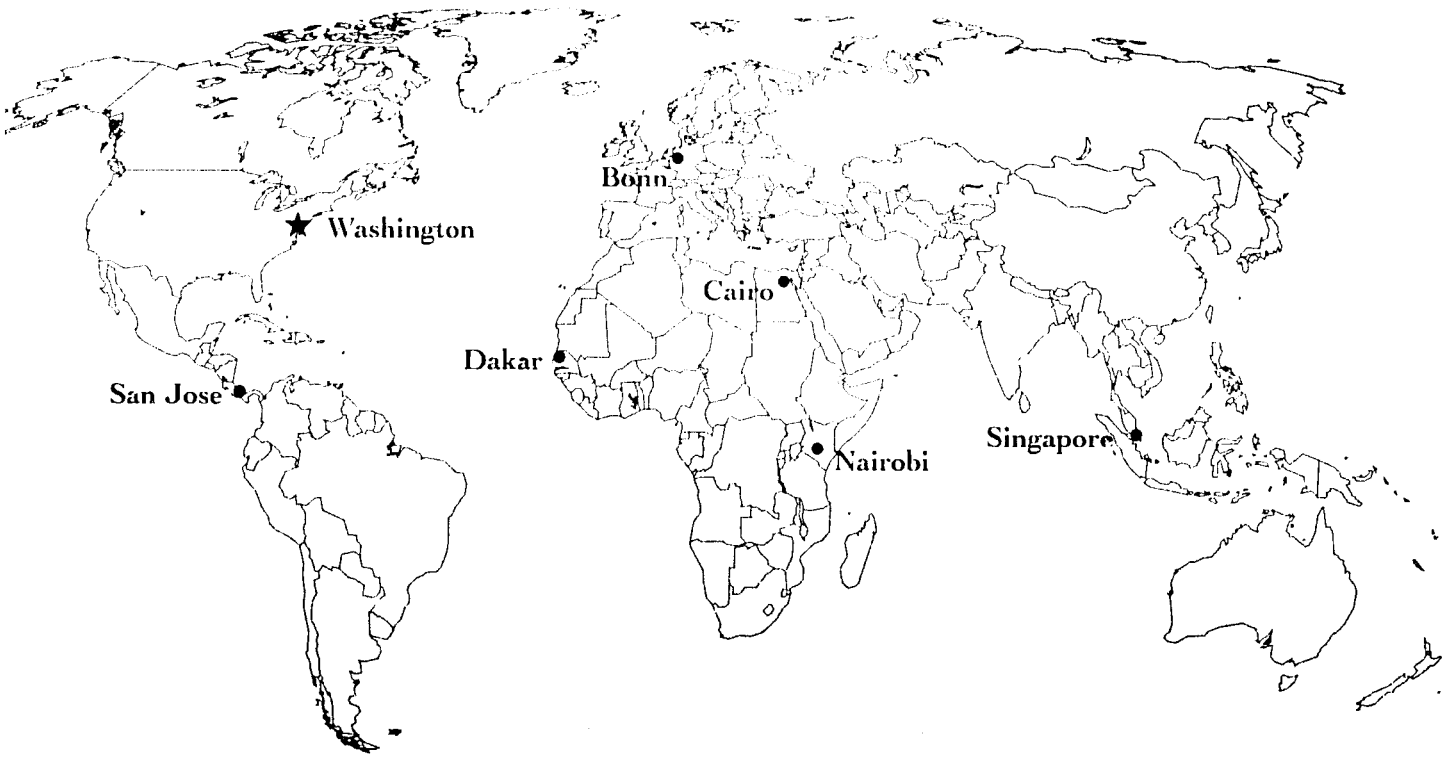
Regional Inspector General for Audit
Cairo, Egypt

Audit of Information Used to Monitor Progress On USAID/Egypt's Irrigation Management Systems Project (Project No. 263-0132)

Report No. 6-263-95-011
September 18, 1995



USAID

UNITED STATES OF AMERICA
AGENCY FOR INTERNATIONAL DEVELOPMENT
OFFICE OF THE REGIONAL INSPECTOR GENERAL/AUDIT

CAIRO, EGYPT

September 18, 1995

MEMORANDUM

TO : Director USAID/Egypt, John R. Westley

FROM : RIG/A/C, Lou Mundy

SUBJECT: Audit of Information Used to Monitor Progress on USAID/Egypt's Irrigation Management Systems Project (Project No. 263-0132)

This is our report on the subject audit. We considered the Mission's comments on our draft report, and have included them in their entirety in Appendix V.

The report contains two recommendations, both of which relate to assessing investment in a proposed follow-on irrigation project. However, the Irrigation Management Systems project is coming to a close and the Mission in its comments to the draft report has stated that it is now no longer planning to invest in a follow-on project. Both recommendations are therefore closed as of the date of this report, and no additional action is required of the Mission.

After much discussion on the issues raised in the report, it was agreed that the certain differences of view between USAID/Egypt and RIG/A/Cairo could not be entirely resolved. The final report attempts to bridge this gap, though differences do remain. The Mission's decision not to fund a follow-on project, however, has made many of the key differences of little immediate practical import.

We wish to express our appreciation to the Mission for the cooperation and assistance it provided on this assignment.

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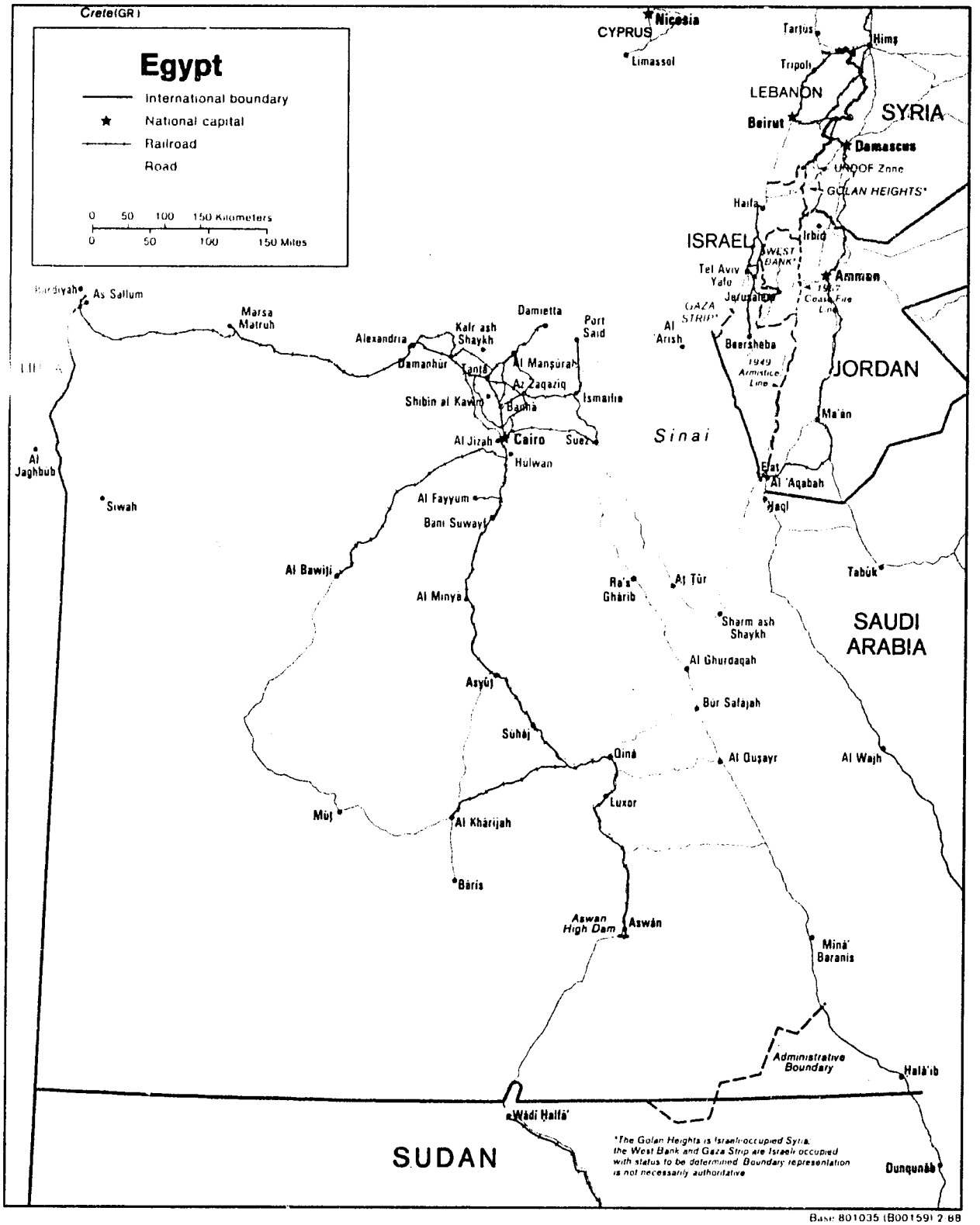

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EXECUTIVE SUMMARY

The Irrigation Management Systems project began in 1981 as a $42 million effort to repair and replace irrigation infrastructure. In 1987 the project was expanded substantially to include a wide array of irrigation activities, with U.S. funding of $336 million plus a host country contribution of $125 million--a total project investment of over $461 million. The purpose of the project is to improve irrigation efficiency. As of September 30, 1994, $274 million in U.S. funds had been spent. And as the project drew close to its planned completion date of September 1995, the Mission was planning both an extension of the current project by a year and (at the time of the audit) a new $50 million follow-on project [see page 1].

The audit answered the following questions: (1) How were funds spent for the project? (2) What results were being achieved? and (3) Did USAID/Egypt verify that information used to monitor project progress was reliable [see page 2]?

As for the **first question**, the audit found that the project had funded ten separate components covering a wide range of activities: for example, a $63 million component to help a Government of Egypt Ministry build and improve irrigation infrastructure; a $48 million component to install a high-tech telemetry system to collect and transmit data on water levels from 800 remote sites nationwide; and a $33 million component to develop the capacity of eleven water research institutes. Project funds were spent largely on technical assistance (36 percent), construction (29 percent), and commodities (24 percent) [see page 3].

For the **second question** (on results achieved), we found that the Mission had difficulties quantifying what improvement in irrigation efficiency had been achieved as the result of project activities. This was because it was not possible to clearly link the outputs achieved by the project to increases in agricultural production (increases in agricultural production being a key part of the indicator the Mission was using to measure irrigation efficiency). Also, too many other factors unrelated to the project (such as policy reforms and research), impact on agricultural production [see page 5].

With regard to project "outputs" (canals built, telemetry units installed, etc.), mixed results are being achieved as the project draws to a close. Two of the ten project

components have been completed, including the largest one, Structural Replacement--which per Mission records had surpassed its target of replacing 18,500 irrigation structures. For the remaining active components, while some output targets have been met, most have not. For example, as of September 1994, for the three largest remaining components (which represent about 44 percent of the total obligated for the project) key output targets have only been about half achieved. [see page 13].

In addition, the audit found that required financial and other analyses had not been done to justify the project's $37 million Survey & Mapping component. The audit could not conclude as to whether this component was a cost-effective way of contributing to the project's purpose [see page 16].

As for the **third question** in the audit, we concluded that for the items tested, USAID/Egypt had verified that information used to monitor progress on project outputs was reliable [see page 19].

Recommendations: The audit recommends that USAID/Egypt (1) redesign the project's purpose-level indicator so as to enable the Mission to decide whether investment in a follow-on project is warranted, and (2) conduct required analyses to determine if further funding of the Survey & Mapping component is justified [see pages 6 and 16].

On June 5, 1995 we discussed these findings with the Mission, and the Mission asserted that it had already come to many of the same conclusions as the audit, and that they were working on resolving many of the difficulties that the audit described. With regard to the Survey & Mapping component the Mission indicated that this was originally an institution building effort, and that even if a financial analysis had been done, a least-cost option may not have been appropriate for such an effort.

Mission Response -

In its written response to the draft audit report the Mission stated that it believes that the project had been "highly successful" and that the audit "does not provide a balanced and accurate assessment of the returns to a very large investment...or of the successful efforts of large numbers of American irrigation experts over many years." In addition, it charged that the audit contained numerous deficiencies, that the audit team "lacked [both] the irrigation expertise necessary for an overall assessment of program design and impact, and...the methodological expertise necessary for an assessment of the system for tracking program results in terms of higher-level objectives."

With regard to **Recommendation No. 1** the Mission asserted that the project's purpose-level indicator was reliable and cost-effective, that it is widely used, and that the audit failed to recognize that Agency guidance does not require higher-level (purpose-level) indicators to meet the "rather exact guidance" required for project outputs.

With regard to **Recommendation No. 2** that further funding for Survey & Mapping not be provided unless analyses required by Handbook 3 are done, the Mission noted that it had informed the Government of Egypt in writing that it would not provide additional support for this component prior to the initiation of the audit.

And finally, the Mission stated it is no longer planning a follow-on project and that its irrigation office would be phased out. Therefore, it requests that as the two recommendations are directed at the assessment of investment for such a follow-on, both recommendations be closed upon issuance of the audit report. [See Appendix V for Mission comments.]

Our Evaluation -

We have attempted to correct the audit "deficiencies" cited by the Mission by adding more balance, eliminating "negative tone" and by fuller recognition of the historical nature of the project and the difficulty of retrofitting a single indictor to a project that began as an institution strengthening effort.

We agree that both recommendations should be closed, as a follow-on project is no longer planned--a fact we learned only in the Mission's written response. We believe, however, that the report's findings are essentially sound, that the audit team possessed expertise appropriate to the audit's objectives, and that the report provides a balanced--and not entirely negative--assessment of the project's achievements [see page 22].

Office of the Inspector General

Office of the Inspector General
September 18, 1995

INTRODUCTION

Background

The Irrigation Management Systems (IMS) project began in 1981 with the purpose of improving the operating efficiency of the total irrigation system and strengthening the Egyptian government ministry which designs, operates, and manages the system. Over the years, with an increase in U.S. funds from $42 million to $336 million--and the addition of numerous project components not originally envisioned--the overall purpose of the project was revised in 1993 to place more emphasis on improving water-use efficiency (at the time of our audit the project consisted of ten separate project components covering a wide range of activities).

These activities, which include numerous institution strengthening components, were meant to help achieve such efficiency. Activities funded by the project include: academic and technical training; the construction, repair and replacement of irrigation infrastructure; map production of irrigated areas; and the installation of high-tech systems to monitor water levels, as well as other activities. Per Mission records, about $274 million in U.S. funds had been spent as of September 30, 1994. In addition, the Government of Egypt pledged the local currency equivalent of about $125 million for the project (of which approximately $102 million has been spent). This represents a planned project investment of $461 million--$336 million in U.S. funds plus the Government of Egypt contribution.

The project is being carried out mainly through various offices and institutes of the Government of Egypt's Ministry of Public Works and Water Resources. Technical assistance under this project was provided to this Ministry through a variety of U.S. contractors, several agreements with U.S. Government Agencies and through a grant given to the Food and Agriculture Organization of the United Nations. As the project draws to a close, USAID/Egypt is planning a follow-on project in water resource management--and the likely extension of the IMS "Project Assistance Completion Date," which at the time of the audit was September 21, 1995.

Audit Objectives

Pursuant to our fiscal year 1994 audit plan, the Office of the Inspector General for Audit in Cairo performed an audit to answer the following audit objectives:

- How did USAID/Egypt spend the funds allocated to the Irrigation Management Systems project?
- What results are being achieved under the project paper objectives and outputs for the Irrigation Management Systems project?
- Did USAID/Egypt verify that the information used to monitor project progress was reliable?

Appendix I contains a discussion of the scope and methodology for the audit.

REPORT OF AUDIT FINDINGS

Our answers to the following audit objectives are qualified to the extent of the effect, if any, of not having received written representations for the audit from USAID/Egypt officials directly responsible for the audited activities. Appendix I includes a discussion of this qualifier.

How did USAID/Egypt spend the funds allocated to the Irrigation Management Systems project?

Funds were spent on ten separate project components covering a wide range of activities. According to Mission records $274 million were spent on these components as of September 30, 1994.

The project started in 1981 as a $42 million effort with the bulk of these funds going towards replacing and rehabilitating irrigation infrastructure--activities which ultimately became the project's $76 million Structural Replacement component. Per mission records, at the completion of this component in 1992, over 19,000 small and medium-sized irrigation structures had been replaced.

Another nine components were added to the project, with most funding being added in 1987. Activities funded under four of these components are described below.

- The Irrigation Improvement component helped the Ministry of Public Works and Water Resources (the Ministry) plan, design and construct improved, more efficient irrigation systems. This effort includes the introduction into a limited area of a new concept of irrigation called "continuous flow."

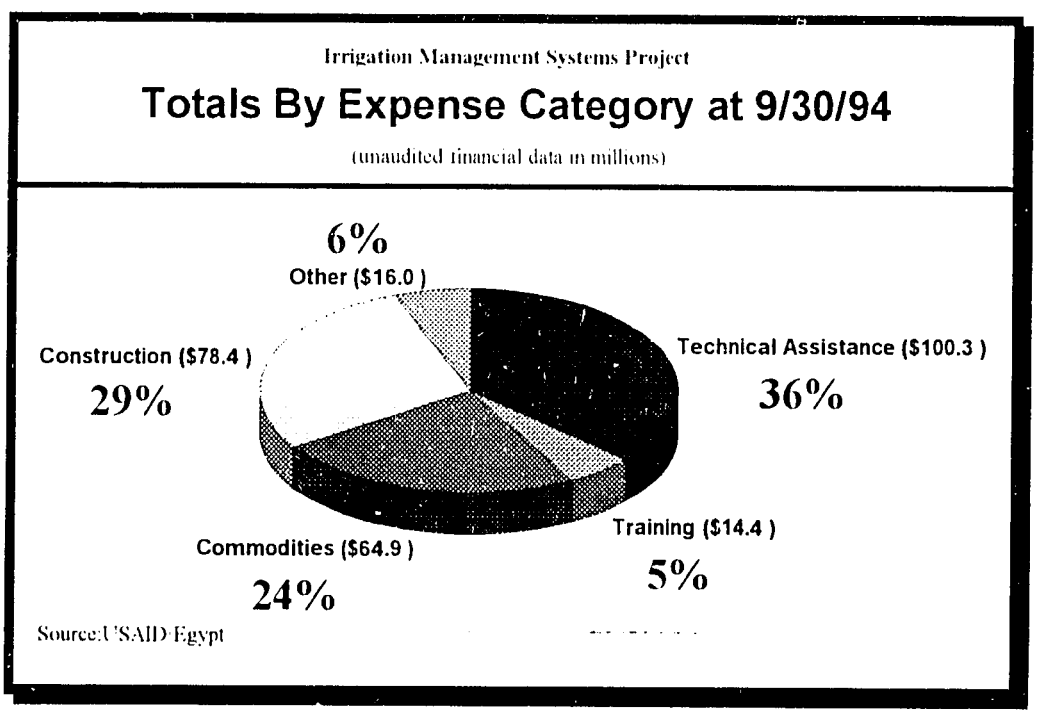
- The Planning, Studies and Models component worked on the other end of the irrigation network by developing planning and operational models to improve

management of the Aswan High Dam--and by establishing a "Forecasting Center" to predict Nile inflows into the lake behind the dam. One model uses meteorological data to predict the timing, duration and quantity of runoff from the Nile watershed south of Egypt.

- The Main Systems Management component was designed to improve the Ministry's capabilities to monitor and manage the Nile River and major canals, through a high-tech telemetry system that collects data on the irrigation system water levels from 800 sites throughout the country.

- The Water Research Center component provided technical assistance to help develop the capacity of the Ministry's 11 water research institutes in proposing solutions to Egypt's irrigation problems. The institutes accomplish this through research in such areas as canal weed control and the reuse of agricultural drainage water.

For an overview of project activities and a component-by-component breakdown on how funds were spent, see Appendix II. The pie chart below gives a general idea of how funds were spent for the project as a whole. Note that the three largest uses of project funds were for technical assistance, construction and commodities (equipment), these uses respectively consuming 36 percent, 29 percent and 24 percent of project funds. For more details on what funds were used for, see the next section on results.



What results are being achieved under the project paper objectives and outputs for the Irrigation Management Systems project?

The Mission has had difficulties in quantifying what improvements in water-use efficiency (the project's **purpose-level objective**) have resulted from the project. This is because the Mission has not been able to clearly link project results to increases in agricultural production in Egypt (increases in agricultural production being a key part of the indicator the Mission is using to measure irrigation efficiency). Basically, too many factors, mostly unrelated to the project (such as agricultural policy, new technologies, etc.) also impact on agricultural production. We recognize that such a linkage need not be absolute. However, at a minimum any evidence used to assert such a linkage should be verifiable, i.e., evidence that irrigation efficiency has increased should have the same meaning for both skeptic and advocate. At present, the Mission's indicator for measuring irrigation efficiency does not meet this test. Furthermore, major project components have yet to be completed, and thus, the Mission cannot assume these components have been contributing to increases in efficiency over the past several years.

With regard to project **outputs** (canals built, telemetry units installed, etc.), mixed results are being achieved as the project draws to a close. Two of the ten project components have been completed, including Structural Replacement which at $76 million is the largest project component. For the remaining active components, while some output targets have been met, most have not. For example, as of September 1994, for the three largest remaining components, which represent about 44 percent of the total obligated for the project, key output targets have only been about half achieved. The Mission was planning to extend the project completion date by one year to September 1996.

In addition, the audit found that the Mission did not conduct required analyses to justify the expenditures of $37 million to provide the host government with a Survey & Mapping capability, and $19 million to construct, equip and organize a new training center for irrigation management (the Professional Development component). Such analyses were critical to determining if these expenditures were a cost-effective way to contribute to the project purpose.

Overall Project Results Cannot Be Objectively Verified

The Agency's "Program Performance Information for Strategic Management System" (PRISM) requires that Missions develop quantifiable performance indicators to measure projects' contributions to strategic USAID program objectives. These indicators are important in that they help USAID determine if its investments in development assistance are worthwhile. Furthermore, USAID Handbook 3 requires that indicators of project performance meet four tests: they must be quantifiable, independent, plausible and

objectively verifiable. The audit found that the indicator used by the Mission to measure project results was not "plausible," or "objectively verifiable," and thus did not provide a basis to determine the project's contribution to increased agricultural production, the project's strategic objective. Basically, the Mission through this indicator gave credit to the project for increases in Egypt's agricultural production when many other factors (such as policy reform) also led to these increases--and when a substantial number of project components had yet to be completed. We could not determine why this occurred, but we did note that (1) the decision to use the indicator was made early in the implementation of the new PRISM system, (2) the indicator was developed late in the project, and (3) an indicator more directly related to water use for irrigation, proposed in a 1993 Project Paper was not used. As a result, the Mission does not have a credible measurement of project results and therefore, whether its investment of USAID funds in this project is worthwhile. Such a measurement is also critical because the Mission is considering whether to invest an additional $50 million of USAID funds in a follow-on project. We believe that without a reliable measure of project results, an objective determination by the Mission of whether a follow-on project is warranted is not assured.

> **Recommendation No. 1: We recommend that USAID/Egypt redesign the current project purpose-level indicator so that it is plausible and objectively verifiable. The redesign should consider how components which are not completed contribute to the overall project purpose and decide whether further investment in a follow-on project is warranted.**

Discussion

The Agency has long recognized that it must decide which projects are worthwhile among the many projects competing for U.S. taxpayer monies. To better accomplish this, USAID initiated PRISM in 1991 to measure how projects contribute to USAID strategic objectives. Based on how projects contribute to these objectives, USAID can decide which projects to fund and whether funding should be continued. The Foreign Assistance Act and USAID Handbook 3 define how the Agency is to develop indicators of progress and compare actual performance against expected targets. Handbook 3 requires that these indicators be:

(1) **quantifiable** and should include a **target** for when a desired change is to be observable;

(2) **independent** of indicators at other levels (e.g., the purpose-level indicator for water use efficiency should be independent of output indicators such as the number of irrigation structures repaired);

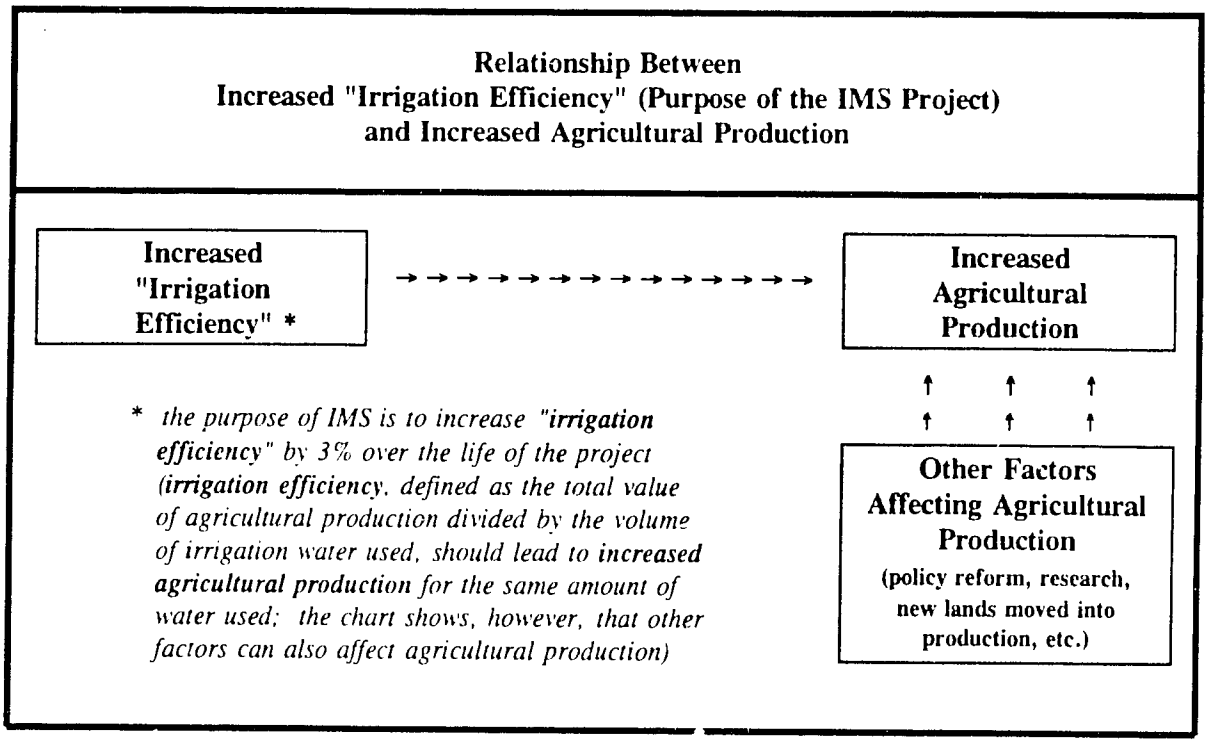
(3) **plausible** (i.e., the indicator should measure change which varies directly with progress toward planned targets); and

(4) **objectively verifiable** (i.e., the indicator should present evidence that has the same meaning for both skeptic and advocate).

The indicator used by USAID/Egypt to measure the achievement of the project's purpose--increasing water use efficiency for irrigation--met the first two tests. The Mission had established a **quantifiable target** of increasing irrigation efficiency by three percent over the life of the project. Also the indicator was **independent** of lower level indicators. For example, per the project paper, irrigation efficiency was to be measured by dividing the total value of agricultural production by the total volume of irrigation water used, an indicator which is clearly independent of such output indicators as number of canals built or number of irrigation structures repaired.

However, the indicator did not meet the third and fourth test. The indicator was not "**plausible**" in that it did not vary fully and directly with progress toward the planned target. This was partly due to the fact that the indicator, countrywide agricultural production divided by water released from the Aswan High Dam, did not adjust for non-irrigation uses of water, such as evaporation and drainage water lost to the sea. That is, the indicator relates agriculture production with water consumed for **all** uses, not just with water used for irrigation (the project paper, on the other hand, suggested that the indicator should relate agricultural production to water consumed for irrigation purposes only).

But more importantly, the indicator did not meet the fourth test that it be "**objectively verifiable**." This test requires that indicators must present evidence that has the same meaning for both skeptic and advocate. The indicator used by USAID/Egypt did not meet this test in that increases in agricultural production (the numerator or top part of the indicator) could not be directly "linked" to changes in irrigation efficiency. The indicator in essence shows that there has been a dramatic increase in agricultural production of some 30 percent since 1982. What the indicator does **not** show is that these increases have resulted from irrigation improvements. (See the chart on the next page which shows graphically the relationship between irrigation efficiency and agricultural production.) An increase in agricultural production, of course, may include the effects of many factors. A 1994 USAID Project Evaluation concluded that it was more likely that the bulk of the increase was due to policy reform and research rather than to improvements in irrigation. Without a clear link between irrigation efficiency and increased agricultural production, the Mission is left in the position of having to "**attribute**" some of this increase to more efficient irrigation.



Moreover, we believe it may be premature for the Mission to use increases in agricultural production over the years as a indication of the achievements of this project since major project components have yet to be completed. While the project started in 1981, only two of ten project components have been completed, and for three major components representing about 44 percent of the funds obligated, key output targets (according to Mission records) had only been about half achieved as of September 30, 1994. These components include (1) improved branch and farm canals and continuous flow irrigation, (2) remote telemetry devices which measure and transmit data on canal water levels, and (3) map production of irrigated areas. Thus, we believe that the Mission should not assume that these--and other components which are not yet complete--have been contributing to increases in efficient irrigation over the last several years.

The examples below illustrate:

- The **Irrigation Improvement** component targeted 75,000 feddans[1] of land (out of over 6 million feddans of irrigated land in Egypt) for improvement. As of September 1994, records show that only about half of the 75,000 feddans had been improved: This amounts to an improvement of about **half of a percent** of

[1] One "feddan" is approximately equal to one acre.

irrigated land nationwide. Considering this relatively small percentage of land improved under this component, it is difficult to determine how a measurable increase in agricultural production could be attributed to this component. We also noted that Mission files indicate that faulty management of "continuous flow" by the Irrigation Department in one water command, which comprised about one third of the total area improved, may ironically have resulted in a **less efficient** use of irrigation water than under the old "rotation" system.[2]

- For the **Main Systems Management** component, as of September 1994 only about half of the telemetry sites planned were installed and in operation. Also, as the use of the data generated from these sites has thus far been limited to local monitoring of water levels, it is difficult to attribute any significant system-wide efficiencies to this component at this point.

- The **Planning, Studies and Models** component was to develop six mathematical models (with software and manuals) that could be used for irrigation management. As of September 1994, four of the six models were complete, but per discussions with project personnel, little use had as yet been made of any these models to improve irrigation efficiency. As of November 1994, training had only been provided in the use of one of these models--and that training was restricted to three irrigation directorates. As a result, these models have not yet had any significant effect on irrigation efficiency.

In summary, the project's purpose-level indicator does not pass the plausibility and verifiability tests and in our view does not reflect the fact that key project components have not yet had a significant effect on water use efficiency--or on increases in agricultural production.

In contrast, the Mission pointed out that in their view many of the project's components were already contributing in some way to the water-use efficiency. For example, the completed Structural Replacement component had replaced over 19,000 irrigation structures, resulting in significant water savings and reduced waterlogging. As for the Irrigation Improvement component, they noted that the institutional capacity of the Ministry had been strengthened in that it was now fully capable of designing feasibility studies, constructing improved farm-level canals, organizing private water user associations, and assisting users in the efficient management of improved irrigation systems.

As for the telemetry component the Mission noted that data were now being collected from over 200 sites and that decision makers in the 23 water directorates were relying on this data to adjust allotments of water on a daily basis. Because of the project,

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[2] The Mission is currently monitoring all areas already brought under continuous flow and is working on resolving the management problems inherent in making the concept work.

decision makers could now make adjustments in water allotments early in the working day; prior to this project such adjustment was not done until late in the day--or even the next day--due to manual reporting from remote sites. (The Mission also noted that when real-time telemetry data from 600 sites becomes available in late 1996, the average water delivery per feddan would be reduced by 5 percent, allowing that 5 percent to be made available to water short areas.)

In addition, the Mission also noted that participants who had received advanced degrees under the Water Research Center component had prepared feasibility studies for the design and installation of hydraulic structures for a Nile dam. This dam, they observed, now saves 1.0 billion cubic meters of water annually (or 2 percent of the total water available yearly)--water which had previously run out into the Mediterranean Sea.

In response, we would agree that it is clear--even though key project outputs may be lagging--that the project has made progress in achieving planned outputs. During the audit we spoke with numerous impressive and committed Egyptian engineers who were trained by the project. We have also observed that infrastructure has been constructed and installed, maps have been printed, and that software has been prepared for use. What the audit questions, however, is the extent to which all of these activities have as yet contributed to a measurable increase in irrigation efficiency.

It is our contention that the current indicator for irrigation efficiency does not tell with any degree of certainty what the project has accomplished to date. It was a series of somewhat conflicting assessments of the overall achievement of this project that brought this to our attention. While Mission semiannual reports indicated that a "precise measurement of system-wide irrigation efficiency" could not be achieved "due to a lack of adequate data," another Mission assessment based on the indicator described above stated that substantial increases in irrigation efficiency had resulted from the project. The next section provides further discussion of this area.

Conflicting Assessments on Achievement of Overall Results - The Mission has reported increases in agricultural production in Egypt due to the IMS project, when many other factors (such as policy reform) also led to these increases and when a substantial number of IMS project components have yet to be completed. However, these reports of achievement are not consistent with a number of other assessments made by the Mission. The table below summarizes these conflicting assessments--as well as our own conclusion.

Irrigation Management Systems (IMS) Project Conflicting Assessments on Achievement of Overall Results	
the 1995 Program Performance Review indicates **increases in agricultural production are due to irrigation efficiency**	the Review concludes that due to the IMS project "crop output continues to increase per unit of water" released by the Aswan High Dam and that crop production "**increased...4.1% annually for the period 1986/88 through 1992.**"
a June 1994 evaluation report says **increases are due primarily to research and policy reform**	the June 1994 evaluation (on another USAID project) concludes that the **increases in crop output resulted from "research programs and significant policy reform during the past 10- to 15 year period."**
various Mission officials say **at least some of the increase in agricultural production is due to irrigation efficiency**	a number of officials asserted that **the IMS project should get at least "some credit for observed increases in agricultural output;"** others pointed out that the project's Structural Replacement component, which replaced over 19,000 irrigation structures early in the project, is bound to have had some effect on irrigation efficiency and agricultural production.
the audit's conclusion... **one cannot tell from the indicator** how much irrigation efficiency has increased, nor what the contribution of the IMS project has been toward increased agricultural production in Egypt	the claimed 4.1% **annual** increase (see first block above) seems extremely high, especially when compared to the project's **life-of-project** target of 3%....And as indicated by the evaluation (see block two), some of the increase in agricultural production is due to factors other than irrigation efficiency--though by how much, Mission officials cannot say.

In short, the audit concludes that the indicator used by the Mission is not adequate to conclude whether irrigation efficiency has increased or that the project has yet contributed significantly to the dramatic increases in agricultural production in Egypt. An internal Mission document we reviewed comes to a similar conclusion: namely, that increases in agricultural output can only be "**attributed**" to the project--and that "substantial and measurable impact" may only come over the longer term.

The Development of the Mission's Indicator - We could not determine why the Mission did not use a more reliable indicator to measure project results. We did note that (1) the indicator was established soon after the initiation of PRISM, (2) the indicator was developed late in the project, and (3) a similar but more precise indicator proposed in a 1993 Project Paper was not used.

Although the project began in 1981, Mission efforts to quantitatively measure overall project results did not begin until 1993. The efforts were prompted by the Agency's implementation of the PRISM system. Initiated in 1991, the Agency's PRISM system has focused on the achievement of **higher level** "strategic objectives" and "program outcomes." What this means is that Agency units are under stricter requirements to track performance with regard to outputs (number of people trained, number of canals built, etc.), but are also expected to measure performance with regard to "higher" outcomes (e.g., was irrigation efficiency improved and by how much).

To meet PRISM requirements, the project paper was amended in 1993 "to focus the project purpose and more clearly reflect objectively verifiable indicators." The 1993 IMS project paper therefore established a three percent increase in "irrigation efficiency" as a life-of-project target. Before this, the project paper had not indicated how efficiency was to be measured nor established a quantifiable target. USAID/Egypt recognized the difficulty in developing a viable indicator, ultimately concluding that "precise measurement of system-wide irrigation efficiency" could not be done due to a "lack of adequate data." In spite of this conclusion, the Mission adopted the indicator which attributed increases in Egypt's agricultural production over many previous years to the IMS project.

Also hampering the Mission's efforts was the fact that the indicator was developed late in the project life. By that time the project consisted of ten separate components funded for $336 million compared to a single component funded for $42 million in 1981. Thus, the Mission found it more difficult to develop an indicator that would demonstrate how all components were contributing to irrigation efficiency--than it would have when the project had only one component.

Finally, the Mission did not use the exact indicator proposed in the 1993 amendment to the project paper. The indicator proposed was the "total value of agricultural production" divided by "total volume of irrigation water used." Instead, the Mission used the total value of agricultural production divided by **total** water discharged by the Aswan High Dam. (The project paper indicator would have estimated water used for irrigation by adjusting total water discharged from the Dam for factors such as water lost to the sea and water consumed for other purposes.)

Conclusion - The Mission does not have a precise measurement of overall project accomplishment for the Irrigation Management Systems project. The Mission should redesign the current project purpose-level indicator so that it is plausible and verifiable. We recognize, that the Mission has been working to come to grips with the complex issue of measurement for some time, and that it is has been difficult to retrofit a single numerical indicator to a project which, as the Mission points out, began as an institution strengthening project. Nevertheless, with the extension of the current project and the Agency's increasing emphasis on measuring achievement of higher-level objectives, the

Mission must ensure that such measurement--and related conclusions--are accurate and convincing.

Without a credible indicator of performance, the Mission does not have a precise measure of the value of its $336 million investment in the IMS project. As the Mission is considering a $50 million follow-on project, we believe that a decision on this investment should be deferred until the Mission can demonstrate benefits resulting from the current project, and justify further investment in IMS.

Project Outputs: Mixed Results
Achieved as the Project Draws to a Close

With regard to project **outputs** (canals built, telemetry units installed, etc.), mixed results are being achieved as the project draws to a close. Two of the ten project components have been completed. For the remaining components, while some output targets have been met, most have not. Notably, as of September 1994, for three of the largest project components (representing about 44 percent of the total funds obligated for the project), key output targets have only been about half achieved. A brief description of the status of project outputs for these three components follows below.

- The $63 million **Irrigation Improvement** component was designed to help the Ministry of Public Works and Water Resources rehabilitate and improve the irrigation system. Interventions consist of (1) changing from rotation to "continuous flow" water delivery, (2) improving main and branch canals, (3) constructing efficient farm-level canals (*mesqas*) and (4) assisting farmers in operating and maintaining the *mesqas*. USAID/Egypt established targets for these interventions: 75,000 feddans to be put under continuous flow; 1,200 *mesqas* to be built and put into operation; etc. Mission records show that, as of September 1994, 37,900 feddans had been put under continuous flow and 303 *mesqas* were built and operating. Mission officials attribute the delay, in part, to the Mission holding up funding to ensure that the host government made several key policy changes. (Page 15 illustrates improvements made under this component.)

- The objective of the $48 million **Main Systems Management** component is to improve Ministry capacity to manage the Nile and major canals, mostly by the installation of a telemetry data collection system. This system collects and automatically transmits water level data to central locations, where the data can be used to manage the irrigation system. When complete, the system will consist of 800 solar-powered data collection units, reporting data hourly (or every two hours[3]) from around the country. As of September 1994, records showed that

[3] The overall system will consist of 200 "Meteorburst" units which report in every two hours, and 600 newer, radio-based units which transmit data every hour.

while 398 out of the 800 units were operating, installation of the remaining units seemed unlikely before the project's end. Also, to present, data generated by existing units have mainly been used for monitoring and control within individual water districts. Broader system-wide benefits of this investment have yet to be achieved. As of November 1994, about 30 Egyptians were in training in the U.S. on the use and maintenance of the telemetry equipment. As a result, there may be insufficient time for requisite institutional development by project end. (Page 18 illustrates elements of the telemetry system we observed at two locations.)

- The objective of the $37 million **Survey & Mapping** component is to provide aerial photography, maps and other geographic data to the Egyptian Survey Authority (the Authority) to help "plan, design and implement" irrigation improvements. To accomplish this, the component provided the Authority with $9 million for remodeling and for state-of-the-art equipment to make maps of irrigated areas. In addition, $24 million in technical assistance is being spent to help produce such maps. Overall, the audit observed that facilities have been renovated and re-equipped, personnel trained, and equipment is being used. However, Mission records indicate as of September 1994 that for five of the seven kinds of maps the component was to produce, targets have been only half achieved or less. In addition, records indicate that the Authority has only recently started paying the component's sizeable recurrent costs[4]. One project official commented that the component's weakness may be the Authority's inability, in the absence of continued technical assistance, to manage component data ("orthophoto" digital files, soil and crop overlays, etc.), data which need to be exploited to increase irrigation efficiency.

If we look at outputs for all ten components, a similar picture emerges: Out of a total of 67 output targets for the project as a whole, Mission records show that 38 had not been met as of September 1994 (See Appendix III on results achieved for a cross section of ten of the targets). As a result, the Mission was planning to extend the project to September 1996.

To summarize, achievements coming from this project have been mixed--with two of ten components complete (including Structural Replacement which at $76 million is the largest component) but with other major components yet to be done. We believe that these mixed results highlight the need for the Mission to redesign the indicator of overall project results to clearly establish what benefits are being derived from the USAID investment. This redesign should be the basis for determining whether a follow-on project is warranted.

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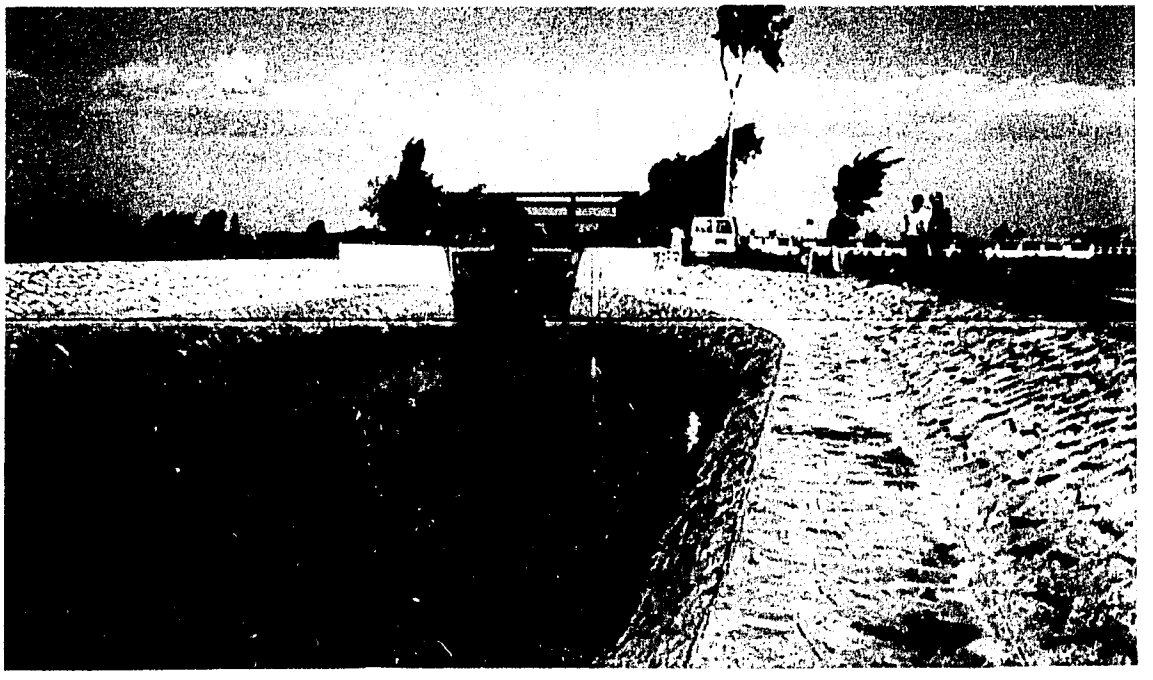
[4] Per mission records over $3 million in local operating costs have been provided to this component.



[ABOVE] Main canal improvements done by the project (Qahwagi, Nov. 1994)

[BELOW] A farm-level canal (or *mesqa*) built by the project (Qiman El Arus, Sept. 1994)

Required Analyses Not Made
to Justify One Project Component

USAID requires that certain analyses be made to justify the expenditure of project funds. In part, these analyses help ensure that funds are spent prudently and in the most cost-effective manner. The Mission did not conduct required financial and other analyses to justify the expenditure of $37 million to provide the host government with a Survey & Mapping capability. Mission personnel indicated that the analyses were not made initially (in 1987) because of lack of personnel; however, the Mission did not know why subsequent project reviews did not question the use of these funds. These analyses are critical to determining if expenditures are reasonable and cost-effective, and whether further funding is warranted.

> **Recommendation No. 2: We recommend USAID/Egypt conduct the analyses required by USAID Handbook 3 to determine if further funding of the Survey & Mapping component is justified.**

Discussion

USAID Handbook 3 requires that a number of analyses be done (technical analysis, financial analysis, economic analysis, etc.) before a project can be approved, and it is clear that these analyses were in fact done for the Irrigation Management Systems (IMS) project when first approved in 1981. However, at that point, IMS was a $42 million effort dedicated primarily to the repair and rehabilitation of irrigation infrastructure. Project components added or significantly expanded in 1987 did not receive the same degree of analysis. Specifically, we noted that required analyses were not made to justify the Survey & Mapping component.

When added to the project in 1987, the Survey & Mapping component was to be a $6 million effort in which the Egyptian Survey Authority would acquire various mapping products through contracts with outside firms. The 1987 project paper indicated that contracting would be "the most cost-effective manner" of obtaining required maps. However, the component turned into a $37 million project in which the Egyptian Survey Authority itself made the maps--using $9 million in project-supplied commodities and $24 million in technical assistance (see discussion in previous section).

We believe had the Mission conducted the required analyses of this $37 million component versus the benefits to be derived, the reasonableness of the expenditure would not have been justified. The Mission, on the other hand, indicated that this component, as well as certain others, were originally institution building efforts, and that even if a financial analysis had been done, a least-cost option may not have been appropriate. Also, the Mission noted that these components are now operating as intended, producing

maps, carrying out training, doing research, etc. Specifically, they noted that the Egyptian Survey Authority was now completing cropping pattern and canal and drainage maps that identify fertile land areas lost to excessive soil salinity and waterlogging. They also noted that the Authority has provided maps to the World Bank for the design of their new irrigation project to install irrigation improvements on 250,000 feddans of land.

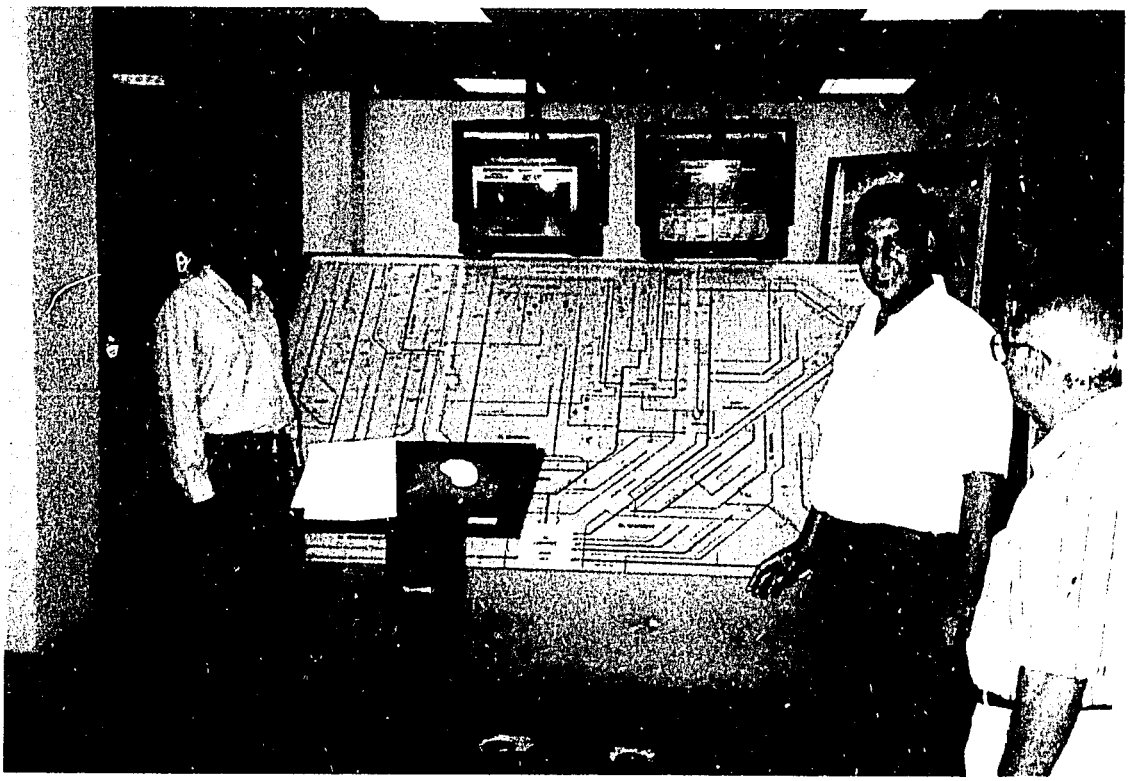
Nevertheless, the audit found that the Mission did not have required analyses to justify significantly expanding the Survey & Mapping component either in the project paper, or in the project files. The 1987 project paper analyses focuses mostly on the Irrigation Improvement component, a component which at the time made up about one third of total project funding.

We recognize that staff who might shed light on what analyses were done and on why funding decisions were made are no longer at the Mission. Current Mission personnel stated that the required analyses may not have been conducted in 1987 due to a lack of personnel. However, since 1987, as more funds were added, we believe that justifications should have been prepared to show that this was a prudent and cost-effective use of these funds. We were provided no evidence that this was done.

USAID/Egypt, therefore, needs to conduct required analyses for Survey & Mapping to determine if further funding is justified. Such analyses are critical to determining whether these expenditures are a reasonable as well as cost-effective way of contributing to the project purpose, and whether further funding is warranted.

[LEFT] This solar-powered telemetry unit (Delta Barrage, September 1994) automatically transmits data on canal water levels every two hours to the Ministry of Public Works and Water Resources.

[BELOW] In the Ministry of Public Works and Water Resources, this console unit (showing the Nile delta and its canals) was not yet working during our visit in September 1994, as the radio-based telemetry sites which were to transmit data were still being installed.



Did USAID/Egypt verify that the information used to monitor project progress was reliable?

We audited data reported on 23 out of the project's 67 output indicators. For the items we tested, USAID/Egypt's records showed that it had verified that information used to monitor project progress was reliable (see Appendix IV for a table showing the 23 indicators tested). During our fieldwork, we found only minor problem areas, which we communicated to USAID/Egypt in a separate management letter.

Based on our review of project files maintained by the Mission, we found evidence that project officers and others in the Mission's Office of Irrigation and Land Development had themselves verified data through site visits, through evaluations performed by third parties, and through progress reports prepared by contractors. In still other cases, the Mission itself gathered data on the project's progress. To illustrate:

- Under the Irrigation Improvement component Mission personnel made numerous field visits to track the status of construction being done under the component. Personnel carefully tracked by construction contract the number of *mesqas* built, main system improvements completed and areas coming under continuous flow--and filed detailed site visit reports complete with annotated photographs and descriptions of problems found and solutions proposed.

- Under the Main Systems Management component, data was verified by project personnel site visits, through meetings and close interaction with host government counterparts and contractors, and by participating in annual workshops. Not only did project personnel monitor the main indicators included in the Mission's semiannual implementation report, but also monitored a host of more technical ones needed to evaluate the progress of the component.

- Under the Preventive Maintenance component the verification of the accuracy of information on number of people trained, manuals completed and maintenance programs established was performed not only through field visits, but also through the use of independent consultants.

Based on the Mission's own verification of information used to monitor project progress as of March 31, 1994, and on our own testing of that data, we concluded that for the items tested, the reported information could be relied on. This conclusion is based, in part, on the Office of Irrigation and Land Development's effective use of site visits, as well as on other means of verification which it used to ensure that reported information was accurate and reliable. In a number of cases first-hand verification by project officers was very good, but for the cases where this was not the case, the absence of first-hand verification had no ill effect. For example, for one component the Mission had itself developed data on project outputs from a general familiarity with the project and from

estimates. Substantive testing done by the auditors in this case found no material differences between the audited figures and figures developed by the Mission through the use of such estimates.

MANAGEMENT COMMENTS AND OUR EVALUATION

Management Comments -

The Mission provided no comment on the first finding on how funds were spent nor on the third finding on monitoring of project output indicators. The Mission did, however, provide lengthy comment on the second finding on results being achieved (see Appendix V for the full text of the Mission's comments).

In its comments the Mission stated that it believes that the project has been highly successful and that the audit "does not provide a balanced and accurate assessment of the returns to a very large investment...or of the successful efforts of large numbers of American irrigation experts over many years." In addition, it charged that the audit contained numerous deficiencies, that the audit team "lacked [both] the irrigation expertise necessary for an overall assessment of program design and impact, and...the methodological expertise necessary for an assessment of the system for tracking program results in terms of higher-level objectives."

Furthermore, the Mission stated that the Inspector General had "abrogated unilaterally" a 1994 policy that was designed to limit performance audits to "the adequacy of project monitoring and... achievement of lower-level objectives" --and had in the current audit improperly attempted to "assess overall project impact and the achievement of higher-level indicators."

With regard to **Recommendation No. 1** that the project's purpose-level indicator be revised, the Mission asserted that the current indicator was reliable and cost-effective, that it is widely used, and that the audit failed to recognize that Agency guidance does not require higher-level (purpose-level) indicators to meet the "rather exact guidance" required for project outputs. Instead, higher-level indicators would use a test of "reasonable attribution."

With regard to the **Recommendation No. 2** that further funding for Survey & Mapping and Professional Development not be provided unless analyses required by Handbook 3

are done, the Mission noted that the Mission had already informed the Government of Egypt in writing that it would not provide additional support for Survey & Mapping and that the required analyses had in fact been done for Professional Development in 1986.

And finally, the Mission states it is no longer planning a follow-on project and that its irrigation office would be phased out. Therefore, it requests that as the two recommendations are directed at the assessment of investment for such a follow-on, both recommendations be closed upon issuance of the audit report.

Our Evaluation -

The main thrust of the Mission's dissatisfaction with the report was that the auditors, without irrigation or "methodological" expertise, had improperly attempted to assess "program design and impact." And that when "urged" (at the end of the audit) by the Mission to procure such expertise, the auditors deemed it unnecessary. We believe that such expertise was not necessary as the audit's scope was relatively narrow and focused primarily on USAID's systems for measuring and reporting project effectiveness. We did not attempt to independently assess project design and impact. Rather, we relied primarily on indicators and targets developed and used by the Mission.

As for outputs, we first determined that the information used to monitor progress was reliable by verifying data for 23 of the project's 67 output indicators (The report concludes that such data were reliable and Mission monitoring was adequate). We then simply compared outputs achieved to the targets established, an exercise we believe requires little more than a systematic and analytical look at the available data. We therefore believe that our overall finding with regard to outputs, that "mixed results are being achieved," is a balanced and accurate assessment of project achievement.

With regard to the achievement of the project's purpose, we again sought to rely on the Mission's data. And in doing so we believe we are entirely within the framework of the 1994 policy cited by the Mission [whether "abrogated" or not] in that we examined progress in terms of "objectively verifiable indicators" as reported in Mission project implementation documents.

In examining progress at the purpose level, however, we found the indicator used did not provide convincing evidence as to what the project as a whole was accomplishing. We found conflicting assessments on what the indicator meant and that the Mission's assertion of success was based not so much on the indicator as on a general belief that because of the numerous interventions made, that irrigation efficiency must have increased. This finding is not entirely negative. It simply points out that overall project results could not be objectively measured--and that the effect of many of the project's interventions are only likely to be felt in the future.

With regard to the audit deficiencies cited, we would like to respond to three. (1) Under "**Biased Reporting**" the Mission cites negative tone and a lack of balanced reporting. In this final report we have attempted to eliminate negative tone and provide more balance (e.g., we agree that the draft report did not point out "that the Mission has been dealing with this complex issue of measurement for some time," and now do so). (2) Under "**Inadequate Reporting**" the Mission charges that the draft report "does not deal well with the historical nature of the project and the difficulty of retro-fitting one indicator on a project which historically has been an institutional strengthening project." We agree and have recognized this fact in the report. However, (3) under "**Incorrect Reporting**" we find no support for the charge that report overlooked facts and "based general conclusions on small samples" and hence have made no change.

We agree that both recommendations should be closed as a follow-on project is no longer planned--a fact we learned only in the Mission response. We also changed Recommendation No. 2 and the related finding to recognize that a required analysis had actually been done for Professional Development, a fact we also learned only from the Mission's written comments.

In closing, we would like to note that having provided 80 days to the Mission for its written response, we were somewhat surprised by an apparent change in view in the interim. In contrast to the Mission's written response, at the June 5 exit conference the Mission had indicated they had come to many of the same conclusions as did the draft report, that they were working on resolving many of the difficulties the report described, and that they were engaged in a project redesign. Nevertheless, with plans for a follow-on now cancelled and the current project scheduled to end in a year, we agree that the recommendations would now serve no useful purpose and should be closed. We do believe, however, that the report's findings are essentially sound, that the audit team possessed expertise appropriate to the audit's objectives, and that the report provides a balanced--and not entirely negative--assessment of the project's achievements.

SCOPE AND METHODOLOGY

Scope

We conducted our audit of the Irrigation Management Systems project in accordance with generally accepted government auditing standards. These standards require auditors to obtain written representations from management when they deem them useful. The Office of the Inspector General deems such representations necessary to support potentially positive findings. USAID/Egypt's Director provided us a management representation letter for the audit that contained essential assertions about the activities we audited. However, USAID/Egypt officials directly responsible for these activities did not provide written representations. As a result, our answers to the audit objectives are qualified to the extent of the effect, if any, of not having such representations.

Fieldwork for the audit took place from August 17, 1994 through March 27, 1995. The audit covered project activities from project inception through March 1995. Detailed audit work, for the third audit objective, however, was limited to eight of the ten project components which were active at the time of the audit.[1] The audit did not cover host country contributions to the project.

As part of our audit, we assessed internal controls in place (in USAID/Egypt's Office of Irrigation and Land Development) for verifying that reported data on project progress was reliable. To perform this assessment, we obtained an understanding of the internal control system used to verify the reliability of such data.

In general, we limited our conclusions to the items we actually tested. That is, we did not attempt to project the results of our tests on reliability of data to data which we did not test. In general, as discussed below, we relied on judgmental samples, as we believed that the cost of selecting statistically valid samples could not be justified.

[1] We did no substantive testing of project data from two components ["Structural Replacement" and "Project Development Department"] which were essentially complete at the time of the current audit and which were largely covered by a 1989 performance audit (see Audit Report No. 6-263-89-07, September 21, 1989).

Methodology

Audit Objective No. 1

We determined how USAID/Egypt had spent project funds by reviewing two reports: (1) the Mission Accounting and Control System P06B report as of September 30, 1994 and (2) a schedule prepared by the Office of Irrigation and Land Development showing expenditures by project component and expense category for the same date. We also held discussions with project personnel and examined project documentation as discussed below.

Audit Objective No. 2

To determine what progress had been made toward achieving planned outputs, we reviewed Mission Semi Annual Project Implementation reports, project paper and grant agreement requirements, recent workplans and progress reports submitted by contractors, and third-party project evaluations. In addition, we substantively tested that reported data was reliable for 23 of 67 output indicators (see Objective No. 3 below). For the determination of progress being made toward achieving the project's purpose, we examined, in addition, the Mission's 1995 Program Performance Review and supporting documentation. We also held discussions with Mission personnel, project contractors, and with project officials in the Egyptian Survey Authority and in the Ministry of Public Works and Water Resources.

Audit Objective No. 3

We substantively tested on a judgmental basis, data reported as of March 31, 1994 for 23 of the 67 project output indicators used by USAID/Egypt in its Semi Annual Implementation Reports to monitor achievement of project outputs. To determine whether the Office of Irrigation and Land Development had verified that information used to monitor project progress was reliable, we interviewed Mission staff and talked to contractors and host government personnel. In addition, we examined project files to obtain evidence that USAID/Egypt was using field trips, evaluations and audits, contractor reports, and other monitoring devices to verify that reported information was accurate. We further evaluated the reliability of the data reported for the 23 indicators by judgmentally selecting from each a number of items for direct verification. We visited project sites in Cairo, Qiman El Arus, Minia, Ashrouba, Beni Ebeid, Delta Barrage, Qahwagi, Menoufia, Qalubiya, and 6 October City.

EXPENDITURES BY PROJECT COMPONENT & EXPENSE CATEGORY FOR THE IRRIGATION MANAGEMENT SYSTEMS PROJECT AS OF SEPTEMBER 30, 1994

(unaudited financial data in millions of dollars)

Project Component	Technical Assistance	Training	Commodities	Construction	Other	Totals By Component
Irrigation Improvement Project	23.51	4.38	8.98	2.91	1.32	41.10
Structural Replacement	0.00	0.21	0.77	73.97	0.67	75.62
Preventive Maintenance	8.55	0.74	16.70	0.00	2.53	28.52
Main Systems Management	8.00	0.73	18.90	1.32	0.97	29.92
Planning Studies & Models	7.96	0.74	1.06	0.00	0.49	10.25
Professional Development	5.45	1.42	2.80	0.04	2.57	12.28
Water Research Center	13.23	5.64	5.29	0.13	1.37	25.66
Project Preparation Dept.	9.71	0.18	0.46	0.00	1.07	11.42
Survey & Mapping	22.25	0.28	9.12	0.00	3.30	34.95
Miscellaneous	1.66	0.03	0.82	0.00	1.71	4.22
Totals By Expense Category	100.32	14.35	64.90	78.37	16.00	273.94

Source: USAID/Egypt

Irrigation Management Systems Project:

Results Being Achieved for 10 of the Project's Output Indicators

(at 3/31/94 and 9/30/94)

Project Component		Output Indicators	Actual at 3/31/94 *audited*	Actual at 9/30/94 *unaudited*	End-of-Project Target
Irrigation Improvement	1	Area served by improvements in main & branch canals (in feddans[1])	43,600	43,600	75,000
	2	Number of improved *mesqas*[2] (farm "canals") built and operating	257	303	1,200
	3	Area under "continuous flow" irrigation (in feddans[1])	32,900	37,900	75,000
Preventive Maintenance	4	Establish preventive maintenance programs in 10 Directorates	10	10	10
Main Systems Management	5	Data collection sites along canals ("Meteorburst" system)	200	200	200
	6	Data collection sites along canals (radio-based)	77	198	600
Planning, Studies & Models	7	Establish "Nile Forecasting Center" (for Nile inflows to Lake Nasser)	1	1	1
	8	Complete mathematical models for irrigation management	2	4	6
Professional Development	9	Establish "National Irrigation Training Institute"	90% complete	95% complete	100% complete
Water Research Center	10	Publish research papers (from the 11 institutes under the Water Research Center)	416	525	485

1 One *feddan* is approximately equal to one acre.

2 *Mesqas* are small farm-level "canals" (some of which are above ground and some of which are below ground, low pressure pipelines).

Irrigation Management Systems Project:

Reliability of Data Used to Monitor Project Progress for 23 Output Indicators

(at March 31, 1994)

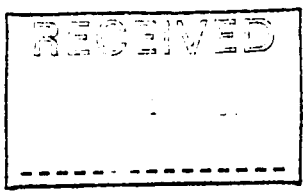
Project Component	Output Indicators		Data at 3/31/94	Data Reliable? *Yes/No*	Project Target
Irrigation Improvement	1	Number of feasibility studies approved	14	*Yes*	17
	2	Area served by improvements in main & branch canals (in feddans[1])	43,600	*Yes*	75,000
	3	Area served by improved *mesqas*[2] (in feddans[1])	28,910	*Yes*	75,000
	4	Number of improved *mesqas*[2] which are operational	257	*Yes*	1,200
	5	Area served by improved *mesqas*[2] which are operational (in feddans[1])	17,900	*Yes*	75,000
	6	Area under "continuous flow" irrigation (in feddans[1])	32,900	*Yes*	75,000
Preventive Maintenance	7	Establish preventive maintenance programs in 10 Directorates	10	*Yes*	10
	8	Develop an inspection and maintenance manual	1	*Yes*	1
Main Systems Management	9	Data collection sites along canals ("Meteorburst" system)	200	*Yes*	200
	10	Data collection sites along canals (radio-based)	77	*Yes*	600
	11	Construct maintenance/training building	1	*Yes*	1
Planning, Studies & Models	12	Complete mathematical models for irrigation management (software)	2	*Yes*	6
	13	Document mathematical models for irrigation management (manuals)	2	*Yes*	6
	14	Establish "Nile Forecasting Center" (for Nile inflows to Lake Nasser)	1	*Yes*	1
Professional Development	15	Establish "National Irrigation Training Institute"	90% complete	*Yes*	100% complete

Project Component	Output Indicators		Data at 3/31/94	Data Reliable? *Yes/No*	Project Target
Water Research Center	16	Develop comprehensive 5-year workplan	1	*Yes*	1
	17	Do yearly workplans for each of the 11 institutes (six years)	5	*Yes*	6
	18	Publish research papers (from work done by the 11 institutes)	416	*Yes*	485
Survey & Mapping	19	Produce cadastral maps [scale = 1:2,500] (in square kilometers)	1,667	*Yes*	3,541
	20	Produce topographic maps [scale = 1:50,000] (in square kilometers)	19,595	*Yes*	50,000
	21	Produce orthophoto maps [scale = 1:10,000] (in square kilometers)	20,900	*Yes*	48,125
Miscellaneous	22	Establish a project monitoring office at the Ministry	1	*Yes*	1
	23	Project monitoring office at the Ministry, operational	1	*Yes*	1

[1] One "feddan" is approximately equal to one acre.
[2] *Mesqas* are small farm-level "canals" (some of which are above ground and some of which are below ground, low pressure pipelines).

UNITED STATES AGENCY for INTERNATIONAL DEVELOPMENT

CAIRO, EGYPT



MEMORANDUM

September 6, 1995

TO: Lou Mundy, RIG/A/C

FROM: John Westley, DIR

SUBJECT: Audit of Information Used to Monitor Progress on USAID/Egypt's Irrigation Management Systems Project No. 263-0132 - Draft Report

Attached is the Mission's response to the subject draft report. Please include in the Executive Summary of the final audit report the full "Summary" on page 2 of the attached response.

I would also appreciate your including the balance of the response in its entirety in the final audit report.

Att: a/s

106 Kasr El Aini Street
Garden City
Cairo, Egypt

Mission Response
to the RIG/A Report:
Audit of Information Used to Monitor Progress
on
USAID/Egypt's Irrigation Management Systems Project
(No. 263-0132)

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SUMMARY

The Irrigation Management Systems project (IMS) is very large ($336 million) and very complex (10 different components). It began in 1982 and will end after fourteen years of implementation in 1996. The IMS project has had a comprehensive evaluation and monitoring system since its inception. Based on a major external evaluation in 1990 and the monitoring and evaluation findings available, USAID/Egypt believes that the project has generally been highly successful in improving the performance of the irrigation system. This has contributed (along with other factors such as an improved policy environment, availability of improved technologies, etc.) to increased agricultural production. Based on the success of IMS (and on strong pressure to reduce US staffing), USAID/Egypt does not intend to fund a follow-on irrigation project as such. Selected irrigation activities will continue to receive support under other related projects.

USAID/Egypt is concerned that this performance audit does not provide a balanced and accurate assessment of the returns to a very large investment of resources, or of the successful efforts of large numbers of American irrigation experts over many years. It contributes very little to improved decision-making for this or similar projects. These deficiencies stem from the lack of adequate expertise on the audit team. The audit team lacked the irrigation expertise necessary for an overall assessment of program design and impact, and lacked the methodological expertise necessary for an assessment of the system for tracking program results in terms of higher-level objectives. USAID/Egypt and the Asia/Near East Bureau offered to help obtain such expertise, but the auditors deemed it unnecessary.

With the IMS audit the Office of the Inspector General (IG) has abrogated unilaterally a 1994 policy (State 070069)on performance audits. The policy was to narrow the scope of performance audits sufficiently to avoid the issue of substantive or methodological expertise. The broader approach taken by the IMS audit is legitimate but carries with it the obligation to assure that adequate expertise is available to the audit team as envisaged by GAO guidance. The IMS performance audit has not fulfilled this obligation and has not contributed to any improvement in USAID irrigation programs or in monitoring and evaluation systems.

Both audit report recommendations are directed at assessment of investment in a potential follow-on irrigation project. Since USAID/Egypt is not planning such an investment, both recommendations should be closed upon issuance of the audit report.

MISSION'S RESPONSE TO AUDIT RECOMMENDATIONS

BACKGROUND

Egypt, as Herodatus said, is "the gift of the Nile." Without the Nile, Egypt would be simply a huge desert punctuated by a few oases. Agriculture based on irrigation drawn from the Nile made possible the emergence of ancient Egyptian civilization over 5000 years ago. Today irrigation-based agriculture accounts for nearly 20 percent of GNP, or 40 percent if defined more broadly to include agriculture-related industries (e.g. fertilizer, food processing, textiles). As a consequence, US assistance to Egypt has always devoted considerable attention to agricultural development, including irrigation. Under the Point Four program in the 1950's, the U.S. assisted in the design of the Aswan High Dam, later constructed with Soviet aid. When USAID initiated its current program in 1975, irrigation projects were among the first to begin under a program called Egypt Water Use and Management.

The subject of this performance audit, the Irrigation Management Systems project (IMS), was the culmination of nearly thirty years of U.S. involvement with Egyptian irrigation when work on the first three components was authorized in FY82 at $42 million. Based on intensive studies and analyses carried out under this project and its predecessors, an additional seven components were eventually authorized through two project paper amendments at a total funding level of $336 million. The evolution of IMS in terms of its components and the funding levels involved is shown in Annex I. The project is now scheduled to terminate at the end of FY96.

The IMS project was designed to meet most of the conditions for sustainable water resources development. USAID attempted to fund and deliver all of the necessary conditions for achieving an increase in the efficiency of the massive Nile irrigation system and simultaneously develop the institutional capacity of Egypt's Irrigation Ministry to continue to improve long-term system efficiency. While some components have been more successful than others, USAID/Egypt believes that the project has generally contributed very significantly to the performance of irrigation in Egypt, and thus to increased agricultural production. This belief is based on monitoring and evaluation efforts which have continued from the beginning of the project in 1982 and covered all components.

USAID established numerous quantifiable indicators to measure IMS success and complemented this monitoring with several external evaluations and assessments. The major external evaluation took place in 1990. In order to do justice to the size and complexity of the project, an evaluation team was comprised of 13 experts with backgrounds in agriculture, irrigation, engineering, and the social sciences. The evaluation was generally positive, and

spoke of "all components" contributing to the IMS purpose. On the basis of the evaluation's recommendations, USAID made several adjustments in the project, including funding levels, personnel selection and qualifications, component inputs and outputs, and life of individual components. Subsequently, different components have been assessed and evaluated more than once, like the Irrigation Improvement component (IIP) and the Preventive Maintenance component (PM).

Given the success of IMS, USAID/Egypt has decided not to proceed with a follow-on stand-alone irrigation project. However, because irrigation is too important to ignore and the U.S. still has much to contribute, future activities related to irrigation will be funded and managed in association with other USAID-supported activities addressing agricultural technology transfer, agricultural policy and water quality. This will permit the Mission to phase out its irrigation office and reduce its US Direct Hire (USDH) staffing for irrigation from 4 in FY95 to 1 by FY97, helping meet the mandated reduction in operating expense (OE) resources.

The IMS performance audit comes as USAID approaches the end of its large-scale and very effective involvement in improving irrigation system performance in Egypt. USAID/Egypt is concerned that the audit report does not provide a balanced and accurate assessment of the returns to a very large investment of resources and the successful efforts of large numbers of American irrigation experts over many years. It also contributes little to improved decision-making for this or similar projects.

USAID/Egypt is a strong supporter of both financial and performance audits, and takes pride in the success of its efforts over the years to improve accountability and to improve (and demonstrate) project effectiveness and impact. An independent audit function is essential. However, program or performance audits can only contribute to improved project design and effectiveness when they are based upon professional expertise adequate to the task at hand. That was presumably the rationale for the policy decision in 1994 (State 070069) to focus performance audits on the adequacy of project monitoring and evaluation systems and on achievement of lower-level objectives ("outputs"). With the IMS audit, the Office of the Inspector General (IG) has decided to unilaterally abrogate the 1994 policy and to attempt to assess overall project impact and the achievement of higher-level indicators ("purpose").

This broader approach requires a level of professional expertise which is not normally available among audit staff (nor should it be). USAID/Egypt's view is that this broader approach is legitimate but carries with it the obligation to assure that adequate expertise is available with respect to the substance of the program involved (irrigation in this case) and evaluation

methodology (which becomes more complex as we proceed from lower-level to higher-level indicators and impacts). This is particularly true since audits are generally the only reports on project performance of interest to Congress, the public and the media. The "general deficiencies" discussed below are a measure of the degree to which this audit has not fulfilled this obligation and has thus not contributed to the performance audit objectives set forth by GAO guidance.

USAID/Egypt's reasoning is set forth in the three following sections which discuss general deficiencies of the audit Report, the Mission response to Audit Recommendation 1 and the Mission response to Audit Recommendation 2.

GENERAL DEFICIENCIES OF THE AUDIT REPORT

The general deficiencies in the report stem from the fact that the audit was conducted by a team which did not possess adequate technical expertise. Contrary to GAO Audit Standards (GAO Government Audit Standards 1994 Revision, 3.3 and 3.10), the team did not possess "adequate professional proficiency" or "skills appropriate" to make the highly technical judgements which it rendered. As noted above, the IMS project is such a technically complex and comprehensive project that when it was fully evaluated in 1990, the evaluation team involved 13 members from different agricultural, irrigation, social science and engineering disciplines. USAID/Egypt urged the audit team to acquire adequate technical expertise, as provided for by the GAO Handbook. USAID also offered to provide staff from USAID/Washington with expertise in irrigation and in evaluation methodology to work with the audit team. Unfortunately, the auditors decided that additional technical expertise was not required. The result was a report which is deficient both in its assessment of the project and in its recommendations regarding evaluation methodology.

The report's general deficiencies include the following:

- the report ignores the impact of major IMS components which account for 37% of project expenditures;
- it fails to distinguish between immediate and long-term contributions by different components;
- it does not differentiate the impact of "key" outputs from all others;
- it conveys its findings in a very negative tone, with examples of biased, inadequate and incorrect reporting; and
- it unilaterally ignores previous distinctions between evaluations and performance audits negotiated between USAID/Washington and the IG

Impact of Major IMS Components The report fails to factor in the impact of major components and characterizes IMS as a number of

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components with equal potential to contribute to the project purpose. For instance, it virtually ignores two components, representing 37 percent of total project expenditures: Structure Replacement and Preventive Maintenance. The former replaced almost half (19,000) of the irrigation structures in the country, and the latter was implemented in governorates comprising about half of Egypt's irrigated area. Irrigation experts would recognize the following linkages between improved irrigation efficiency and key IMS elements:

1. To increase efficiency, it is essential to improve equity and reliability of water distribution at all levels, and to avoid spilling water to "sinks" from which it cannot be retrieved. The increased operational control provided by replacement of over 19,000 badly deteriorated structures under the Structure Replacement (SR) component would absolutely be recognized as a major reason for measured increases in irrigation efficiency. SR work was completed in 1992. One study shows that the structural component was implemented so successfully that it may have increased system efficiency by 5 percent while the overall target for all components was 3 percent (See Annex III).

2. There was a similar contribution from the Preventive Maintenance (PM) component. This component was implemented in governorates comprising about half of Egypt's irrigated area, and most component elements were in place by early 1993. To date, Ministry managers have focused PM resources on priority rehabilitation and major maintenance activities that have achieved the same results as noted above for SR. (PM was not addressed in the draft audit report, apparently because its potential impact on efficiency was not recognized!); and

3. With infrastructure needed for controlling the distribution of water in place as a result of SR and PM components, the MSM telemetry system has been providing the information needed for management.

Immediate vs. Long-term Impacts The report reflects limited understanding of the interrelationships and differing impacts of the individual components on irrigation efficiencies. Some components like Structure Replacement have immediate impact on the system. Others involving training, irrigation research, planning studies and models, and main systems management have long-term impacts which are realized only gradually, e.g. as human resources are developed.

The report questions whether IMS initiatives could have resulted in improved efficiency because "major project components have yet to be completed" (p. 8). The analysis reflects a limited understanding of the kinds of impact that each IMS component should have on irrigation efficiency. It was erroneously assumed that all IMS outputs have equal potential for improving

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irrigation efficiency in the short term. Page 5 of the draft report states that: "...for the three largest remaining components...key output targets have only been about half achieved." Implying that uncompleted outputs were "key" to achievement of increased efficiency, page 8 erroneously concludes that "the mission cannot assume that these--and other components which are not yet complete--have been contributing to increases in efficient irrigation over the last several years."

The report's perspective does not take into account the following points:

1. Irrigation Improvement Program (IIP): While this component accounts for a substantial portion of the project budget, it is a pilot effort covering a relatively small area. Its impact on efficiency must be viewed in a long-term perspective; no substantial system-wide impact to date is claimed by USAID, and auditors should not have considered it as a means to increase efficiency in the short term. The IIP pilot is so successful, however, that the World Bank is lending Egypt $250 million to replicate this program on 250,000 *feddans*[1].

2. Planning Studies and Models (PSM): Although most benefits from this component are indeed to be achieved in the future, comments on page 9 do not reflect an understanding of the significance of the Monitoring, Forecasting, and Simulation (MFS) element (the largest) of PSM. This activity is not discussed in the draft, yet MFS forecasts of Nile flows are being used to plan irrigation operations on a macro scale, thus contributing to increased efficiency.

Impact of Key Outputs vs. All Outputs The report fails to distinguish between key outputs of a component and all outputs. In all projects certain outputs are essential and basic to project success while other outputs complete the project. For instance, the report argues that the Main Systems Management (MSM) component of IMS is characterized as having achieved only about half its targets. However, the report fails to point out that the essential telemetry sites (those on main canals and key branches), installed and operating by MSM, have been in operation for some time and provide continuous irrigation data to decision makers who manage all of the water distribution throughout the entire national system. The other sites which are being completed provide more comprehensive data and are being completed in the project's last stages. On page 9, the draft audit states that it is unlikely that efficiency has improved as a result of these sites because their use has been limited to "monitoring of

[1]One *feddan* is equivalent to 0.42 hectares, 1.037 acres.

water levels." The auditors understood neither that (a) the function of the telemetry sites is indeed to monitor water levels; nor (b) that even if these levels are not converted to discharge (rate of flow), their constant availability is invaluable to managers because of the unique characteristics of Egypt's canal system.

Negative Tone

1)Biased Reporting: We question the negative tone and lack of balanced reporting. Example: The Mission never made claims that the audit insinuates that it did. In the executive summary (p.6), the report recommends that USAID/Egypt "Revise over-optimistic conclusions on results achieved by the project." This is based on a gross misinterpretation of the portfolio review documents. Example: Four valid points by Mission personnel are lumped together in one paragraph (p. 10, second full paragraph) in a way which discounts their validity and force of argument. Example: The paper fails to point out that the Mission has been dealing with this complex issue of measurement for some time. It was the motivation behind the Project Paper amendment and much of the portfolio review process.

2)Inadequate Reporting: Treatment of certain significant issues is lacking in rigor. Example: It fails to deal with the fact that this "project" is more akin to a "program;" which means that the nature of its indicator is less direct, but nevertheless still a valid indicator. Example: It does not deal well with the historical nature of the project and the difficulty of retro-fitting one indicator on a project which historically has been an institutional strengthening project. Had the Mission opted for RIG/A's suggestion that survey and mapping work could have been done more cost effectively by purchasing the work from US supplier of these services and products the Mission would not have been consistent with the previous IMS Purpose, which was institutional strengthening. Example: It claims that certain components do not "deal directly" with **water-use efficiency**. This fails to take into account their crucial, indirect relationships to the project. (The report attacks the Professional Development, Water Research Center, and Survey and Mapping components on these grounds (see p. 9.) Criticizing program components because they do not "deal directly" with the program objective indicates a total lack of comprehension of development assistance, which by design takes on activities whose impact is felt only in the long term as part of the interacting series of improvements.

3)Incorrect Reporting: It seems that the audit report has overlooked facts and has based general conclusions on small samples. Example: It argues that the proxy indicator is not the proper indicator to be using even though the proxy **underestimates** *the water-use efficiency*. The report also doesn't acknowledge the close relationship between proxy and estimates that the

auditors were shown from statistical models which attempted to measure consumption of agriculture more accurately. The audit team was shown modeling analysis that began well before 1992. Example: The draft contends that the Mission became concerned about performance measurement in 1993 when in fact our efforts were initiated prior to that. Proof exists in 1992 not only from the performance review documents but also from the Webb report on the impact of Structure Replacement (Annex III).

Unilaterally Ignores Distinctions between Evaluation and Audits The audit report ignores the distinction between evaluations and audits which had been reached in 1994 between USAID and IG (see State 070069). The previous guidance on the relationships of performance audits to evaluations defined the general focus of audits to be at the output level and the analysis of the agency's monitoring systems, rather than delving into areas which required extensive, specialized expertise. The report and its weaknesses stem from the fact that the IG unilaterally decided to ignore the agreed-upon distinction. The IG decision to abandon a strategy which prevented wasteful overlap between performance audit and evaluation has serious implications for USAID's efforts to manage for results.

THE MISSION RESPONSE TO RECOMMENDATION NO. 1:

Recommendation No. 1: We recommend that USAID/Egypt revise the current project purpose-level indicator, so that it is plausible and objectively verifiable. The redesign must consider how components, which are not completed, contribute to the overall project purpose and must also be used to decide whether further investment in a follow-on project is warranted.

Response:
This recommendation fails to take into consideration the following points:

- the indicator utilized is reliable and cost effective;
- it confuses Agency guidance on project outputs with guidance on purpose and performance level results.

A Reliable and Cost Effective Indicator The original project purpose of IMS was to strengthen the MPWWR's capability and capacity to plan, design, operate, and maintain the water distribution system. The project's goal was to establish effective control of Nile Water for all uses, but particularly for their optimal allocation to and within agriculture as a means of helping increase production and productivity. The original impact level indicator from the 1982 IMS Project Paper was increased productivity and adequate water supplies for farmers. When the IMS project was amended in 1993, the project goal was to increase production and productivity in the agricultural sector. The project purpose became "to improve the system-wide water use

efficiency for irrigation," and the indicator was irrigation efficiency system-wide would increase by 3% over the life of the project. (Irrigation efficiency was defined as total value of agricultural production divided by total volume of irrigation water used.)

The report criticizes the Mission for not calculating the indicator as specified in the project logframe, i.e. that efficiency would be measured by the value of agricultural production divided by the quantity of irrigation water. Instead, the Mission divided value of agricultural production by total water released into the system by the High Aswan Dam. This data is reliable, readily available and it vastly simplified the calculations. Attempts to measure the exact amount of water available for agricultural production found the figure unreliable and costly to obtain. The Mission estimated that it would run in the million dollar range and decided that this was not a cost-effective investment for a project nearing the end of its lengthy implementation.

The fact is that the Nile basin is a closed system with virtually all surface <u>and</u> ground water originating at the High Aswan Dam. Rainfall is negligible. The use of total water released in the denominator of the efficiency fraction gives a more conservative estimate than using an estimate of the amount actually delivered for irrigation. This is because calculating water for irrigation only subtracts out: 1)water consumed by municipal and industrial users; 2)water lost to evaporation; and 3)water flowing to the sea. In Egypt, USAID analysts have attempted to more accurately measure the exact amount of water use in irrigation. It has been explained and demonstrated to the auditors that even if more accurate data existed (and it does not) on the exact amount of water available for agricultural production, it would not significantly change the computed results of the indicator for water use efficiency.

The audit challenges the validity of the IMS Purpose-level indicator. By definition it is only an indicator: water use efficiency defined as and measured by the total value of agricultural production produced in the Nile irrigation system, divided by the volume of water entering the system from the High Aswan Dam, the only <u>significant</u> source of supply. Ample, verifiable data and official documentation was shown to the audit team that proved this indicator is widely used as a measure of irrigation system performance by irrigation experts worldwide. Economic and engineering development experts with whom the Mission consulted all agree that the indicator is quantifiable, independent, plausible, and objectively verifiable. (See Annex II).

The Mission realized at the time the indicator was selected that IMS activities were not the only factors contributing to water

use efficiency, as measured by this indicator. The Mission also knew that IMS investments were of the type that are necessary for and can be expected to lead to improved operational efficiency of any irrigation system. In 1993 the Mission conservatively estimated an increase of 3 percent in the IMS Purpose-level indicator over the life of project. The actual, measured increase in the indicator was approximately 38 percent. The Mission is well aware that some of the increase was due to the combination of impacts attributed to the Mission's policy reform efforts, technology generation and transfer and human resource development. The indisputable increases in area cultivated, cropping intensity, and productivity gains that might be attributed to policy reform, however would not have been possible without the improvements in irrigation management, directly supported by IMS.

This fact is easily documented because the supply of water available for agricultural and other uses has been essentially fixed with minor variations and it is closely monitored and well documented. Over the period 1981 to 1993, competing demands for water from sectors other than irrigation have grown significantly. Thus, the share of the total supply available for irrigation is reduced. At the same time, cropped area increased from 6.1 million *feddans* to 7.2 million *feddans* and the cropping intensity (times a plot of land is cropped annually) increased from 170 percent to 200 percent. Thus annual irrigation area has increased from 10.4 million *feddans* (6.1 million times 1.7) to 14.4 million *feddans* (7.2 million times 2.0). This indicates how significantly overall system efficiency has improved.

Moreover, the GOE policy change in the mid-1980's, allowing farmers to decide what crop they will grow and the area planted, changed the peak demand for water and caused a different management problem for the Ministry of Public Works and Water Resources (MPWWR). IMS information systems, planning tools, infrastructure, training and research enabled the MPWWR to respond to the different and more dynamic set of crop water requirements, to allow an increase in productivity.

The audit correctly reports the lack of precise, quantifiable causality between the outputs of the IMS components and the purpose level. The Mission could have attempted to verify the link in causal terms had it been required to and wished to invest the funds to produce such an analysis. Such an investment for statistically valid testing of the hypothesis that project inputs caused purpose level effects would have cost an estimated $1.0 million. The Mission considered this option and rejected it as unnecessary and a poor investment of public funds.

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Misinterpretation of Agency Guidance on Project Output and Project Impact Indicators The audit misinterprets or fails to take into account the difference between the rather exact guidance on project outputs which calls for precise, verifiable indicators and the more indirect linkages with higher level indicators. "Targets at the output, project purpose, and sector/program level are to have a hypothesized, causative relationship to each other which is susceptible to verification..." In addition, Agency guidance on program performance indicators use the test of "reasonable attribution." The Mission's position is that the IMS performance indicator used meets these requirements, is recognized by irrigation experts, and continues to be valid despite the audit's unwarranted criticism.

USAID Handbooks, PRISM guidance, and evaluation principles do not require quantifiable attribution of project outputs to the project purpose. Furthermore, Near East Bureau's Manual for Program Planning and Performance Measurement and Reporting states "Attribution expresses the idea that a direct causal link can be made between the achievement of an objective and the resource allocation. It can be extremely difficult to do this, and neither the Near East Bureau nor CDIE are interested in tackling causality or trying to assess the portion of results for which AID resources are directly responsible, at the strategic objective level." Development theory and widely accepted irrigation practices confirm that the indicator is a reasonable measure of change in performance of the Nile irrigation system and that elements of IMS are exactly the kinds of interventions one would try in order to maintain or improve system-wide efficiency.

Recent Agency efforts to measure performance led the Mission to move to a single indicator of water use efficiency for the whole project. Difficulties in retro-fitting a massive, 14 year old project with a single cost-effective indicator are quite evident. Given this history and the points elaborated in Annex II, the revision of the indicator as recommended would not lead to any increase in plausibility or verifiability. Nor is it necessary to revise the indicator to determine how components not yet completed contribute to the project purpose; this can be done easily using the current indicator. Moreover, a revised indicator would not help in determining whether further investment in a follow-on project is warranted, since USAID/Egypt has already decided not to invest in a stand-alone follow-on irrigation project. For these reasons, Recommendation 1 should be closed upon publication of the audit report.

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THE MISSION RESPONSE TO RECOMMENDATION NO. 2:

Recommendation No. 2: We recommend USAID/Egypt conduct the analyses required by USAID Handbook 3 to determine if further funding of the Survey & Mapping and Professional Development components is justified.

Response: The Mission decided prior to initiation of this audit that the Survey and Mapping (SM) component had met its objectives and required the GOE to fund 100 percent of the local operating budget for this component. In 1993 and again in 1994 the Mission advised the GOE in writing that it would not provide additional support for this component (See Annex III).

The audit report criticizes USAID/Egypt for investing the funds it did into the SM component rather than simply acquiring the maps for the GOE at far less cost. This criticism ignores the fact that IMS needed to strengthen the MPWWR's institutional capabilities in map-making for irrigation purposes. Simply acquiring a set of maps would have provided a product which would have quickly become obsolete. USAID/Egypt's approach on SM was not only consistent with the project purpose and goal, but was also designed for the long-term sustainability of Egypt's irrigation system.

The audit incorrectly states that required analysis was not done prior to initiating the Professional Development (PD) Component. In fact the IMS Project Paper Amendment 2, Annex F, page 71 refers to a detailed assessment of the Ministry of Irrigation's training needs and a report that was issued on February 20, 1986. This report was included as Annex S to PP Amendment 2. The report is titled "Training Needs Assessment for the Ministry of Irrigation Arab Republic of Egypt"

The report is comprehensive and recommends "Upon weighing the advantages and disadvantages of a National Irrigation Training Institute, it is the judgement of the Assessment Team that such an institute is fully justified and recommends that the Ministry proceed promptly to establish it". Furthermore, section F. Cost Effectiveness, stated that "...one would expect an Internal Rate of Return for this project to not be less than for education generally, i.e. at least 20-25 percent."

The last USAID-funded technical assistance support for the Professional Development component ended prior to the start-up of this audit and the remaining local operating budget support from IMS will end September, 1995. Given these decisions, which are fully documented in Annex III the Mission recommends that with the publication of the audit this recommendation be closed.

CONCLUSION

The Mission is troubled by the quality and disturbing tone of the audit report for the following reason: an inordinate amount (over 600 hours) of Mission staff time has been consumed at taxpayer expense on this audit activity while providing minimal, if any, new information to improve accountability and decision-making. The time spent trying to "educate" the auditors would have been more productively spent on the analyses and assessments the Mission was in the process of carrying out, and has since completed, to document lessons learned from IMS and their implications for irrigation development in Egypt.

ANNEX ONE

IRRIGATION MANAGEMENT SYSTEMS CHRONOLOGY AND FUNDING LEVELS
(OBLIGATION TIME LINE BY FISCAL YEAR, LOP FUNDING, AND AREA SERVED)
BY COMPONENT

IMS COMPONENT / FY	82	83	84	85	86	87	88	89	90	91	92	93	94	95	LOP[1]	COMP. AREA[2]
Plan. Studies & Models (PSM)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	15.7	6,000
Proj. Prep. Depart. (PPD)	X	X	X	X	X	X	X	X	X	X					11.5	409
Structure Replacement (SR)	X	X	X	X	X	X	X	X	X	X	X				75.7	6,000
Preventive Maintenance (PM)				X	X	X	X	X	X	X	X	X	X		29.2	3,000
Irrigation Improvement (IIP)							X	X	X	X	X	X	X	X	60.0	258
Miscellaneous							X	X	X	X	X	X	X	X	9.1	6,000
Survey & Mapping (SM)								X	X	X	X	X	X	X	39.1	6,000
Water Research Center (WRC)								X	X	X	X	X	X	X	31.6	6,000
Main System Mgt. (MSM)								X	X	X	X	X	X	X	50.9	6,000
Professional Develop. (PD)								X	X	X	X	X	X	X	13.4	11,400[3]

[1]U.S.$ millions of USAID funds. Total = $336 million.

[2]Area in thousands of *feddans* (0.42 ha) improved or influenced by IMS Components. The entire cropped area is approximately 7,200,000 *feddans*.

[3]Number of engineers trained. There is no reliable estimate of the relationship between engineers trained and areas improved.

ANNEX TWO

EXPERT VIEWS ON INDICATORS: Citations From Development Literature to Support the Mission's Choice of Purpose-Level Indicator for the IMS Project (Estimate of $1.0 million in item no. 3)

1. **Ramesh Bhatia and Lalith Dassenaile.** 1995. Quantification and Measurement of Minimum Set of Indicators of Performance of Irrigated Agriculture (Draft for Discussion). International Irrigation Management Institute. Colombo.

The approach taken in this paper assumes that "the performance of many systems cannot be evaluated in relation to management targets, or internal indicators, because actual operation is substantially at variance with what is officially planned .... External indicators would attempt to estimate the interactions between the system and its surroundings and may still have value." (p. 1) The authors concluded that **"the single "external" indicator that will tell us most about system performance [is]: What is the net value of agricultural production per unit of water consumed from the hydrological cycle? This indicator summarizes the contribution of the irrigation activity to the economy**, and desegregated in time and space, can also show trends, equity, and farm impact." (p. 2) They describe the **"simplest estimate - gross value of production per unit water diverted and/or lifted."** (p. 3)

2. **S.C. Hseih and V.W. Ruttan**, 1967. "Environmental, Technological, and Institutional Factors in the Growth of Rice Production: Philippines, Thailand, and Taiwan". Food Research Institute Studies, Vol 7, No. 3.

In comparing rice yield data for the Philippines, Thailand, and Taiwan, Hsieh and Ruttan have shown that **differences in aggregate yields across regions may depend more importantly on differences in the quantity/quality of irrigation available and other environmental factors, and less importantly on such factors as new varieties, better cultural practices, or more intensive use of technical inputs such as fertilizer**.

3. **Jack Keller.** 1995. Personal Communication. USAID: Cairo.

"The Imperial Valley Irrigation district, which is a 500,000 acre irrigation district receiving water from the Colorado river, is selling water to the Metropolitan Water District of Southern California (MWDSC), which supplies water to 37 million people. MWDSC is paying $100 million plus to transfer 100,000 acre-feet, or 123 million cubic meters of water saved. The transfers cannot take place unless it can be proved that the water being transferred was in fact saved and not merely taken away from some other authorized use.

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Verifying water savings in this project costs over $1.0 million, or about 1 percent of the cost of the water. It would have been possible to put systems in place to prove that IMS achieved its purpose but it is highly unlikely U.S. taxpayers would have considered the cost justified."

4. **Yitzhak Kiriati**, 1994. "Israel Report - Israel: A Growing Success" in INTERPAKS DIGEST, Vol 2 No. 2&3, Summer/Fall 1994.

Kiriati reports on the successes of Israel's investments in "the development of an agricultural infrastructure, including a national water carrier and other water resources" in terms of "a fall in agricultural fresh water needs over the last 20 years. Crop sales have registered high profits, and **yields from one cubic meter** of water rose from US $0.46 in 1950 to US$2.04 in 1990."

5. **P.S. Rao.** 1993. Review of Selected Literature on Indicators of Irrigation Performance. International Irrigation Management Institute. Colombo.

"For mixed crops, productivity needs to be expressed in monetary terms, i.e., dollars/ha or dollars/m3 of water. These indicators are easier to compute from generally available data than the indicators of water delivery performance." (p. 59)

"Focusing on systems in which water is the scarce resource, annual yield per hectare and the productivity per unit of water delivered at the head of the system give a good picture of the performance with respect to production....Agricultural production information can thus be used as a powerful screening device, as well as for long-term performance monitoring." (p. 59)

Rao concluded that "A PRINCIPAL OBJECTIVE of the current studies on performance assessment is to facilitate the development of a consensus on a limited set of performance indicators that irrigation agencies concerned with irrigation management in developing countries could incorporate in their monitoring and evaluation and also in their research and development efforts to improve irrigation performance." He goes on to describe two considerations for choice of indicators: "the set should provide adequate information to assess over seasons and years the performance of the water delivery system, agricultural production, and returns to farmers and the broader economy without excessive demands on data collection and hence cost of obtaining the information.;... the set should contain as few indicators as possible." (p. 63)

One of the recommended indicators for performance of the irrigated agriculture system was: **"Yield per unit water."** And **"In the case of diversified cropping systems, the productivity**

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values will need to be expressed in monetary terms;..." (p. 64)

6. **Cynthia Rosenzweig and Daniel Hillel.** 1994. "Egyptian Agriculture in the 21st Century." Collaborative Paper for the International Institute for Applied Systems Analysis. Laxenburg.

"Egyptian agriculture is entirely based on irrigation and hence is utterly dependent on a tenuous balance between the supply of water (from the Nile, and to a lesser degree from groundwater) and the demand for it by crops." (p.1) The authors characterize agronomic water use efficiency, defined as **the economic yield obtained per unit volume of irrigation applied, as a truer measure of the productivity of irrigated agriculture"** than either field water application efficiency (fraction of the water applied that is consume by the crop in transpiration in a given field) or system water application efficiency (fraction of the volume of water taken from the source that is used consumptively by crops along the entire irrigation district or region. (pp. 10-11)

7. **R. Bhatia, Upalia Amerasinghe and KAUS Imbulana.** 1995. "Productivity and Profitability of Paddy Production In the Muda Scheme, Malaysia." in Water Resources Development, Vol 11, No. 1.

"The Muda irrigation scheme in Malaysia is one example of an effort to improve water-use efficiency in irrigated agriculture with a view to producing "more food with less water". p. 42 "Productivity gains in the Muda scheme, over time, have been analyzed using the following indicators: gross irrigated area per year; total production of paddy over time; paddy output per hectare per year; and **paddy output per million cubic metres of water released/supplied.**" p. 43 Their study concluded that "a combination of favourable policy environment and a supportive irrigation bureaucracy which enabled farmers in the Muda irrigation scheme to increase total crop output during the 1980's..." (p.58)

8. **Leslie E. Small and Mark Svendsen.** 1992. A Framework For Assessing Irrigation Performance. Working Papers On Irrigation Performance 1. International Food Policy Research Institute: Washington, D.C.

"Evaluation of irrigation performance in terms of water deliveries minimizes the confounding influence of other non-irrigation variables. "One must consider the types of inputs to be used in the denominator of the efficiency measure. The amount of water diverted or released into the head of the irrigation system is one possibility and leads to efficiency measures that can be interpreted in terms of traditional concepts of water use efficiency." (p. 28)

9. **Addel-Wahab M. Amer and Abdallah S. Bazaraa.** 1993. Development of Key Performance Indicators For The Irrigation Management Systems Project. Final Report. Ministry of Public Works and Water Resources: Cairo.

"The overall goal of the Irrigation Management System Project is to increase the agricultural production and productivity through better management and control of the available irrigation water. Implied in these goals are the needs to improve yield levels and water use efficiency. The two parameters are inter-related. Poor water delivery and irrigation application efficiency may lead to some unfavorable effects resulting in lower yield per unit of area and per unit of water, less total area irrigated, and detrimental environmental effects, as well as lower returns from the irrigated crops." (p. 12)

Efficient control and use of water would free extra amounts to be utilized for extending the cultivated area or to allow shifts to new crop varieties that increase the grower returns. The following derived indicators reflect the efficiency of using the water in economic or absolute terms...**Indicator (1) reflects the value of agricultural production per unit of water used (LE/m3)=** Value of the Agricultural Production /Quantity of Water Used....Again, agricultural production is not only a function of the irrigation effectiveness, but it does depend largely on other agricultural inputs." (p. 18)

ANNEX THREE

REFERENCES FROM OFFICIAL DOCUMENTS:
That Support the Mission's Comments
on the IMS Project Performance Audit

IMS Impacts on Overall Irrigation System Efficiency

1. James M. Webb. Analysis of the Structure Replacement Project Egypt. Paper prepared for USAID/Cairo. 1992.

The author analyzed the impact of the IMS Structure Replacement (SR) in the Sharkia Governate and found "a reduction in water use of approximately 11 percent since the start of the project. As a result of this program and other corollary improvements a fertile area in the delta was able to increase its agricultural base from 580,000 *feddans* to 850 *feddans* an increase of 46 percent." He goes on to conclude that "considering that cropping patterns, market influence, cropping intensity and varying water conservation efforts have not been evaluated as to their influence on the results, a conservative figure of 5.5 percent is applied to the irrigation system which equates to approximately 2.0 billion cubic meters of irrigation water saved annually throughout Egypt's irrigation system as a result of the Structure Replacement Project."

2. Carl G. Maxwell. Portfolio Review of Structure Replacement Project. Memorandum. USAID/Cairo. 1992.

Reporting on project status Maxwell noted "there are a few concrete indicators illustrating the affect this project has had on increasing the efficiency of the irrigation system and improving agriculture outputs through increased lands being put into production as a result of water savings." In referring to the findings by Webb (see no. 1, above), he stated that the overall savings of water in the main system "is measured observing water levels at major control points. The water level in the irrigation system over the last 8 years has been able to be reduced to serve the same agriculture area (6.0 million *feddans*) as a result of increased efficiency of irrigation structures to hold and control water use." And finally "increased efficiency of the system enables use of the savings in water in new lands which equate to increased agriculture output...."

Mission Decisions Leading to Limited Increases in the IMS LOP For The Survey & Mapping (SM) Component

1. Carl Derrick. Information Memorandum For The Files. USAID/Cairo. 1993.

Survey and Mapping (SM) was discussed in terms of the technical

justification for the cadastres and its contribution to project purpose and sustainability of the Egyptian Survey Authority (ESA). "Rather than continuously fund local operating costs through LOP for SM component, Director Bassford directed that the requested increase in project funding be conditioned upon MPWWR providing its own financing for all ESA local operating costs required by the SM component...and no further funding will be provided to ESA for local operating costs effective August 31, 1993."

2. Gamil Mahmoud. GOE Funding of ESA and the IMS Survey & Mapping (SM) Project. Letter to Acting Director Christopher Crowley. Cairo. 1993.

Following the Mission's decision on local operating support for SM the GOE advised by letter that "the Ministry of Planning has allocated L.E. 7.9 million to be available for the GOE contribution for the components of the IMS project during FY93-94." and "I trust that the actions of both the Ministry of Planning and MPWWR will convince USAID of the GOE's interest in continuing the IMS-Survey and Mapping component until June 1995; as it presently agreed, and that the GOE, MPWWR, and ESA are doing their best to ensure this component's sustainability thereafter."

3. Donnie Harrington. Justification for Increased Funding for SM. Memorandum to AD/AGR. USAID/Cairo. 1994.

Memorandum describes SM progress in meeting project output targets and justifies final tranche of USAID funding through July 31, 1995. "We have no plans to provide support for survey or mapping under the new Water Resources Management Project."

4. Donnie Harrington. Irrigation Management Systems Project Implementation Letter No. 92, Amendment No. 17. to Engineer J. Mosaad Ibrahim, ESA Chairman. USAID/Cairo. 1994.

This was the final no-cost extension of the USAID/Cairo funded technical assistance contract to September 21, 1995.

5. Clemence J. Weber. No cost Extension of Geonix Contract. Letter to Engineer Mosaad Ibrahim ESA Chairman. USAID/Cairo. 1995.

In response to a late request to reconsider its decision not to extend SM the Mission informed the ESA Chairman that "we have reassessed our plans to conclude assistance to the Survey and Mapping (SM) component of the Irrigation Management Systems (IMS) Project and have decided not to support an extension of the Geonix contract." And "...firm commitments have been made within USAID to terminate some components of the IMS Project, including

SM, in September 1995. Accordingly, unexpended funds that have been earmarked for SM and other components scheduled to end in September 1995 are needed for the completion of activities to which USAID has assigned the highest priority and are planned for the IMS extension period."

6. Mosaad Ibrahim. Letter to Ambassador Walker. Egyptian Survey Authority. Cairo. 1995.

In transmitting a copy of the recently completed Strategic Plan for the Egyptian Survey Authority Mr. Ibrahim stated "The completion of this plan marks the conclusion of Phase One of our Modernization Program..." He thanked the American people for "your generous support" and declared that "Without that support our Strategic Plan and all that it represents would not have been possible. Your government's support has materially improved our ability to supply the GOE and the people of Egypt with the maps and digital geographic data so badly needed to support the development of our beloved country. Your support has also given us a running start on the completion of our national cadastre, a program sorely needed to secure unambiguous land ownership, equitable land taxation, orderly land transfer and more rational environmentally conscious land use." In terms of sustainability of USAID's investment in SM he noted "We are committed to going forward with implementation of the Strategic Plan as evidence that the substantial investment made in our Authority by both the GOE and the USG has been well used and will continue to bear fruit in the years ahead."

<u>Sustainability of IMS Investments in the Professional Development (PD) Component of IMS</u>

1. Flynn Fuller. Professional Development (PD) Component Conditions Resolution for Continued Support. Memorandum to IMS Project Committee. USAID/Cairo. 1992.

Project Officer Fuller described PD as "designed to support the IMS Project to improve the management and operating efficiency of the irrigation delivery and drainage system. PD institutionalizes a multidisciplinary training program to serve the MPWWR's manpower training and development requirements. The Program is expected to provide continuing education and training for about 2,500 managers, engineers, and technicians annually." He mentions the September 1990 IMS Evaluation, which "recommended to extend PD support to 1995." Consistent with the Missions comments to the auditors "It was envisioned that PD would develop the capacity to serve the entire training needs of the Ministry." The MPWWR has over 80,000 employees of which at least 18,000 are engineers and middle managers.

Mr. Fuller also reported conditions the Project Committee agreed

the GOE should meet before additional USAID funds would committed for PD. One of these conditions was that "MPWWR must provide an Operation and Maintenance budget for the GOE 1992/93 fiscal year, (and agree to include increases in future yearly budgets as appropriate, and assume the full responsibility for O&M costs by 1995/96)."

2. Gamil Mahmoud. Irrigation management Systems Project Professional Development Component (PD) USAID Continuing Support. Letter to USAID/Cairo. 1992.

In response to USAID conditions required in Project Implementation Letter No. 129, Mr. Mahmoud, as Head of the Planning Sector & Chairman of the IMS High Coordinating Committee, advised the Mission that "At the conclusion of the Project, MPWWR will assume full support of the operating budget of the Center [National Irrigation Training Center]."

3. Irrigation Management Systems (IMS) Project Paper Supplement No. 3. USAID/Cairo. 1993.

"The PD component began in 1982 utilizing whatever MPWWR staff, facilities and organizations could be made available. The 1987 amendment provided for assistance to establish the National Irrigation Training Institute (NITI) and provide it with facilities, equipment and staff. This phase of the component began in 1989 with assistance of a host country contract team providing TA, training and procurement services. To date more than 7,600 MPWWR staff have been trained in planning, design, construction management, quality control, operations maintenance and water management through both off-shore and in-country events. Most of this has occurred during the past three years. Phase out from this component is scheduled for March 1993 (TA contract end date) with diminishing support (operation and maintenance until 1995."

<u>Extension of IMS Components Beyond September, 1995</u>

1. Russ Backus. WRM Project: Meeting with Engineer Gamil Mahmoud. Memorandum. USAID/Cairo. 1995.

Project Officer reported on a meeting in January, 1995 with the Chairman of the IMS High Coordinating Committee. It was the Chairman's opinion "that only three IMS components will require extension: Main System Management, Irrigation Improvement, and Preventive Maintenance." The Chairman "intimated that although requests for other component extensions may be received, they should be quickly dismissed."

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