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BY THE U.S. GENERAL ACCOUNTING OFFICE

Report To The Administrator, Agency For International Development

Irrigation Assistance To Developing Countries Should Require Stronger Commitments To Operation And Maintenance

The United States, directly through the Agency for International Development and indirectly through the World and Asian Development banks, has invested billions of dollars in irrigation systems in Asia. Whether the recipient countries have the capability or commitment to operate these systems efficiently or to maintain them adequately is seriously questioned.

GAO assessed the operation and maintenance of U.S.-financed irrigation systems in Indonesia, Sri Lanka, and Thailand. It recommends that AID:

--Require a recurrent cost plan that identifies operation and maintenance requirements and funding sources for each project.

--Adopt stronger project design and construction criteria to reduce recurrent costs.

--Require that water user associations be established before financing on-farm construction.

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GAO/NSIAD-83-31
AUGUST 29, 1983

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UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

NATIONAL SECURITY AND
INTERNATIONAL AFFAIRS DIVISION

B-206848

The Honorable M. Peter McPherson
Administrator, Agency for
International Development

Dear Mr. McPherson:

This report presents the results of our review of the operation and maintenance of U.S.-financed irrigation systems in Indonesia, Sri Lanka, and Thailand.

The report contains recommendations to you on pages 22, 34, and 41. As you know, 31 U.S.C. §720 requires the head of a Federal agency to submit a written statement on actions taken on our recommendations to the House Committee on Government Operations and the Senate Committee on Governmental Affairs not later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report.

We are sending copies of the report to the Director, Office of Management and Budget, and to appropriate congressional committees.

Sincerely yours,

Bill W. Thurman

for Frank C. Conahan
Director

U.S. GENERAL ACCOUNTING OFFICE
REPORT TO THE ADMINISTRATOR,
AGENCY FOR INTERNATIONAL
DEVELOPMENT

IRRIGATION ASSISTANCE TO DEVELOPING COUNTRIES SHOULD REQUIRE STRONGER COMMITMENTS TO OPERATION AND MAINTENANCE

D I G E S T

Poor operation and maintenance (O&M) practices are seriously limiting the efficiency of donor-assisted irrigation systems in developing countries. Operation and maintenance includes the management of water supplies to the end users and the upkeep of system facilities. Systems often require extensive rehabilitation because of neglect after only a few years of operation. The pervasiveness of the O&M problem represents an increasingly important issue to the Agency for International Development (AID) and other donor agencies that plan additional investments in irrigation estimated to total billions of dollars. (See pp. 1 and 2.)

GAO made this review to determine how AID can (1) improve O&M practices of developing countries and extend the economic life of U.S.-financed irrigation systems and (2) design irrigation projects that adequately consider O&M requirements. GAO examined operation and maintenance for AID projects in Indonesia, Sri Lanka, and Thailand, where AID and the host countries are jointly financing over $700 million in ongoing and recently completed irrigation development. GAO also considered the reported conditions affecting World Bank and Asian Development Bank projects. The United States contributes to both organizations, which have substantial irrigation investments. (See p. 3.)

Effective operation and maintenance requires a commitment by both the aid recipient and the donor. GAO found several problems affecting the performance of irrigation systems in each country visited, which raises questions concerning the level of capability and commitment that actually exists.

RECURRENT COSTS ARE NOT BEING MET

Donors have demonstrated their concern with developing country food problems through investing in irrigation systems and other

facilities. At the same time, they have not given sufficient attention to the complementary institutional and financial costs of operating and maintaining the facilities.

Donors have assumed that recipient countries would provide recurrent budget support to effectively operate and maintain projects, but this has not happened. For example, AID project loan agreements have specified that recipient countries will provide adequate O&M funding. And as required by Section 611(e) of the Foreign Assistance Act, AID has certified that these countries have the economic and human resources to operate and maintain specific irrigation projects. Notwithstanding such agreements and certifications, recipient countries have not provided adequate recurrent cost support and recipients and donors continue to invest in rehabilitating neglected systems and in new systems. (See pp. 10 through 18.)

AID has prepared a policy on recurrent cost financing, but the World Bank and Asian Development Bank have not. Donors need to define their policies toward recurrent cost financing to aid them in working together on the O&M problem. (See pp. 18 through 22.)

GAO believes that institutional as well as financial weaknesses affect recipient countries' ability to effectively use and maintain irrigation systems. AID should give more attention to these needs as part of its assistance to the irrigation sector. Many irrigation systems do not provide reliable water sources and have not become self sustaining. By addressing institutional and financial constraints, AID assistance should help to achieve the development of self-sustaining irrigation systems.

As a possible source of O&M funds in selective situations, the Administrator should examine the feasibility of using Public Law 480-generated currencies for operation and maintenance on a short term basis. Such selective use of generated local currencies should help to integrate Public Law 480 programs with development assistance programs and to improve

recipient country self-help measures--objectives sought by AID and the Congress. (See pp. 20 through 22.)

RECOMMENDATIONS

AID should strengthen the project planning, loan agreement, and section 611(e) certification process as a serious mechanism for establishing recipient country capability, willingness, and commitment to operation and maintenance. To do this, GAO recommends that the Administrator of AID:

--As a condition for AID project approval, require a recurrent cost financial plan for each irrigation project, to include annual life-of-system O&M cost estimates and how such costs will be financed; also required should be plans to strengthen budgeting and accounting, if needed, and to establish an institutional capability for implementation and monitoring.

--Encourage other donors to further define their policies toward recurrent cost financing. (See pp. 22 through 23.)

DESIGN AND CONSTRUCTION IMPROVEMENTS CAN REDUCE O&M COSTS

Weaknesses in system design and supervision of the design process reduce the efficiency of irrigation systems and directly increase O&M costs. Adequate consideration of O&M requirements, such as need for canal linings and strengthened quality control over the design process, can reduce O&M costs over the life of the system. Local farmers should be involved early in the design process, to promote a sense of responsibility for on-farm operation and maintenance, and donors should support a transition period after construction, to assure that systems operate properly and that adequate O&M programs are established.

Failure to remove debris from soil and inadequate soil compaction have increased O&M costs, because canals and other structures have rapidly deteriorated and greater water conveyance losses occur. In some instances, facilities have had to be repaired or improved before they could be used. (See pp. 25 through 33.)

RECOMMENDATION

GAO recommends that the Administrator of AID adopt stronger irrigation system design and construction criteria, addressing quality assurance control, involvement of local farmers, O&M requirements, and a transition period after construction. (See p. 34.)

WATER USER ASSOCIATIONS--
AN ELUSIVE GOAL

AID project designs have assumed that water user associations would be established and provide on-farm maintenance, ensure equitable water distribution, and maintain discipline among users. Generally these assumptions were not realized. Consequently, irrigation systems had been vandalized, water wasted or stolen, and routine maintenance ignored. (See pp. 36 through 40.)

RECOMMENDATION

GAO recommends that the Administrator of AID adopt specific provisions in project designs and loan agreements to promote successful farmer organizations. Before financing irrigation construction, AID should require evidence from the host country that active associations have been established, want the system, and have accepted responsibility for on-farm operation and maintenance. (See p. 41.)

AGENCY COMMENTS

AID agreed that more attention must be given to the financial and institutional costs associated with operation and maintenance over the life of U.S.-financed irrigation systems. Its comments indicated agreement with the thrust of GAO's recommendations. However, AID did not say how it would implement them. (See pp. 23, 34, 41, and app. II.)

Contents

ABBREVIATIONS

AID	Agency for International Development
GAO	General Accounting Office
O&M	Operation and maintenance

CHAPTER 1

INTRODUCTION

Irrigation systems in developing countries are poorly operated and maintained. These systems cost billions of dollars and are often funded directly by the United States through the Agency for International Development (AID) and indirectly through the international development banks. Operation and maintenance (O&M) problems will likely increase in the future and become more complex because of continued irrigation development and increasing inability of these countries to finance the recurrent costs of development programs.

Overall estimates indicate that irrigation systems in most developing countries are less than 50 percent efficient, resulting in reduced acreage coverage and yields and in social tensions among farmers. In many instances, irrigation systems have been so neglected that donors have been forced to spend millions of dollars for early rehabilitation.

This situation represents a special dilemma for donors who must justify additional investments in new irrigation during the next decade. There is clearly a question of developing country absorptive capacity in the irrigation sector, in terms of recurrent budget capability and institutional expertise. Inherent in these issues are the extent to which the United States should continue to finance new irrigation activities in the face of inadequate operation and maintenance and whether it should resolve to provide such assistance only if recipient countries show the willingness, commitment, and capability to effectively operate and maintain such systems. The issues discussed in this report pertain to the irrigation sector, but they also have direct relevance to other sectors of development assistance.

Irrigation systems greatly vary in size and complexity. They consist of a water supply and an allocation and distribution system to convey the water to farms. The water supplies of large systems usually are reservoirs or flowing rivers. The water is conveyed from the water source to the farms in primary and secondary canals (for the purposes of this report, we will call this the main system). Smaller canals (tertiary and field channels) distribute water from the main system on to the farms (the on-farm system). Usually the government is responsible for main systems and the farmers for on-farm systems. Because donor-assisted irrigation projects in developing countries are usually directed toward helping the poor, the farms served by these projects are usually very small.

For the purposes of this report:

--Operation is defined as the allocation and delivery of water supplies and handling of drainage runoff.

--Maintenance is defined as the upkeep of irrigation and drainage structures, embankments, and channels and the removal of silt and vegetation from canals.

The two activities have basic distinctions, but for ease of reference, we generally refer to operation and maintenance, recognizing that our review and report emphasize the maintenance component. However, in some instances either component may be discussed. Our focus on adequate maintenance does not minimize the importance of efficient operations.

O&M deficiencies which reduce the economic life of irrigation systems occur at both the resource allocation level and the project level (planning, design, construction, and post-project operation.) Resource allocation problems are generally the easiest to identify; host-country planners and aid-donor agencies typically press for capital investments in new systems and give little or no priority to recurrent O&M expenditures. (See ch. 2.) O&M problems at the project level are more technically complex but equally important, as they reduce the economic attractiveness of irrigation systems to the farmers who must rely on them. (See chs. 3 and 4.)

Much of the increase in food production has occurred through expanding irrigation areas. As the sites for new irrigation development are exhausted, the future of expanded agriculture lies with better use of existing irrigation systems as well as new investments in systems that better take into account O&M requirements.

IRRIGATION DEVELOPMENT ASSISTANCE

Because irrigation development relies heavily upon public financing, it has been a priority area for a number of donors, including AID, the World Bank, and the Asian Development Bank. Most of this donor activity has taken place in Asia, as indicated in the following statistics.

--AID has concentrated its irrigation assistance in Asia and plans to invest as much as $750 million in Asian irrigation development in the next 5 years.

--In South Asia, the World Bank has invested more than $4 billion during the first 3 years of this decade, and, assuming the trend continues, its investments in South Asia during the 1980s will exceed $13 billion.

--As of December 1981, the Asian Development Bank had financed 65 loans for 60 irrigation projects totaling $1.3 billion, representing about 13 percent of total bank lending. It plans

continued new investment in irrigation as well as greater emphasis on improving existing systems to obtain greater efficiencies.

Recent data indicates that Asia has about 70 percent of the world's irrigated land area, 60 percent of the world's potential new irrigation areas, and 90 percent of the irrigated area of all developing countries. AID's Asia Bureau considers unsatisfactory irrigation system productivity its largest single problem. Comprehensive irrigation management is expected to be a major development area at least until the end of this century.

In recognition of irrigation inefficiencies in Asia, AID's Science and Technology and Asia Bureaus are jointly implementing a 5-year, $20-million Water Management Synthesis Project. This project, which began in fiscal year 1982, is designed to provide training, technical assistance, special studies, and technology transfer to help developing countries improve their capability to plan and implement irrigation water management projects and programs. The project is viewed as a centerpiece in evolving an AID strategy to meet the irrigation water management needs of AID missions and host countries.

OBJECTIVES, SCOPE, AND METHODOLOGY

In view of the continuing emphasis on developing irrigation to help feed the world's people, we made this review to determine what actions AID should take to (1) improve O&M practices of developing countries and extend the economic life of U.S.-financed irrigation systems and (2) design projects that give adequate emphasis to O&M problems.

We focused on irrigation development in Asia because of the importance of irrigation to the region. From September through November 1982, we visited AID missions and U.S.-financed irrigation systems in Indonesia, Sri Lanka, and Thailand. In these countries AID has financed over $200 million of the $700 million in recently completed and ongoing irrigation projects. (See app. I for list of projects.) We visited project sites, reviewed irrigation project files, and talked with incountry representatives of other donor organizations and countries, including the World Bank, Australia, Japan, the Netherlands, and the United Kingdom, to obtain their views on O&M problems and potential solutions.

The emphasis of our work was on the reasons for and impact of inadequate maintenance and how these shortcomings can be addressed. Operational issues are discussed in more general terms as they relate to irrigation performance and efficiencies.

Indonesia

We visited 14 subprojects and site locations in Indonesia selected by the AID mission in Jakarta.

The World Bank has 17 irrigation loans totaling about $800 million and, because of continuing O&M problems, has recently included special covenants in its irrigation loan agreements to bring about better host-government commitment to resolving them. We inquired into the Bank's experiences in the loan agreement area to determine whether AID should consider adopting stronger covenants as a part of its future strategy.

Sri Lanka

We reviewed AID's support of Sri Lanka's Accelerated Mahaweli Ganga Irrigation Program, one of the most ambitious irrigation project development schemes in the developing world, involving multi-donor and host-country investments of nearly $1 billion.

We visited two AID-assisted irrigation projects to observe O&M conditions. Much of our work focused on discussions with donor and host-country officials concerning the financial and institutional capability of the country to develop O&M programs for the Mahaweli Program, an issue of importance as demonstrated by AID in its past Congressional Presentation descriptions of systems that have deteriorated due to government neglect of maintenance and proper management.

Thailand

We reviewed O&M conditions affecting the performance of the Lam Nam Oon On-farm Development Project and the Northeast Small Scale Irrigation Project. These on-going projects offered two special areas of study: (1) a follow-up on previously identified O&M problems affecting the economic viability of Lam Nam Oon systems and (2) an analysis of specific issues of interest to overall AID efforts to improve water management, including the lessons learned in attempts to help organize farmers' associations and to implement cost-recovery programs at the farm level. In addition, we followed up on the status of AID projects financed in the late 1960s and early 1970s to determine the O&M lessons learned from them. These projects--an irrigation loan and a previous Lam Nam Oon effort--represented investments of about $13.5 million in the northeast part of Thailand. This region includes the in-process Lam Nam Oon and Northeast Small Scale Irrigation Projects. We visited the northeast region of Thailand and saw portions of each AID-funded irrigation project.

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We reviewed legislation and congressional committee reports pertinent to AID responsibilities in ensuring that U.S.-financed facilities are efficiently used and maintained. We talked with AID officials in Washington, D.C., and reviewed AID policies and procedures to determine how AID monitors projects and ensures that they are properly maintained. We also discussed O&M problems and solutions with World Bank officials in Washington,

D.C., and Asian Development Bank officials in the Philippines and with irrigation experts at Cornell University, Ithaca, New York; International Engineering Company, Inc., San Francisco, California; and PRC Engineering Consultants International, Denver, Colorado.

Our work at all locations was tailored to complement AID's evolving design for its Water Management Synthesis Project. We followed up on relevant O&M issues identified in the irrigation sector analyses conducted in 1980 in Thailand and in 1982 in Sri Lanka. Because a similar sector analysis had not been done in Indonesia, we discussed with AID mission officials how the project might be used. In all three countries, we dealt with issues of host-country commitment, recurrent cost budgeting, fulfillment of project loan agreements and conditions for loan disbursements, and AID certification of recipient country capability to effectively use and maintain U.S.-financed facilities.

Our review was made in accordance with generally accepted Government auditing standards.

CHAPTER 2

IMPROVED OPERATION AND MAINTENANCE OF U.S.-FINANCED IRRIGATION SYSTEMS REQUIRE ADEQUATE FUNDING AND COMMITMENT

Many donor-financed irrigation systems in Indonesia, Sri Lanka, and Thailand were in poor condition. Operation and maintenance had not been emphasized and were often ignored, so the systems were unreliable. Each country tended to defer routine maintenance until the systems deteriorated to the point that major but premature rehabilitation (generally donor financed) was required.

A primary reason for this is inadequate funding of the day-to-day regular operation and maintenance, or recurrent costs (cost requirements which continue throughout the life of a system). O&M funds must come from the host governments, the system users, or donors through additional or redirected assistance. Host-government budgets have been inadequate and user fees have not been collected regularly. Donors normally restrict their financial involvement to design and construction and view operation and maintenance as a recipient country responsibility.

NEGLECTED SYSTEMS HAVE DETERIORATED

AID mission and host-government officials, irrigation consultants from several countries, and representatives from the World Bank, Asian Development Bank, Australia, and United Kingdom agreed that many recently completed irrigation projects in most developing countries were deteriorating rapidly because of poor maintenance. They felt that operation and maintenance often suffered because of the emphasis placed on new construction and rehabilitation. Inadequate operation and maintenance and its results were confirmed during our site visits to AID-financed irrigation projects in Indonesia, Sri Lanka, and Thailand.

At Indonesia's Luwu Irrigation Project, it was evident that no routine maintenance was being performed. As a result, the canal banks we inspected were heavily eroded. The canals had all been constructed since 1979. In addition, AID-funded project consultants told us that water management at the Luwu project was poor--the system was not being operated as it was designed and the supply of water to the fields was unreliable. These personal observations were further confirmed by two AID engineers who visited the Luwu project in November 1982.

At Indonesia's Rural Works' subproject sites we found heavy erosion damage to canal banks. In addition there was siltation and weed growth which eventually can restrict water flows. There were signs of vandalism at all of the Sederhana subproject

sites visited. Indonesia project officials said farmers often broke division boxes and made unauthorized cuts in canal banks to get more water.

Indonesian Rural Works Project

Heavy erosion damage

AID fieldtrip reports on other Sederhana subprojects also cited damage from water buffalo walking in the canals, lack of water user associations, unreliable water sources, weirs about to collapse because small damage was not repaired in time, and canals needing major repairs, that could have been prevented with better routine maintenance.

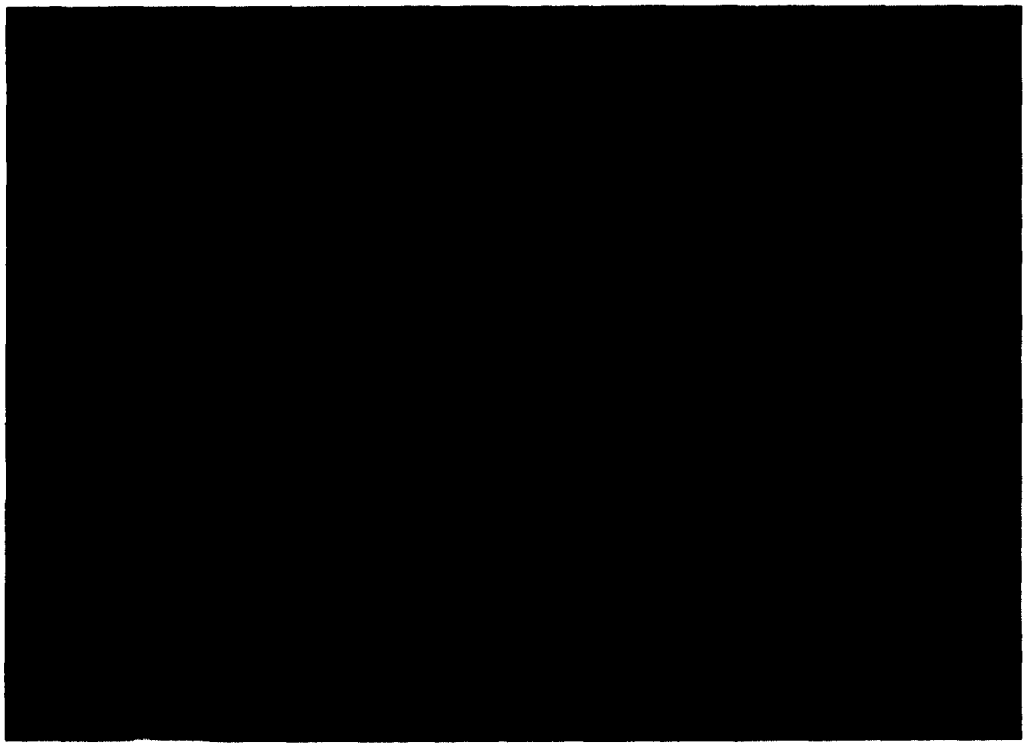
At Sri Lanka's Mahaweli Irrigation Project, we saw many examples of poor operation and maintenance, including weed growth in canals and more evidence of farmer vandalism. A January 26, 1979, inspection report by representatives from AID, the World Bank, and other donors stated that:

> "O&M facilities were found inadequate for the project needs. In the H1 and H2 areas where irrigation works are two years old, there was little evidence of proper maintenance program for irrigation works. Settlers were encroaching on service roads, channel banks were sloughing and illegal turnouts were being cut in channels."

In Thailand, at all three irrigation projects we saw silt and weeds in the canals and holes and cracks in the concrete canal linings. Small, unattended problems gradually grow until major repairs are needed. The slightest hole or crack in the

concrete linings allows the sandy soil which is prevalent in the project areas to wash out, resulting in further damage. After the soil washes away the linings collapse as evidenced by a 25-foot area which collapsed and washed away at one of the Northeast Small Scale Irrigation project's main canals. We also saw many cracks forming in newly rehabilitated canals. Royal Thai Government officials told us they are not provided the needed funds and manpower to do much maintenance. Consequently, small damage rapidly gets worse until, and in a relatively short time, systems need extensive rehabilitation.

Thailand Lam Pao Project



Concrete linings have collapsed

An AID official noted that much of the vandalism that occurs is a result of poorly operated/managed systems and/or poor design. When farmers fail to receive water in a timely/dependable manner, they take matters in their own hands. Thus, while the repair of broken structures and illegal turnouts may be a maintenance activity, their cause is most often from poor system management or faulty design (wrongly placed turnouts). Better maintenance does not get at the root of the problem. (Ch. 3 discusses design and construction problems.)

DETERIORATED SYSTEMS REDUCE BENEFITS AND LEAD TO NEED FOR EARLY REHABILITATION

Inattention to operation and maintenance gradually leads to systems which do not realize anticipated benefits, to a lack of

maintenance commitment by farmers, to undependable water supplies, and eventually to premature (and expensive) project rehabilitation.

In Sri Lanka, according to a World Bank inspection report on the Mahaweli Ganga Irrigation Project, the crop yield was far below average due to improper operation and maintenance. AID similarly reported that poor operation and maintenance in one project area accounted partly for the failure of the 1981 winter crop.

In Thailand, the Lam Nam Oon irrigation system had deteriorated so badly that in 1981 it would not deliver enough water to meet anticipated requirements, and an AID consultant evaluation team seriously questioned continuation of the project. There were serious doubts as to whether the project could accomplish its goal of intensified irrigated agricultural production. Other irrigation projects in the northeast part of the country reportedly suffered many of the same problems and, in some cases, were considered to be in worse physical state.

As maintenance is deferred, small problems gradually become worse, and eventually entire systems must be completely renovated. In essence this approach creates a "maintenance backlog," which escalates funding problems. Maintenance problems continue to accumulate, because resources are not available to perform routine maintenance until neglected maintenance eventually reduces project benefits to the point that major rehabilitation is needed. We were told that this is how many developing countries deal with maintenance problems--in anticipation that donors are willing and able to finance rehabilitation.

A 1981 AID report cited two options for maintenance: "either provide enough funds for an effective maintenance program or allow systems to quickly deteriorate and rebuild them often," and concluded "For both the long and short runs, it is considerably less expensive to provide an effective maintenance program."

In Indonesia, the World Bank and AID have supported numerous rehabilitation efforts. In Thailand, two AID projects involved rehabilitation, including systems constructed in the early 1970s under the $10 million Irrigation Loan Project. This project is being extensively renovated by the World Bank. In Sri Lanka, most of the $9.8 million in loan funds for the AID Water Management Project were being used to rehabilitate a canal system.

AID and others recognized the problem but have not effectively dealt with it. For instance, the AID mission in Indonesia reported to Washington in 1980 that operation and maintenance is a pervasive problem area and the cause of much of the need for continual, massive investments in irrigation rehabilitation. This rehabilitation, the mission stated, is in fact

deferred maintenance. Two Government of Indonesia studies stated similar conclusions.

An April 1981 donors' report made after a visit to Sri Lanka's Mahaweli project stated that:

> "The condition of irrigation infrastructures in Block 303 is probably representative of general conditions in the areas of system H which were brought into production as part of the Mahaweli Stage I. The need for extensive maintenance work and rehabilitation of structures even along the main canals is evident. Some of the field channels have deteriorated to the point that it is now impossible to properly distribute the flow of water * * * farmers suggested that the yield in the areas affected is far below average."

In Thailand, a 1981 AID irrigation sector study contained the following statements.

> "The O&M division operates with a very small staff (10-15) and funds are not sufficient for either managing the irrigation systems properly or maintaining them in working order. The result is that farmers are not provided with a reliable supply of irrigation water. Furthermore, because of poor maintenance, the canal systems have become severely deteriorated, and in many cases, already need renovation."

In addition to leading to the need for rehabilitation, an AID irrigation expert emphasized, as highlighted in the above examples, that inadequate operation and maintenance results in poor water use, low crop productivity, and economic returns too low to justify the investment involved. It severely reduces returns to both farmers and the public sector at large.

LOAN AGREEMENT PROCESS SHOULD BE STRENGTHENED TO ESTABLISH RECIPIENT COUNTRY CAPABILITY AND COMMITMENT

Operation and maintenance of irrigation systems generally have been inadequate, notwithstanding agreements by the recipient countries to perform adequately these functions and certifications by the AID missions that recipient countries have the capability to perform O&M functions for AID-financed activities. Most loan and grant agreements required the host country to provide adequate funds to operate and maintain each project.

The specific wording of these requirements varied, but typically read as follows.

--The government shall furnish to AID, among other things, a satisfactory (1) O&M plan for the irrigation systems, including primary and secondary canals, (2) plan and cost estimates for each irrigation system to be rehabilitated or constructed by the project, including agriculture support services such as operation and maintenance of the terminal irrigation system, and (3) evidence of adequate budget support and the government's commitment to carry out the plans.

--The borrower/grantee agrees to assure an effective program of and adequate annual budget provisions for operation and maintenance for all infrastructure components of the project.

--The government recognizes that improved maintenance of existing irrigation systems is of great importance and agrees to (a) provide funding to operate and maintain the system and (b) implement other changes as required to insure that the newly improved systems under this project are maintained as improved.

Such provisions are expected to reflect the parties' commitments to fulfill the stated goals, purposes, and methodologies of the projects; for AID, they represent the results of the project planning and approval process. As discussed in the following sections, however, the governments of the three countries we visited have not made the required financial commitments to assure adequate operation and maintenance. Equally important, AID missions generally have not monitored host-country efforts to provide adequate budgets for these functions or worked with the host governments to identify ways to strengthen the budgeting process.

Recent World Bank irrigation loans in Indonesia have incorporated stronger and more specific terms for O&M budgeting. The direct impact of such provisions is difficult to document in quantitative terms. The Bank monitors compliance in very general terms (central budget allocations), but does not monitor how O&M funds are actually used in individual projects. However, Bank officials in Indonesia stated that the results of the provisions have been generally positive because the government has substantially increased its central budget for O&M programs. They believed that greater host-country commitment to operation and maintenance requires stronger covenants and enforcement provisions in donor loan agreements. Many AID officials felt that, although stronger covenants may provide additional leverage, they must be tailored to each situation and be diplomatically enforceable.

Briefing documents prepared by the Indonesia mission for our incountry work stated that AID can and should take a stronger stand, requesting conformance after project completion, with agreement O&M covenants/conditions. We agree with this position, particularly if future agreements and covenants are to be taken more seriously by either party.

RECIPIENT COUNTRIES FAIL TO FULLY MEET O&M FUNDING EXPECTATIONS

Because of problems, such as fragmented budgeting authority in Indonesia and difficulties in documenting actual spending levels for recurrent costs in Sri Lanka and Thailand, only rough estimates of O&M expenditures were available. The following discussions, however, illustrate the gap between recurrent cost allocations and requirements--a gap that is probably much larger than indicated, because significant portions of developing country O&M budgets typically are for salaries and other adminstrative requirements.

Indonesia

In Indonesia, the central government provides most O&M funding for the main systems through subsidies intended to flow through the provincial to the district governments. The central government's subsidy had increased from 1,600 rupiahs[1] per hectare (2.471 acres) in Indonesian fiscal year 1974-75 to 6,920 rupiahs in fiscal year 1982-83. However, central government officials expressed the opinion that at least 12,000 rupiahs per hectare were needed in Indonesian fiscal year 1982-83 for adequate operation and maintenance, an amount that will increase in future years.

During our project site visits, district officials said they had received varying amounts (per hectare) of O&M funds for the current fiscal year and that the amounts received were inadequate. For example, one district participating in the Rural Works Project has received about 1,000 rupiahs per hectare from the provincial government but needed 5,000. Another district received 3,000 rupiahs per hectare but needed 7,000. One district participating in the Citanduy Project had an O&M budget of 5,500 rupiahs per hectare, but an official of the District Irrigation office estimated that about 18,000 rupiahs per hectare were necessary. The Citanduy project consultant said that as much as 25,000 rupiahs per hectare was needed. Thus, the central government's estimate of 12,000 rupiahs per hectare, even if it were available, may still be inadequate for proper operation and maintenance.

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[1] Official exchange rate on Feb. 10, 1983, was $1.00 = 697 rupiahs.

Unless additional sources are found to supplement Indonesia's O&M budget, the problems will worsen over time as maintenance requirements accumulate for existing and new systems. Central government officials told us that the government could not continue to increase the irrigation subsidies and that future subsidies would level off or decrease. Further, the provincial and district governments have no other reliable sources for more O&M funds.

In some instances O&M funding problems were magnified because budgeted funds were not provided on time. An official of the Ciamis District's Irrigation Service (Citanduy project) told us that it sometimes takes as long as 9 months for budgeted funds to reach the district where operation and maintenance is performed. This complicates the district's planning and allows minor maintenance problems to become more serious (and expensive).

Inflation is another factor that will increase the seriousness of future O&M funding problems in all developing countries. For example, a feasibility report on the Citanduy Project stated that, with inflation, by 1985 the project would require between 25,000 and 40,000 rupiahs per hectare annually to maintain the systems at designed performance levels. Similarly, there has been accelerating domestic inflation in Sri Lanka and Thailand, thereby increasing recurrent cost requirements.

In some instances the countries did not have budget or reporting systems which would provide the information needed to ensure that they were complying with requirements for adequate O&M resources. For example, according to an Indonesia Ministry of Finance official, there are no overall consolidated figures of funds actually used for operation and maintenance. Since there are at least 11 different government sources for O&M funds and no single source responsible for collecting and disbursing funds, there is likewise no single source of accountability. Such situations illustrate opportunities for donors to help developing countries document O&M requirements and to establish standard budget classifications for local O&M programs.

Sri Lanka

Adequate funds for the recurrent costs of irrigation operation and maintenance have not materialized in Sri Lanka. Further, there is evidence that O&M funding problems will be magnified as irrigation expansion proceeds unless actions are taken to provide more funds.

The following data obtained from AID documents and contractor evaluations indicate the magnitude of funding deficiencies.

--Historically, except for minor irrigation works and those within statutory bodies, the Irrigation Department has been responsible for operation and maintenance of irrigation schemes. As the tempo of construction work increased, these functions were relegated to a low budget priority, representing about 6 percent of total irrigation budget allocations. This state of affairs, coupled with the farmers' reluctance to undertake maintenance brought the canal network to such a condition that in the late 1960s a "Crash Programme" was initiated to rejuvenate the existing schemes.

--Over the years, there has been no consistent policy for construction, operation, and maintenance of the terminal works (field channels). This may have contributed significantly to the present deteriorated condition of these works.

--Current maintenance allocations represent about one-third of that estimated to be needed by the Irrigation Department. O&M funding relative to construction expenditures has declined steadily.

It has been estimated that the Accelerated Mahaweli Irrigation Program will cost over $1 billion when completed. It is not apparent how the Government of Sri Lanka will finance the recurring costs on a system of this magnitude when combined with other demands for resources. The Mahaweli Program has already experienced problems due to inadequate financial and human resources capability. Without an adequate commitment to operation and maintenance, future crash programs may be required to rejuvenate the irrigation systems currently being financed.

Thailand

The Thai Government's O&M budgetary allocation increased from about 7 percent of total annual construction outlay in 1972 to between 10 and 13 percent between 1974-81. However, since continued construction also must be maintained by recurring O&M expenditures, a constant percentage of annual construction costs devoted to these functions has resulted in a drastic decline in funds available. The percentage of budgeted O&M funds to accumulated construction declined from 7 percent in 1972 to only 2 percent by 1981.

An August 1981 AID evaluation concluded that the Lam Nam Oon canal system had suffered extensive deterioration due largely to a complete lack of attention to operation and maintenance. There have never been sufficient funds for maintaining the system. For example, Thai budget documents provided to us

indicated that for fiscal year 1982, 5.2 million baht[2] was requested for operation and maintenance but only 2.4 million baht was received. The Lam Nam Oon project also experienced funding delays. Project staff told us that they performed very little maintenance during the first 2 months of each fiscal year because O&M funds were received late. The staff explained that this 2-month period is the best time to inspect the canal sections, which are otherwise under water.

A similar situation exists for the irrigation systems constructed under the older AID irrigation loan project--which included irrigation systems at Lam Pao, Lam Pra Plerng, and Me Tang. The O&M chief at the site we visited said that he had developed an O&M plan and budget for the irrigation system, but the Thai Royal Irrigation Department does not fund all the requested repairs. For fiscal year 1982, his approved budget was not nearly enough to operate the system and to repair structural damage.

For the one Northeast Small Scale Irrigation Project site we visited, the budget was so small that it covered operational staff salaries but almost no maintenance. There were also insufficient operation staff for the project. The Irrigation Department O&M chief explained that there is no specific O&M plan for the project or any of the other irrigation systems in his province.

User fees fall short of planning assumptions

None of the countries were routinely collecting water user fees--a condition which was often inconsistent with AID and other donors' plans and assumptions. For example, AID's 1977 Lam Nam Oon project paper indicated that the Government of Thailand would be able to recover from users a significant part of both the O&M and investment costs. Yet, the viability of such an assumption was questioned in the 1980 project paper for the Northeast Small Scale Irrigation project, which stated that:

> "although the Irrigation Act allows for collection of O&M fees for maintenance and operating of the on-farm system, these have rarely been collected and WUA's consequently have little or no operating budget. (One reason they have not been collected is probably because farmers see little reason to contribute to support a system that does not function very well anyway.) The above problem areas tend to preclude any kind of broad farmer participation in the control

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[2] Official bank note rate on Feb. 10, 1983, was $1.00 = 22.6 baht.

and management of irrigation water and certainly contribute to inefficient water utilization and poor system maintenance."

Sri Lanka has had some success in collecting fees from project beneficiaries. However, there is some question among the donors as to whether policies to recover a portion of capital and recurrent costs from project beneficiaries will work. In Sri Lanka, the World Bank has had a policy of cost recovery from project beneficiaries, but AID has not. Inconsistent donor policies such as these can lead to less than full host-country support for cost recovery programs and O&M financing.

We believe uncertainties about O&M cost recovery should be addressed in the context of a financial plan concurred in by all donors supporting irrigation development. We support the concept that users should aid in supporting operation and maintenance of irrigation systems. However, it is apparent that water or system user fees will not be a reliable source of O&M revenue until such time as the irrigation systems provide reliable sources of water and collection of user fees has been demonstrated to be feasible.

In some situations, collection of user fees is related to the establishment of effective water user associations. This need is discussed in chapter 4.

Countries with neglected O&M were certified by AID to have necessary capability

In addition to recipient countries' agreements to perform operation and maintenance, AID missions certify that such countries have the capability to effectively operate and maintain AID-financed capital projects.

These certifications are required by Section 611(e) of the Foreign Assistance Act, enacted in 1967 to encourage AID to avoid financing additional projects in countries which had not effectively used or maintained previous projects. Section 611(e) provides in essence that no development assistance:

"shall be furnished with respect to any capital assistance project estimated to cost in excess of $1,000,000 until the head of the agency primarily responsible for administering part I of the Act has received and taken into consideration a certification from the principal officer of such agency in the country in which the project is located as to the capability of the country (both financial and human resources) to effectively maintain and utilize the project taking into account among other things the maintenance and utilization of projects in such country previously financed or assisted by the United States."

Although this section focuses on recipient country capability, emerging conditions in developing countries may also require greater consideration of a recipient country's commitment and willingness to perform required operation and maintenance.

For projects we reviewed, the AID missions had certified recipient country capability despite strong evidence of inadequate budgets and less than full commitment to effective operation and maintenance.

--In Indonesia, certifications of capability have been made even though operation and maintenance has been a persistent problem.

1. A 1978 World Bank review observed that the overall O&M standard in the country was unsatisfactory, resulting in below-optimum food production and perpetuating the need for system rehabilitation.

2. A mission telegram in January 1980 to Washington identified "an apparent indifference to O&M at high levels in the Indonesian Government" and recommended using the occasion of World Bank loan negotiations "to raise the issue with Government of Indonesia representatives and to try to bring about a high-level policy commitment to facing up to O&M realities and needs and to responding to them at a much higher priority level than they now receive."

3. The World Bank included special covenants to its irrigation loan agreements, principally aimed at encouraging better government commitment to operation and maintenance.

--In Thailand, the principal officer of AID, having taken into account, among other things, the use and maintenance of projects previously financed or assisted by the United States, certified in 1977 that in his judgement Thailand had both the financial and human resources capability to effectively use and maintain the proposed Lam Nam Oon Irrigation Project. However, in 1981 the AID consultant team found the project components had deteriorated to the point that, unless maintenance improved, consideration should be given to discontinuing the project. During field visits, we saw similar O&M problems in earlier funded AID projects in the Northeast part of the country, further

demonstrating an overall lack of commitment to operation and maintenance by aid recipients.

Based on the (1) deteriorated conditions and extent of irrigation system rehabilitation in each country, (2) apparent capability but questionable commitment to O&M budgeting in Indonesia and Thailand, and (3) serious questions of financial and human resources capability in Sri Lanka, we believe the 611(e) certification as currently conducted is not meeting its original intent. A recipient country's willingness and commitment to carry out efficient and adequate operation and maintenance are equally as important as capability. To better assure the validity of its certifications, AID, during the planning, approval, and agreements process, should establish that the necessary personnel, training, equipment, and funds have been provided for. Also, as discussed in chapter 3, the recurring O&M costs can be reduced through improved project design and construction.

DONORS HAVE YET TO FORMULATE AND IMPLEMENT VIABLE O&M COST OPTIONS

Although donors are increasingly concerned about the effect of recurrent cost problems on their irrigation investments, they have yet to formulate viable options for dealing with these costs.

Asian Development Bank officials in the Philippines told us that the Bank does not have a policy on financing recurrent costs but has demonstrated a strong interest in rehabilitating projects. Officials from Japan and the United Kingdom that we talked to in Thailand said that their countries do not fund recurrent costs. Officials from Australia that we talked to in Sri Lanka were also against donor funding of recurrent costs. World Bank officials in all three countries were against donor financing of recurrent costs, citing poor experiences in such financing in the past, when host countries did not continue to fund recurrent costs after donors stopped.

AID mission officials in the three countries were more receptive to the general concept of donor involvement in recurrent cost financing, particularly in the poorer developing countries. However, they were not in favor of AID's funding recurrent O&M costs in more developed countries, such as Indonesia and Thailand, because these countries have the resources to fund such costs if they so choose. Mission officials in Sri Lanka said that donor financing of recurrent O&M costs of irrigation might be acceptable to the government if it did not decrease new construction. However, it was felt that the government preferred to defer maintenance and let donors rehabilitate systems.

The mission is currently funding some recurrent costs in declining proportions through 1987 as part of a project to establish and maintain national parks in the Mahaweli Project

area. AID officials told us that the Government of Sri Lanka does not like this project because it forces them to obligate funds for recurrent costs when they would rather fund more capital construction projects elsewhere.

In May 1982, AID published a policy paper on recurrent costs which stated that:

> "There is a growing awareness that many of the poorest countries in the world * * * are not allocating adequate budgetary resources to finance the recurrent costs of their present portfolio of development investments. Existing investments are, therefore, becoming unproductive, and future investments are likely to suffer from the same problem."

The policy paper recognized that donors tend to limit their financing to new projects. For many countries, this results in funds being more readily available for new capital projects because they come largely from donor assistance, while the funds available for financing the recurrent costs of existing projects are more scarce because they come mostly from domestic sources.

The paper outlined several ways that AID can respond to the problem, including

- --designing projects to ensure that their recurrent cost components are consistent with economic feasibility,
- --encouraging developing countries to reform their policies toward recurrent cost support, and
- --funding recurrent costs in certain limited instances.

The paper also outlined several conditions that must exist before AID can fund recurrent costs, including

- --acceptable host-government policies or a clear movement toward such policies,
- --the likelihood that AID support of recurrent costs would have higher development impact than new project investments, and
- --inability of the host country currently to fund recurrent costs and a phased plan for shifting these to the host government.

The policy paper also stated that if a host government refuses to take sufficient action on project design and/or

policy reform, AID should consider reducing its level of assistance.

According to a September 1982 World Bank presentation to a workshop on aid to irrigation, developing countries should be encouraged to formulate O&M projects, which could be funded in 5-year increments over 15 years to include management, technical training and equipment, and system improvements. The Bank further stated that operation and maintenance is necessary for minimizing rehabilitation costs and should receive greater attention by both aid recipients and donors. AID, based on its recognized leadership in the irrigation field, could perform a lead role in helping developing countries formulate O&M projects to meet country-specific needs.

In Indonesia, the mission indicated that it would consider designing a new project for O&M support and financing studies under the Water Management Synthesis project of the relative costs and benefits of rehabilitation as opposed to routine maintenance. We believe both considerations should be encouraged as a means of dealing with the country-specific problems in Indonesia and effectively using the project funds.

CONCLUSIONS

AID and other donors plan to continue investing substantially in irrigation and other sectors of capital development, yet the question of recipient country support of recurrent costs remains unsettled and will likely become more serious as donor involvement accumulates.

The recurrent cost dilemma presents donors with several options; for example, they can:

--Continue to finance new construction despite continued system deterioration and costly early rehabilitation.

--Finance new construction only if the recipient country demonstrates the willingness, commitment, and capability to effectively operate and maintain such systems, assuming donors have the flexibility to reduce assistance levels to the affected sector or country.

--Develop viable O&M financing plans that recognize the conditions affecting the economic life and efficiency of irrigation investments.

Although it is generally recognized to be more efficient and economical to perform adequate operation and maintenance, there is some sentiment for the "business as usual" approach. Such an approach recognizes the immediate economic benefits of

new construction, productive potential of expanded total irrigation systems, early rehabilitation of systems to conform to changing conditions, and the difficulty that developing countries have in meeting recurrent costs as well as technical and institutional constraints.

We believe the business as usual approach is not in the best interests of donors or of recipient countries. It results in failure to realize the economic development potential of donor investments; costly early system rehabilitation which otherwise may be unnecessary; inefficient and less than fully productive systems; and erratic and undependable water supplies which affect farmers' incentives to perform on-farm operation and maintenance and to pay user fees--an important potential and critically needed source of O&M revenues.

Donors have demonstrated their concern with developing country food problems through investments in irrigation systems and other facilities. At the same time, they have not given sufficient attention to the complementary institutional and financial O&M costs over the life of the facility. The general provisions included in project documents, requiring recipient countries to adequately operate and maintain donor-financed facilities, have not achieved desired results and will not do so in the absence of realistically ensuring the availability and commitment of necessary resources.

From our analyses of the recurrent costs for U.S.-financed irrigation systems in Asia and of AID plans for new investments totaling millions of dollars, we believe AID should put greater emphasis on the recurrent costs of these investments. AID and other donors must stress the importance of meeting recurrent costs and encourage each country to redirect additional resources to specific O&M needs. An essential element should be making the systems economically viable and recovering costs from all beneficiaries. Also, in the project approval process each donor should establish a sound basis for O&M support and for other measures, such as O&M projects.

We believe AID should strengthen the project planning, loan agreement, and section 611(e) certification process as a serious mechanism for establishing recipient country capability, willingness, and commitment to operation and maintenance. To do this AID, in conjunction with other donors, should work with recipient countries to

--build necessary institutional capability through O&M projects (management, technical training, and equipment maintenance);

--estimate annual life-of-system O&M costs, including personnel, training, and equipment requirements;

--establish O&M funding sources with the ultimate objective of recipient countries, including system users, assuming all O&M costs; and

--provide necessary monitoring and early warning of O&M shortfalls.

Donor support of O&M projects should be based on a reasonable possibility that, at the conclusion of such efforts, there will be evidence (physical, institutional, and fiscal) that the irrigation systems will be fully supported by the host government.

A possible short-term source of funding for irrigation system operation and maintenance or pilot O&M projects is local currencies generated through the import and local sale of U.S. commodities provided concessionally under Public Law 480, which a number of developing countries receive with an established degree of regularity. AID and the Congress have a strong interest in integrating Public Law 480 programs with development assistance programs and in improving self-help measures under the Public Law 480 program. The selective use of generated local currencies for irrigation operation and maintenance may serve both objectives. The Administrator should explore ways to use currencies generated through Public Law 480 to the extent feasible for operating and maintaining irrigation systems. Such a mechanism should be used only in conjunction with a plan for making such systems economically viable and supported by all beneficiaries.

RECOMMENDATIONS

We recommend that the Administrator of AID:

--As an integral part of project planning and as a condition for project approval, require that recurrent cost plans be developed in conjunction with recipient governments and other donors. This financial plan would

1. recognize the principle of cost recovery, to the extent feasible, from all beneficiaries;

2. project the annual life-of-system O&M costs;

3. identify the source of O&M funds, and the O&M funding options available to the country and the donors, recognizing that system user fees, while an objective to be worked toward, have yet to be established as a reliable source of income;

4. include specific plans to strengthen each recipient country's capability to budget for O&M funding and to account for O&M expenditures on a project basis; and

5. institutionalize management monitoring and evaluation of plan implementation, including identification of O&M shortfalls.

--Encourage other donors to define their recurrent cost financing options.

Because of the magnitude of the O&M financing problem and the need for donors to work in unison, we believe other donors, such as the World Bank and the Asian Development Bank, should be encouraged to further define their policies toward recurrent cost financing. The Administrator, in his role as coordinator of U.S. assistance programs and in conjunction with the Secretary of the Treasury, should encourage the multilateral development banks to further define their recurrent cost financing options as they relate to future financing of irrigation project development.

AGENCY COMMENTS AND OUR EVALUATION

AID agreed that improper operation and maintenance seriously limit the efficiency of irrigation systems and shorten their life span. To deal with this problem, more attention must be given to the institutional and financial costs associated with operation and maintenance over the life of the system. While AID agreed that Public Law 480 generated currencies might be used as a short term solution to cover operation and maintenance, they felt it is more appropriate to build a technical and financial plan into the project implementation plan as we recommended.

Although AID agreed that a technical and financial plan was appropriate for each project, it did not say what actions would be taken to develop such plans or to address the specific elements of the recommendation. AID referred to the possible development of an overall agency irrigation policy; this would be useful for providing general guidance, but specific action in the planning and design of each project will be required to meet the requirements of loan agreements and to strengthen the 611(e) certification process. To assure the validity of AID's certifications of recipient countries' capability to adequately operate and maintain U.S.-financed facilities, approved projects should clearly establish that necessary O&M personnel, equipment and funds will be provided.

AID said it is working closely with other donors, particularly the World Bank and Asian Development Bank, to develop joint funding and technical assistance arrangements advantageous to donors and recipient countries. We believe AID should encourage other donors to define their recurrent cost financing options to help in dealing with the O&M problems for donor-financed irrigation systems.

CHAPTER 3

DESIGN AND CONSTRUCTION IMPROVEMENTS CAN REDUCE O&M COSTS

AID and other donors can help developing countries overcome irrigation system design and construction problems which have resulted in project delays, increased construction costs, immediate and substantial O&M problems, and reduced overall benefits from the systems. To varying degrees, systems as designed and constructed did not give adequate consideration to minimizing O&M requirements, provide the necessary supervision to assure that design specifications were met, involve the farmers in the design and construction process, or provide for an appropriate transition from contruction to operation and maintenance.

Remedial actions to alleviate problems such as these, which are manifest in completed and ongoing projects, should be standard prerequisites for financing future irrigation projects. Very basic to this process should be the establishment of strengthened quality control in designing and constructing projects.

PROJECT DESIGN PROBLEMS

Design quality has been a significant factor in construction and O&M problems. The solution to many of these problems appears to be designing low-maintenance projects; more supervision of the system designers; visits to project sites during the design phase by the local designers and AID engineers or consultants; early involvement of system users; greater use of available consultants' expertise; and a transition period to ensure system operability.

O&M requirements should be a priority consideration

Irrigation system designers sometimes either give low priority to or do not fully consider O&M requirements. In an analysis of 63 AID and World Bank-financed irrigation projects, an AID advisor noted that operation and maintenance was a major consideration in the design for only two of the projects.

Irrigation officials told us that certain features can be incorporated in irrigation projects to reduce O&M costs. One is to line irrigation canals, particularly the main system, with concrete or masonry when they are located in areas with loose, sandy, or silty soils. Such linings, although expensive, can greatly lower O&M costs because it is difficult to compact canal banks in sandy or silty areas. The banks tend to crumble and erode even before the canals are finished and placed in service. In addition, unlined canals in sandy or silty soils allow seepage which results in substantial water losses and can ruin (waterlog) adjacent farming areas.

In Indonesia, critical sections of the canal banks were not being lined at the AID-funded Luwu Irrigation Project, and many of the canal banks had severely eroded even though they had been built since 1979. The Netherlands is currently constructing a project to irrigate 5,000 hectares at Lamasi in the Luwu area, and the project officer told us that all of the main system and much of the on-farm system will be masonry-lined even though it is expensive. The Lamasi cost estimate per meter of canal is about five times the cost estimate of similar-sized unlined canals at the AID-funded Luwu project, but they will greatly reduce O&M costs.

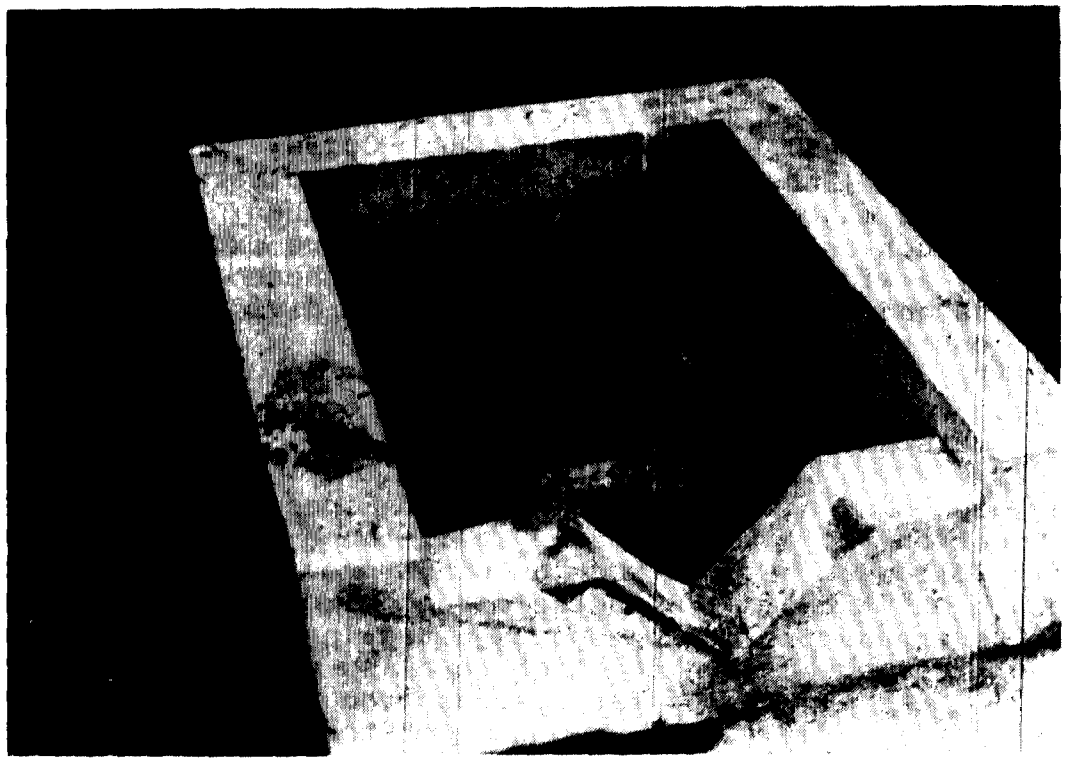
Indonesian Luwu Project

Erosion damage

In Sri Lanka, reports filed by donor field investigators at the Mahaweli project stressed the need for concrete canal linings in many places, and severe water losses were predicted. One report estimated that 50 percent of the water would be lost in unlined canals before it reached the farmers.

We visited a pilot project in Sri Lanka sponsored by the World Bank, which incorporates design features that might lower O&M costs under the right circumstances. This project uses an underground pipe network to deliver water from the main system to the farmers' fields. Farms connected to the system have concrete turnout structures with screw valves which allow farmers to control the flow of water to their fields. In traditional irrigation schemes, flow is regulated by irrigation authorities. Initial construction costs for the system are higher, but it is expected to require less maintenance.

Sri Lankan Mahaweli Pilot Project



Turnout box and valve for underground pipe
allow farmer to regulate water flow

These are only examples of features that should be considered during the design phase to reduce O&M costs. They increase initial construction costs and must be weighed against the benefits to be realized. However, in view of the availability of construction funds, scarcity of O&M technical and financial resources in developing countries, and reluctance of developing countries to devote necessary resources to operation and maintenance, we believe greater consideration should be given to designing irrigation systems that require as little operation and maintenance as possible.

Quality control should be maintained during design process

The need for better quality control over the design process was evidenced in Indonesia and Sri Lanka. AID project officers and AID-funded consultant engineers in Indonesia and Sri Lanka said that the design of projects by inexperienced local contractors resulted in construction errors that increased costs and delayed benefits for the farmers.

A common mistake made by the local designers was using maps not sufficiently detailed and not visiting the project sites to check out actual conditions. For example, one AID fieldtrip report stated that:

> "The designers * * * did not check the field before they started to design. They designed the plans on a small scale map, 1:5000. Consequently, PW [Indonesian Ministry of Public Works] found some major changes were needed in the field, such as additional structures, more excavation, a wider weir, etc. Because of these changes and a limited budget, PW had to divide the construction into three years."

The project was originally scheduled to be completed in a much shorter time span.

In Indonesia, a consultant irrigation specialist at the Luwu Irrigation Project told us of an instance when a contractor carefully followed the construction plans provided for the Luwu project and built a canal with the direction of flow running uphill. Sederhana fieldtrip reports cited instances where system structures were placed too high to allow water flow; were in the wrong place, preventing the systems from functioning; and were either too large (waste of money) or too small (restricted water flow). Because of incorrect data, Citanduy designers did not anticipate problems that arose later, such as drainage and flooding problems.

In Sri Lanka, reports by a joint donor review mission pointed out numerous instances where irrigation system modifications were necessary to correct design errors.

Poor placement of farm turnout structures hindered equitable water distribution to farmers. Consequently, the farmers damaged the structures or nearby canal banks to obtain needed water. The damaged turnout structures and canal banks resulted in even more inequitable water distribution, because upstream farmers tended to take too much water through their unauthorized "modifications," leaving little or no water for downstream farmers.

The solution to many of these design problems appears to be more supervision of the system designers. Most AID officials and consultants that we talked to agreed that local engineering firms and host governments should be involved in the design of irrigation projects; however, they need more supervision by AID managers or consultants.

Donors should insist on visits to each project site during project design. The AID engineers or consultants should check not only the designs themselves but also how each design fits the actual site conditions.

Early involvement of farmers desirable

Host-country and AID officials pointed out that farmers sometimes lack interest in maintaining their on-farm systems because they are not involved in project design and construction; if farmers help to design and construct their on-farm systems, they may develop a sense of ownership and be more willing to operate and maintain them.

Reports by AID officials on several Sederhana subprojects showed that many farmers were not fully participating in the irrigation system built for them and system output was reduced due to inadequate maintenance.

Until recently, the Thai Government's policy was to design and construct dams and main irrigation systems only, leaving it to local farmers to design and construct connecting on-farm systems. Usually only a relatively few farmers close to the canals were able to benefit. The rest would rely on rain water as they had always done. This policy has changed and on-farm systems are now being built at all three projects by AID and the World Bank.

The concept of local involvement in small-scale project design is not new. The Japanese, who are building a large number of very small-scale irrigation projects in Thailand, recognized the importance of local farmer involvement. The farmers must request the projects and prove that they have an effective association before project construction is authorized.

Designs should provide for an operational "shakedown" period

Because of the complexity of irrigation systems--even the relatively small ones--we believe O&M problems can be minimized by including in the project design a transition period after construction to work out the system "bugs" and train government staff and farmers who will ultimately be responsible for operation and maintenance. Even the best designed system may have problems with construction, water drainage, water levels and flow speed, and location of water off-takes.

A formal transition period, lasting several years for a large and complex project, could be included as part of the project design and funded from seemingly more abundant construction funds; it would give the irrigation projects funded by AID and other donors a better chance to start operating properly and help to establish a reliable water supply. No formal transition periods were designed into any of the AID-financed projects we reviewed.

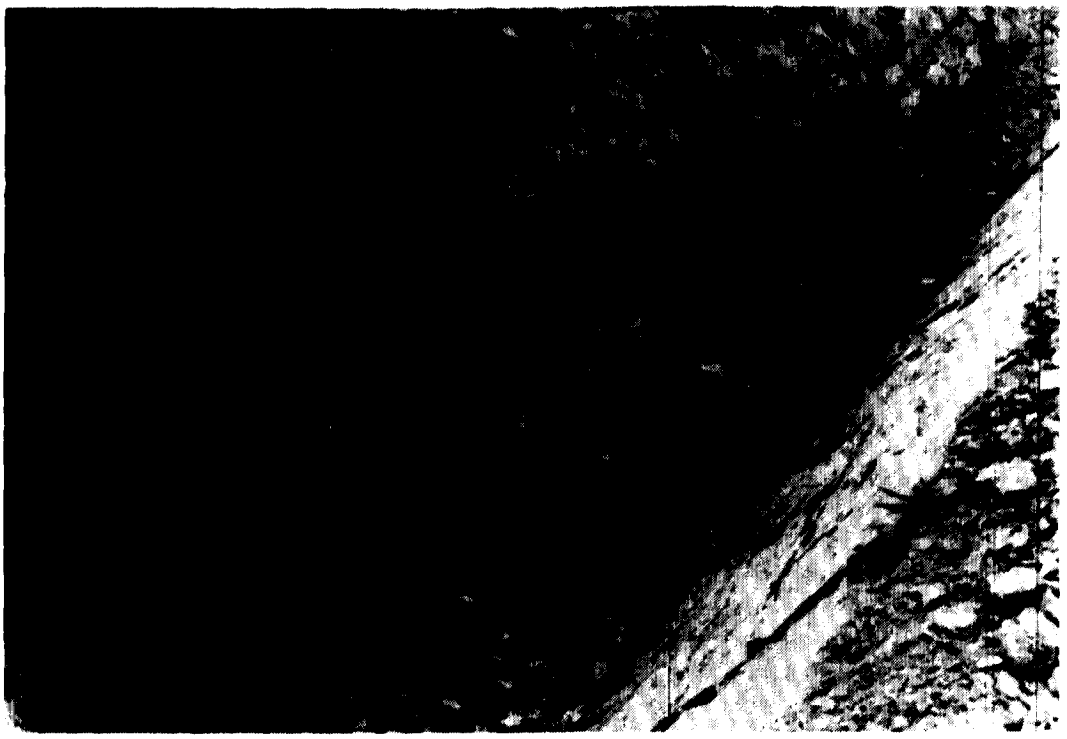
Government of Indonesia officials told us that Indonesia is beginning to adopt the concept of transition periods in its new or newly rehabilitated irrigation projects. Termed "trial runs," the concept was developed through the Sedeku Trial Run Project, being administered jointly by Indonesia and the Netherlands. Government officials said that operational training is emphasized, enabling the O&M responsibility to be gradually turned over to the provincial governments. Transition periods range from 6 months for small projects to 2 or more years for larger, more complex efforts.

CONSTRUCTION PROBLEMS

Inadequate construction quality was a problem at the AID-financed irrigation projects in two countries. The primary problems were poor soil compaction in canal banks and failure to remove debris from the soil used in forming the canal banks (this is called soil stripping). The debris makes it difficult to achieve adequate compaction. Poor construction greatly increases O&M problems, as poorly built structures deteriorate before they should and greater water conveyance losses occur.

AID officials reported that soil compaction was a problem on some Sederhana subprojects and that construction quality was one of the problems which delayed completion of the Citanduy project.

Poor compaction and soil stripping, along with the need for canal linings, were the main reasons for the deteriorated main canals at Luwu, even though they had never been used. The consultant irrigation specialist told us that these canals will probably have to be rebuilt before they can be used. We observed parts of one canal being rebuilt and were told that other repairs were planned.



Indications of inadequate
soil compaction in unlined canal

A particular problem at Luwu was that AID-funded consultants under host-country contracts acted only in an advisory capacity, with no authority to carry out necessary measures to maintain quality construction. These consultants told us that they were aware of the construction problems and had so informed the Indonesian staff. However, their advice was often ignored and construction quality suffered. The consultants, who are Americans, actually work for the Indonesian Government under a host-country contract and have no authority to take direct action when they spot inadequate construction--they can only advise the Indonesian project staff and hope their advice is followed.

The host country pays the contractor as construction progresses, and AID reimburses the government for the AID portion of the project (per loan agreements). This generally occurs at the completion of a project or subproject. According to the AID project officer, once construction is completed and problems are identified, the only remedy AID has is refusing to disburse the loan funds. He said that this is regarded as a very undiplomatic gesture and that it would be better if the consultants, as AID representatives, could take earlier actions to obtain quality work, such as withholding the contractors' pay as construction progresses.

The Netherlands Lamasi project officer said that he has the authority to withhold contractor payments if he finds inadequate work. He said, for example, that the contractor responsible for much of the inadequate work at the AID-funded Luwu project had performed satisfactorily on the Lamasi project. The Netherlands project officer can spot inadequate work early and require it to be corrected before it progresses too far, whereas AID must decide whether or not to disburse loan funds after entire sections of irrigation systems are completed. By that time, completing work to meet specifications would require substantial delays and have financial implications for the contractors.

Inadequate construction quality was also a problem at a Mahaweli project in Sri Lanka. The main cause appeared to be a decision by the Sri Lankan Government to accelerate project construction. An October 1977 review by an inspection team from AID, the World Bank, and other donors concluded that:

> "we do not believe the Mahaweli II project can be completed in one year, and still result in a well constructed, high quality project with the well planned and executed components necessary to ensure its success. We are apprehensive that in the rush to complete the project, the works will be improperly located and constructed, resulting in high operation and maintenance costs over the life of the project * * * ."

A later review concluded that:

> "The fears of the October 1977 supervision mission are being realized, in that poor quality construction work and improperly coordinated work programs are resulting from the Government's decision to complete the project within one or two years. Unrealistic target dates have been set for completing the irrigation works and settling the farms, and construction forces are trying to meet target dates without regard to work standards or proper planning. Work has been undertaken in all areas of the project (seemingly at random) without completing necessary prior works or coordinating programs which would insure more successful development. As a result of the poor quality construction, water conveyance loss inefficiencies are being built into the system, water losses will be much larger than planned, and maintenance problems and costs will be considerably greater than if good quality construction was achieved."

To improve construction quality, the World Bank, in a letter to the Mahaweli Development Board, urged the formation of

construction quality control units to monitor all construction work and train construction inspectors and field engineers in quality control.

An October 1980 inspection report noted some improvement, stating that:

> "The Mission noted significant improvement in the quality of constructed works and is generally pleased with implementation progress."

* * * * *

> "All construction inspectors appear to be aware of the need to maintain quality control and the quality of recently completed works is very good."

However, construction quality problems still persisted. An AID engineer reported in June 1982 that the irrigation systems needed extensive repairs and modifications in areas where there were no quality control units. Also, an inspection team from AID, the World Bank, and other donors, stated that, while Sri Lanka's efforts to maintain construction quality control were appreciated, there were shortcomings which would be extremely difficult to correct. According to their March 1982 report:

> "The Mission's field review again revealed that the completed irrigation infrastructure, particularly at the distributory canal and field canal level, clearly will not function as planned to enable efficient and equitable irrigation water deliveries to be made. Some structures either are not operable or cannot be used to measure flows without repair or modification, and siltation and erosion problems have altered the hydrological characteristics and usability of the canals. A massive and concerted effort must be made to make the irrigation system responsive and operational."

The amount of repairs, modifications and clean-up work envisioned in the report was estimated at $1.5 million.

CONCLUSIONS

Weaknesses in design and construction severely affected some irrigation systems. As part of its assistance program, AID should help developing countries to overcome these weaknesses and improve the quality of project design and construction. Assurance of reasonable quality control should be a prerequisite to funding future projects. This is especially important, recognizing the inexperience of developing country personnel and contractors, the possible overload of available personnel, and the pressures to get the job done.

One possibility for improving quality control would be to give AID consultants more supervisory authority over AID-financed projects. The consultants' approval could be required before the government disburses periodic payments to the contractor. In addition, if the consultants' salaries were funded with AID grant money, it would help the consultants to maintain an objective, independent posture.

While we suggest this only as one possible alternative, we believe it is incumbent upon AID and other donors to work with host governments in assuring that urgently needed irrigation systems are well designed and constructed. We have traveled extensively in developing countries during this review and others and have experienced the constraints common to these countries. Notwithstanding these constraints, AID and the recipient countries working together can improve the quality of design and construction of irrigation systems, which are needed so urgently to increase food production.

In summary, we believe a basic need is to build quality control--quality assurance with the necessary tests, checks, and balances--into both the design and construction phases. Such procedures would benefit both the recipient country and AID.

RECOMMENDATION

We recommend that the Administrator of AID adopt stronger design and construction criteria for improving O&M performance as standard prerequisites of approval for new irrigation projects and rehabilitation projects. This criteria should include:

--Quality assurance measures in design and construction; for example,

1. ensuring that local engineers and contractors take heed of technical advisors and

2. making site visits during the design process.

--Involvement of farmers in the planning, design, implementation, monitoring, and evaluation process.

--Priority consideration of O&M requirements during project design.

--Appropriate transition between construction and operation and maintenance.

AGENCY COMMENTS AND OUR EVALUATION

AID said it is dealing with design and construction improvements through in-country training, research, and

technical assistance. Its studies on irrigation projects are to provide background for an irrigation policy which is being considered. However, AID did not address how it would implement the specific elements of the recommendation.

We believe implementation of this recommendation is basic to improving irrigation system design and construction.

CHAPTER 4

ESTABLISHMENT OF EFFECTIVE WATER USER ASSOCIATIONS--AN ELUSIVE GOAL

Close farmer cooperation is essential for successful operation and maintenance of on-farm irrigation systems and equitable water distribution because of a high concentration of very small farms in a relatively small area. For example, we were told that over 64 percent of Indonesia's 17 million farms were 1/2 hectare or less. Consequently, efficient on-farm maintenance and water management is directly related to the degree of cooperation among farmers. Without close cooperation, some farms will receive more water than needed, others will do without, and routine maintenance will not be shared among all those receiving irrigation benefits.

Water user associations should provide the administrative structure needed to ensure proper on-farm maintenance and the efficient and equitable distribution of water to farmers' fields. These functions include removing silt and weeds from canals, repairing cracks and eroded banks, scheduling water deliveries, opening and closing gates, and maintaining discipline among the users. In active associations, members are expected to pay user fees (usually a portion of their crop) and to do maintenance work.

In addition to the local role discussed here, it was also suggested that water user associations should have a larger role, such as representing farmers' interests in management of the irrigation systems and facilitating communication between managers and farmers.

--All project papers recognized the importance of establishing active water user associations.

--Two of the four Indonesian project papers included establishment of water user associations as a condition precedent to loan disbursement.

--The Citanduy project paper stated that development of water user associations was the most important element for successful irrigation management at the farm level.

--The project papers assumed that active associations would collect user fees.

Notwithstanding these highly important assumptions which helped form the basis used in estimating project benefits, we found that effective organizations generally had not been established and that most O&M problems at the on-farm level were

directly related to the absence of effective water user associations. Furthermore, an appropriate host-country environment is an essential prerequisite to formation of water user associations.

Indonesian Citanduy Project

Water user association's meeting place
along tertiary canal

PREREQUISITES FOR ESTABLISHING ASSOCIATIONS

We did observe some instances where organizations appeared to be functioning efficiently or pilot programs had been used to experiment with association management. These efforts incorporated some, if not all, of the following elements identified to us as essential for successful on-farm management. Discussions with AID, other donors, donor consultants, and government representatives as well as analyses of project trip reports and other studies, suggested that each association should

--be "tailored" to meet the specific needs of the locality; for example, ethnic background, religion, local custom, size, and local organizational structures should be carefully considered;

--have a strong organizational structure that can establish discipline and ensure equitable water distribution;

--be convinced of the benefits and advantages of the irrigation system and the importance of operating it efficiently and maintaining it regularly; and

--participate in the system's design and construction to help establish a sense of ownership.

In Indonesia, the High Performance Sederhana Irrigation System, funded by AID and the Ford Foundation, is a pilot effort to improve irrigation water use and agricultural production by involving farmers in system development and water management. It is patterned after a program developed in the Philippines and has a main priority of increasing farmer participation in planning and implementing irrigation systems. The organizers work closely with water user associations. In locations where there are no associations, the first priority is to establish one.

Over the past 7 years, the Sederhana project primarily was concerned with construction, and farmer participation was minimal. With construction nearly complete, the Indonesian Government and the AID mission have begun shifting program emphasis from construction to farmer participation in operating and maintaining the system. The shift in emphasis is a result of an increasing awareness of engineering errors that were made during construction due partly to lack of understanding of the farmers' needs.

Mission officials told us that a portion of the project had been implemented and is going well; however, in August 1982 an Indonesian official asked AID to postpone its implementation portion, primarily because of delays in training organizers. The project officer told us that this will delay the program. The mission had not responded to the request at the time of our review.

The most effective water user associations we visited were the Balinese Subaks in Indonesia. Their irrigation systems appeared to be well maintained and in excellent condition. The Subaks had, in most instances, designed and constructed their own systems; the religious and ethnic structures were an important part of the association; each Subak had a strong organizational structure; and fees were collected to help operate and maintain the systems.

An AID official suggested that we should note that the Subaks are indigenous organizations with a long history; they were not set up by the government. Therefore, applicable lessons can be learned from them, but they do not provide a model of how to start such associations.

Indonesian Subak System

Work being done on ditches

EFFECTIVE ASSOCIATIONS WERE NOT ESTABLISHED

Although no current statistics were available to determine the number of water user associations needed to operate and maintain the on-farm systems versus the number actually in place, we found many instances where associations were needed but had not been organized.

According to an October 1978 World Bank study (the most current data available), water user associations had been formed for only 250,000 hectares of the 5 million hectares under irrigation in Indonesia. And of the 2,927 associations that had been formed, it was estimated that only 1,641 were active. An AID project impact evaluation report dated February 1982 stated that water user associations had been formed in only 20 of the first 52 Sederhana subprojects and a relatively small number of these associations were functioning effectively. In the Ciamis District (Citanduy project), district officials gave us a September 1982 report stating that only 9 of the district's 224 water user associations were active; another 69 were described as developing; and the remaining 146 were inactive--local farmers generally claimed no knowledge of the associations.

In Sri Lanka, the information available showed that many project sites had no active associations. According to a June

1982 AID-financed study by Cornell University, the rapid pace of rehabilitation and new construction had resulted in systems being constructed before local farmers were organized and prepared to operate and maintain them. The report recommended that either the pace of construction be slowed or the organization and preparation of farmer groups be accelerated. For the Gal Oya area, about 122 water user associations had been formed, representing about 10 percent of planned associations. According to project managers, only about 60 percent of these associations were considered to be well organized and managing water flow.

According to the Royal Thai Irrigation Department's O&M Division, the Thai Government had organized associations in the past because of a legislative requirement. However, most were large groups (as many as 1,000 farmers) that did not function, existing only on paper. This was the situation for the Lam Pao project. The department's Lam Pao project officer confirmed during our site visit that several associations had been organized in the early 1970s, but they never really functioned because they were too large. He said that associations of 30 to 50 farmers were best suited to meet local O&M needs of tertiary systems. At Lam Nam Oon, 64 associations had been formed at the time of our visit. The project was about 12 percent complete, and the government hoped to have over 600 water user associations organized upon completion.

An April 1982 World Bank analysis of water user groups at two World Bank projects in Thailand noted some progress in establishing groups during the last 2 years. However, according to the analysis:

> "there is no doubt that in both projects many of these WUAs were created by administrative fiat rather than by systematic build-up of farmers' interest, awareness and concensus. Therefore, it is realistic to consider that a large fraction of these WUAs are paper entities rather than real organizations with viable operating structures and a continuous performance of their functions."

Many established associations lacked the necessary cooperation and organization to establish discipline among association members and ensure equitable water distribution. Consequently, irrigation systems had been vandalized, water wasted or stolen, and routine maintenance ignored. Some of these problems were aggravated by poor project design and construction; however, strong associations should have minimized the vandalism and ensured more equitable distribution of water to users.

CONCLUSIONS

Apparently, part of the problem in forming and maintaining active associations has been caused by the fact that the local

users could not depend on the main irrigation systems for a regular source of water. Implementation of our recommendations relating to funding, design, and construction should lead to irrigation systems with more dependable water supplies to local users.

We believe that there are still other changes that must be made to ensure that water user associations are established. As stressed by AID mission officials and others, we believe that, when organizing water user associations, it is important for each association to be tailored to meet local conditions and to have a strong organizational structure to establish discipline. The local users also must be convinced of the systems' benefits and the importance of good operation and maintenance. Further, they should be included in the design and construction of their on-farm systems. The Subaks and the ongoing pilot projects in each country have demonstrated that when associations have adhered to these principles, they have been more effective in operating and maintaining their on-farm systems.

AID should incorporate provisions in its project designs and loan agreements to ensure that these principles are addressed in future irrigation projects.

RECOMMENDATION

We recommend that before construction of irrigation systems begin, the Administrator of AID require from the host government, written certifications that

- --Active, viable water user associations have been established.
- --Designers have met with association members, discussed their needs and system benefits, elicited their input into on-farm design, and stressed that the on-farm system will be theirs and that they must operate and maintain it.
- --Each association has submitted a written request for the system and has agreed to the on-farm operation and maintenance.
- --Local users to the extent possible will be used to help construct the on-farm portions of each project.

AGENCY COMMENTS AND OUR EVALUATION

AID said that our recommendation is valid, but actions to implement it were not identified other than to consider it in the proposed irrigation policy paper. We do not minimize the potential usefulness of an irrigation policy statement. However, the problems in establishing water user associations exist

even though project documents have specified that they would be formed. These requirements generally were not met. Therefore, in addition to a policy statement, AID needs to take practical and realistic measures to assure that each project requirement is carried out.

AID-FINANCED IRRIGATION PROJECTS INCLUDED IN REVIEW

Country	Project title/ number	Funding source	Amount (note a) millions
Indonesia	[b] Citanduy I 497-0245	AID	$ 12.5
		Host government	12.9
		Other	0
			25.4
	Citanduy II 497-0281	AID	27.0
		Host government	19.3
		Other	0
			46.3
	[c] Luwu 497-0244	AID	4.8
		Host government	6.7
		Other	0
			11.5
	[d] Rural Works II 497-0285	AID	34.8
		Host government	59.5
		Other	13.6
			107.9
	[e] Sederhana I 497-0242	AID	23.7
		Host government	35.6
		Other	0
			59.3
	[e] Sederhana II 497-0252	AID	29.5
		Host government	85.1
		Other	0
			114.6
Sri Lanka	Mahaweli Ganga Irrigation 383-0042	AID	6.0
		Host government	38.0
		Other	37.2
			81.2
	Mahaweli Basin Development I 383-0056	AID	10.0
		Host government	4.2
		Other	.0
			14.2
	Mahaweli Basin Development II 383-0073	AID	85.0
		Host government	113.6
		Other	5.0
			203.6

Country	Project title/ number	Funding source (note a)	Amount (million)
Thailand	[f] On-Farm Water Management 383-0048	AID	$ .8
		Host government	0
		Other	0
			0.8
	Water Management I 383-0057	AID	9.8
		Host government	8.5
		Other	0
			18.3
	[g] Irrigation Loan 493-H-010	AID	10.0
		Host government	38.0
		Other	0
			48.0
	[h] Lam Nam Oon On-farm development 493-0272	AID	4.6
		Host government	39.3
		Other	0
			43.9
	[i] Northeast Small Scale Irrigation 493-0312	AID	8.6
		Host government	8.4
		Other	0
			17.0

[a] AID project papers were the source of contributors and amounts unless otherwise noted.

[b] Citanduy sites visited included Rawa Onom and Ciseel Cross Connection. We also visited the project office and maintenance shop near Banjar, West Java.

[c] Cost estimates are only for irrigation activities, which are part of the Luwu Agricultural Development Loan Project; project now contains several area development and transmigration activities. In Luwu, we visited Bone Bone and Kalaena sites.

[d] Rural Works Program has 446 irrigation subprojects; we visited five subprojects: Karangploso, Jabung, Wajak, Gudanglegi, and Kademangan in East Java.

[e] Sederhana Projects I and II have 1380 subprojects; we visited five subprojects: Ulu Ulu Banyu in East Java and Cibodas, Cilengis, Cipicung and Cumanggala in West Java.

[f] Initially a grant under Mahaweli Ganga Irrigation Project; it is for research to develop methods for land preparation, farm and field channel design, and water delivery procedures.

[g] Project consisted of constructing Lam Pao, Lam Pra Plerng, and Me Tang irrigation systems. We visited the Lam Pao project. Cost estimates are based on AID mission information.

[h] Project represents continuation of AID involvement in Lam Nam Oon area which began in the late 1960s under project to construct a dam and main and lateral canals.

[i] Project consists of rehabilitation and extension of seven projects in Northeast Thailand. We visited the Huai Aeng Project--none of the other six projects had been started at the time of our review.

UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D.C. 20523

ASSISTANT
ADMINISTRATOR

7 JUL 1983

Mr. Frank C. Conahan
Director
National Security and International
Affairs Division
United States General Accounting Office
Washington, D.C. 20548

Dear Mr. Conahan:

This letter is in response to the recommendations in your draft report on Irrigation Assistance to Developing Countries. In the report you recommend that U.S. and other donors' irrigation assistance should require stronger commitments to operation and maintenance. We agree that improper operation and maintenance seriously limit the efficiency of irrigation systems, and shortens the life span of such systems.

As your report points out, more attention must be given to the institutional and financial costs associated with operation and maintenance over the life of the project. To this end, A.I.D.'s May 1982 policy paper on "Recurrent Costs" states "...that if recurrent costs constitute a problem, and LDC government policies are appropriate, A.I.D. Missions may consider funding a portion of the recurrent costs for periods of up to ten years". The recurrent cost support period would also include working with the host country to help assure country commitment.

Your suggestion that the use of locally generated currencies from PL 480 sales might be used to cover operations and maintenance is an appropriate but short-run solution. While missions may agree to the use of these resources for irrigation operation and maintenance costs, it is more appropriate, we believe, to build a technical and financial plan into the project implementation plans as your report suggests.

At the same time, viability of project design and project implementation are continuously under review as an integral part of each irrigation project. The objective of the review is to ensure that each project has a favorable cost/benefit ratio and a good chance to becoming self-sustaining.

We are in full agreement that agricultural and irrigation assistance projects should include farmers and water users as participants in developing the project and as a means of strengthening the local institutional base. A.I.D.'s project design and justification procedure contains a social analysis component which defines these institutional requirements. These criteria will be re-examined and strengthened as necessary.

A.I.D. is also acting in the area of donor coordination. A.I.D. is working closely with other donors, particularly the World Bank and the Asian Development Bank, to develop joint funding and technical assistance arrangements that are to the mutual advantage of the donors and the host country. Although these joint efforts are under consideration world-wide, they are presently being applied to programs in India and Pakistan.

A.I.D. is dealing with the problem of design and construction improvements across countries through in-country training, research, and technical assistance. A main activity in these areas is the "Water Management Synthesis II" project funded jointly by the Asia Bureau and the Bureau for Science and Technology. In addition, the Bureau for Program and Policy Coordination is conducting extensive studies on irrigation projects to determine A.I.D.'s experience in this area and to locate problems. The findings of this analysis will be synthesized in a review report to be prepared by PPC's Evaluation Office. These findings will provide background documentation for the revised Agency policy on irrigation now under consideration.

A.I.D. recognizes the validity of GAO's recommendation on water users associations and is in the process of preparing additional policy guidance on irrigation. Agency policy will emphasize the need to have water user associations in place where necessary.

We also agree that a more comprehensive methodology should be developed to provide further guidance on the creation of viable water users associations and better procedures to involve farmers. One objective of the proposed Irrigation Policy Paper is the development of such a methodology.

The Agency appreciates this opportunity to comment on the GAO report "Irrigation Assistance to Developing Countries Should Require Stronger Commitments to Operation and Maintenance by

Donors and Recipients." Copies of the report have been circulated to our A.I.D. missions in Sri Lanka, Indonesia, and Thailand, and we are awaiting their comments and suggestions. We have welcomed this opportunity to share with you the constructive steps that we have undertaken or are considering to strengthen our irrigation assistance.

Sincerely yours,

John R. Bolton

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