducting each trial must be documented, regardless of whether the trial is ultimately considered successful or not. The reasons for successes and failures must be known so that the former can be applied on a larger scale and the latter not repeated.

7.10 Any necessary studies of the existing situation should be carried out concurrently with the trials. The action program should not be delayed in order to do further research.

7.11 At the end of the project, a program of expansion for the successful trials should be prepared.

7.12 The number of trials must be kept to a minimum. It will be far better to complete one program than to accomplish several partially. The output from a trial is not useful unless it is developed to a point where a decision considering its adoption or rejection can be made.

The Action Program Recommended

7.13 In light of the discussion in Sections 4 and 5, the action program outlined below is recommended for the remaining phase of the project. The suggested action program will both test the interventions which have a good potential for payoff and replicability (para 4.2) and satisfy MOI data needs (para 5.6). It should be borne in mind that some of the interventions will not be sufficiently advanced in 1½ years to provide conclusive answers (para 3.29). The action program suggested below should be further subjected to EWUP manpower constraints in order to come down to a doable program. The recommended activities are discussed separately for each project site. The action program consists of four activities for each site, of which the first two activities at each site are considered high-priority and the other two secondary.

7.14 Action priorities at Mansouriyah:

Primary: (a) Canal lining: Determine water savings and benefits due to lining by completing the study of the Beni Magdoul canal and lined mes/ahs in comparison with neighboring unlined ones.

(b) El Hammami buried pipe, including replacement of mes/ah 2 by buried pipe: install, organize farmers, establish farmer advisory service, determine water consumption, costs and benefits.

Secondary: (c) Supplementary well irrigation: Determine the benefits by studying profitability of farms with and without wells in El Hammami.

(d) Gravity irrigation:[1] Raise mes/ah 10, organize farmers to operate a single pump, advise farmers, compare with a neighboring unimproved mes/ah, determine water consumption, costs and benefits.[2]

7.15 Action Priorities at Minya:

Primary: (a) Mechanical clearing of mes/ahs: Determine appropriate equipment, costs, improvement in

1/ Given a lower priority since this activity will be more intensively pursued in Minya.

2/ The 30,000-fd San el Hagar irrigation project of the Ministry of Land Reclamation (Sharqiyah), which is irrigated by pump-driven sa/iyas supplying water to 200-fd mes/ahs each and operated by the farmers (footnote to para 4.13), should be studied as an existing pilot area for gravity irrigation.

water distribution and yields over existing situation.

(b) Gravity irrigation: Raise mes/ah 26, organize farmers to operate a single pump, advise farmers, compare with a neighboring unimproved mes/ah, determine water consumption, costs and benefits.[1/]

Secondary: (c) Tambour improvement and replacement: Import and field-test an IRRI diaphragm pump, create and field-test a bicycle-driven tambour, determine costs and labor savings.

(d) Gate improvement: Install an improved (Nyrpic) gate on Abueha canal, measure water savings, determine whether improved water control reduces yields as is sometimes claimed.

7.16 Action priorities at Kafr El Sheikh:

Primary: (a) Precision leveling: Determine technology, costs, field size, yield increases, water consumption, influence on water table, possibilities for eliminating field drains.[2/]

1/ The 30,000-fd San el Hagar irrigation project of the Ministry of Land Reclamation (Sharqiyah), which is irrigated by pump-driven sa/iyas supplying water to 200-fd mes/ahs each and operated by the farmers (footnote to para 4.13), should be studied as an existing pilot area for gravity irrigation.

2/ This activity should best be carried out with private contractors to gain experience of real costs and achievable precision.

(b) Conjunctive use: Irrigate an area with mixed canal and drain water, determine effect on yields, water requirements and soil salinity.[1]

Secondary: (c) Improvement of pumps and sa/iyas: Select and install a slow-speed helical pump, a motor-driven sa/iya and a ball-bearing-mounted animal-driven sa/iya, determine costs and discharge.

(d) Gate improvement: Install an improved (Nyrpic) gate on Omm Sen mes/ah, measure water savings, possible yield reduction.

7.17 The proposed action program is an optimal one in the sense that it would both test the interventions with the highest potential for payoff and replicability (para 4.2) and satisfy MOI data needs (para 5.6). If the analysis of program manpower needs finds it to be beyond EWUP capacity, then only the primary-priority items (a) and (b) at each site should be implemented. It should be noted, however, that except for item 7.14 (d), the secondary-priority interventions represent relatively minor efforts.

1/ The activity itself has a priority; its practicability at the Kafr El Sheikh site should be examined.

7.18 The action program proposed by the evaluation team differs from the one suggested by EWUP in the following main aspects:

(a) It does not claim to be a pilot program, since none of the interventions (except precision leveling to some extent) constitutes a package of pretested techniques ready to present to the farmers. Neither is the EWUP program a true pilot program (para 3.32). The difference is that the program proposed by the evaluation team places the accent on separating the costs and benefits of the irrigation interventions so that they will not be masked by the higher-payoff agronomic interventions.

(b) As a consequence, wherever manpower resources do not permit testing both irrigation and agronomic interventions (separately and combined), only irrigation interventions would be tested.

(c) An unimproved mes/ah would be measured as a control for every improved (cleared, lined or elevated) mes/ah.

(d) Raising the entire Abueha canal is considered premature and was eliminated.

(e) Farmer organization is recommended only around new technologies such as a common pump for an entire mes/ah.

(f) A number of low-cost appropriate technologies (mechanical canal clearing; tambour, sa/iya and pump improvements) is included.

(g) The utilization of existing prototypes (lined canals, wells) for obtaining information is maximized.

(h) Precision leveling, in view of its limited potential for replicability (para 4.22), is suggested for one site only (Kafr El Sheikh, where irrigation losses to drains and groundwater are largely irretrievable).

7.19 Time frame for the action program: The EWUP action program was designed for two years (January 1981 - December 1982). Realistically, meaningful results regarding most of the activities recommended cannot be expected by the present project end in June 1982 (para 3.24). There is a certain logic for allowing the project a six-month extension in order to run five years as planned (January 1977 - December 1982). On the other hand, there is no particular reason to excuse the contractor for a late start (para 3.7) and execution delays (para 3.21, 3.24). To put the matter in perspective: assistance to on-farm water management is recommended for the long term (para 7.20); whether to allow a six-month extension of the present contract, or to complete the work up in the framework of a future contract, is primarily a matter of administrative feasibility. Judging by past performance, however, it does not seem likely that the project will reach its outputs by December 1982 either, so it seems better to make a long-term decision regarding the form of future assistance to improved water use than to grant a temporary extension.

Post-Project Considerations

7.20 Framework for post-project water use improvement: The evaluation team submits that the EWUP has made a promising start, which should be continued. In the team's judgment, the solid accomplishments of the project in creating a qualified, experienced and dedicated Egyptian water use improvement team able to work successfully with the farmers, and in gaining acceptability for the methodology of on-farm agro-irrigation research, far outweigh the implementation delays experienced by the project. It is better to proceed slowly in more or less the right direction than to charge down the wrong road.

7.21 The institutional formula for continuing the assistance to on-farm water use improvement depends first of all on the nature and scope of the activities contemplated. The continuation of various research activities on three sites of 1000-2000 fd each (including bona fide pilot projects on that scale) requires a different organization than technically backstopping a 40,000-fd project. For follow-on activities at the same sites, including pilot projects, it would be logical to keep them under the aegis of the Water Distribution Research Institute. As to continuing donor support to the institute, several formulas are possible, for example:

(a) extension of the present CSU contract as is;

(b) a new long-term contract with CSU for a reduced level of technical assistance;

(c) a long-term technical assistance contract, to be opened to bids; or

(d) a contract with the Water Distribution Research Institute to produce specified water use improvements, allowing it to have the expatriate assistance it deems necessary to fulfill its obligations.

7.22 All approaches have their advantages and drawbacks, to wit:

(a) Extension of the present contract would be administratively the easiest and would compensate for the fact that the present contract runs 4½ years of effective work, as against five in the original project design. However, this is a stopgap solution since such project extension would probably not be for more than a year, by which time the problems would probably not be markedly different. This solution would probably constitute a disappointment for MOI. Finally, it remains to be seen whether the new Project Technical Director can furnish the dynamic, well-focused leadership required.

(b) A new long-term contract with CSU would have the advantage of continuity and of avoiding the risk of another team committing some of the errors avoided by the CSU team. Such a contract would call for a reduced level of technical assistance. This could be furnished for example by one engineer, one agronomist, one economist and one sociologist.

These should be senior persons with wide experience in their respective fields and would serve primarily for technical backstopping, while Egyptians would be in charge of the field work. On the other hand, most of the delays experienced by the project can be traced to the lack of well-focused, results-oriented project management; and the need for such management will increase as the project moves into the implementation phase.

(c) A long-term technical assistance contract to be opened to bids would hold the potential of finding a TA team with an experience and approach more suitable than that of a university team for backstopping larger-scale water development activities. On the other hand, one would risk obtaining a team more interested in advocating American technology than in identifying and implementing Egyptian solutions to Egyptian problems.

(d) A contract with the Water Distribution Research Institute to produce specified water use improvements: under such a contract the institute management would be bound by performance specifications (e.g. create a pilot area of a given size functioning at a given water use efficiency and yield levels), and will determine the input mix necessary to achieve this performance, including the number and type of expatriate advisers required. This alternative holds the promise of making a more effective use of donor resources

(this has often been the case where control of funds had been given to the beneficiaries, with clear performance specifications and appropriate incentives for fulfillment). On the other hand, it demands a higher level of Egyptian management capability.[1/]

7.23 The formula to be selected for continuing assistance depends, as noted above (para 7.21), on the nature of the activities contemplated. Assuming that in the post-project period there would be expanded USAID assistance to the MOI for modernization of the irrigation system, including both continuation of the field/canal trials and initiation of pilot projects and larger-scale activities, the Egyptian project direction stated a preference for channeling such assistance through a host-country contract. This would enable the assistance to solve the problem of incentives to the Egyptian project personnel (para 6.11). Contract execution would be managed by a board (as is the case with the MOI/Dutch drainage project). The board could consist of five Egyptian members (e.g. the Minister of Irrigation, the Egyptian EWUP director and three other MOI nominees) and five U.S. members (e.g. the USAID project officer, EWUP technical director and campus director, and two persons representing the technical assistance to implementation, discussed below). The board would meet every six months to set general policy and approve work plans. A reduced CSU team would continue

1/ It may be noted in passing that in Brazil the Agricultural Research Service has been converted into a company which performs all agronomic research in Brazil under contracts with various agencies.

the basic studies, trials and pilot project activities, to provide the benefits of continuity and CSU institutional memory, while an implementation-oriented contractor will be added to provide technical assistance to the large-scale rehabilitation activities. Direction by the same project board would assure coordination between the two technical assistance teams.

7.24 The evaluation team sees in the above formula both advantages (of preserving continuity) and disadvantages (of creating coordination problems between two technical assistance teams). Not having discussed the matter with other Egyptian officials, the team cannot offer a recommendation on the subject. The matter deserves further discussion.

7.25 Feasibility of the interdisciplinary approach during implementation of a larger project: The EWUP proved without a doubt that Egyptian professionals from different disciplines and institutions can successfully work as teams for solutions of given problems (para 3.16). In considering larger agro-irrigation projects, three situations may arise:

(a) Large components of the project may be essentially free-standing. For example, once an interdisciplinary team has designed a major buried-pipe project, its construction aspect will essentially involve only the engineers.

(b) A task may require a small interdisciplinary field team (e.g. redesigning a canal may involve a sociologist to

ascertain local concerns, an agronomist to determine water requirements according to the cropping pattern, and an engineer). The resulting situation would be similar to that of the EWUP field teams, and cooperation should be equally successful if the entire project is structured so as to allow/require different professionals to work together.

(c) Cooperation at the top level will be the critical element, since it is at this level that intra-institutional rivalries tend to pull cooperation apart.

7.26 Thus to assure the success of a larger interdisciplinary project, two conditions must obtain:

(a) the project leadership must understand the interdisciplinary nature of the problem and the project; and

(b) the donor must design into the project conditions which carefully specify the contribution to be made to the project by each of the participating institutions.

8. CONCLUSIONS

8.1 Project design is very good and could not be significantly improved with the benefit of hindsight. The three-stage phasing (problem identification/testing of solutions/pilot projects) is logical. The interdisciplinary approach is appropriate. The institutional framework and physical location of office and field sites is optimal. Addition of an expatriate project administrator would have allowed the technical director to focus more on the management function of keeping outputs on course.

8.2 Inputs: Due to startup delays the project will have by June 1982 only 4½ years of effective work time to accomplish a five-year program. Monetary and staff inputs were generally available as planned and did not constitute serious constraints on achieving outputs, although there was an insufficiency of Egyptian civil engineers and an overabundance of short-term consultants. Equipment and instruments procured were sometimes not the most appropriate. Relations between the national and expatriate teams are excellent. There is a high regard in the Egyptian team to the dedication of the contractor team, although there is a feeling that some new advisors are junior in age and experience to those they replaced.

8.3 Project assumptions held true and did not constrain achievement of outputs and purpose. However, unless a solution is found by January 1981 to the problem of incentives, motivation of the Egyptian staff will decrease significantly, with a serious effect on the attainment of project outputs.

8.4 Outputs — internal objectives: The chief achievements of the project to date has been (a) creation of a well-trained, motivated, truly interdisciplinary Egyptian water use research team which is field-oriented and has an excellent rapport with the farmers, and (b) establishment of the methodology of doing bona fide agro-irrigation research on the farmers' fields and with their cooperation. The evaluation team considers that these institutional achievements far outweigh the shortfalls in meeting external objectives, noted below.

8.5 Outputs — external objectives:

(a) The problem-identification stage is essentially complete, including soil studies, outlet studies and on-farm surveys. Most (though not all) of the problems identified were known before, but this is the first time that they were quantified. The farm budget studies are the best in Egypt, but they were not constructed with specific uses in mind, which may limit their usefulness for the coming project trials. Altogether, none of the findings of the problem-identification stage was such that the interventions contemplated at present could not have started one or two years ago.

(b) The crop experiments constitute the most notable results of the project to date. Apparently they constitute the only on-farm agronomic research going on in Egypt. Significant yield improvements were found to result from zinc application in most (although not all) cases and from pest control in vegetables. However, most agronomic experiments were divorced from irrigation factors and as such of little relevance to project purpose (although, by serendipity, they might have a greater effect on achievement of project goal of raising small-farmer income). At present agronomic experiments are more closely related to irrigation practices, but not yet completely.

(c) Irrigation trials at field level are on the way in all three sites through the use of precision leveling, large basins and long furrows combined with agronomic improvements. Results are still preliminary.

(d) Delivery system interventions (canal and mes/ah trials) have not yet started; this constitutes the chief shortfall of the implementation and precludes the possibility of the project reaching its most important output targets (pilot-tested replicable technologies for improved irrigation) by June 1982. The evaluation team finds nothing in the results of the problem-identification phase or other factors which would not have allowed canal and mes/ah trials to start one or two years ago, in time to achieve project outputs.

8.6 The next project stage: The upcoming phase cannot be called "pilot programs", since none of the technologies proposed have yet been tested by EWUP and found worthy of wider application. The interventions contemplated consist mostly of mes/ah and canal trials for establishing prototypes of new technologies, such as raised mes/ahs and buried pipelines for gravity irrigation. Naming them "pilot projects" masks the fact that they could and should have started 1 - 2 years ago, and encourages loading them with other interventions (agronomic practices, advisory service) to the extent that by project end it may not be possible to define the benefits of the irrigation technologies per se.

8.7 The project plans assume a six-month project extension, with final reports on the "pilot projects" due by December 1982. In light of project delays to date, it is less than likely that definitive results of the canal trials will be available by that date. The most likely result is that the contractor will fulfill the letter of the contract, but will not satisfy MOI expectations.

8.8 Agronomic interventions were found to have higher payoff and replicability potential and lower initial investments than irrigation interventions. Thus zinc application showed yield increases of up to 67% in rice and apparently 100% in wheat; pest control increased vegetable yields by 88% to 1400% in certain trials; use of a rice transplanter increased yields by 24% while reducing costs; and halving fertilizer application in Mansouriyah increased yields

by 16%. Project staff is confident that improved agronomic techniques (better fertilizer and micronutrient application, pest control, cultivation techniques, higher plant densities and improved varieties) can increase national average yields by about 25% without changes in the irrigation system.

8.9 Irrigation interventions may consist of the following, listed roughly in the order of their payoff and replicability potential.

(a) Improved gates have high replicability and offer considerable local water savings (17% in Beni Magdoul), but the effect on yields is unknown and may be negative.

(b) Mechanical clearing of branch canals and mes/ahs offers high payoff and replicability at relatively low investments.

(c) Improved water-lifting equipment (e.g. low-speed pumps, ball-bearings-mounted sa/iyas, bicycle-driven tambours, farmer-operated diaphragm pumps) have the potential of high payoff (reduction of pumping labor and costs) and replicability. However, prototypes must still be tested.

(d) Conjunctive use of drain and canal water has a good replication potential for water savings.

(e) Supplementary well irrigation has a good potential in light soils, at least for vegetables.

(f) Lining canals and mes/ahs induces local water savings at relatively high investments. Yield increases are probable. Replication potential is low to medium.

(g) Raising canals and mes/ahs saves pumping costs but incurs relatively high investments. Due to MOI resistance, replicability is limited. Effect on water saving is not known but probably negative.

(h) Buried pipes save land, but effect on energy and water use is not determined. Due to the high investments, complex organization and pipe shortages, replicability is limited.

(i) Precision leveling may bring about savings of water and irrigation labor, and free land occupied by farm ditches. However, due to constraints of the cropping cycle, access roads, skilled personnel, need for organization at farmer and GOE level, and low felt need of the farmers, replicability potential is low.

8.10 The Ministry of Irrigation is the chief interested party in the project. The overriding MOI objective is water saving for horizontal expansion. MOI professes little interest in yield increases in the presently cultivated areas through better water management, and is against reducing farmer labor and costs by eliminating pumping, since it believes this will increase water use.

8.11 MOI expectations from the project are the following, roughly in order of priority:

(a) technology, water use, costs and benefits of buried pipelines;

(b) water savings and benefits of lining;

(c) possibility of doing without covered drains by better field water management;

(d) technology and water savings of improved gates;

(e) other reductions in total water requirements.

8.12 The MOI has considerable anticipations regarding the project, and must have at least preliminary results on the above topics by June 1982.

8.13 Lack of a sufficiently results-oriented attitude on the part of the contractor team is considered the chief reason for project shortfalls to date and limited perspectives for fulfilling MOI expectations by June 1982 or even by December 1982. This is evidenced by the following:

(a) the existing lined canal at Beni Magdoul was not used to determine the benefits of lining;

(b) the existing lift and gravity irrigation in different parts of the Abueha canal command area were not yet utilized to compare the water usage by these two methods;

(c) start on water budgets was delayed 6 - 9 months behind schedule to avoid a possible bias in the on-farm survey;

(d) the farm budget study is not geared to specific uses;

(e) no obvious solutions were tried before the end of the problem identification period, as the PP had recommended;

(f) a local consultant firm was not used to speed design of the Hammami pipeline; and, most seriously,

(g) EWUP choice of technologies to be tested in the coming phase reflects to a large extent an adoption of U.S. technologies (precision leveling, gravity irrigation, irrigation advisory

service) which for various reasons have a low potential in Egypt, rather than either a response to felt MOI information needs (para 8.11) or testing of the technologies which, at least in the view of the evaluation team, are believed to have the highest payoff and replicability potential (para 8.9).

8.14 On the other hand, no serious errors have been committed by the project, and all of the above defects are corrigible. The worst which has happened so far is that the project is about a year late on its planned outputs.

8.15 Dissemination of project results is quite insufficient. The technical papers seem directed at USAID evaluations and the technical articles at international seminars and publications, while the project findings are concentrated mostly in the staff papers, which are meant for internal use only.

8.16 The form of future assistance to water use improvements depends first of all on the scale of the aid envisioned. For continuation of studies and pilot activities, a long-term contract could be either awarded to CID, opened for bids or channeled through the Water Distribution Research Institute. For a major investment in improved water use a project board could be formed, with technical assistance offered by CSU on research aspects and by an implementation-oriented consultant on the large-scale execution aspects; or a single new consultant could handle both aspects.

9. RECOMMENDATIONS

9.1 The project should definitely be continued since it is well designed, has had considerable institutional achievements to date, and its implementation problems can be overcome.

9.2 Project purpose should be expanded to include not only yield increases but also labor savings, cost reductions and water savings as means to reach project goal of increased farmer income (water savings imply income of new settlers who would benefit from the water saved).

9.3 USAID should formally establish to the contractor that for purposes of contract fulfillment "on-farm" means not only fields but also those parts of the water delivery and drainage systems which are not regularly maintained by the MOI.

9.4 An optimal action program for the last phase of the project, which would both satisfy MOI information needs and test those irrigation technologies which have the highest potential for payoff and replication, would be:

(a) Mansouriyah:

Primary: i. Study lining of Beni Magdoul canal and mes/ahs to determine water savings and benefits.

ii. Establish, operate and study the El Hammami buried pipe.

Secondary: iii. Study the economy of supplementary well irrigation.

iv. Establish, operate and study elevated mes/ahs for gravity irrigation.

(b) Minya:

Primary: i. Establish mechanical clearing of mes/ahs with appropriate equipment.

ii. Establish, operate and study gravity irrigation by raising mes/ah 26. Study the irrigation by raised mes/ahs at San el Hagar as an existing pilot project.

Secondary: iii. Field-test a slow-speed pump and a ball-bearing-mounted sa/iya.

iv. Improve gate on Omm Sen canal, study water savings and effect on yields.

(c) Kafr El Sheikh:

Primary: i. Precision leveling on a large enough area to establish the effects on water balance (including possibilities for eliminating surface or covered drains) and yields.

ii. Conjunctive use of canal and drain water to determine effects on yields, water requirements and soil salinity.

mes/ahs

Secondary: iii. Field-test a slow-speed pump and a ball-bearing-mounted sa/iya.

iv. Improved gate on Om Sen canal, study water savings and effect on yields.

9.5 The above action program represents less effort than the one proposed by EWUP since raising the entire Abueha canal is eliminated and precision leveling is confined to one site. It should be subjected to analysis of staff constraints and reduced if necessary to the "primary" items above only.

9.6 In implementing the action program, personnel and time must be managed carefully. Management must focus on a minimal number of well-defined objectives. Implementation plans must be detailed and clear, and every Egyptian and U.S. staff member assigned specific responsibilities. The advisors should spend at least half of their time in the field, and short-term consultants brought in only if necessary for field jobs. Both successes and failures should be carefully documented as to costs, benefits and necessary institutional effort. Necessary studies should proceed along with the interventions, rather than using the research as a reason to delay the interventions or conducting the research as usual and adding the interventions.

9.7 In order to separate the effects of the (high-payoff) agronomic interventions and the (low-payoff) irrigation interventions, every trial should be carried in four variations: (a) farmer's practices, (b) improved irrigation only, (c) improved agronomy only, (d) both improved irrigation and agronomy. Where resources do not allow this, only improved irrigation practices should be studied, always in comparison with the farmer's practices.

9.8 The following topics should be studied, as a part of the trials program:

(a) water distribution among, and along mes/ahs (the "tailender problem"), water quantity and flow rate to farmer, and irrigation efficiencies;

(b) benefits from increased efficiency of water use;

(c) effect of various water management practices on waterlogging, salinity and alkalinity problems;

(d) predicted upstream and downstream effects of the improved water use practices;

(e) extent to which the farmers are already informally organized for distributing the water among themselves; and

(f) the significance (or lack thereof) of intake rate and advance time in small basins in the heavy Delta soils.

9.9 Farmer organization in the framework of the trials should take place only around a technological innovation (e.g. sharing a pump for an entire mes/ah).

9.10 Distribution of project results: The present system of staff papers and technical papers should be changed. Every paper should appear as a draft which would be circulated among the staff for comments. Papers meeting the director's approval would then be revised, edited and broadly distributed; what is not useful to Egyptian irrigation and agricultural planners and scientists should not be worthy of publication. The project should get an editor to assure the English quality of the publications, and compose a mailing list (by name, not position) of all persons in Egypt to whom the results may be useful.

9.11 Short-term consultants should only be called in for functions necessary to accomplishment of the action program defined above and at the initiative of the Egyptian project direction.

9.12 Stateside procurement should be tightened to assure that the equipment and instruments which arrive are the best for the job. Before project end, a standby and a ten-year stock of spare parts should be acquired for each of the measuring instruments.

9.13 The problem of staff incentives should be monitored to assure that a solution is found before damage is caused to project progress.

9.14 Project continuation: A six-month extension could be granted to allow the CID project to complete five years of study as originally planned before proceeding to another long-term contract, or the present project terminated and another long-term contract for assistance to improved water use initiated in June 1982. Which route to take is primarily a matter of administrative feasibility. If the latter option is chosen, final report should be prepared by June 1982 on the work completed by that date. If project continuation is on roughly the same scale as the present project, a team of four experts (engineer, agronomist, economist and sociologist) would be sufficient. These should be senior people with broad theoretical and practical experience who would serve for technically backstopping the Egyptian team, rather than for daily management of field activities. Technical assistance to project continuation should be opened to a bid, which CID can win if its performance between the present time and June 1982 justifies it. If a much larger project including both continuing trials and large-scale irrigation system improvements is contemplated, then the contractor must be a firm dealing in large-scale execution of water projects, with CID conceivably continuing in the research function. To assure the success of the interdisciplinary approach, the new project should specify in detail the activities required of MOI and any other participating agencies, and make these binding conditions.

9.15 Other projects: As agronomic interventions were found to have in general a higher payoff and replicability potential at a lower per feddan cost than irrigation interventions, USAID should direct more resources to assist agronomic interventions such as micro-nutrient application, pest control, improved cultivation practices, fine-tuning fertilizer requirements, increasing plant populations and introducing improved varieties.

ANNEX A: EGYPT WATER USE AND MANAGEMENT PROJECT — LOGICAL FRAMEWORK

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS
Program Goal: Improve the social and economic conditions of the small farmer.	**Measures of Goal Achievement:** In project areas, farmers' crop production and real income will have increased.
Project Purposes: 1. Develop and demonstrate replicable improved irrigation water management and associated practices that increase agricultural production. 2. Increase institutional capacity to develop and sustain an improved on-farm water management program.	**Conditions that will indicate purpose has been achieved (EOPS):** 1.A. Three pilot areas established. B. Farmers are practising recommendations derived from the Project. C. Yields have increased significantly over non-Project areas. 2.A. Government approval exists for program expansion. B. Farm problem feedback mechanism exists. C. An evaluation program exists for the research. D. Interministry and interdisciplinary approach accepted. E. Farmers' views understood and incorporated in planning.
Outputs: 1. Identification of the major constraints to improved on-farm water management and optimal delivery system operation. 2. Established optimal water practices available for use at the farm level in Project areas. 3. Improved water control practices for the delivery system in the project areas established. 4. Plans for organization and implementation for future program expansion. 5. Experienced scientists and technicians in place.	**Magnitude of outputs:** 1. A process of listing and selection of research priorities is being carried out. 2. Farmers have available (in a practical form) the results of applied research. 3. Water budgets and other managerial information available to systems operators, program and policy makers. 4. Expansion plans exist and are based upon cost-effective program analysis of pilot area results and farmers' views. 5. Improved job knowledge and staff competence reflected in above outputs and project purpose achievement measures.
Inputs: 1. USG: TA (Scientists, field party personnel) TDY, Equipment, training, studies. 2. GOE: Staff officers, local labor costs, local costs of support of research, local materials and equipment, advisory and evaluatory.	**Implementation Target (Type and quantity):** 1. TA staff in GOE 90 days after contract signed. 2. GOE staff on project 90 days after contract signed. 3. Staff officers equipment and vehicles available 120 days after contract signed.

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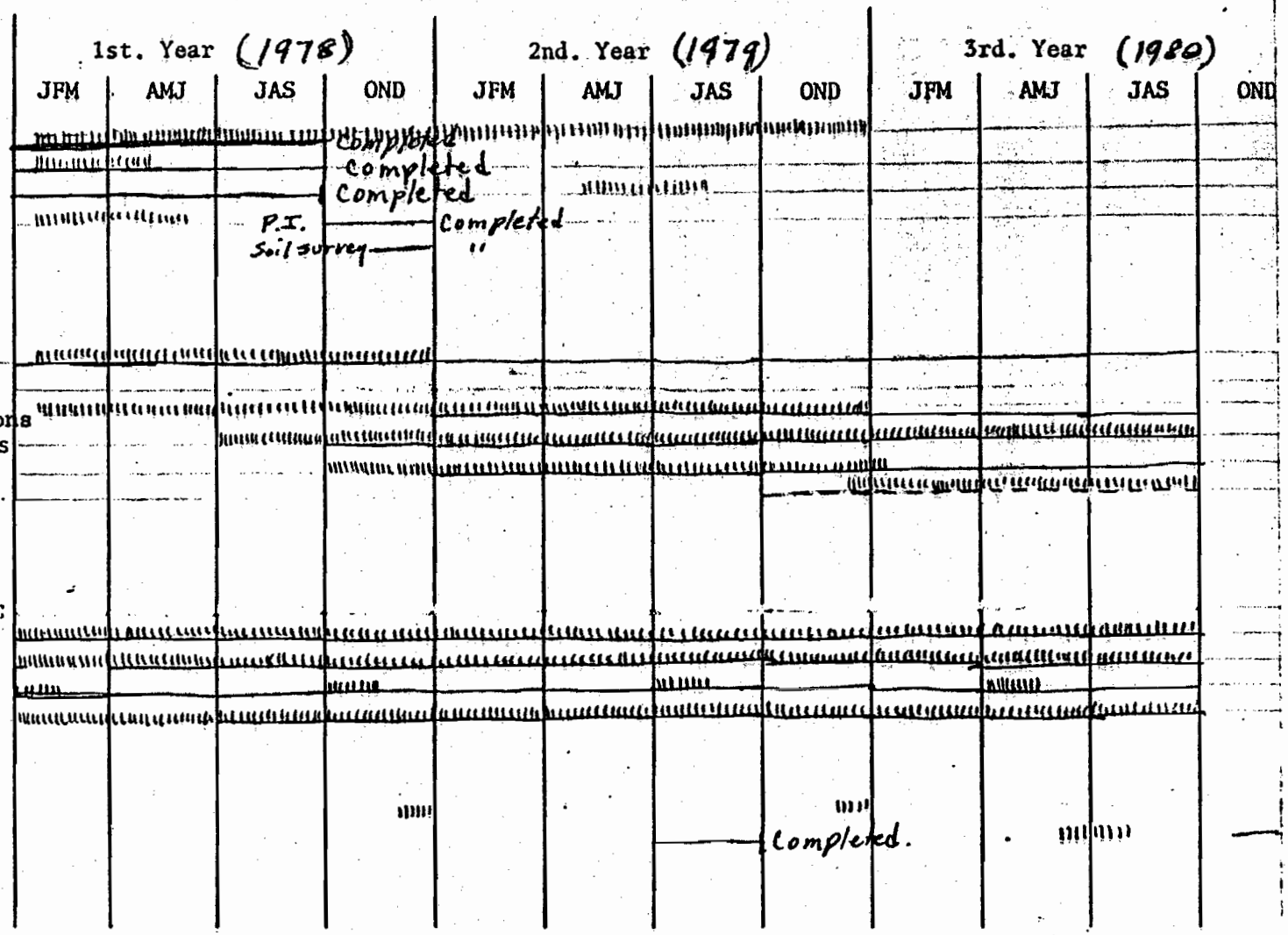
ANNEX A: PROJECT LOGICAL FRAMEWORK (cont'd)

MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program Goal:	**Assumptions for achieving goal targets:**
Comparison of conditions found in initial Project surveys with status found later.	That there continue to be cost/price relationships at least as favorable as at present.
Project Purpose:	**Assumptions for achieving purpose:**
1. Project monitoring	1. Adequate supplies of improved seed, fertilizer and other inputs available, as well as reliable markets for crops produced.
2. Annual report.	2. Adequate GOE personnel are available.
3. Sampling of farmers in project areas.	3. That engineers and agriculturists from the two joined ministries will continue to work together to achieve project purpose and that external assistance contributes to this end.
Outputs:	**Assumptions for achieving outputs:**
1. Project monitoring.	- (Same as for project purpose.)
2. Annual report,	
3. Irrigation and Agricultural Statistics.	
Inputs:	**Assumptions for providing inputs:**
1. Project monitoring.	1. Inflation within budget estimates
2. Annual report.	2. Timely GOE authorization of budget and staff required.
3. Revised work plan at end of first six months of Project.	3. Contractor with required expertise will be available.

Figure 1: ON-FARM MANAGEMENT SCHEDULE OF ACTIVITIES — EL MANSOURIYAH



Component A On-Farm Surveys

1. Farm Outlet Studies
2. Village Soil Testing
3. On-farm Survey
4. Design Experiments
5. Reports

Component B On-Farm Testing

1. On-going WDRI Research
2. On-farm Experiments:
   - a - Outlet changes & Observations
   - b - Crop Management Experiments
   - c - Delivery change (leveling)
   - Pilot programs

Component C Water Budget

1. Water delivery data collection:
   - a - Water discharge
   - b - Water quality
2. Water budget
3. Drainage evaluation

Project Evaluation

1. Annual
2. Mid-Project Review
3. Program final

!!!!!!! Activity as planned

- - - - Planning period in reality

_____ Implementation period in reality

Figure 2: ON-FARM WATER MANAGEMENT SCHEDULE OF ACTIVITIES — KAFR EL SHEIKH

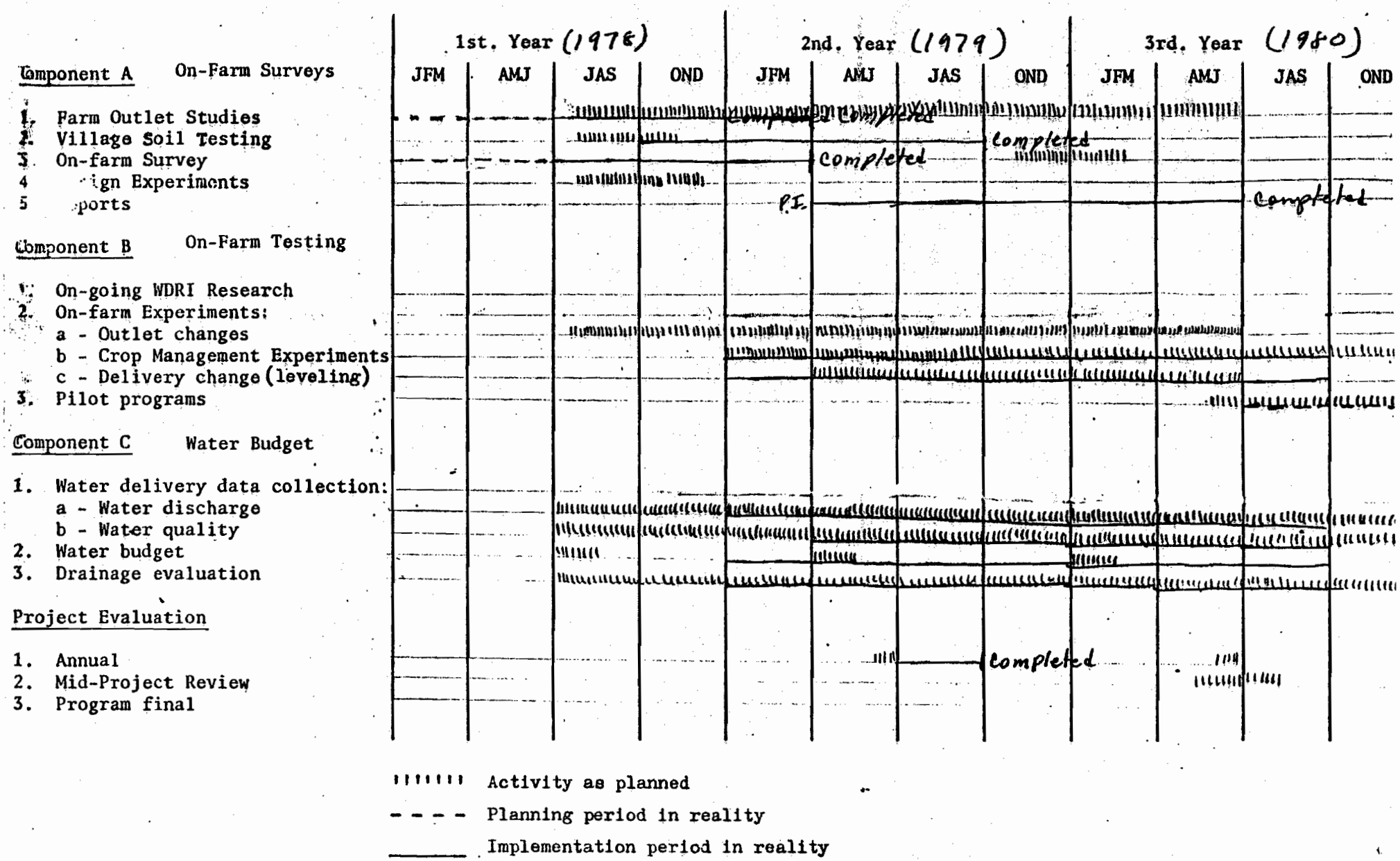
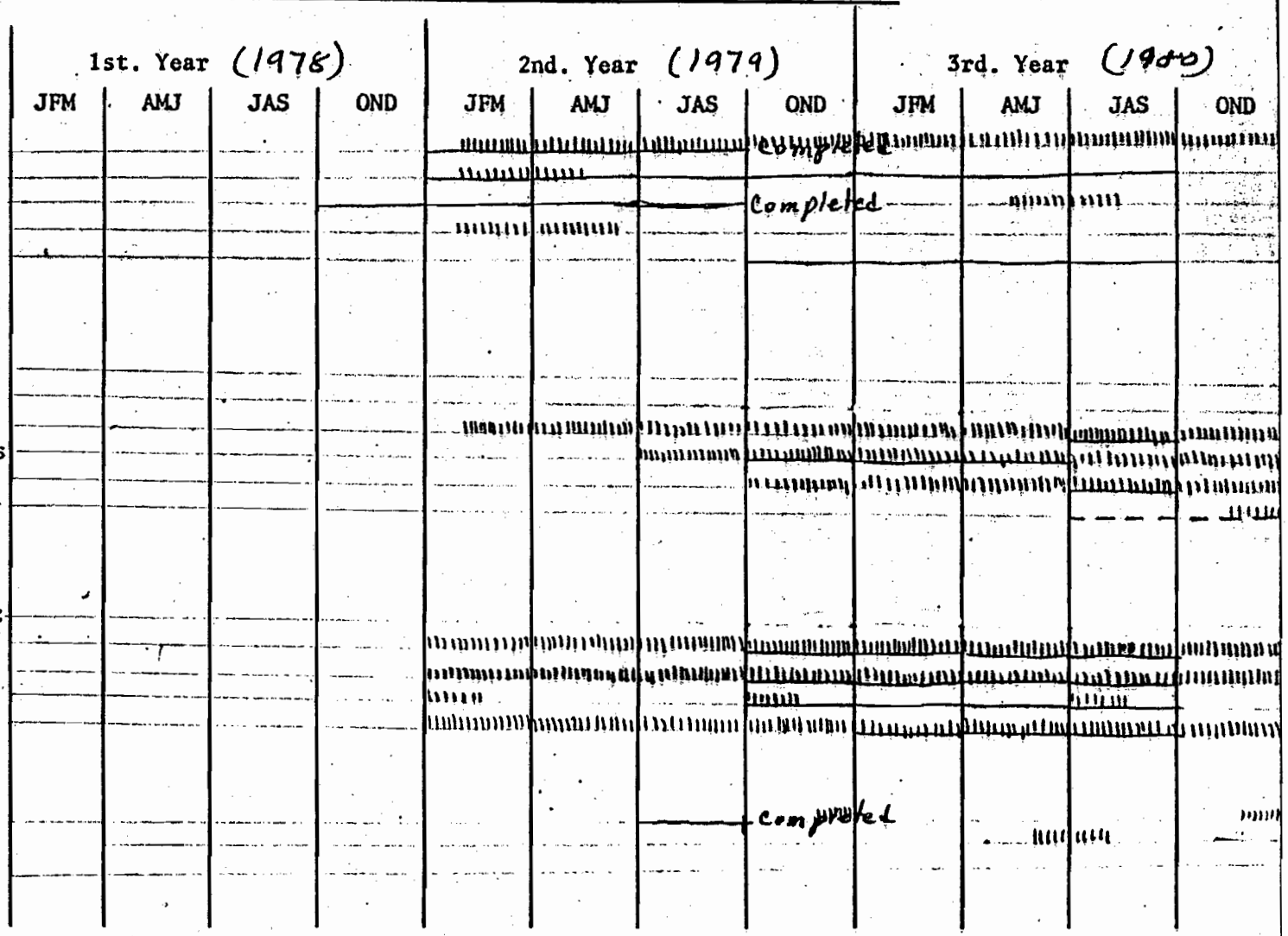


Figure 3: ON-FARM WATER MANAGEMENT SCHEDULE OF ACTIVITIES — EL MINYA



!!!!!!! Activity as planned

- - - - Planning period in reality

_____ Implementation period in reality

ANNEX B: PROBLEMS IDENTIFIED BY THE PROJECT

1. Poor frequency, amount and uniformity of irrigation water causes over- or under-irrigation. The reasons for this are:

   a. unlevel fields
   b. poor condition of meska (weeds, cross-section)
   c. lack of water (inadequate water supply)
   d. lack of knowledge - farmer, MOI, MOA, personnel
   e. upstream users taking more than they need
   f. rotation on main canal, turns on meska
   g. conveyance losses (seepage)
   h. small discharges of water
   i. need to lift water
   j. lack of water control in canals, meskas and fields
   k. waste of water from delivery system (no night irrigation)
   l. poor condition and inadequate maintenance of gates, ditches and meskas

2. Salinity and Water Logging

   a. ineffective field drains
   b. lack of field or tile drains
   c. too much water in ditches and drains
   d. poor condition of canals, meskas and control devices such as gates and diversion structures
   e. waste of water from delivery system

3. Micro-Nutrient Deficiency

4. Rate and Timing of Fertilizers

5. Low Plant Stand Density

6. Shortage and Cost of Labor at Critical Times

7. Land Preparation (seedbed)

8. Poor Weed Control on Farm in Addition in Ditches

9. Poor Insect Control

10. Planting Dates for Some Crops (Maize and Cotton) not optional from climate point of view

11. Social-Economic Cost of Lifting Water

12. Extension Service doesn't Provide adequate (any) Support.

ANNEX C: PILOT PROGRAMS PROPOSED BY EWUP

PILOT PROGRAM STRATEGY

1. Farmer Irrigation Advisory Service

   a. Help farmer
   b. Advise Dist. Eng.

2. Farmer Organization

   a. Manage meska, water distribution
   b. Plan, Implement and maintain meska improvement
   c. Manage drains - plans, maintain
   d. Communication to MOI

3. Improved Farm Water Management

   a. Level Basin and irrigation method
   b. Long furrows

4. Improved Distribution System - Gravity

   a. Meska
   b. Branch canal
   c. Main canal

5. Evaluation

   a. Social-Economic benefits
      i small farmer
      ii country
   b. Irrigation improvement
   c. Drainage improvement

PILOT PROGRAMS

I MANSOURIA

A. Beni Magdoul

1. Meska 6

a. Improved irrigation on-farm (land leveling)
b. Improved meska but still lift
c. Farmer organization
d. Irrigation scheduling
e. Insection control and improved varieties
f. Advisory service

2. Meska 10

a. Gravity
b. Farmer organization
c. Joint operation of single pump (costs)
d. Improved on-farm irrigation (Land leveling)
e. Improved varieties and insect control
f. Advisory service

B. El Hammami

1. Buried Pipeline Serving all 800 Feddans (Costs)

a. Farmer organization for branch canal
b. Farmer advisory service
c. Water scheduling
d. Meska improvement
e. Improved irrigation (on-farm) (land leveling)

2. Meska 2

a. Buried pipeline under pressure
b. Farmer organization (meska)
c. Improved on-farm irrigation methods (land leveling)
d. Improved varieties and insect control
e. Advisory service

PILOT PROGRAMS Contin.

II EL MINYA

A. Abueha Canal - Model Farm-Gate Gravity System

1. Meska Improvement to Gravity System

   a. On-farm irrigation improvement - land leveling etc.
   b. Farmer organization - Meska
   c. Micro-nutrients
   d. Advisory service (Farmers - MOI)
   e. Irrigation scheduling

2. Raise Abueha Canal for Gravity System

   a. Farmer organization - Branch canal
   b. Farmer organization - Meskas
   c. Meska improvement
   d. Gravity irrigation farmer control
   e. Advisory service
   f. On-farm irrigation improvement (land leveling)

PILOT PROGRAM Contin.

III KAFR EL SHEIKH

A. Dacalt Canal

1. Hammad and Manshia Meskas

a. Farmer-improved meska
b. Farmer-imrpoved on-farm water management (Land leveling, layout)
c. Irrigation scheduling
d. Advisory service
e. Micro and Macro nutrients, Pest control
f. Involve extension service

2. Special Programs

a. Farmer newsletter
b. Information bank

IV ADDITIONAL PROGRAMS

A. Field Drains - Kafr El Sheikh

B. Plant Population Density

C. Sweet Corn Production

D. Relationships Farmer Support Program

E. Irrigation Law

F. Farm Management Dynamics

G. Role of Livestock