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DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D.C. 20523

PROJECT PAPER

SRI LANKA - Water Management (383-0057)

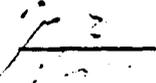
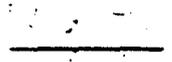
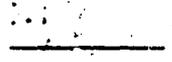
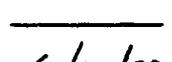
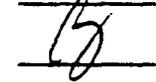
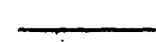
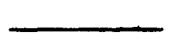
Date: July 1979

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15. PROJECT GOAL (MAXIMUM 240 CHARACTERS) Agriculture development that: 1) increases domestic food production; 2) expands employment opportunities; and 3) improves the small farmers' standard of living.																												
16. PROJECT PURPOSE (MAXIMUM 480 CHARACTERS) Development of an institutional capability to manage large irrigation schemes in Sri Lanka in a more effective and efficient manner with active farmer assistance.																												
17. PLANNING RESOURCE REQUIREMENTS (staff/funds) Under a Requirements Contract Delivery Order with CH2M Hill Engineering Consulting firm, \$123,521 was provided which estimated the man-days to be provided at 297. A feasibility study was prepared for the project by the firm.																												
18. ORIGINATING OFFICE CLEARANCE Signature: <i>John R. Eriksson</i> Title: John R. Eriksson, Acting Director Date Signed: 016 25 79				19. DATE DOCUMENT RECEIVED BY AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION MM DD YY																								

PROJECT PAPER CLEARANCE SHEET

WATER MANAGEMENT

<u>POSITION</u>	<u>NAME</u>	<u>SIGNATURE</u>	<u>DATE</u>
Acting Director	John R. Eriksson		
Chief, Rural Development Office	Richard R. Kriegel		
Regional Legal Advisor	Douglas Robertson		
Program Officer	Clark H. Billings		6/20/79
Controller	Douglas Franklin	D.C.F.	6/19/79
Project Development and Support	James Meenan		6/20/79
Chief, Water Management Division	Ken Lyvers		

PRINCIPAL ABBREVIATIONS AND ACRONYMS USED

APC	-	Agricultural Productivity Committee
APAC	-	Asia Project Advisory Committee
ARTI	-	Agrarian Research and Training Institute
CO	-	Cultivation Officer
CRB	-	Cooperative Rural Bank
DA	-	Disbursing Authority
D&C	-	Design and Construction
DSB	-	Development Support Bureau
FAO	-	Food and Agricultural Organization
GNP	-	Gross National Product
GSL	-	Government of Sri Lanka
IBRD	-	International Bank for Reconstruction and Development
ID	-	Irrigation Department
IDA	-	International Development Association
IEE	-	Initial Environmental Examination
IRR	-	Internal Rate of Return
IRRI	-	International Rice Research Institute
JSPS	-	Jala Sampath Palaka Savahawa
KVC	-	Agriculture Extension Worker
MADR	-	Ministry of Agriculture Development and Research
MPC	-	Multi-Purpose Cooperative
MLLD	-	Ministry of Lands and Land Development
O&M	-	Operation and Maintenance
OFWM	-	On-Farm-Water Management
PES	-	Project Evaluation Summary
PID	-	Project Identification Document
PP	-	Project Paper
RFP	-	Request for Proposal
RVDB	-	River Valley Development Board
SLFP	-	Sri Lanka Freedom Party
TA	-	Technical Assistance
UNP	-	United National Party

Crop Year

Maha Season	-	November through February
Yala Season	-	May through September

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* Retained in ASIA/PD and with USAID, Sri Lanka and can be borrowed on request.

WATER MANAGEMENT PROJECT

PART I SUMMARY AND RECOMMENDATIONS

A. Recommendations:

1. General Terms. It is recommended that a loan and grant with a combined total of U.S. \$9.8 million be authorized to enable the Government of Sri Lanka to finance the partial costs of a water management project as described below. The total project cost is \$18.34 million of which \$3.0 million is proposed for USAID grant funding, \$6.8 million loan funding and \$8.54 million (rupee equivalent) by the Government.
 - a. Proposed Grant. The grant will not exceed \$3 million and could be budgeted annually over U.S. fiscal years 1979 to 1981. The proposed grant would cover the entire cost of technical assistance, the major cost of socio-economic research and the cost of a mid-project evaluation. The Mission believes there is a strong case for grant funding of technical assistance in view of Sri Lanka's low per capita income and growing foreign resource gap.
 - b. Proposed Loan Terms.

Loan Amount: Six Million and Eight Hundred Thousand U.S. Dollars (\$6,800,000).

Maturity: Forty (40) years including a ten (10) year grace period.

Interest: Two percent per annum during the grace period and three percent per annum thereafter.

Currency: Interest and principal repayable in U.S. dollars.
 - c. Proposed Funding.

While the Mission would prefer to fully fund this project in FY 1979, funding availabilities may necessitate tranche funding of both the grant and loan components over three years. In view of these limitations it is proposed to fund this project as follows:

	<u>Grant</u>	<u>Loan</u>	<u>Total</u>
1979	\$ 500,000	\$ 5,400,000	\$ 5,900,000
1980	\$1,250,000	-	\$ 1,250,000
<u>1981</u>	<u>\$1,250,000</u>	<u>\$ 1,400,000</u>	<u>\$ 2,650,000</u>
Total	\$3,000,000	\$ 6,800,000	\$ 9,800,000
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2. Borrower and Recipient Agencies. The Borrower is the Government of Sri Lanka and the Implementing Agency is the Department of Irrigation, Ministry of Lands and Land Development.
3. GSL Contribution. The total GSL direct contribution is estimated to be U.S. \$8.54 million equivalent in local currency which is 46.6% of the total estimated project cost.
4. Source and Origin. Source and origin will be Code 941 (U.S. and other selected Free-World countries) and the cooperating country (Sri Lanka) for the loan and U.S. Code 000 and Sri Lanka for the grant.

B. Description of the Project:

1. Why.

Sri Lanka is an island about 66,000 square kilometers in area (about the size of West Virginia) lying off the Southeast coast of India. With a 1977 capita income level of \$160 U.S., Sri Lanka remains a very poor country in overall economic terms. It is predominantly an agricultural and rural country. About fifty percent of its labor force is in agriculture and almost eighty percent of its population is classified as "rural".

All the main irrigation systems in Sri Lanka are releasing more water for irrigation and other purposes than is actually required or is desirable. In one particular report, issues of water from several existing reservoir sluices were equivalent to 12 to 39 acre feet of water per acre per year. Another study shows that in one district the amount of irrigation water needed to supplement rainfall to meet the evapo-transpirational demand for two crops was less than 2.5 ft of water per year in three out of four years. A Government survey of 15 irrigation schemes showed the water duty to average 12 acre-feet whereas successful cultivation was possible with only 8 acre-feet. Another report concluded that during an average year an amount of water equivalent to about 80% of the irrigation water released to the present projects is escaping from the areas by surface or subsurface drainage.

Most of these water management problems and inefficiencies in water use stem from the lack of operational control of the project

facilities and excessive water use on the farm by those farmers, usually at the head of the system who can physically take excessive amounts of water. The lack of operational control means the system cannot deliver pre-scheduled flows of water to various parts of the system including the farmer's field. Therefore, when the farmer can do so, he will take more water than he needs since he is not sure of either the timing or amounts of the next delivery. Much water is also wasted which would be partially re-used through a planned drain recapture and re-use program. Another major problem interfering with good system water use, as well as giving concern for public health reasons, is water deliveries for domestic or household use, which are made periodically during the non-irrigation season.

Increased food production and small farmer incomes are major objectives of this project. As indicated in the Government's Public Investment Plan for 79 - 83, paddy (which is the primary crop being grown on the left bank irrigation area of Gal Oya) is the single most important crop in the country, influencing the overall performance and viability of the economy. It is grown primarily by relatively small (5 acres or less) low-income (less than \$100 per capita) farmers. A country-wide production target of 110 million bushels has been set for 1982 - 83, which is 22 percent over the 90 million bushel level of 1977 - 78. Sri Lanka, which even during the bumper year of 1978, imported rice equivalent to 11.92 million bushels of paddy, must achieve this target at a minimum in order to achieve self-sufficiency. This target will be achieved through increased acreage, productivity, and cropping intensities. This Water Management Project will directly increase production in the Gal Oya area by improving water management and will through its training, extension, research and planning components improve water management and increase agricultural, especially rice production and small farmer incomes in other parts of the country. In the Government's Public Investment Plan the GSL has further outlined its water management policy as follows:

"To meet the problem of water management, in general, the Government has decided on a whole series of measures. Water Management Committees, consisting of officials and farmers, will be established to take decisions in respect of the issue of water and cropping patterns. Farmer participation and involvement in water management for the good of the farmers will be ensured and strict discipline in matters of water issue and water use will be enforced. To assist the government in enforcing water management, steps have been taken to introduce water charges under the legislation enacted in 1979. This measure will also help in the recovery of a portion of operation and maintenance cost. The Government also intends to recover a part of the capital cost of the development of irrigated land through sale of state land to settlers, either in the form of outright payments or installments".

This project will assist the GSL in carrying out this policy.

2. What.

This project will develop an institutional capacity in the GSL Irrigation Department which will enable it to manage large irrigation schemes in a more efficient manner. Specifically the project will modernize the left bank of the Gal Oya irrigation system, (a major system located in the Eastern Region of Sri Lanka), develop master plans and conduct on-farm water management research both at Gal Oya and Uda Walawe (a major irrigation project located in the Southern Region of Sri Lanka), improve country-wide irrigation training and extension programs, improve the central support provided by the Irrigation Department in water-use systems maintenance and operation, and assist the Government to formulate irrigation organizations whereby farmers will participate in the building, operation and maintenance of field channels. For most of these project elements, operating and maintenance procedures and other techniques will be developed which can be replicated throughout Sri Lanka. All project elements will be coordinated and directed to not only benefit the farmers in the Gal Oya irrigation system but to assist in other areas of the country.

The Gal Oya left bank system, which is composed of 32 miles of main canals, 50 miles of major distributaries, and 68 miles of minor distributaries and field channels, will be modernized and improved to gain operational control of the water. Initially, socio-economic research will be conducted to test several "models" of irrigation organizations. On the left bank, by the end of the project, about 19,000 farmers with 57,000 acres of land will be organized, and will rehabilitate their field channels and operate and maintain them more efficiently.

Master Plans will be developed for both Gal Oya and Uda Walawe Systems to include return flow re-use, operation of main canal and tank systems, and domestic water. An on-farm water management research component will be conducted in each system to study ways to improve the lay out of field channels, to level land and to study and obtain farmers' assistance in better water management practices. Training will be given a major emphasis and will include everyone from the farmer and the lower level irrigation and agriculture officials to higher level officials and policy makers.

3. How.

The Irrigation Department of the GSL will be the principal implementing agency for this project. In Colombo, a Central Support Office will be created within the Irrigation Department to support and coordinate at the national level, project activities as well as to be responsible for the overall supervision of field activities including project design, documentation and implementation. This office will provide country-wide training assistance and coordination as well as develop

country-wide operation and maintenance procedures. It will direct and assist in the master planning and on-farm research efforts in both Gal Oya and Uda Walawe. A special Field Project Office will be set up in Gal Oya. It will consist of two separate divisions, the Master Planning Division and the Operations and Maintenance Division. The Master Planning Division will be responsible for the three major planning components; Re-use Plan, Main Canal Plan and Domestic Plan. The Operations and Maintenance Division will consist of two sections; the Operations Section which will operate the system and the Maintenance Section which will rehabilitate and maintain the system. Technical assistance will be provided to both the Central Support Office and the Field Project Office by an engineering and management consultant advisory team.

The main steps, some of which will be accomplished concurrently during project implementation, will be:

- a. Preparation and signing of the consultants contract under the AID grant.
- b. Equipment and commodities procured.
- c. Aerial photo maps completed for the Gal Oya area.
- d. Initial Left Bank modernization/rehabilitation plans completed.
- e. Research executed and Master Plans developed for Gal Oya and Uda Walawe areas.
- f. Local and overseas training conducted.
- g. Operation and maintenance procedures developed and implemented by trained staff.
- h. Pilot irrigation organizations tested and then replicated for entire Left Bank of Gal Oya area.
- i. Left Bank of Gal Oya modernized.

AID support to the project will be through grants to cover the cost of the technical assistance, mid-project evaluation, and the social science and water management research. The loan will cover the cost of the equipment, commodities and training. Frequent site inspections and project reviews will be made by the Irrigation Department and USAID. AID direct hire personnel requirements for the project will be a minimum of one full-time American and one full-time national employee engineer.

C. Summary Findings of the Project Paper:

The CH2M Hill report, "Proposed Water Management Program for Major Irrigation Schemes in Sri Lanka," while providing the overall basis for this project, was too ambitious for either the GSL or USAID to undertake. This report proposed a major eight year effort to modernize and rehabilitate the two largest irrigation systems in the country which along with other proposed elements would cost nearly \$80 million. The GSL thus decided to focus reconstruction and modernization activities on the left bank of the Gal Oya irrigation system and simultaneously emphasize planning, organizations, research, and training with country-wide scope. By limiting and more narrowly focussing this construction effort in a shorter period of time than envisioned in the Hill report, and at the same time by doing the planning, research, training and the other aspects, we believe the resulting project is technically, socially, economically and financially sound.

The Technical Analysis (Part III A) provides the technical details of the project and demonstrates the project to be technically feasible and sound. A description of both the administrative and social aspects of the project as given in Part III B and D also prove these areas to be sound. The Economic Analysis of the project is provided as Part III C which gives an IRR of 23% (by using a sensitivity analysis the IRR varies from 13% to 32%) and thus indicates that the project constitutes a very efficient allocation of economic resources. The Financial Analysis and Plan are provided in Part IV and the Mission concludes that reasonably firm estimates of Project costs have been made.

The project will help upgrade the capability and efficiencies of the Irrigation Department, through its technical assistance and training components. Thus while the Irrigation Department's budget will increase from 12 to 20 percent each year with this project, this will not impose an unrealistic burden on the GSL.

During the Project Identification Document (PID) review, a number of environmental concerns were raised and satisfied. However, a summary of the analysis is included in the Paper (Part III - E). This examination shows the project to be neutral to mildly positive with an overall positive impact in the Gal Oya area. The Mission endorses the proposed loan and grant (Mission Director's certification is provided as Annex 1) and certifies that it meets all statutory criteria (Annex 2). Furthermore, the Government's request for assistance is provided in Annex 3

D. Project Issues :

The initial PID for this project was approved by APAC on July 19, 1978 with a total USAID life-of-project funding of \$6 million. As the project evolved through various consultant reports and finally as defined in the CH2M Hill study, it became apparent that the water management problem in Sri Lanka was much greater than envisioned when the PID was submitted. Not only did a package of improved operations and maintenance procedures need to be designed and implemented for major irrigation systems, and research concerning on-farm water management need to be conducted (which was the major purpose of the earlier project described in the PID), but major irrigation systems also need to be rehabilitated and modernized to gain operational control of the irrigation water. Unless water is controlled and provided to the farmers' field in a reliable manner it will be extremely difficult to persuade farmers to use water efficiently and other water management efforts are not likely to be as effective as they could be. This project therefore had to be re-designed to include modernization of the Left Bank of the Gal Oya. The remainder of the Gal Oya and other major systems like the Uda Walawe will also have to be modernized and rehabilitate in the future, either with or without USAID and other donor assistance, if these systems are to reach their potential for increasing production of the Sri Lanka farmers.

Issues raised previously by AID/W in the PID approval message (attached as Annex 4), which are addressed in this Paper, are briefly covered as follows:

1. Water loss information: Additional information was gathered by the consultants in the preparation of their study, which shows all systems are issuing much more water than required for double cropping. Additional research will be conducted as part of the project and the water measurement capability of both the Gal Oya project staff and the Irrigation Department are being enhanced under this project. (See Part II & III).
2. Selection Criteria: Selection criteria for location of the project included potential for saving water and increasing production as well as the potential for active farmer and official participation and involvement (See Annex 5, Chapter 5).
3. Project Economics: The PP includes a detailed analysis of the economic benefits and cost of the water management project. (See Part III C).
4. Cost Sharing: The Government has recently increased the land improvement charge per acre from Rs.6 to Rs. 20 - 30 per acre as a step in the direction of more adequate cost sharing. Also, as part of this project, the farmers are expected to contribute

their labor in rehabilitating their field channels and then to operate and maintain them in the future as members of their irrigation organization.

5. Local Participation: Organizing farmers into viable water user or irrigation organizations in which they influence the allocation of irrigation water is an integral part of this project. Both USAID and the GSL believe such organizations are essential to improved water management. Since neither the GSL or USAID has a strong belief that one type of irrigation organization is superior to another, the initial socio-economic research will be conducted to test several different models. By the end of the project, about 19,000 farmers are expected to be organized into irrigator organizations based on which ever model (s) worked the most successfully on a pilot basis. This experience is also intended to suggest replicable model (s) for the rest of the country (See Part III-A-7 and Annex 12)
6. Past Experience: The Mission drew heavily upon AID-supported water management and small scale irrigation projects currently being implemented in Pakistan and the Philippines in putting together this project.

E. Project Team:

The Project Team which was responsible for preparing this Project Paper is as follows:

GSL:

Nanda Abeywickrema, Sec. Min. of Lands and Land Development
A. Maheswaran, Director of Irrigation
E.W.M. Perera, Director Planning, Min. of Finance and Planning
S.M.F. Marikar, Dep. Director of Agricultural Economics,
Min. of Lands and Land Development
K.D.P. Perera, Dep. Director of Irrigation
P. Sangaravel, Dep. Director of Planning, Min. of Finance and Planning
Achiel Mohamed, Addl. Director of External Resources,
Min. of Finance and Planning
D. Amarasinghe, Director of Technical Education, Min. of Higher Education
Justin Abeygoonsekera, Addl. Sec., Min. of Agriculture, Development
and Research
Tilak Palamakumbura, Chairman of River Valley Development Board

USAID:

1. Sarah Jane Littlefield, Director
2. John R. Eriksson, Assistant Director
3. Clark H. Billings, Program Officer
4. Douglas S. Franklin, Controller
5. James R. Meenan, Capital Development Officer
6. Richard Kriegel, Chief, Office of Rural Development
7. Ken Lyvers, Project Manager
8. Charles Antholt, Agriculture Development Officer
9. John Roberts, Capital Development Officer (AID/W)
10. Senaka N. Abeyratne, Agricultural Economist

F. Relationship With Other USAID Projects

The Water Management Project can be viewed as a centerpiece for much of the USAID Program of Assistance to the Government of Sri Lanka. Water Management per se is a vital activity within the Mahaweli Ganga Irrigation Project and the On-Farm Water Management Project. The Agriculture Base Mapping Project will provide improved information on cropping patterns in the project area. The Rice Research Project is specifically committed to undertake research in the Gal Oya area related to developing brown leaf hopper resistant varieties of rice and overcoming soil deficiencies. The Agricultural Inputs Project provides an AID fertilizer assistance strategy which supports our general agricultural sector strategy and more specifically assures to a large extent adequate fertilizer inputs for the Gal Oya farmers.

The Agricultural Education Development Project through the Faculty of Agriculture in the University of Sri Lanka, Peradeniya Campus and the Post Graduate Institute of Agriculture, will be both directly and indirectly involved in the Water Management Project. The Malaria Control Project, including the new amendment, will continue to provide support to the Gal Oya Project area as well as to other major irrigation systems, including Uda Walawe and the Mahaweli Basin Program. The Paddy Marketing Board Project has one of its major rice milling complexes located in the Gal Oya area. Implementation of the proposed Watershed Reforestation and Firewood Development Project will directly effect the Gal Oya River Basin area. Finally, the experience gained from this project will have direct and important relevance to AID's proposed assistance to the Mahaweli Basin Program.

The relationship between all of these Projects and the Water Management Project is a two way street. They directly or indirectly assist and support each other in a wide variety and scope of activities including research, training, technical assistance, planning and implementation.

PART II THE PROJECT

A. Background:

The problem of water management is both larger and more complicated in Sri Lanka than the Mission originally suspected. This is partially confirmed by the Agriculture Sector Assessment for Sri Lanka drafted in March-April of 1978. As stated in this assessment, USAID should concentrate on helping the Government of Sri Lanka (GSL) address the problem of low efficiencies of water delivery and field use. The Assessment Team further recommended that AID accord a very high priority to a water management effort over a period of not less than 10 years and preferably up to 20 years. They also proposed that a project preparation team of five highly qualified and experienced personnel develop the details of the project and prepare a project paper for submission and FY 1979 funding.

Recognizing the need for better water management, USAID, at the request of the GSL, commissioned two studies in April of 1978 on this subject.^{1/} In Wickam's opinion the two most important problems of water use in Sri Lanka are disorganized cropping schedules and the overuse of water at the head ends of systems with a corresponding water shortage at the tail ends of systems. He suggested that a major project should be supported by USAID which would address these two major problems. Kemper^{1/} illustrates the high inefficiency of water use by examples of the use of 12 to 39 acre-feet of water per year, when in one district 2.5 feet of water along with the normal rainfall is adequate in 3 years out of 4 for double cropping of both paddy and legumes. He further concluded that a total of 8 feet of irrigated water per year is adequate in Sri Lanka's irrigation systems and that while the average is 10 acre-feet per acre being actually released from impoundments (not including rain), about 80% is escaping from the project areas by surface or subsurface drainage. He suggested a program which included extensive education of the farmer and the training of extension, agrarian services and irrigation personnel in better water management practices.

Many donors including the IBRD, UNDP and the FAO have long recognized the need for better water management.^{2/} In recent years the Government of Sri Lanka and especially the Irrigation Department, which is primarily responsible for the operation and maintenance of major irrigation schemes, has taken steps to improve water management. In February, 1978 the then Ministry of Irrigation, Power and Highways issued a policy directive entitled "Water Management

^{1/} See Thomas Wickam's report titled "Supplementary Report on Water Management" and Doral Kemper's report "Apparent Investment Potentials for Increasing Food Production through Improved Water Management in Sri Lanka".

^{2/} See IBRD Reports No.PA-134 of 8 February 1973; No.1425 HCE dated February 28, 1977; and No.1937-CD of March 22, 1968. A major FAO/UNDP report "Water Management for Irrigated Agriculture (Gal Oya Irrigation Scheme), Sri Lanka, Project Findings & Recommendations", UNDP/FAO, Rome 1975 is attached as Appendix 5 to CH2M Hill Report.

in Irrigation Schemes". This directive cites data from the Agriculture Department indicating that successful cultivation for both the Yala and Maha seasons is possible in the Dry Zone with a water duty of 8 acre-feet. A survey of 15 tank schemes showed actual water duty to be 12 acre-feet. The directive also gave some of the major causes of excessive water use in existing schemes and provides a listing of the remedial measures required. The report further commented on the Mahaweli Scheme by saying that unless substantial economy on water use is achieved in the future, the scheme could run into difficulties.

To further the process of water management, some of the needed changes in the legal and organizational infrastructure were identified in a statement forwarded by the Irrigation Department to the then Ministry of Irrigation, Power and Highways (now Ministry of Lands and Land Development) in September 1978. The statement addressed procedures to be adopted on irrigation schemes and proposed some changes in the Irrigation Ordinance. Among the topics addressed were the maintenance of irrigation systems, cultivation meetings and water issue, distribution of water, offences by cultivators, and encroachment. The statement emphasized the organizational arrangements needed to rationalize the operation of irrigation schemes and defined the roles of Irrigation Department^{3/} and farmer organizations in the maintenance of irrigation systems.

Efforts are now underway to revise and update the Irrigation Ordinance and also revise the Operations and Maintenance Manual. There is now close coordination between the Irrigation and Agrarian Services Department in making changes in the water law revision of the Agrarian Services Act which will help promote water control and management.

The Project Identification Document (PID) was submitted to AID/W on May 2, 1978 and approved by the ASIA Project Advisory Committee (APAC) on July 19, 1978 for Project Paper development. While subsequent in-depth research and project design activities raised the general need for and magnitude of the project, the concept remained valid and of major concern to the Government of Sri Lanka. This subsequent research showed the problem of water management to be much greater than initially envisioned, finding that most older irrigation systems in Sri Lanka would have to be extensively modernized and rehabilitated in order to gain operational control of the irrigation water.

In mid 1978, AID commissioned the CH2M Hill engineering consultancy firm to define the details of a program of assistance to the Government of Sri Lanka for the improvement of water management on major irrigation schemes in the Dry Zone. During October and November 1978, a five-person team spent 7 weeks in Sri Lanka reviewing the literature, interviewing Government officials, visiting irrigation projects, analyzing problems and drawing up details of a proposed water management program. Their report, which is attached as Annex 5, outlined

3/ The need for organizational effectiveness as a requirement for rapid economic development in Sri Lanka, along with investment and innovation, was previously highlighted by W. Howard Wriggins, Ceylon, Dilemmas of a New Nation, Princeton University Press 1960.

a major program of water management over an eight year period with a total estimated cost of \$79 million and included major modernization and rehabilitation of the two largest irrigation schemes in Sri Lanka (Walawe and Gal Oya).^{4/} Other aspects of the proposed program included an improved training program, improved extension, expanded central support for the Irrigation Department and a social research program.

As indicated in the CH2M Hill report and as noted by many others, including other donors, the lack of adequate maintenance of existing irrigation systems has been a major contributing factor to poor water management in the country. The Government has recognized the problem and has doubled the funds available for maintenance this year from Rs.30 to Rs.60 per irrigated acre. The Irrigation Department is now pressing the Government to increase this rate to Rs.125 per irrigated acre for the next year.

A related problem to this lack of maintenance has been the need of farmer involvement through both improving the distributory system and through increased water charges per acre. Water rates have recently been increased from Rs.6 to Rs.30 per acre if water is received for both the Yala and Maha seasons. Indications are that these rates are likely to be further increased in the future to at least cover the maintenance cost. It is also expected that under this project the farmer, through his irrigation organization will be responsible for both the maintenance and operations of the system at the distribution level. This will help reduce the burden on the Government and increase the farmers involvement in the lower part of the delivery system which does not belong to him.

The Gal Oya irrigation project area is located in Amparai and Batticalca Districts on the eastern coast of Sri Lanka, almost due east from Colombo. About 110,000 acres are fully irrigated during the Maha (Winter season) and about 60,000 in the Yala (Summer season). Irrigation comes primarily from the Senanayake Samudra dam and reservoir which was constructed from 1949 to 1951 by Morrison-Knudsen International Co.Inc. of Denver, Colorado. This is a multi-purpose dam designed initially to provide flood protection, irrigate 42,000 acres of new land, generate power and provide drinking water for 20,000 people. The Left Bank irrigation system, which will be modernized under this project, was built by the Irrigation Department and was turned over to the Gal Oya Development Board in September of 1955. A series of minor tanks and detention reservoirs were also constructed by the Board on the Left Bank to check floods and enable additional water resources to be made available for irrigation. The following Vicinity Map shows the location of the Gal Oya system in Sri Lanka. The Gal Oya Project Map includes the Left Bank, the Right Bank which was built later, and the Central System which is generally a system of river diversions dating from historic times.

^{4/}

See, "Proposed Water Management Programs for Major Irrigation Schemes in Sri Lanka", prepared for USAID by CH2M Hill in February 1979, in Annex 5.

The Uda Walawe project area (see Vicinity and Uda Walawe Maps) is located in the southern part of the country. The area is irrigated primarily by the Uda Walawe dam and reservoir which was designed by an American firm, Engineering Consultants, Inc. in 1962 and was constructed by the Government between 1963-68. Currently, only 33,000 acres are developed, primarily for paddy during the Maha season. This acreage drops to 20,000 during the Yala due to poor water management and the lack of water. According to the CH2M Hill report, 69,000 acres of land could be double cropped if the systems were modernized and the Left Bank completed and if better water management practices were initiated.

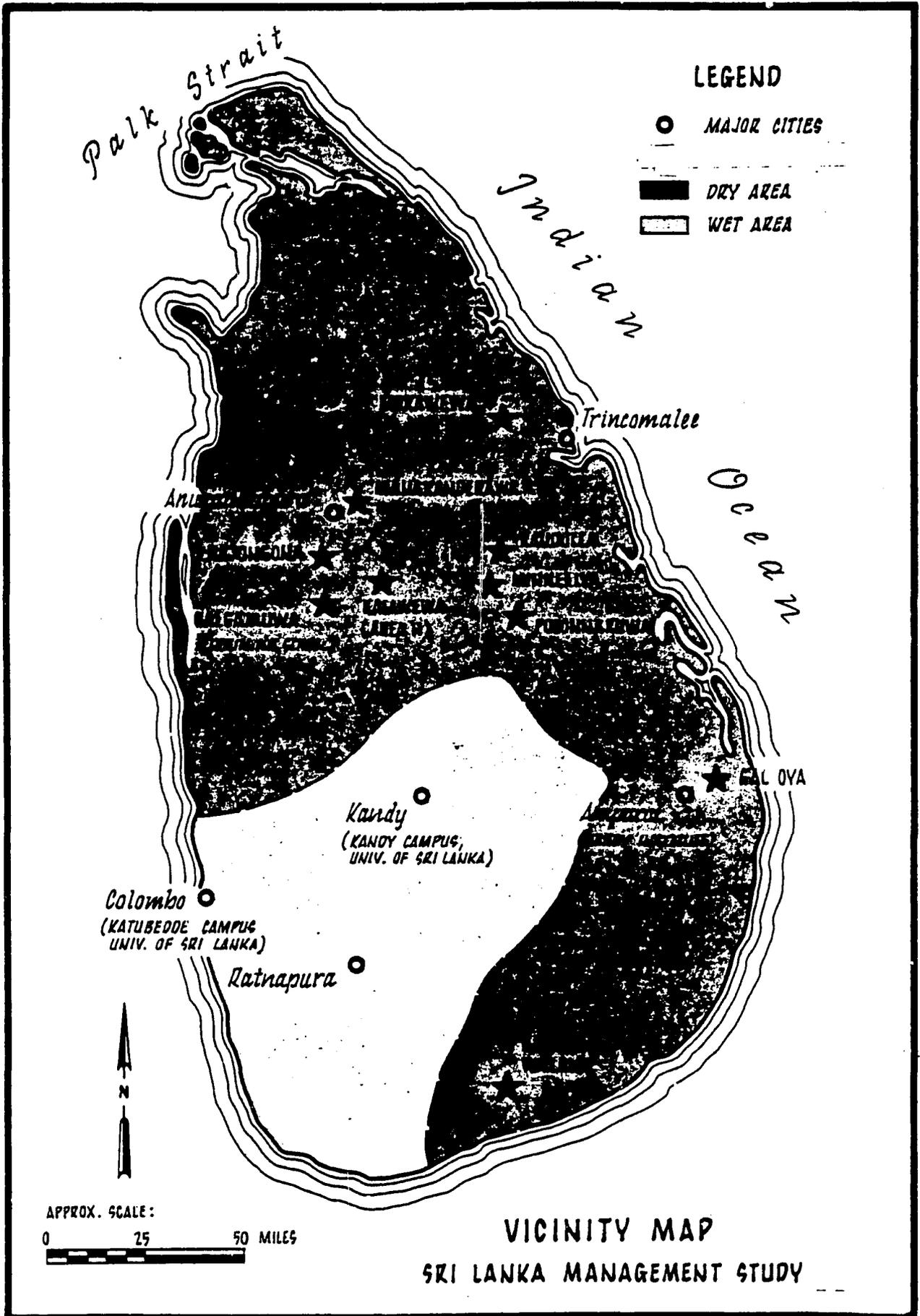
B. Relationship to AID Objectives and Other Donors:

This project is considered the first of several possible efforts in the Irrigation Sector during the next six years and the relationship of this project to AID objectives is quoted from the CDSS as follows:

"A major assistance program to improve water management throughout the country will also be getting underway at the beginning of the CDSS period. The findings of recently-completed project development work suggest that the problem is both larger and more complicated than originally suspected. Current irrigation water usage runs twice that needed for current rice production. The implications of more efficient use for increased yields, cropping intensities, and total production are therefore substantial. The problem is pervasive, ranging from system design to construction standards, to operation and management, and to farmer use, attitudes and organization. USAID anticipates that the experience gained during the first phase will lead to follow-on efforts during the CDSS period".

The CDSS proposes \$40 million of assistance to irrigation and related projects from 1981-85.

Nearly all of the major donors are involved with irrigation and related aspects of water in Sri Lanka. This is particularly the case with development of the Mahaweli Ganga where the World Bank, IDA, Canada, Netherlands and the United Kingdom are providing funding in addition to the U.S. Several donors are also involved with modernization of Sri Lanka's traditional tank irrigation and drainage system (United Kingdom, World Food and IDA). However, no donor other than AID, is involved in a major water management project such as this one.



LEGEND

○ MAJOR CITIES

■ DRY AREA

□ WET AREA

Palk Strait

Indian Ocean

Ocean

Trincomalee

ARU

PAL OYA

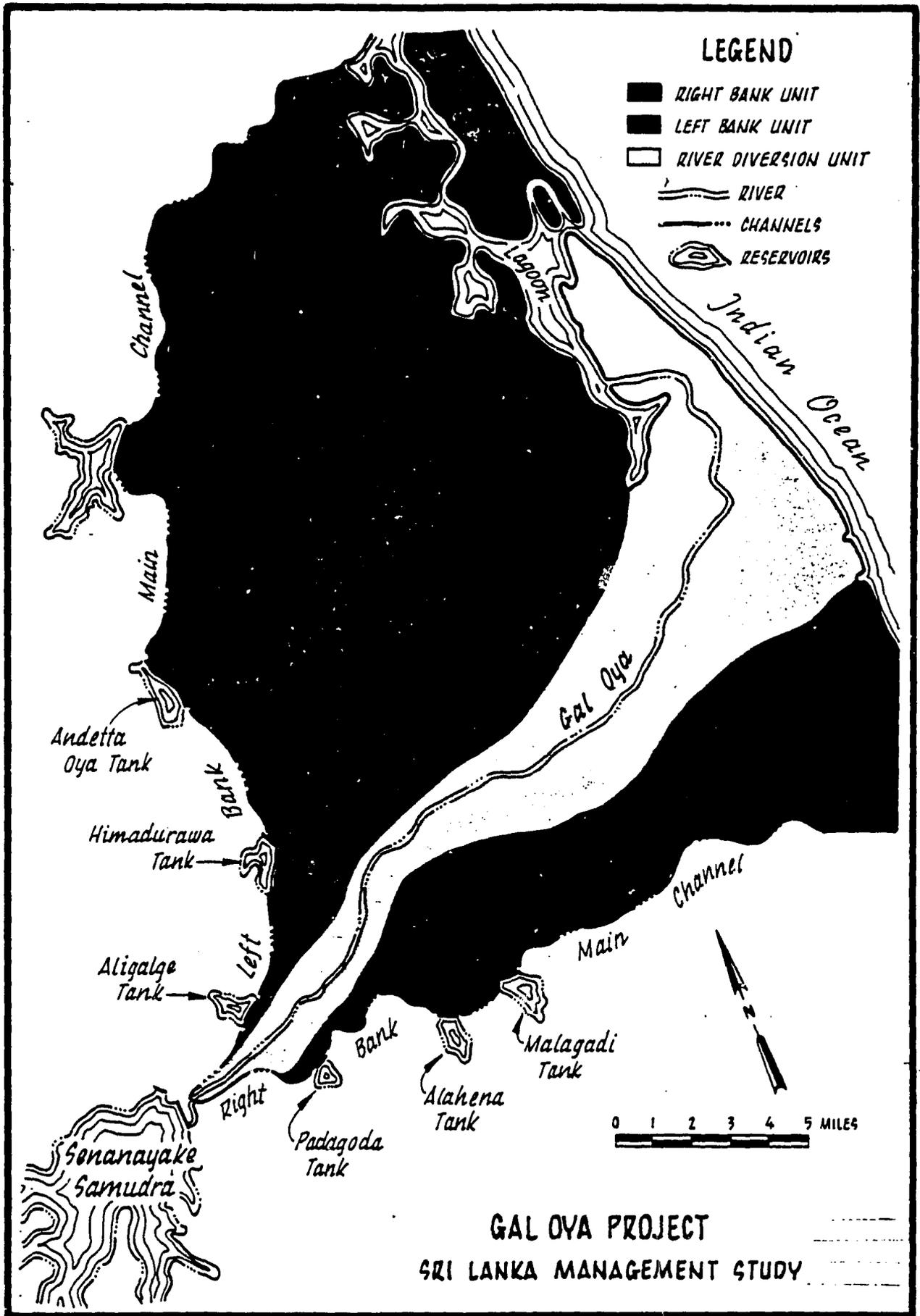
Kandy
(KANDY CAMPUS,
UNIV. OF SRI LANKA)

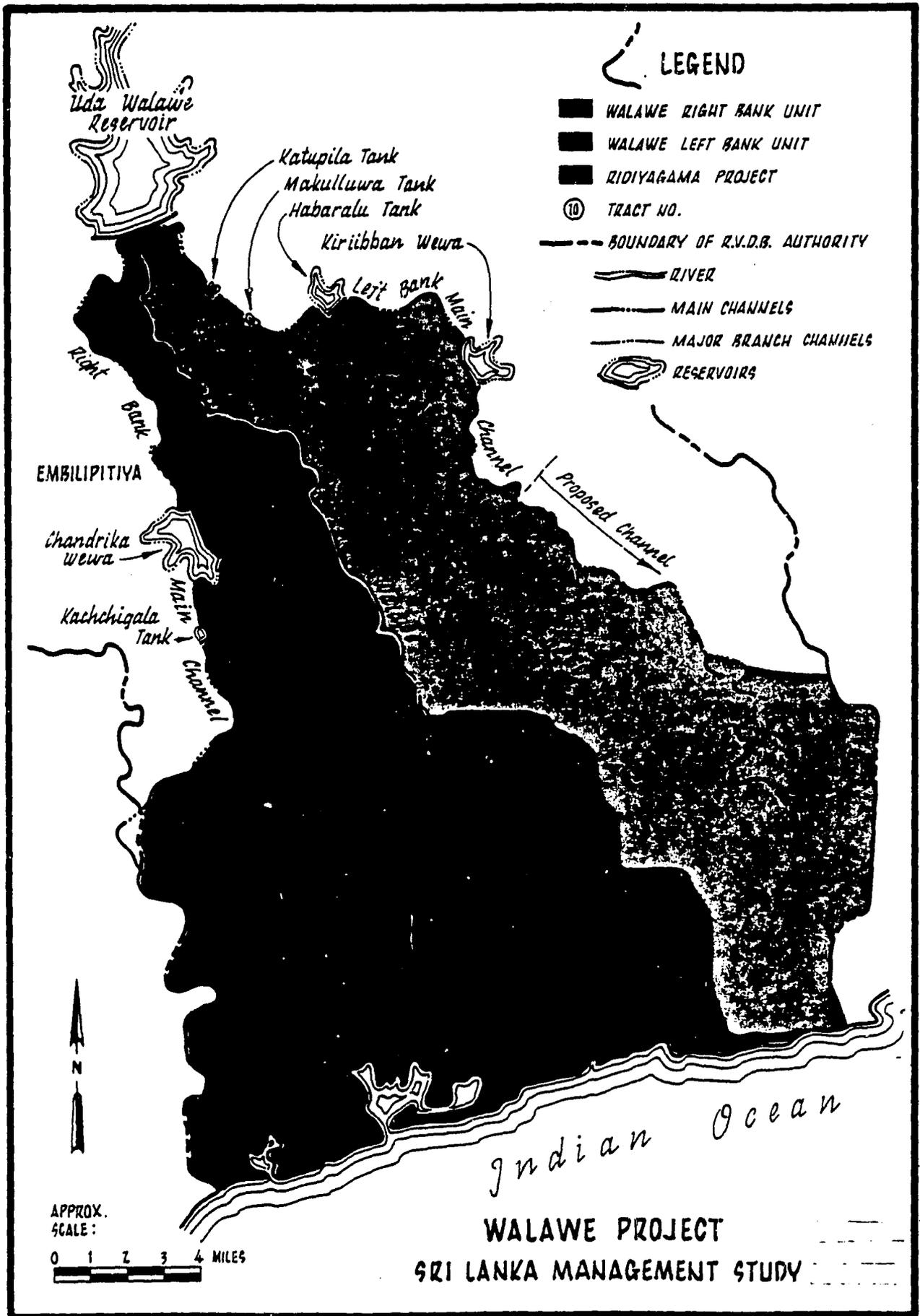
Colombo
(KATUBEDDE CAMPUS
UNIV. OF SRI LANKA)

Ratnapura

APPROX. SCALE:
0 25 50 MILES

VICINITY MAP
SRI LANKA MANAGEMENT STUDY





C. Project Description

1. Long Range Planning Activity

This project is viewed as the first of a possible series of major efforts by USAID over the next 20 years to assist the Government of Sri Lanka to improve water management in the country with special emphasis on major irrigation schemes. The CH2M Hill report, while providing the basis of the Mission's first project as described in this paper, was much too ambitious for either the GSL or USAID to fully undertake at this time. The report was very useful in explaining in financial and technical terms, how costly and difficult it would be to improve water management in the country on large irrigation schemes, since these systems have to be rehabilitated to gain operational control of the water.

2. The Project

The purpose of this project is, "To develop an institutional capacity in the GSL Irrigation Department which will enable it to manage large irrigation schemes in a more effective and efficient manner." The logical framework, which provides the specific outputs, inputs, objectively verifiable indicators, as well as the means of verification and assumptions, is attached in Annex 6.

After detailed discussions with the Government, a decision was taken that major modernization and rehabilitation work would only be undertaken in one of the two major irrigation schemes recommended by the Consultants. Therefore, in this first four-year project, construction work will be undertaken on only the Left Bank of Gal Oya, but master planning and on-farm research will be carried out in both Gal Oya and Uda Walawe systems. Other major aspects of the project are extensive training, central support, socio-economic research, extension work, and assisting the GSL in organizing farmers to participate in determining the allocation of irrigation water and to rebuild, operate and maintain field channels. All of these project elements will be coordinated and directed so as to provide direct and indirect benefits to the major irrigation schemes in Sri Lanka. The major End-of-Project outputs and objectives are further defined as follows:

a. The Gal Oya Modernization Scheme:

- Prepare a modernization/rehabilitation plan for Left Bank System.
- Remove silt and restore eroded banks on the main Left Bank, its branch and tributary canals, and the large field channels. Repair and replace control gates and install measuring devices.

- Reshape and regrade field channels on Left Bank system with farmer assistance to provide flows required by delivery schedules. Also, install adequate farm takeouts and added regulators to facilitate internal rotation of water.
- Re-organize and appoint staff, equip and train a water management field office which will have the responsibility for the operation, modernization and maintenance of the system.
- Prepare maps of the irrigated service areas for canal systems. Prepare and implement delivery schedules for those field channels for which water delivery can be guaranteed.

b. Planning and On-Farm Research (Gal Oya and Uda Walawe)

- Plan and implement with farmer assistance a detailed water management program on one tract in each system. (Tract 3 in Uda Walawe and Unit 21 in Gal Oya). Elements of the program would include analysis of physical and social reasons for current water use practices, on farm management training, advice, equipment, and financial assistance for earthworks, maintenance and modification of structures, and provision of facilities for special water measurement and control.
- Prepare plans to extend the program on the one tract to all tracts and begin implementation in other tracts with farmer assistance.
- Prepare three master plans for each of the two major systems:
 - (1) Conduct a drain and river flow measurement program. Prepare a master plan for reuse of water and an estimate of program costs.
 - (2) Prepare a plan to optimize the operation of the Left and Right Bank main canal systems.
 - (3) Prepare a domestic water plan to meet the requirements for domestic and animal use without wasting water or damaging structures.

c. Training Program:

- Establishment of a permanent water management training school under the Irrigation Department at Galgamuwa. The school would run four courses which are further explained in Part III 1 - 4., but would include:

- (1) An annual four-week course for 15 staff irrigation engineers and senior technical assistants.
 - (2) A 12-week course for 40 staff technical assistants twice a year.
 - (3) A 12-week apprenticeship course for 40 newly trained and recruited technical assistants annually.
 - (4) A one-week course for 160 students of the National Diploma and Technology (NDT) course to familiarize students with the use of laboratory and field equipment.
- The provision of equipment and training for four staff members to strengthen the NDT course in civil engineering at Katubedde and the Hardy Institute, Amparai.
 - Three special two to four week courses for a total of 150 persons of the Irrigation Department, Agrarian Services Department and farm leaders at the Hardy Institute in Gal Oya.
 - Special short courses or in-service training in water management at the Agriculture Training School for 80 agriculture extension workers annually.
 - Special farmer leader training in water management and related subjects will be taught at the Agrarian Services Centers for an annual total of 480 farmer leaders.
 - Two Types of Participant Training will be Provided:
 - (1) A special 3-month training course at the International Rice Research Institute, Philippines and in the United States for a total of 12 training instructors, project staff of Gal Oya, for Central officers and staff of the Agriculture Department. The staff of the Agriculture Department will be responsible for the training of extension workers in the project areas.
 - (2) Special observation cum training tours for a total of 20 policy makers and high level officials to visit nearby countries to study water management annually.

d. Extension/Application Program:

The project plans training of two experienced agricultural instructors in soil-water-plant inter-relationships plus work on use of visual equipment and other educational techniques. After completion of training the extension instructors will be stationed at Gal Oya to help insure that all extension workers are adequately training in water management. The project also includes production of a film on water management to be produced in the first year of the project.

e. Improved Central Support to the Field:

The project also provides for an expanded staff to administer the water management unit in the Irrigation Department in Colombo. The Water Management Section will support, administer, and monitor the effectiveness of the Gal Oya project and provide operations and maintenance support to the country wide program.

f. Organizing Farmers and Socio-Economic Research:

A major objective of the project will be the organization of farmers along the minor systems (field channels) to participate in determining the allocation of water, to reconstruct and when necessary rehabilitate field channels, and then to operate and maintain them. Unification of these irrigation organizations into larger units is also planned for the future. Initially, various models or types of farmer organizations will be designed and developed. These models will then be tested in the field during the first year of project implementation as a major aspect of project activities. Every effort will be made to involve the farmers in the conception and design and implementation phases. The model(s) chosen will then be widely replicated to maximize the organizing of the farmers on the Left Bank by the end of project.

Specific applied research activities will also be conducted with the assistance of the Agrarian Research and Training Institute (ARTI). This will include: 1) a bench-mark survey of socio-economic conditions in the Gal Oya area; 2) help to articulate various irrigation association models and test them in the field; 3) continuous studies to monitor changes in the area in the form of bi-annual evaluations; 4) special water management studies. The results of this applied research will provide continuous input into project implementation and will also provide useful information for both annual and mid-project evaluation to be conducted by the GSL/USAID (See Part VI, Evaluation Plan).

PART III. PROJECT SPECIFIC ANALYSIS

A. Technical Analysis:

1. General.

The technical feasibility of this project is described in terms of six major project components. The six components will form an integrated water management program and they include: (1) modernization of the Gal Oya Scheme, (2) master planning and research, (3) training, (4) extension, (5) central support, and (6) farmer organization cum social research.

The project consists of the designing, development, financing, and implementation of a phased operations, maintenance, and rehabilitation program. The target objective is the Gal Oya scheme, a previously developed major irrigation scheme which is badly in need of modernization and rehabilitation. At Gal Oya, excessive and insufficient water issues are occurring at the same time, both causing severe losses of crop production and contributing to the poor quality of rural living. The major features of the proposed project in Gal Oya are organizing, staffing, training, equipping and reconstruction to gain operational control of water and improve the operational maintenance, planning, extension and field research for improved water utilization.

Other significant direct and indirect benefits will result from the project. A comprehensive training program is proposed which will directly benefit much of the entire Sri Lanka irrigation sector. Other program features which are expected to provide some direct countrywide benefits of improved water management are farmer irrigation organization and socio-economic research, central support and extension. Significant country-wide indirect benefits include the policies and procedures necessary for effective water management which should evolve from the project elements and which will allow the GSL to extend an effective water management program to the entire country-wide irrigation sector.

2. Choice-Gal Oya Scheme.

After examining eight different irrigation schemes, the CH2M Hill Consultants recommended both Gal Oya and Uda Walawe for major modernization and rehabilitation. Following detailed discussions with USAID, the GSL has decided to initiate the major program only in the Gal Oya Area. The following are the most significant features of this modernization project:

- There are substantial opportunities for the improved utilization of water. The opportunities are particularly great in Gal Oya because of the very high rates of usage and wastage especially at the top of the system.
- The scheme is not in receipt of substantial foreign resources and is not likely to have any other donor financing or assistance in the foreseeable future.
- In the Gal Oya area there is substantial evidence of the willingness among the farmers, project staff and policy makers to cooperate in programs to improve water management.

Overall, the obstacles to effective water management in the Gal Oya Area are much the same as in most other irrigation schemes in Sri Lanka. The dominant needs are for "operational control" ^{1/} of the system at all levels and for more efficient water use. Rehabilitation and improvements of canals and structures will be necessary before operational control can be achieved.

The water management project at Gal Oya is designed to organize staff and to equip a water management office with the capability to implement a major rehabilitation program along the Left Bank. This is needed because canal erosion and siltation severely limits any control over system water flows. Over 15,000 acres in the lower section of the system are not receiving reliable irrigation water or domestic service due to extreme deterioration and siltation of the main, branch, distributary, and field channels. The major elements of the Gal Oya modernization project are:

- Develop a rehabilitation and modernization plan for the Left Bank.
- Establish a field office with a separate operation and maintenance capability and continuously train all personnel in water management.
- Adequately equip the Maintenance Office to undertake rehabilitation work.
- Modernize and rehabilitate the Left Bank irrigation system which includes 32 miles of main canals, 50 miles of major distributary and 68 miles of minor distributary and field channels.
- Design and construct a water management headquarters and improve the shop and maintenance facility.

^{1/} Two tables, which more fully explain what is planned for the Gal Oya Left Bank systems to obtain "operational control", are provided in Annex 7, Technical Annex.

- Implement the aerial photo and canal inventory project starting with the Left Bank. Develop the delivery schedules and the flow criteria for the entire system.
- Organize and implement an operations program on the Left Bank.
- 3. Master Planning and Research (Gal Oya and Uda Walawe Areas):

a. Master Planning.

The purpose of the master plan program is to conduct the necessary investigations and planning for three major areas: 1) return flow reuse; 2) main canal; and 3) domestic water. The master plans will provide the basis for future program implementation including technical details, design, cost and related material for both the Gal Oya and Uda Walawe systems.

(1) Return Flow Reuse.

Better reuse is a major requirement if both the Uda Walawe and Gal Oya irrigation schemes are going to achieve their original design objectives. This project will fund a master planning effort for this purpose and will include planning teams which will be equipped and staffed to conduct return flow measurements and to develop a master re-use plan.

(2) Canal System.

A master plan for operation of the main canal and tank system is needed for both Gal Oya and Uda Walawe systems. For Uda Walawe the plan will include an evaluation of ways to improve operational storage at Chandrikawewa. The other aspects of both plans will include identification of operational deficiencies along the main canal, development of operational criteria to reduce water losses, maximize diversions, and ensure equitable distribution of flows to all reaches of the main canal.

(3) Domestic Water.

A master plan for domestic water is required for the following reasons: 1) domestic water runs cause major problems with canal operation and maintenance; 2) canals used for domestic use present health hazards; and 3) the loss of water for the amount which is beneficially used is extremely high. The plan will investigate domestic water requirements, ground-water quantities and quality, and will develop and evaluate alternative plans for domestic water service. This plan will be developed concurrently with the return flow reuse plan.

b. On-Farm Water Management Research.

The On-Farm Water Management (OFWM) research is a program designed to evaluate revised and improved field channel layout with on-farm land levelling and water management features which will permit return flows to re-enter the field channels. The intent of the research is to show the farmers how they can help themselves through their own organisations by improving their field channels and land topography.

(1) Field Channel Improvement.

On a pilot basis, field channels will be improved with farmer help through an irrigation organization to do the following: (a) improve and revise the field channel layouts; (b) provide partial masonry or concrete lining if required and compact the earth lining for the remainder of the channel; (c) construct masonry or concrete control structures and outlets; and (d) make other improvements such as scheduling and rotation as deemed necessary. Equipment, personnel, and technical assistance will be provided by the project to re-use water efficiently on farms in the area starting in Tract 3 of the Right Bank of Uda Walawe and in Left Bank Unit 21 of Gal Oya. These will serve as demonstrations to control and make available water in field channels which at present are not capable of serving farmers at the lower ends. These demonstrations will continue for the life of project and will provide continuous feedback into the operational program at Gal Oya and to the Master Planning effort of both the Gal Oya and Uda Walawe. Several other tracts (units) may undertake similar field work if there is sufficient personnel, funds and time.

(2) Land Improvement.

Extension agents professional technicians or engineers working under the River Valley Development Board in Uda Walawe and under the Irrigation Department in Gal Oya will be in charge of teams of surveyors and land levelling units which will lay out model farms for best utilization of water from the improved field channel and/or drainageways. in the respective irrigation systems. Objectives of the work will be to devise systems to retrieve and reuse water by returning it to the field channel and/or drain by levelling fields and constructing farm ditches and drains with sufficient precision to have this kind of control. The planning of technical aspects will be done by a committee of Sri Lankan engineers and agriculturists assisted by an expatriate agricultural engineer who is trained in on-farm irrigation development. They will utilize the best known technology for water control compatible to the country and to design systems to fully utilize available rainfall.

Benefits will be derived from water savings that can be used on lands not now receiving water in sufficient amounts for full production. Savings will come from applying smaller amounts of water at each issue, better utilization of rainfall, and reuse of surface runoff from farms at the head of the field channel. Also, longer fields and larger basins will allow plowing to be done in a shorter period of time, thus reducing the time water is needed during the planting period.

4. Training:

There are four separate components to the training program. They are discussed separately below under the headings: "The Galgamuwa Water Management Training School", "Support for the National Diploma in Technology", "General Water Management Training" and "Overseas Training Courses". To understand these components the three levels of field Irrigation Department staff should be identified. In descending order of professional qualifications these are : (1) Irrigation Engineers (4 year degree); (2) Technical Assistants (2 year certificate); and (3) Irrigators (High School Diploma).

a. Galgamuwa Water Management Training School.

The Galgamuwa facility in central Sri Lanka will be re-opened under the Irrigation Department primarily to provide water management training. The purpose in re-opening the Galgamuwa school is to provide training courses in water management for the staff of the Irrigation Department and other Government agencies responsible for irrigation issues including the Mahaweli Development Board, the River Valleys Development Board and the Department of Agrarian Services. The need for such courses is urgent. The educational courses that qualify people for jobs as Irrigation Engineers and Technical Assistants currently contain very little of the technical training needed for good water management. The need for such specialized courses has long been recognized by the Irrigation Department. They were formerly organized on a regular basis at Rajangane, and ceased only due to a series of unforeseen circumstances. The plan now is for a resumption of these courses at Galgamuwa but on a larger scale with more staff and physical facilities. It is also proposed that once the Galgamuwa school becomes established, that it provides an annual water management course for all newly recruited Irrigation Department Technical Assistants as a part of their apprenticeship. The intention is to induce right at the beginning a greater awareness of, and competence in, the water management side of irrigation work.

The school buildings at Galgamuwa are large enough for the proposed training programs. Space is available for the development of workshops and laboratory facilities. The buildings are generally in good condition and a considerable amount of housekeeping equipment is still available. The budget includes an allowance for rehabilitating and re-equipping some of the buildings. The school will run at least four types of courses and will turnout the following number of personnel per year by the second year of the project.

(1) A 4-week course to be given once each year for 15 staff irrigation engineers and senior technical assistants.

(2) A 12-week course to be given twice each year for a total of 80 staff Technical Assistants.

(3) A 12-week apprenticeship course to be held once each year for 40 newly trained and recruited technical assistants.

(4) A 1-week course to be held four times each year for a total of 160 people to include students of the National Diploma and Technology (NDT) course, irrigators, and others to familiarize them with the purpose and use of laboratory and field equipment.

b. Support for the National Diploma in Technology Course (Civil Engineering).

This course is currently conducted at both the Katubedde Campus, south of Colombo and the Hardy Institute in Amparai which is the training ground for Technical Assistants. This project element is intended to alleviate the following four problems in the existing course:

- The total output of trained personnel is less than the accelerating national needs, mainly because of the requirements of the Mahaweli project.
- The quality of the course is lower than what is desirable. In large part this is because of the shortage of staff, laboratory equipment, and resources for field trips.
- The practical training element in the course is inadequate.
- Considering that a large proportion of the successful students are recruited into the Irrigation Department and the Mahaweli Development Board, the proportion of the course material relating to irrigation and water management is inadequate.

The program for giving assistance to the existing courses has the following four objectives:

- Increasing the total output from 40 to 80 diploma holders each year. This will be done by increasing enrollment and by strengthening the teaching staff and reducing the currently very high failure rate in the second year examinations.
- Increasing the practical element of the course by providing laboratory facilities and field trips.
- Increasing the amount of training given to the subjects most relevant to irrigation by providing additional teachers in these subjects.
- Improving the quality of the student in-take by providing for recruitment partly on the basis of aptitude and achievement tests.

The following are the program elements for which financial support is provided under the project: 1) support for establishing/expanding the hydraulics laboratories at Katubedde (in the new section for non-degree courses) and at the Hardy Institute, Amparai; and 2) for new buildings at the Hardy Institute. This will be required since the Institute is to assume the teaching of the second year of the NDT courses in civil engineering.

c. Overseas Training Courses.

In order to staff the Water Management Training School at Galgamuwa with qualified instructors, begin the planned programs at Gal Oya and Uda Walawe, and strengthen the Water Management Division at the Irrigation Department headquarters in Colombo, it is necessary to rapidly build up a cadre of about a dozen persons who have a thorough training in water management and associated skills including rehabilitation and maintenance work and management. A special overseas training course is necessary which will include practical demonstrations and firsthand acquaintance with techniques used in other important rice producing countries. It is proposed to organize such an intensive 3-month course during the first year of the project. One month of the training will be spent at the International Rice Research Institute (IRRI) in the Philippines and 2 months in the United States at appropriate Universities and Institutes. The course of study will be the same as that proposed for Course One under the Galgamuwa program (see CH2M Hill Report). A division of the areas of responsibility will be worked out between IRRI and the components of the course. IRRI already has extensive training facilities and the course there may be common to all of the dozen people proposed

for this training program. However, for the training the trainees will be divided into three groups according to their assigned job responsibilities: (1) systems operating and maintenance for the majority of trainees; (2) planning for those assigned to jobs in this sphere; and (3) training for those destined to be instructors at Galgamuwa. The main activity of the training courses will be demonstration and visits to research and field sites under the close tutorship of the consultants. Trainees will be asked to produce written work in the form of reports on field visits and evaluations of observed practices and procedures in the light of their applicability to the Sri Lanka situation.

The overseas training course will be held twice in the first and third years of the project with 12 students participating in each session. The repetition is intended to train those senior staff of the project who did not receive a place on a previous course and to train replacements for those persons who are lost to the project by transfers, promotions, resignations, etc. If the situation permits some of the senior water management staff on projects other than those directly incorporated into the Gal Oya project may be trained.

A 1-year overseas training experience will be made available for the two selected professionals to become water management extension specialists. Qualifications for such training will include 10 years of field extension experience, interest in onfarm water management, and advanced knowledge of soil, water, and plant relationships. The training program will consist of approximately 9 months on irrigation and 3 months study on the use of visual and/or education techniques.

Another element of the overseas training program will be special observation cum training tours for up to 20 policy makers and high level officials each year to study water management in nearby countries such as Philippines, Thailand, Pakistan and Taiwan.

d. Other Short-Term Training.

Three short-term training programs are planned under this project.

- (1) Special 2-4 week courses three times each year for the recently appointed personnel (Irrigators) and work supervisors of the Irrigation Department, Cultivation Officers of the Agrarian Services Department, and farm leaders. This course will be held at the Hardy Institute in Gal Oya for 150 people annually.

(2) All agricultural Extension Workers in Gal Oya will be given at least two weeks in-service training in water management at the Agricultural Training Schools. A total of 80 participants annually are anticipated beginning in the second year.

(3) A third training program which is potentially the most important of all is for the farmers. At the present time there are two classifications of farmers; farmer leaders and contact farmers. They will be selected by the other farmers along the field channels. Farmer leaders are directly associated with the Irrigation Department and will be primarily concerned with irrigation water below the turn-out. They will be responsible for mobilizing other farmers for rehabilitating the field channel and for operation and future maintenance of the field channel. The contact farmer will be the agriculture extension worker (KVC) contact point for agriculture related matters along the field channel and lower levels. All of these farmers will attend periodic training courses to be conducted by Agriculture, Irrigation, Agrarian Services and other Departmental officials at the Agrarian Service Centre or other relevant locations. They will be provided per diem for attending such training. After attending these training sessions these farmers will return to their village (tract) and discuss what they have learned in the field channel organization (to be established). These periodic training sessions are planned twice each month for 20 leaders each and will be started in the second year of the project.

5. Extensions:

Although there is a fairly large program of extension in the country, a need exists for additional work on water management at the farm level. This element of the program will initially train two experienced agricultural instructors in soil-water-plant inter-relationships plus the use of audio-visual equipment and other educational techniques. After completion of training, the extension instructors will be stationed at Gal Oya with the objective of helping insure that all 200 extension workers of the Agriculture Department in Gal Oya are adequately trained in water management.

The World Bank is also planning to expand its Training and Visit Extension Program throughout Sri Lanka and efforts will be made to expand this program to include Gal Oya during the first year of the project. A training film on water management will also be made in the first year of the project and will subsequently be used by the Extension and Irrigation Departments, Agrarian Services and others throughout Sri Lanka to train farmers in on-farm water management.

6. Central Support and Water Resources Development Offices:

A Central Support Office will be established within the Irrigation Department and located in Colombo. Operational control facilities

practices, and procedures not presently available in this country will be developed by the new organization. Further, it will be responsible for extending successful plans and procedures as they are developed under this project to other irrigation systems throughout the country.

As explained in the Administrative Analysis (Part III - B) this Central Support Office will provide direct support to the Field Project Office at Gal Oya and to the overall training, planning and research efforts. The Central Support Office will have three special sections under senior officers as follows: 1) Assistant Director/Operations and Maintenance; 2) Assistant Director for Training and Extension; and 3) Assistant Director for Planning. The exact composition of these three sections is yet to be determined but they will be small in numbers of assigned personnel.

The Central Support Office will help ensure aerial photos will be obtained during the early stage of the project. These are essential for many reasons including: a) preliminary design and construction plans; b) developing delivery schedules; c) for master plans; and d) to provide information on current land use. The present plans call for the Gal Oya project area to be aerial surveyed (mapped) by early 1980 in order to provide the required aerial photos. The Surveyor General of Sri Lanka is also planning to provide two people who will be stationed in the project area to assist project personnel in the utilization of the photos and the Central Office will assist as required.

As further explained in the Administrative Feasibility section which follows, a special Water Resources Development Office is also being established by the Secretary to give more emphasis and importance to the area of Water Management. This office will be headed by a Director with two Deputy Directors; all of whom will help coordinate and facilitate project activities.

7. Farmer Organizations and Socio-Economic Research :

A major objective of the project is to develop more appropriate practices and organizations at the farm level within the project area. This requires a program of socio-economic research and experimentation concerning how farmers use and maintain channels, handle disputes, make collective decisions, organize or fail to organize themselves, etc. Of particular importance would be the organization of farmers along the minor systems (field channels) to do the following: 1) to reconstruct, operate and maintain field channels; 2) to deliver and distribute water according to quantities and rights of members; 3) to encourage efficient use of water through better application and cultivation practices, cropping schedules and use of other improved agricultural production inputs; 4) to minimize and resolve disputes equitably among members according to rules of the organization; and 5) to serve as a channel of communication to the Irrigation Department to affect the decision making process. The functions of the organizations would be flexible to allow for future growth to expand to such activities as obtaining

agricultural chemicals, fertilizers and commonly used equipment. If feasible, such irrigation organizations would be federated up to the tank level. (See Annex 12 "Organizing farms for Water Management in Sri Lanka" by Dr. George Radosevich for additional information)

The establishment and monitoring of irrigation organizations would be part of the proposed program of socio-economic research and experimentation. This overall program would include also: 1) a bench-mark survey in the project area; 2) continuing socio-economic surveys to assess changes (positive and negative) in the project area; and 3) a bi-annual evaluation of the project (including the consequences of the water management program for the farmers, and the effectiveness with which the program is being implemented). Because of this evaluation component, it will be necessary for the socio-economic program to closely coordinate with the Water Management staff, but also to have a degree of organization autonomy.

The Agrarian Research and Training Institute (ARTI) is an institution under the Ministry of Agricultural Development and Research which has established a pre-eminent position in Sri Lanka in rural sector socio-economic research. An Enabling Act of Parliament establishing ARTI assigns to it research work on the socio-economic aspect of agriculture and rural development. Moreover, it has undertaken applied socio-economic research which has an action and experimentation element in its "field laboratory" (at Beminiwatte). This involved undertaking organizational and administrative innovations with farmer organizations and evaluating them in terms of productivity and participation objectives.

This will involve working with the Irrigation Department and other government agencies to facilitate organization of irrigators into viable irrigation organizations. ARTI would initially help define various types or "models" of organizations to be tested in the field. They would then study, document, help train farmers and officials in the field, and provide recommendations on a continuing basis for the establishment and improvement of these organizations. Training programs for farmers and officials, irrigation rules and regulations, different modes of irrigation organizations and alternative water management practices would be tried and tested in the field. It is not assumed that there will be one optimal pattern of practices and organization within the project area, because of the diversity of ecological, hydrological and sociological conditions. The research program would undertake to determine what kinds of practices and organization are most appropriate for different sets of circumstances and most likely, several different organizational structures will emerge.

In addition, other socio-economic studies of irrigation practices and local organizations in other parts of Sri Lanka should contribute to providing a richer body of knowledge about water management and will be undertaken by ARTI, MARGA Institute and others such as the Universities of Sri Lanka. Furthermore, some discussions have taken place with DSB, Cornell University and the Government concerning the possibility of implementation of both the "Participation" and "Water Management" research projects in Sri Lanka. From these preliminary

discussions, the Mission believes that both projects could be implemented in Sri Lanka and would be supportive of irrigation organizations and other activities under this water management project.

8. Equipment and Labor:

In development of the Project Paper there was a great deal of discussion over the equipment (capital intensive) vs. labor intensive method of reconstruction of the two major systems. While there is a surplus of labor during much of the year in Gal Oya, this is not the case during the critical periods of water requirements. During the harvest season when the system is closed and could be maintained, there is lack of labor, even for normal farm activities. This is generally the case at other times when the system is closed. Also many of the unemployed men are fairly well educated and therefore are either not in the rural country-side where the irrigation systems are located or would not provide the handlabor needed for the physical repairing of dikes etc. An added problem at Gal Oya is the need for the system to flow nearly all the year to provide domestic water for Amparai and other communities. Therefore, a capability needs to be developed to de-silt the system in the "wet" i.e. (while the system is still flowing).

It is anticipated that heavy equipment will be needed on the major canals and branches, while hand labor will be used for work on the smaller distributaries and field channels. Farmers are expected to provide their labor to up-grade the channels through their field channel irrigation organizations. The GSL would provide help in the form of technical design and supervision, and some materials for partial lining and for concrete or masonry turnouts and other structures. Obtaining farmer involvement and participation in the reconstruction will help insure that the farmers consider the field channels as their own and they will maintain and operate them properly in the future.

With this in mind, the commodity and equipment list has been reduced from that proposed by the CH2M Hill Consultants, although the basic list has remained unchanged. Annex 7, Table 6 of the Technical Annexes gives the basic Excavating Unit which will allow "de-silting in the wet" at Gal Oya. Two of these units will be procured for the project. The Maintenance Equipment Unit and Shop Units are also listed in Annex 7 and two of each unit are required. This is the minimal basic equipment required to do the major de-silting and reconstruction work on the Left Bank system of Gal Oya and to enable the required maintenance in the future.

9. Technical Assistance:

A heavy technical assistance grant component is necessary during the early years of the project since the Irrigation Department is upgrading its capability to better manage, operate and maintain the major irrigation systems in the country. One Senior Advisor will head up the consultant team and will be responsible for the overall technical assistance needs under the project. He will be assisted by full-time water management advisors at both Gal Oya and Uda Walawe and by a

full-time training advisor at Galgamuwa. A full-time rural sociologist cum anthropologist will also be assigned to the team to advise on socio-economic research and establishing irrigation associations. Short term specialists will also be required to cover such components as heavy equipment operation, maintenance, planning, technical research, waterflow, etc. The consultant team will advise and consult with the Government and with the implementing agencies as well as USAID on all activities related to the project. This will include:

- 1) modernization and rehabilitation of Gal Oya;
- 2) the master planning and research at both Gal Oya and Uda Walawe;
- 3) training, investigations and facilities engineering;
- 4) aerial photomapping;
- 5) organization of farmers and social-economic research; and
- 6) on the job training for equipment operations and maintenance.

The Technical Assistance Organization is enclosed as Administrative Chart 1 in Annex 8. Major aspects of the Request for Proposal (RFP) for the Technical Assistance is enclosed as Annex 9.

B. Administrative Feasibility

1. Current Situation:

In Sri Lanka the Irrigation Department has the responsibility for most major irrigation systems. A few major systems which are still under development, are in the hands of special area development authorities like the Mahaweli Development Board and the River Valley Development Board. Minor irrigation projects, defined as those with a command area of less than 200 acres, are under the Department of Agrarian Services, Ministry of Agricultural Development and Research.

The Irrigation Department, which is under the Ministry of Lands and Land Development, has a long-established record for good work, high technical standards, and a strong sense of commitment to the civil engineering profession. ^{1/} Its capacity is currently being severely tested by the rapid acceleration of irrigation and power construction programs throughout the country, and the consequent shortage of engineering resources of all kinds, especially manpower and organization. Furthermore, it is generally recognized that the performance of the Irrigation Department in operations and maintenance (O&M) activities is deficient in comparison with its investigation, design, and construction (D&C) work. There are many reasons for this including inadequate budget allocation for O&M in comparison to D&C, an organizational structure which places more emphasis on D&C, and the generally more urgent nature and political pressure for D&C as compared to O&M. Also, the existing practice of combining D&C and O&M duties in range or field engineering posts, inhibits the promotion of well qualified Technical Assistants to senior Central headquarters O&M positions.

The different levels of staff positions within the Irrigation Department, especially in the field, tend to generate separate social groups which interact only within their own group rather than between the different groups. As a result, the level of communication among the groups is low. Communication tends to be in the form of reports and requests from below and orders and permission from above. Therefore, effective two-way communications which is essential for successful O&M activities, is generally blocked. The organization is unable to communicate within itself and thus respond to changing situations in the field on such vital matters as water availability and requirements, potential or actual defects in the physical structures, and farmer attitudes and problems.

^{1/} For a detailed description of the Irrigation Department organization see Appendix 6 of the CH2M Hill Consultant Report, which is Annex 5 of this Paper.

2. Implementing Agency for this Project:

The Irrigation Department will be the principal implementing agency for this project. This Department has the ability to select, award and administer contracts with both local and foreign firms and is currently doing so. As explained below as part of this project, a Water Resource Development Staff Office and a Central Support Office will be established in Colombo. The Water Resource Officer will report directly to the Secretary, Lands and Land Development and will have a deputy for Water Management and a deputy for Institutional Development. The Central Support Office will be established in the Irrigation Department to include special offices of Operation and Maintenance, Training, Extension and Planning. The Gal Oya Project field organization will be upgraded, and Master Planning and Research Units will be established at both Gal Oya and Uda Walawe. The Irrigation Department will establish a water management training school at the Galgamuwa Training Complex.

As detailed in the CH2M Hill report, qualified personnel are not available in adequate numbers in Sri Lanka for the Government's expanding development program and the private sector. This is primarily because of the drain of some of the most qualified personnel to the Mid-East. Although this problem may be easing, efforts are being undertaken to increase the output of engineers from the Universities. For this project, USAID has been assured that adequate numbers and kinds of staff will be available. Furthermore, with the project emphasis on training and with expatriate assistance, it is believed that the project can be adequately managed and implemented.

a. Water Resource Development Office:

In order to give more emphasis to the important area of water management, the Secretary of the Ministry of Lands and Land Development has decided to establish a special staff office headed by a Director of Water Resource Development. (See Annex 8, Administrative Chart 2). This officer will be on equal status with the Director of the Irrigation Department and while performing special functions and actions for the Secretary, will also help coordinate and facilitate activities of the Project with other relevant Departments and Agencies. Two special Deputy Directors will also be established to assist the Director: the first will be for Water Resources Management primarily to coordinate water management activities country-wide, and the second will be for Institutional Development to help coordinate the organization of farmers and the socio-economic research conducted by ARTI. Further, the Deputy Director will assist in law enforcement and institutional coordination.

b. Improved Central Support Office:

An enlarged staff will be required to administer this project under the Irrigation Department. (See Annex 8, Administrative Chart 2). A Deputy Director, Water Management, will be Project Director, responsible for all of the project elements. He will need to be a professionally qualified senior engineer and be able to work with legislation and institutional innovations and have a general knowledge of agriculture plus experience in working with farmers. Below him will be an Assistant Director for Operations and Maintenance. His office will be established to improve country-wide operations and maintenance standards and procedures and coordinate with other Government agencies connected with the project, as well as coordinate the technical support elements within the Irrigation Department. Specialists will be provided to other divisions of the Department in the fields of agriculture, soils hydrology, hydraulics engineering and salvinia weed control. The Hydrology Branch hydraulics laboratory and soil mechanics laboratory will be expanded and equipped to investigate canal losses, develop rating curves for measuring devices, and provide soils engineering assistance for compacted earth lining and other technical assistance.

A special Assistant Director and staff for Training and Extension will also be established to function under the Director of the Project. The various types of training programs, as shown on Chart 2 and described in the Technical Feasibility section, will be coordinated by this office. This office will work with the Departments of Higher Education, Agriculture and Agrarian Services who will be conducting various components of the training programs. This office will assist in the preparation of training material, provide equipment and funding, and carry out other coordination functions. Furthermore, this office will be specifically responsible for establishing and supporting the Galgamuwa Water Management Training School. It will also coordinate a wide spectrum of specialized courses including training at Hardy Institute, overseas, and for farmers. Also a special Assistant Director for Planning will be assigned to the Project Director to assist and facilitate the preparation of the Master Plans for Gal Oya and Uda Walawe.

c. Gal Oya Organization:

The proposed Field Project Office for Implementation at Gal Oya is shown in Annex 8, Administrative Chart 3. Under this organization the Deputy Chief Engineer will have overall responsibility for implementation of the project in the Gal Oya area. He will have two major offices under him:

the first is the Operations and Maintenance Office which will be headed by a Senior Engineer. He will be in charge of both the operations of the Left Bank system and the maintenance and rehabilitation of the Left Bank. The second office will be a special Master Planning Office which will be headed by a Senior Engineer who will be responsible for the preparation of the three master plans for the Gal Oya Area.

The Operations Division of the O&M office will be headed by an Operations Manager. It will provide services at all project levels including operational procedures to be extended to all of the Gal Oya area and to other schemes. Emphasis will be to schedule, deliver, measure, and record the operation of the system and to develop the confidence and trust of the farmers. Procedures will also be developed for the operation and control of the communications and transportation equipment. There are three key positions in the Operations Division. They are the Operations Manager, the Left Bank Water Master, and the Water Planner. Below this level, the current planned and budgeted staff of one TA for every 5,000 acres, one Overseer for every 2,500 acres, and one Irrigator for every 500 acres will be adequate.

The Maintenance and Rehabilitation Division will be concerned with the proper execution of pre-planned and pre-designed maintenance activities. Special attention will be given to cost accounting, quality control, and equipment performance practices and procedures. The Central Support Office will also provide support to the Maintenance and Rehabilitation Division in basic planning, design, survey, investigations, material selection, and compaction standards as well as actual rehabilitation of the Left Bank Canal System. The overall objective of this office is to build up and maintain strong maintenance capability and to develop procedures to be extended to other schemes. The selection and training of the Maintenance and Rehabilitation Manager as well as his Operations Officer and Shop Foreman and supporting staff is critical and will require inputs from the Central Support Office.

d. Master Planning and Research Organizations:

As explained in the Technical Analysis, a special Master Planning and On-Farm Water Management and Research Unit will be established for both Gal Oya and Uda Walawe. As shown in Annex 8, Chart 3, a special Master Planning and Research office will be established in Gal Oya for this work. Most of the staff for the Master Planning and Research at Walawe (see Administrative Chart 4) will be seconded from the River Valleys Development Board and will report directly to the Assistant Director for Planning in the Colombo Support Office.

e. Galgamuwa Training Staff:

The following core staff will be assigned to conduct water management training at the Galgamuwa Water Management Training Center:

Director	(1 person)
Water Management and records	(2 persons)
Management and human relations	(1 person)
Earthwork	(1 person)
Concrete work	(1 person)
Use of equipment, machinery and labor	(1 person)

This core staff will be assisted by part-time instructors, especially those who are already working with the Irrigation Department, the Universities and the Mahaweli Development Board. A special training and review task force is being formed to deal with all aspects of the proposed training outlined in this Paper including the organization, recruitment, coordination and finance required by the various Government agencies including the Departments of Higher Education, Agriculture, Agrarian Services and Irrigation.

3. Steering Committee and Project Coordination Committee:

It is planned that a Steering Committee will be formed to function throughout the life of the project. The Committee would meet two to four times per year preferably at project sites to:

- Review project progress and performance
- Prepare progress and evaluation reports
- Give direction and support to the program

The committee will consist of the following:

Secretary of Lands and Land Development— Chairman
AID Mission Representative and Consultant— Observer/
Advisor
Deputy Director, Water Management for Gal Oya—Secretary
Members—Representatives from:

Irrigation Department (Director)
River Valleys Development Board
Mahaweli Development Board
Galgamuwa Training School
Agriculture Development and Research
Agrarian Services
Agrarian Research and Training Institute
Ministry of Higher Education

A similar high-level Project Coordination Committee will be established in Gal Oya to coordinate project implementation in the field. This will be chaired by the Government Agent with members from the Departments of Irrigation, Agriculture, Agrarian Services, Cooperatives, the Hardy Institute and others as may be required.

C. Economic Analysis

1. Summary Conclusions:

The purpose of the economic analysis is to appraise the project from the point of view of the economy as a whole. It gives some indication as to whether the project represents an efficient allocation of scarce resources relative to other possible uses of these resources.

The various project elements described in the previous sections -- deepening of main and secondary channels; improved control of water issues; more effective supervision of water distribution and utilization; better maintenance; increased recycling of water; increased involvement of farmers in allocation, control and maintenance; etc. -- all have the objectives of increasing the supply of available irrigation water, improving the equity of its distribution, and increasing its reliability and timeliness. Accomplishment of these latter objectives is in turn required in order to permit the farmer to increase cropping intensity and to provide an incentive for undertaking improved cultivation practices and complementary investments which increase yields. The resulting increased production and incomes are critical to project appraisal from both the economic and financial points of view.

The economic analysis of this project, explained in detail below, indicates that it should command high priority on economic grounds. ^{1/} Based on the best available data supplemented by informed judgements on the most likely future values for such parameters as cropping intensities, yields, and prices, the Gal Oya (Left Bank) Modernization component of the project yields an internal rate of return (IRR) of 23%. ^{2/} This "base case" IRR may be compared against a 10% opportunity cost of capital employed by the Central Bank of Ceylon and a 13% opportunity cost of capital estimated for Sri Lanka by economist Deepak Lal of the World Bank. When somewhat more optimistic assumptions concerning future parameter values are employed than those assumed for the "base case", the IRR increases to 32%. When the most pessimistic assumptions are employed, the IRR drops to 13%. The latter is still above the 10% opportunity cost of capital estimated by the Central Bank. The nature of these assumptions and alternatives will be explained in the following sections. The reason for the relatively high rate

^{1/} The following analysis draws on the Economic Evaluation section, pp. 9-12 to 9-18 of the Hill Report, op.cit. It also draws on several other sources of information as explained later in the analysis.

^{2/} All rates of return are stated in 1978 prices. This reflects the standard assumption that inflation affects benefits and costs in the same way, so that inflation can be ignored.

of return follows basically from the fact that this project focusses on improving the efficiency of already existing irrigation systems rather than the creation of an entirely new system.

The Gal Oya Modernization component represents the largest cost element of the total project (86%) and lends itself more easily to quantification of benefits. The training, central support, socio-economic research and Uda Walawe master planning and research elements of the overall project are also expected to make important contributions to improved water management and to small farmer production and incomes in other major irrigation schemes in Sri Lanka, but the benefits of these other elements are extremely difficult to quantify.^{3/} Even if only the costs and not the benefits of these components are added to the Gal Oya costs and benefits, the "base case" IRR drops by only three percentage points. If the benefits of the non-Gal Oya components could be quantified and added to the analysis, the resulting IRR for the entire project would be undoubtedly higher than 20%.

The following detailed explanation of the economic analysis is organized into three sections:

Land use and production benefits;
Evaluation of costs; and
Rate of return and sensitivity analysis.

Final sections discuss cost per beneficiary and the need for concessional resources.

2. Land Use and Production Benefits:

In Sri Lanka, the principal constraint on expanding food production is water, not land. Since in this country, unlike in other parts of Asia, no perennial sources of water exist, the tanks and even large rivers have ultimately to depend from year to year on an adequate supply of rainfall. But the monsoonal rains in this island are noted for their high variability and unpredictability. Therefore water, not land, becomes the most limiting factor on agricultural production.

^{3/}These elements will also benefit the Gal Oya component significantly. In estimating the Gal Oya IRR, it was therefore judged that 50% of the training, central support, and socio-economic research costs and 100% of the extension costs, should be attributed to the Gal Oya Left Bank Modernization. These shares are also reflected in the percentage represented by Gal Oya given above in the text. Contingencies and inflation have also been allocated among the various components.

Reliable sources estimate the amount of new land that can be bought under gravity irrigation at about one million acres. More than half this extent (located both within and outside the Mahaweli Basin) will be developed by the GSL within the next 10 years, requiring massive investments in land development, irrigation and colonization.

The ultimate economic justification for this investment is not the acreage developed but the output therefrom, output in turn being a direct function of water availability and water-use efficiency. Therefore, given this country's vulnerability to the vagaries of monsoonal rainfall, the area of water management assumes critical importance. Since by definition, the rate of land development and settlement depends on the rate of provision of irrigation facilities, it is eminently clear that without the most rigorous application of water management practices, Sri Lanka's entire development effort could encounter serious obstacles.

The present status of on-farm water use indicates that vast improvements need to be achieved in the shortest possible time. In most irrigation schemes, the volume of irrigation water consumed per acre of paddy, especially in the Maha season is two to three times the amount actually needed, while at the same time distribution is poor, with some lands getting too much water and some too little. The result is decreased average production or yield per acre in the Maha season and insufficient water for the Yala season. This in turn depresses cropped acreage and yield per acre in the Yala, resulting in a level of total, annual output well below potential levels. It is axiomatic that future development in Sri Lanka will be determined by the present base. Since irrigation water in different parts of the island is supplied by inter-connecting networks of tanks, streams and rivers, the level of water-use in ongoing schemes directly affects the supply of water to new schemes. If therefore, future investments in land development, irrigation and colonization are to yield meaningful social and economic benefits to the country, it is a matter of the highest urgency that existing irrigation schemes, where water conservation is minimal, be swiftly upgraded.

The Gal Oya Left Bank settlement has been selected for development assistance with these considerations in mind. It represents a scheme where as a consequence of poor water use and poor water control, both cropping intensity and productivity are low and much of the potential for rapidly expanding total output remains under-utilized. It is anticipated that by the end of the life of the project (4 years), a carefully designed, controlled and monitored water management program will have established the base for a highly productive and energized system of agriculture which will serve as a model for the rest of the country.

The Left Bank in Gal Oya currently has 52,000 acres of rice paddy land under production, of which 7,000 acres is encroached land. Cropping intensity is only 129% (i.e. Yala sown acreage equals only 29% of Maha sown acreage -- Table III-1), and the annual average yield is only 52.5 bushels of paddy per acre (bu/ac).^{4/}

Table III - 1

	<u>Maha</u> (ac)	<u>Yala</u> (ac)	<u>Total</u> (ac)
Settled	45,000	15,000	60,000
Encroached	7,000	-	7,000
Total	52,000	15,000	<u>67,000</u>

Even though the life of this project is about 4-1/2 years, it is estimated that the project will yield benefits for at least 20 years. Therefore, benefits and costs for this project are evaluated over a 20 year period (this evaluation period was also adopted by the Hill Report). Over a 20-year period, assuming there is no project, paddy yields are projected to increase by no more than their annual trend increase in Gal Oya over the last ten years, or 1% a year, and cropping intensity, by zero percent. Consequently, production will also increase by only 1% a year - from 2.840 mn.bu in year 1 to 3.430 mn.bu. in year 20. (See Table III-2).

^{4/} GSL, Ministry of Agricultural Research and Development and Ministry of Lands and Land Development (Irrigation Department) statistics. These figures may be contrasted with the Hill Report. (Tables 9-1 and 9-6), which shows a current cropping intensity of 155% for all of Gal Oya and a current paddy yield of 56 bu/ac for Gal Oya and Uda Walawe taken together.

Table III - 2

PADDY PRODUCTION LEFT BANK GAL OYA
WITHOUT PROJECT

<u>Year</u>	<u>Gross Sown</u> <u>Acreage</u> (ac)	<u>Average</u> ^a <u>Yield</u> (bu/ac)	<u>Production</u> ^a (1,000 bu)
1	67,000	52.5	2,840
2	67,000	53.0	2,867
3	67,000	53.5	2,894
4 to 20	67,000	54.0 to 63.4	2,921 to 3,430

^a Average yield and production are assumed to increase by 1% a year as explained in the text. Since yield figures are on a net harvested acreage basis, production is obtained by multiplying yields by net harvested acreage. The following conversion factors based on observed relationships have been employed: gross harvested acreage equal to 95% of gross sown acreage and net harvested acreage equal to 85% of gross harvested acreage.

Although other crops are grown in the highland and homestead areas of the Gal Oya region, the irrigated areas of the Left Bank are devoted entirely to paddy. It is assumed that with continuation of a guaranteed price scheme for paddy and with continued substantial national deficits projected for rice production in Sri Lanka until the mid-80's at the earliest, paddy will continue to be the sole irrigated crop on the Left Bank. Therefore, projection of production benefits to be derived with the project are based in terms of paddy production.^{5/}

In response to the greater supply, more equitable distribution, and improved reliability of irrigation water produced and promised by the project, it is projected that:

(a) 5,000 new acres of paddy land will be developed and brought under irrigation at the rate of 1,000 acres per annum beginning in the third year; and

(b) cropping intensity will, also beginning from the third year, increase from 129% to 189% in the eighth year (at a rate of 8% a year) and remain constant thereafter. In addition, when farmers become convinced on the basis of a couple years'

^{5/} The Hill Report also assumes that paddy will be grown on acres to be added under their larger proposed Gal Oya-Uda Walawe Water Management program, even though sugar is currently grown on irrigated land on the Right Bank of the Gal Oya and in Uda Walawe. The Hill Report also cites questionable profitability of sugar and farmer preference for paddy as factors (see p.9-15, Hill Report).

experience that adequate water is assured, they will invest the effort and resources in improved practices and complementary inputs which should increase yields per harvested acre. Therefore, while yields are projected to increase by 1% a year upto the fourth year, they are projected to rise sharply thereafter, reaching a peak of 7% a year in years 7 and 8, then tapering off gradually to 1% a year again in the final 3 years. These rates of growth result in a yield in year 20 of 85.4 bu/ac. Production will thus increase from 2.840 million bushels in year 1 to 7.427 in year 20, an implied annual average growth rate of 5.2% a year (see Table III-3).^{6/}

Table III - 3

PADDY PRODUCTION LEFT BANK GAL OYA
WITH PROJECT

<u>Year</u>	<u>Irrigable Paddy</u> ac	<u>Cropping Intensity</u> %	<u>Gross Sown</u> ac	<u>Average Yield</u> bu/ac ^a	<u>Production</u> (1000 bu)
1	52,000	129	67,000	52.5	2,840
2	52,000	129	67,000	53.0	2,867
3	53,000	139	73,700	53.5	3,183
4	54,000	150	81,000	54.0	3,532
5	55,000	162	89,100	55.6	4,000
6	56,000	175	98,000	58.4	4,622
7	57,000	189	107,700	62.5	5,436
8 to 20	57,000	189	107,700	66.9 to 85.4	5,818 to 7,427

(See note^a below)

^a From year 7 to year 20, yields and production increase at the following annual percentage rates: 7%, 5%, 3%, 2%, 2%, 2%, 2%, 2%, 2%, 2%, 1%, 1%, 1%, respectively. See text for explanation.

The ensuing incremental benefits over the 20 year period are substantial. Table III-4 combines Tables III-1, 2 and 3 to indicate the incremental benefits with the project over the

^{6/} These projections differ significantly from those of the Hill Report. The latter assumes, for all of Gal Oya and Uda Walawe, that a maximum cropping intensity of 200% will be reached by year 8 and that yields will reach 85 bu/ac by year 8 and, 96 bu/ac by year 20. See Hill Report, pp.9-12 and Table 9-6. USAID's discussions with agricultural specialists both in Colombo and in Gal Oya indicate that at least for the Left Bank, Gal Oya, the assumptions in the text, above, and in Table III-3 of this paper are more reasonable.

projected situation without the project. In terms of land use, 40,700 additional acres should be sown by year 7 as a result of increased irrigable acreage and cropping intensity. Increased production would amount to 3,997,000 almost 4 mn. bushels of paddy by year 20 which, valued at the world market price of about Rs.58.43/bu., would represent an incremental value of Rs.233.5 million (\$15.1 million).^{1/} Production benefits are valued at world prices in order to reflect the value of the increased production to the economy as a whole in terms of the resources saved by not having to import the equivalent amount of rice.

Table III - 4

<u>Year</u>	<u>Incremental Acreage^a</u> (ac)	<u>Incremental Production</u> (bu 1000)	<u>Incremental Gross Benefit</u> (1000 Rs)
1	-	-	-
2	-	-	-
3	6,700	289	16,886
4	14,000	611	35,701
5	22,100	1,052	61,468
6	31,000	1,646	96,176
7	40,700	2,428	141,868
8 to 20	40,700	2,778 to 3,997	162,319 to 233,545

(Based on Tas. III- 2 & 3)

^aGross sown acreage Ta.III-3 less gross sown acr. Ta.III-2.

3. Evaluation of Costs:

The projected costs to the economy of this project can be classified into three components: capital costs; operating and maintenance costs; and production costs.

a. Capital Costs.

The Left Bank Gal Oya capital costs shown below in Table III-5 are derived from the total project costs -- GSL and AID -- shown in Table IV-2 of the Financial Analysis (Part IV). The costs shown in Table III-5 exclude inflation allowances since inflation has not been projected for either the cost or the benefit sides of the analysis. They include 100% of the costs of the "Gal Oya Modernization, Planning and Research" and

^{1/} This price is based on the 1974-78 annual average price of rice imported into Sri Lanka, \$265 per metric ton, converted into bushels of paddy at \$1.000 = Rs.15.5 and employing a paddy-to-milled rice conversion ratio of 0.68.

"Extension" components of the project but include only 50% of the costs of the "Training", "Central Support", and "Socio-Economic Research" components and none of the cost of the "Master Planning and Research (Walawe)" component. These excluded costs, which account for only about 15% of total project costs, are assumed attributable to water management improvement in other portions of the Gal Oya scheme (the Right Bank and River Division), to the Uda Walawe scheme, and to other major irrigation schemes.

Table III - 5

CAPITAL COSTS, LEFT BANK GAL OYA

<u>Year</u>	<u>Rs.1000</u>
1	59,008
2	51,072
3	33,402
4	53,677
5 to 20	-

Dollar conversions at \$1.00 = Rs.15.5.

Sources and other explanations in text above.

b. Operating and Maintenance Costs.

In addition to capital costs, operating and maintenance (O & M) costs, allocated to the Irrigation Department on a per acre basis, are included in total economic costs. As reported in Part II above, the Government has doubled funds available for O & M in 1979 from Rs.30 to Rs.60 per irrigated acre, and the Irrigation Department is pressing for an increase in this allocation to Rs.125 per acre in 1980. It is assumed in this analysis that this new per acre O & M rate will become effective next year and be maintained throughout the project. Total incremental O & M costs are shown in Table III-6 below. They are derived by multiplying the incremental Left Bank Gal Oya acreage attributable to the project (from Table III-4) by Rs.125 per acre.^{8/}

^{8/} This approach differs from that of the Hill Report. The latter applies the difference in per acre O & M expenses between those estimated to prevail with and without the project to the incremental acreage. The Mission believes this results in an under-estimation of incremental O & M costs attributable to the project and has instead applied the total per acre O & M allocation to incremental acreage to obtain incremental O & M costs.

TABLE III - 6

LEFT BANK GAL OYA, TOTAL INCREMENTAL
OPERATING AND MAINTENANCE COSTS

<u>Year</u>	<u>Incremental Acreage</u> (from Ta III-4)	<u>Total Incremental O&M Costs @ Rs.125/ac.</u> (1000 Rs)
1	-	-
2	-	-
3	6,700	838
4	14,000	1,750
5	22,100	2,762
6	31,000	3,875
7	40,700	5,086
8 to 20	40,700	5,086

See text for further explanation.

c. Production Costs.

The basic source of production cost information utilized in this analysis is a study prepared by the GSL's Agrarian Research and Training Institute.^{9/} This study presents yields and farm production cost data for paddy in five districts of Sri Lanka. Farm production costs for the Left Bank Gal Oya were estimated by first estimating the relationship between costs per acre and yields per acre implied by the data from the five districts, and then estimating Gal Oya costs from this relationship and known information on yields in Gal Oya. These costs amount to Rupees 23.48 per bushel in 1978 prices.^{10/}

^{9/} A.S. Ranatunga and W.A.T. Abeysekera, "Profitability and Resource Characteristics of Paddy Farming", Research Study No.23, Agrarian Research and Training Institute, (Ministry of Agricultural Research and Development; Colombo: Dec. 1977).

^{10/} Farm production costs were regressed against yields among the following districts: Hambantota, Polonnaruwa, Kegalle-Kandy, and Colombo. The estimated Gal Oya per bushel costs in 1978 Rupees for the major components were: labor-Rs.8.86; tractor and buffalo-Rs.4.04, fertilizer-Rs.3.58; agro-chemicals-Rs.1.09; seed-Rs.0.82; and non-cash inputs (labor, buffalo, tractor, seed) - Rs.5.09. The data were inflated from 1977 to 1978 prices on the basis of Central Bank data and discussions with ARTI researchers.

An alternative source of farm production cost data is provided by the CH2M Hill report (op.cit., Table 9-10). Although these data have not been used here in the calculation of internal rates of return, partly because they refer to both Gal Oya and Uda Walawe, and partly owing to some uncertainties in their interpretation for purposes of economic analysis, they do indicate a range of costs per bushel -- Rs.21.20 to Rs.24.90 -- of the same magnitude as that estimated from the ARTI study (Rs.23.48).^{11/}

In order to compare these farm production costs with the value of benefits from the point of view of the economy as a whole, a margin for transport, handling, milling, and marketing costs must be added. A figure of Rs.5.87 per bushel for this margin, taken from the Hill report (Table 9-7), is therefore added to Rs.23.48, yielding Rs.29.35 per bushel production costs. Finally, from the perspective of the economy as a whole, resources should be valued at their opportunity costs. The costs of two farm inputs need to be re-priced to more accurately reflect their opportunity costs: fertilizer and labor. Fertilizer carried a 50% subsidy when the ARTI data were collected (and still does). The opportunity cost or "shadow price" of farm labor, because of unemployment and underemployment, was estimated from the ARTI study to be 20% less than the market price. The net impact of these adjustments (increasing the cost of fertilizer by Rs.3.58 per bushel and decreasing the cost of labor by Rs.1.77 per bushel) is to increase the production cost per bushel by Rs.1.81 to Rs.31.16.^{12/} This cost is employed in Table III-7 below to generate total incremental production costs as a result of the project.

^{11/}The Hill report figures were calculated from the "present" and "projected" columns of Table 9-10 of the Hill report by first adjusting the data to reflect the cropping intensities and yields employed in the present analysis, and then dividing the "Expenses for 3 acres" row by the "Production" row to obtain cost per bushel.

^{12/}The Hill report (Table 9-7) uses a factor of .3 for upward shadow price adjustments for fertilizer, agro-chemicals, tractors and the foreign exchange component of project capital costs. Since Sri Lanka is now on a floating exchange rate and fertilizer is the only subsidized input, the Mission decided to adjust upward (by 100%) only the price of fertilizer. The Hill report made a downward shadow price adjustment of 30% for labor. The Mission has used an adjustment of 20%, based on the ARTI study.

TABLE III-7

LEFT BANK GAL OYA, INCREMENTAL PRODUCTION COSTS

<u>Year</u>	<u>Incremental Production</u> (1000 bu.) (From Ta. III-4)	<u>Incremental Production Costs</u> <u>@ 31.16/bu.</u> (1000 Rs.)
1	-	-
2	-	-
3	289	9,005
4	611	19,039
5	1,052	32,780
6	1,646	51,289
7	2,428	75,656
8 to 20	2,778 to 3,997	86,562 to 124,547

See text for further explanation.

4. Rate of Return and Sensitivity Analysis:

Table III-8 brings together the information from Tables III-2 to III-7 on incremental gross benefits and incremental gross costs. The economic feasibility of the project will be judged first on the magnitude of the "internal rate of return" (IRR) on these benefits realized and costs incurred, then by an evaluation of the sensitivity of the rate of return to changes in the most important parameters.

The third column of Table III-8 shows the difference, or "incremental net benefits". It will be noted that while these net benefits are understandably negative during the first four years, they become positive thereafter, increasing to Rs.108.562 million by year 20. The IRR of the project to the economy as a whole is defined as that discount rate which makes the sum of these incremental net benefits equal to zero. Alternatively, the IRR may be viewed as a rate of return to the economy yielded by the stream of benefits of the project, over and above the stream of costs.

The IRR implied by Table III-8 is about 23.3%. This may be compared with an opportunity cost of capital of 10% employed for economic analysis by the Central Bank of Ceylon and with a 13% figure estimated by a World Bank consultant (Mr. Deepak Lal). This indicates that the project constitutes a very efficient and highly desirable use of economic resources compared with alternative uses. The above IRR may also be compared with the IRR of 20.6% estimated by the Hill report for all of Gal Oya and Uda Walawe. (Table 9-9).

TABLE III - 8

LEFT BANK GAL OYA, INCREMENTAL NET BENEFITS
(Rs.1,000)

<u>Year</u>	<u>Incremental Gross Benefits^a</u>	<u>Incremental Gross Costs^b</u>	<u>Incremental Net Benefits^c</u>
1	-	59,008	-59,008
2	-	51,072	-51,072
3	16,886	43,245	-26,359
4	35,701	74,466	-38,765
5	61,468	35,543	25,925
6	96,176	55,164	41,012
7	141,868	80,742	61,126
8	162,319	91,648	70,671
9	177,160	99,563	77,597
10	185,983	104,268	81,715
11	191,183	107,042	84,141
12	196,909	110,095	86,814
13	202,635	113,149	89,486
14	208,361	116,202	92,159
15	214,555	119,506	95,049
16	220,807	122,840	97,967
17	227,059	126,174	100,885
18	229,221	127,327	101,894
19	231,441	128,511	102,930
20	238,195	129,633	108,562

^aFrom last column of Table III-4, except year 20 which adds a salvage value of 5% of the equipment cost, or Rs.4.650 million.

^bSum of last columns of Tables III-5, III-6, and III-7.

^cDifference between first two columns.

The critical assumptions employed in this "base case" IRR are:

- (a) maximum cropping intensity: 189%
- (b) maximum yield: 85.4 bu/ac
- (c) labor shadow price adjustment factor: 20%
- (d) c.i.f. price of rice: \$265 per metric ton. (Average 1974-78).

It is believed that these and other assumptions employed in the "base case" analysis are realistic; in fact, many are, as noted in the preceding discussion, on the conservative side.

The four assumptions above have been varied to test the sensitivity of the IRR to these critical parameters. A "high alternative" assumed the following values: (a) maximum cropping intensity of 199%; (b) maximum yield of 90.6 bu/ac; (c) labor shadow price adjustment of 40% (suggested by World Bank consultant Deepak Lal); and c.i.f. rice price of \$300 per metric ton (the price of rice imported into Sri Lanka in 1973-74 exceeded this). The high alternative yields an

IRR of 32%. Although assumptions (a) and (b) are believed quite optimistic, they could possibly be achieved. The Hill report in fact concludes that cropping intensities and yields of these magnitudes could be achieved. Assumptions (c) and (d) could also prove to be more accurate than those taken for the base case.

A "low-alternative" assumed the following, "pessimistic" parameter values:

- (a) maximum cropping intensity of 180%;
- (b) maximum yield of 75.5 bu/ac;
- (c) no labor shadow price adjustment; and
- (d) c.i.f. rice price of \$230 per bushel.

This alternative yields a rate of return of 13%, equal to the IBRD consultant's estimate of the shadow price of capital, but still significantly above the 10% figure employed by the Central Bank of Ceylon.

A final alternative involved assuming the "base case" parameters, but including all project costs, including those of the central support, training, research, and master planning activities which are expected to benefit other parts of Gal Oya, Uda Walawe, and other major irrigation systems. This modification resulted in a lowering of the IRR from 23 to 20%. The latter is an extremely conservative result because it does not include a quantitative estimate -- an inherently difficult one to make -- of the benefits to be derived in these other irrigation areas.

5. Costs per Beneficiary:

The total cost -- GSL and AID -- for the four year project is \$18.340 million. However, only \$15.831 million (including an inflation allowance) of this total is directly attributable to the Left Bank Gal Oya activities (see text above for further explanation). The most immediate beneficiaries are the roughly 17,330 farm families (assumes 52,000 acres and 3 acres per farm) living on the Left Bank of the Gal Oya. In addition to these families, roughly 1,670 additional families will benefit from the 5,000 acres of new irrigated land to be added as a result of the project. At an average family size of six, the total immediate beneficiaries in these 19,000 families would number 114,000. Project cost per immediate beneficiary would thus be \$139. Somewhat more indirectly but still benefitting from the project would be the population of the entire Gal Oya area, estimated in the Social Soundness Analysis (Part III - D) at 280,000. Project cost per beneficiary for the Gal Oya area

would thus be \$63.^{13/}

The population of all existing major irrigation schemes, including Uda Walawe, has been estimated at about 300,000 families or 1.8 million people. That would result in a cost per family of \$61 and a cost per beneficiary of \$11. When account is taken of the fact that 120,000 new farm families or 720,000 people are to be settled in the Accelerated Mahaweli Basin Development Scheme, which is also intended to benefit from the experience of this Project, the cost per family drops to \$44 and the cost per beneficiary to \$7.

6. Need for Concessional Resources:

The Summary and Recommendations section of this paper (Part I) requests \$3.0 million in Grant funds to permit grant funding of all technical assistance, mid-project evaluation costs, and socio-economic research. Sri Lanka's need for concessional resources is indicated by its low per capita income (even with the 8% real GNP growth in 1978, per capita income is still only about \$170), its increasing balance of payments deficit on current account, and the impressive social and economic efforts it is making and has already achieved. These considerations are discussed fully in the Mission's FY 1981 Country Development Strategy Statement and more recently in the World Bank Aide Memoire, "Sri Lanka Aid Requirements in 1979 and 1980", presented to the Sri Lanka Aid Group Meeting in Paris, May 31 - June 1, 1979. The latter document projects, as a result of a number of factors, including the government's economic liberalization policies (which in the long run should save and earn foreign exchange), an increase in Sri Lanka's current account deficit from \$122 million in 1978 to \$243 million in 1979, and to \$323 million in 1980. Although gross foreign aid disbursements are expected to increase accordingly, the implications for future debt burden and the continuing need for as concessional assistance as possible cannot be ignored.

^{13/}The total cost figure for this calculation is adjusted upward to include all elements of the project with the exclusion of the Uda Walawe Master Planning component (\$0.88 million). The total costs employed for calculations in the following paragraph are for the entire project (\$18.34 million).

D. Social Soundness Analysis

"Out of the community of interests thus engendered throughout the district arose another curious practice which still prevails in some parts. For the care of the fences and water-courses entrusted by sections to every field servant interested in the crop, and to secure their faithful performance of this duty, it is customary for the villagers to elect one of themselves as an overseer, with power to inspect every portion of the work, and by common consent to inflict corporal punishment in case of neglect, the delinquent being compelled at the division of the harvest to pay to this functionary a proportion of his own share as remuneration for his trouble in whipping him." (Sir Emerson Tenent's Ceylon, Vol. II)

1. Beneficiaries — An Overview:

Viewing the Gal Oya Project as a socio-economic innovation of regional proportions, it can be anticipated that its implementation will affect a wide range of beneficiaries both within and beyond the region. In the long-run it will have the effect of increasing agricultural production, raising farm and non-farm incomes, and improving living standards for many people.

Those benefitting directly from improved water management will be the 19,000 farm families (114,000 persons-see III-C-5) who are or will rely on the existing Left Bank irrigation system for their livelihood. They include people of all economic levels from poor farmers and laborers to relatively well-to-do farmers. In fact it is anticipated that the relatively poorer families at the tail ends of field channels and of the system as a whole, who currently receive little or no irrigation water will benefit most from this project. Among them are members of the dominant ethnic and religious groups in Sri Lanka. The 280,000 population in the Gal Oya area consists of 7 percent Sinhalese Buddhists while the remaining are Tamil-speaking people of which 65 percent are Muslims and 28 percent are Hindus. Women in farm families will derive varied benefits from the project. Also directly benefitting from implementation of the project will be the management-level personnel of various government agencies and will include administrative technical staff and both skilled and unskilled laborers.

Because of its spread effect, the project will have a beneficial impact on those living in the market towns who provide goods and services to the farm communities. As a model, the Gal Oya Project will provide valuable lessons and guidelines for similar projects in other regions. Over a period of time, as the impact of the project deepens and spreads, the ultimate beneficiary will be the country of Sri Lanka as a whole.

2. Farmers as Beneficiaries:

Potentially, the bulk of the 280,000 people living in the Gal Oya Project Area located in the eastern portion of the Dry Zone will benefit from this project. Of these, 7500 families were formerly landless families that were settled in the area by the GSL when the first Gal Oya Irrigation Scheme was implemented in the 1950's. Some of these colonists were Sinhalese Buddhists from other parts of Sri Lanka. They were provided with an average of 3 acres of paddy land plus one acre of "highland" (i.e. non-irrigated) on which their farmsteads were located. The indigenous population of the area was for the most part Tamil-speaking Muslims and Hindus. Those local Muslims and Hindus who participated in the scheme received an average of 5 acres per family.

Numerous factors, wrought by the ruling political parties, have given rise to varied patterns in the social organization of water management which are very important to consider in the implementation of the current project and also in assessing the role of the farmers as beneficiaries of improved water management schemes. These include the implementation of the original Gal Oya Scheme and the subsequent changes in the roles of the traditional irrigation headmen called the V&l Vidane by the Sinhalese and the Vatta Vidane by the Tamil speaking populace. The socio-economic patterns are affected by a farmers' geographical location in the system, i.e. whether he is located at the top-of-the-system (the head or zone just below the Senanayake Samudra main tank), the middle, or the end of the system (the tail or zone near the coast). These patterns are also determined by ethnic-religious affiliation, i.e. whether the farmers are members of the Sinhalese, Muslims (Tamil-speaking), or Hindu (Tamil-speaking) communities. Water Management Zones are detailed as follows:

- a. The Top-of-the-System Zone. The farmers in this zone are colonists or sons of colonists who were moved into the Gal Oya Scheme in the early 1950's. Some are Sinhalese Buddhists and their settlements are composed of somewhat dispersed farmsteads located along lines of communications such as roads, dikes or channels. One water management problem in this area is the many farmers at the head end of the field channel either deliberately or unwittingly, use excessive amounts of irrigation water during the maha and yala seasons. There is strong evidence that their yields are correspondingly reduced. There are other farmers particularly those at the tail end of the field channel who receive inadequate amounts of irrigation water during the yala because of the uneven distribution system or because other farmers are negligent in maintaining their field channels thereby blocking the flow of water. Traditionally these types of problems

were dealt with by the Vel (or Vatta) Vidane. It should be noted that the Vel or Vatta Vidane was elected by his peers and his authority was sanctioned by the government and recognized within the community. He could thus effectively arbitrate water disputes and even boundary disputes. For political reasons, however, the role of the Vel (or Vatta) Vidane was abolished in the 1960's. In 1978 the Government incorporated the Vel Vidane responsibilities in the role of the Cultivation Officer under the Agrarian Services Department. The role of the Cultivation Officer has not been recognized or accepted by most farmers and the Sinhalese communities now lack any distinct or effective authority to maintain the irrigation system within their tracts. The result has been that irrigation is largely unregulated or uncontrolled in many Sinhalese tracts.

- b. The Middle-of-the-System Zone. Water distribution in the middle of-the-system zone is complex. Some farmers receive inadequate supplies of irrigation water for the yala-crop. Others receive an excess of water due to insufficient drainage facilities or because of the poor placement of field channels. The same social organization problems noted above for the Sinhalese communities located in the top-of-the-system zone is to be in the middle-of-the-system zone among the relatively few Sinhalese living in this zone.

However, on the basis of field investigations the situation clearly is quite different among the Tamil-speaking Muslims and the Tamil-speaking Hindu communities which are located in this zone. In both cases their villages have been established for a long time. Their settlement patterns are characterized by densely grouped clusters of farmsteads. Interlocking kinship networks, which are reinforced in the Muslims villages by well-organized mosque societies, give these communities a positive cohesiveness. Leadership is strong and effective in satisfying community needs. Although the role of the Vatta Vidane has been officially abolished, it is evident that the men who were Vatta Vidanes continue to be recognized not only as leaders in regulating the local irrigation systems, but also in arbitrating land and boundary problems. The result is a relative high degree of order in maintaining the usage of the available irrigation water.

c. The Lower-End-of-the-System Zone. The worst water management problems in the Gal Oya Scheme are found at the end-of-the-system zone. Some farmers receive no irrigation water whatsoever and must rely entirely on rain water for cultivating paddy. Others receive water only intermittently during the maha and none during the yala. There are also farmers who experience flooding due to lack of adequate drainage or to the poor placement of field channels. In the coastal Attalachenai-Akkaraipatu area of Amparai District, inadequate planning for the original Gal Oya has resulted in some 10,000 acres being permanently inundated, and an additional 5000 acres being under water much of the time. Most of the villages in this zone are inhabited by Tamil-speaking Muslims and Hindus. Their socio-economic organization for irrigation is the same as that noted above for Tamil-speaking Muslim and Hindu villages located in the middle-of-the-system zone. It appears that the available irrigation water is used as effectively and equitably as possible under the existing circumstances primarily because of the collective ability and willingness of farmers to discipline themselves.

3. Anticipated Impact of the Project on Farm Families:

In order to benefit the farm families in the system by improving their quality of life, implementation of the Gal Oya Water Management Project will have to result in increased agricultural production and therefore increased incomes. This should, in turn, have the effect of raising living standards of the people. However, improved water management by itself and even including the modernization of the physical irrigation system, the reorganization of management, and attaining a more efficient social organization of irrigation at the local level, cannot achieve the project goal without a concomitant implementation of support services. These include: support services of the extension programs including information and availability of fertilizer, pesticides, improved rice varieties and agricultural credit; better marketing facilities and organizations; improvement of the delivery and distribution of water from the tank to the farm level; and direct involvement of farmers in water distribution and use enforcement, including sanctions. While long-range socio-economic effects of the project are likely to be positive for all of the socio-economic groups, and particularly for the poorer farmers in the tail-end zone and the tail-ends of channels within all three zones, there will be some short-range disruptions.

- a. Increased Agricultural Production. Physical modernization of the Gal Oya Irrigation System, improved management, and creation of an effective socio-economic organization of irrigation at the local level will have the effect of providing water to farmers throughout the system with adequate and reliable sources of irrigation water. The first phase of the water management program will be to improve the left-bank (main channel) irrigation system, resulting in more reliable irrigation water distribution in both the Maha and Yala seasons. At present the total acreage planted on the Left Bank during the Yala season is about 15,000 acres. It is estimated that this project will increase the total acreage cultivated in the yala season to about 50,000 acres -- almost as great as that currently irrigated during the maha season (52,000 ac.).

Physical improvement of the system will also result in those fields which are now excessively flooded being properly drained. The improved extension services will provide for the more effective use of fertilizer and of pesticides. It is also anticipated that improvements will be made in agricultural credit and marketing systems. (See Part III-C, Economic Analysis).

- b. Institutional Improvements. The Project will enable the Irrigation Department and other appropriate agencies to devise, adopt and implement rules for water distribution and enforcement. The project will show that water management practices are the responsibility of both the farmers and the Irrigation Department. Sanctions will be adopted under a system that provides for quick administrative remedies for water abuse and misuse. There may be a Water Tribunal appointed. Another institutional improvement that will lead to increased agricultural production is the enactment of ground water control legislation and/or rules for areas where ground water could be utilized for domestic and irrigation uses. With increased pressure on surface water, more ground water development will be taking place in many areas. It is important to prevent the uncontrolled exploitation of ground water including aquifer contamination and receding water tables. Farmers' attitudes towards this source of supply must be properly shaped before both misimpressions and "rights" are entrenched.

The organizations of farmers into either informal or formal organizations with or without legal status will in many instances contribute to a long range beneficial

impact of the program. In addition to instituting a collaborative mechanism for distribution of water among farmers, and the operation, maintenance and rehabilitation of the delivery system, their own irrigation organizations can effectively serve as the communication link between the farmer and the Irrigation and Agrarian Service Departments as well as other government agencies. Since disputes inevitably occur among farmers over water, these farmer organizations can serve as the forum and mechanism for resolving disputes and preventing anticipated confrontations.

- c. Increased Demand for Labor. Increased agricultural production throughout the Gal Oya System will result in a concomitant increased demand for farm labor. This will not only benefit those who work full-time as laborers, but also those small farmers and members of their families (particularly the women) who work as laborers part-time to supplement their incomes. This impact, will be felt less strongly among the Sinhalese colonists who already rely on mutual aid for their labor needs, than it will among the Tamil-speaking farmers who hire labor.
- d. Improved Positions of Small Landholders. Due primarily to water shortages during the Yala season at the lower end of the system, wealthier farmers have been able to expand their holdings by becoming mortgagees to small landholders. Although "colonists" are not allowed to sell their land they eventually lose the use of their land to the wealthy farmers to whom they are indebted. The increased production and income of the small landholders from harvesting a Yala crop will permit more of them to retain use of their land.
- e. Improved Drinking and Household Water. In the Gal Oya area the irrigation system is the major source of water for domestic purposes including drinking, bathing, cooking, and washing of clothes. Approximately 5,000 people living at the lower end of the system suffer shortages of household water during the dry season. Any increase in the amount of water reaching these areas through more efficient water management at the head of the system will bring an improvement in their living conditions. There are certain health risks in drinking canal water, so an attempt will be made to identify, through a domestic water master plan, alternate sources of potable water that can be developed.

- f. Women in Development. Sinhalese and Tamil-speaking Hindu women participate actively in the transplanting, weeding, and threshing of paddy, and the importance of their contribution will increase as agricultural production is augmented. This is not the case with Muslim women because the tradition of purdah restricts women more or less to household affairs. All farm women will benefit from the raising of incomes as production is increased, permitting house improvements and purchase of consumer goods such as radios, sewing machines, water pumps, cooking utensils and various labor saving devices. All farm women also will have household tasks made easier by the increased availability of domestic water.
- g. Reduced Water Use at Head-of-the System. Equitable distribution of water as part of the project will mean that some farmers at the head of the system, who now use more water than they need, will have their supply of water reduced. For them, this restraint will be a disruption which is probably mostly psychological as they are forced to make more efficient on-farm use of irrigation water. Any resistance on their part should disappear as they become assured that more efficient use of less water will not only not increase their production and incomes but should, through more careful practices, increase their returns.

4. Anticipated Impact of the Project on Management Personnel:

Modernization and reorganization of the Gal Oya Irrigation System as part of the Water Management Project will bring varied benefits to a wide range of personnel involved in this effort. Numerous administrative positions will be created and personnel will be hired to fill them. Technicians are both skilled and unskilled laborers will be needed for the planning, construction, and operational aspects of the project. Some of these personnel will receive the benefits of special training programs both in Sri Lanka and overseas.

5. Anticipated Spread Effects:

Implementation of the original Gal Oya Scheme in the early 1950's produced vast socio-economic changes in the area. The previous isolation of the population diminished as roads were cut through the forested interior and towns such as

Amparaf grew rapidly. With the newly developed agricultural base there arose a demand for a wide range of goods and services. As farmers increased their production and their incomes, they began to purchase more farm goods (fertilizer, pesticides, tools, and so forth); farm equipment (notably tractors); and consumer goods (including some luxury goods such as radios and sewing machines). Today market centers such as Amparaf have many well-stocked stores, tractorsshow-rooms and service centers. In addition, one finds many schools, hospitals, and other social services' facilities functioning in the area.

The reorganization and modernization of the Gal Oya water management system will have the effect of not only continuing this process of socio-economic development but also of accelerating it. As a result, a large number of people in the entire region will experience direct and indirect benefits. (For further information see Annex 10, Socio-Economic Patterns in the Gal Oya Region).

E. Environmental Concerns

In general terms, the project's Initial Environmental Examination (IEE) stood at neutral to mildly positive. During the PID review of the Water Management Project, a number of environmental issues were raised, and satisfied. However, a Threshold Decision was not made by the Assistant Administrator. Therefore, Mission has resubmitted the Initial Environmental Examination as Annex 13 and requests a Negative Determination be provided at this time. This determination is further substantiated by additional material provided below and by the "Environmental Soundness" analysis provided in Chapter 9 of the CH2M Hill Feasibility Report (See Annex 5 of this Paper). The analysis compares the project area with Mahaweli Ganga, analyses the previous environmental assessment of Stage II of the Mahaweli Ganga (Weatherly Report of 1977) and generally indicates the environmental impact of this project would be more positive than irrigation resettlement activities in Mahaweli. This analysis concludes that the project ... "can only have positive impacts over what is now occurring".

The project is directed at improved operations and maintenance of the Gal Oya irrigation system, training, extension, master planning and field research, farmer organizations and social research. The project objectives are aimed at bringing the levels of management organization, operations and distribution maintenance in the project areas to acceptable and replicable levels. This can only have an overall positive impact over what is presently occurring in the Gal Oya project area and in other parts of the country. The following relevant and specific issues were focussed upon in the final environmental analysis and were taken in part from the CH2M Report.

1. Incidence of Malaria

There may be a possible effect on the incidence of malaria by the project's implementation due to planned wider distribution of water. This has the potential of increasing the number of mosquito breeding places. However, it can be expected to be offset by the removal of excessive water in the upper areas of the system. As a further counterbalance, the extension and expansion of the GSL Anti-Malaria Campaign with USAID project assistance in Malaria Control will focus on the major irrigation schemes.

2. Water-borne Diseases

There will be no major expected population density increases related to the project. The project will, however, decrease the risk of water-borne gastro-intestinal disease problems, partly as a result of improved nutrition made possible by higher real incomes. Concurrently, domestic-water improvement (expected to start around mid-project after "domestic plans" have been developed) will have a positive effect in reducing the incidence of water-borne disease because of the availability of higher quality water.

3. Risk of Pesticide Residue

Because of an anticipated increase in the use of agrochemicals, this may have a slightly adverse consequence on the project. An offsetting factor would be reduction in water levels and consequent reduction of transmission of pesticides by water flow, with increased reliability of water availability.

4. Soil Loss through Erosion

This project will, in fact, reduce soil loss through erosion due to more proper water applications and lower incidence of large quantities of water flow through fields.

5. Water Logging of Soils and Salinity Build-up

Since water applications are anticipated to be less than at present, the water logging and salinity build up should also be lessened with better distribution and reduced quantities.

6. Reduction in Birds and Animals

The effect, if any, may be slightly negative due to increased agricultural intensification. However, because little or no agricultural land will actually be diverted from natural uses, the impact will be only slight.

7. Energy Losses or Greater Energy Demands

There will be little or no effect since the increased production is labor intensive, emphasizing the under and unemployed, and no significant increase in population is anticipated.

8. Changes in Stream Flows

There will be no impact since the project anticipates no major changes. The timing in canal flow levels will be changed, however.

PART IV. FINANCIAL ANALYSIS AND PLAN

A. FINANCIAL PLAN:

Tables 1 and 2 contain the Summary Cost Estimate and Financial Plan and the Projection of Expenditures by Fiscal Year for this proposed project. These tables were developed jointly by USAID with representatives of the Irrigation Department using the CH2M Hill Report as a basis. They show total Government of Sri Lanka (GSL) inputs of \$8.54 million in local currency equivalents which, when combined with AID inputs of \$9.8 million, result in a total cost of \$18.34 million. Annual inputs expressed as a percentage of total inputs are as follows:

PROJECT FUNDING BY YEAR

<u>Year</u>	<u>AID</u>	<u>GSL</u>	<u>Total</u>
1	37%	17%	27%
2	30%	21%	26%
3	16%	19%	18%
4	17%	43%	29%
Total	100%	100%	100%

This presentation reflects the initial high foreign exchange requirements during the first two years and an increasing local currency requirement during the final year of the project.

As discussed in Part III of this paper, the \$3.0 million grant element proposed herein will be used primarily to finance the services of five long-term and several short-term consultants providing technical assistance to the project and for socio-economic water management research. The Mission anticipates disbursements of these funds as shown below:

TA DISBURSEMENTS
(US \$ 000)

<u>Year</u>	<u>Amount</u>
1	790
2	800
3	930
4	480
Total	\$3,000

The grant element of this project shall be disbursed primarily thru Direct Letters of Commitment (L/Comms) to the technical assistance Contractor(s). Since the Mission plans to provide source/origin of Code 941 plus Sri Lanka for the loan, it may be possible to acquire some commodities such as cement and reinforcing steel in India and thereby greatly reduce transportation charges. Such procurement would be made mainly via bank L/Comms. Procurement of U.S. manufactured materials and equipment will be done primarily thru Direct L/Comms to the various suppliers.

Participants, to include policy makers and officials from the GSL Ministries going to the U.S. and third countries for observational training, will be processed and paid directly by the Mission. Other foreign training requirements, both long and short-term, will be provided in the host country contract(s). The "other cost" component of the foreign exchange element will be disbursed primarily via Disbursing Authorizations (D.A.'s) issued to the Mission.

B. FINANCIAL ANALYSIS :

1. Private Profitability.

Table 3 reflects the anticipated return to a farmer operating a 3-acre farm. This model was developed from information contained in the CH2M Hill Report (Annex 5, Table 9-10), and uses the same assumptions except for the following which were drawn from the Economic Analysis (Part III-C) and are based on current and projected production conditions on the left bank of the Gal Oya.

- a) A current cropping intensity of 1.29 is used;
- b) Projected cropping intensities of 1.62 and 1.89 are used;
- c) A current per acre yield of 52.5 bushels is used; and
- d) Projected yields of 55.6 and 72.3 bushels per acre are used.

The CH2M Hill Report projected cost increases in certain inputs but assumed a constant price per bushel of Rs.36 (\$2.34) which also has been used in the above model for both current and projected production values. The Mission questions the likelihood of this price remaining stable. During the past 10 years the farm gate price of paddy in Sri Lanka has fluctuated dramatically but overall has increased at an implied growth rate of 11.6 percent per year.

As shown on Table 3, the annual return to the farmer is projected to increase 16 percent by year 5 and 88 percent by year 10 (using year 1 as base year). This growth results solely from higher cropping intensities and greater yields per acre, and, although it assumes higher operating costs, it ignores potential increases in the price received for paddy.

The impact of increases in paddy prices may be illustrated as follows:

<u>Production Value Increase</u>	<u>Return to Farmer</u>	
	<u>Year 5</u>	<u>Year 10</u>
3%	\$200	\$323
5%	\$213	\$343
10%	\$244	\$390

Sensitivity measures to determine the degree to which farm performance can be worse than expected and still maintain present cash flows are presented below:

- a) Percent decrease in projected production allowable to maintain current cash flows: Yr.5, 4%; Yr.10, 14%.
- b) Percent increase in projected expenses allowable to maintain current cash flows: Yr.5, 6%; Yr.10, 21%.
- c) Number of times additional operating income exceeds debt service requirements* Yr.5, 7 times; Yr.10, 2.5 times.

An alternate model developed by using cost information obtained from an ARTI study of economic resources used in paddy cultivation (also employed in the Economic Analysis, Part III-C) yields a farm gate cost per bushel of Rs.23.83 (\$1.55)** Use of this cost produces net income to the farmer as follows:

<u>Year</u>	<u>Net Income</u>
1	\$161
5	\$213
10	\$324

The above income figures are in all cases, slightly higher than those shown in Table 3, partly because they assume constant per bushel costs and returns. The projected costs included in Table 3 have been grossed up in accordance with the rates of inflation implied in the CH2M Hill Report (Table 9-10 of Annex 5) (See foot-notes to Table 3 for details.)

* Interest only.

** Includes Rs. .35 per bushel transportation cost paid by farmer. The Economic Analysis uses transportation, marketing and milling costs from CH2M Hill report.

2. BUDGET ANALYSIS.

The most current available budget figures for the Irrigation Department, the primary implementing Agency under this project, are shown on Table 4. As this table illustrates, expectations are that operations for 1979 will exceed 1977 levels by \$20.6 million or 374%. The following schedule demonstrates that most of these increases are associated with capital or project activities; not current or administrative functions.

OPERATING LEVELS
(U.S.\$ 000)

	<u>Expenditures</u>		
	<u>Current</u> <u>(Admin.)</u>	<u>Capital</u> <u>(Project.)</u>	<u>Total</u>
1977 - Amount	2,128	3,377	5,505
Percent of Total	39%	61%	100%
1978 - Amount	2,312	9,505	11,817
Percent of Total	20%	80%	100%
1979 - Amount	5,779	20,336	26,115
Percent of Total	22%	78%	100%
All Years - Amount	10,219	33,218	43,437
Percent of Total	24%	76%	100%

Although current expenditures increased from \$2.1 million in 1977 to \$5.8 million in 1979, project costs increased more than 500% (\$3.4 to \$20.3 million) during the same period.

The 1979 budget provides for the Irrigation Department's involvement in 81 projects relating to gravity irrigation works, 1 lift irrigation scheme and 7 drainage and reclamation projects. In addition, approval has been granted for work on 74 other projects, subject to the availability of funds. Projects funded in 1979 range in size from \$2.9 million to less than \$10,000.

The implementation of this proposed project will have a significant impact on the Irrigation Department's level of operations. The annual project inputs proposed herein, expressed as a percentage of the Department's 1979 Budget are as follows: Year 1, 19%; Year 2, 19%; Year 3, 12%; and, Year 4, 20%. As shown in the table above, dramatic budget increases occurred in both 1978 and 1979. During this period the department has experienced and is experiencing the normal problems associated with large increases in operational levels. It is fortuitous that these increases occurred prior to implementation

of this proposed project. These prior increases are providing the department valuable experience in project implementation which can be applied to the AID project. Therefore, this project should not impose an unrealistic burden on the Irrigation Department.

Table 1

SUMMARY COST ESTIMATE AND FINANCIAL PLAN
(US \$ 000)

SOURCE	AID		TOTAL	GBL LC	TOTAL
	LOAN	GRANT			
Technical Assistance	-	2,450	2,450	-	2,450
Commodities	4,170	-	4,170	2,080	6,250
Training	700	-	700	230	930
Personnel	-	-	-	1,540	1,540
Other Costs	230	280	510	2,470	2,980
Contingencies & Inflation	1,700	270	1,970	2,220	4,190
	8,800	3,000	9,800	8,540	18,340

TABLE 2

**WATER MANAGEMENT PROJECT
PROJECTION OF EXPENDITURE BY YEAR
(US \$ 000)**

O U T P U T S	Yr. 1		Yr. 2		Yr. 3		Yr. 4		LIFE OF PROJECT	
	GSL	AID	GSL	AID	GSL	AID	GSL	AID	GSL	AID
*Modernisation, Planning and Research (Gal Oya)	890	1,820	1,030	1,470	940	630	2,280	680	5,140	4,600
Training	200	500	170	350	100	420	60	130	530	1,400
Master Planning and Research (Walawe)	50	200	190	120	150	60	30	80	420	460
Central Support	10	210	20	130	10	120	20	60	60	520
Socio-Economic Research	20	190	20	170	20	180	10	160	70	700
Extension	20	100	30	50	30	-	20	-	100	150
Contingencies & Inflation	240	580	340	640	410	160	1,230	590	2,220	1,970
Totals	1,430	3,600	1,800	2,930	1,660	1,570	3,650	1,700	8,540	9,800

*This output for the construction aspects of the Left Bank Major Canal Systems will be undertaken by the Department of Irrigation through Force Account procedures (Departmental staff and administrative arrangements).

TABLE 3

AVERAGE FARM PROFITABILITY
3 - ACRE FARM

	Present	Yr.1	Yr.5	Yr.10
Gross Value of Production ^{1/}	\$ 475	\$ 475	\$ 632	\$ 958
Less Expenses:				
Land Preparation	\$ 65	\$ 65	\$ 82	\$ 95
Seeding ^{2/}	35	35	48	70
Fertilizer, Weed & Pest				
Control ^{3/}	69	69	133	241
Harvesting, Transport & Water				
Charges ^{4/}	122	122	151	203
Interest ^{5/}	28	28	37	55
Total Expenses	\$ 319	\$ 319	\$ 451	\$ 664
Return to Farmer	\$ 156	\$ 156	\$ 181	\$ 294

Assumptions:

- ^{1/} Assumes cropping intensities by year as follows: 1.29 1.29 1.62 1.89
 Assumes by per acre as follows: 52.5 52.5 55.6 72.3
- ^{2/} Assumes annual increases of \$.52 acre/Yr./Cropping intensity
- ^{3/} Assumes annual increases of \$3.02/Acre/Yr./Cropping intensity
- ^{4/} Assumes annual increases of \$1.04/Acre/Yr.Cropping intensity
- ^{5/} Based on a loan of 75% of production costs at 12%/Year.

**IRRIGATION DEPARTMENT BUDGET
FISCAL YEARS 1977 (ACTUAL), 1978 AND 1979 (BUDGETED)
(US \$ 000)**

TABLE 4

	Actual 1977	Budget 1978	Budget 1979
GENERAL ADMINISTRATION & STAFF SERVICES- PROGRAM (1)			
Current Expenditures:			
Admin. Finance and General Services	\$ 102	\$ 149	\$ 221
Planning, Design, Research and Consultancy	473	469	657
Capital Expenditures:			
Const. & Improvements to Buildings	35	39	97
Purchase Furniture, Equipment & Vehicles	46	136	162
Investigations & Consultancy	- 74	174	13
Total - Program (1)	\$ 730	\$ 967	\$1,150
CONSTRUCTION & DEVELOPMENT OF IRRIGATION AND DRAINAGE WORKS - PROGRAM (2)			
Current Expenditures:			
Supervision of Construction & Maintenance	\$ 172	\$ 203	\$1,566
Maintenance of Gravity Irrigation Works	1,119	1,223	2,846
Maintenance of Lift Irrigation Works	197	208	227
Maintenance of Drainage Schemes	65	60	195
Maintenance of Departmental Buildings	-	-	67
Capital Expenditures:			
Additions & Improvements to Buildings	320	-	78
Construction & Improvements to Gravity Irrigation Works	1,773	6,870	19,442
Lift Irrigation Works	123	13	12
Drainage & Reclamation Works	750	2,085	305
Purchase of Vehicles, Machinery & Furniture	256	188	227
Total - Program (2)	\$4,775	\$ 10,050	\$24,965
TOTAL BUDGET	\$5,505	\$ 11,817	\$26,115
PERCENTAGE INCREASE (1977 BASE YEAR)	0%	115%	374%

PART V IMPLEMENTATION PLAN

A. Implementation Schedule:

The Implementation Schedule for this project is presented in the following Table. As laid out in the schedule, the project would start with approval of the Project Paper and with a loan/grant authorization on August 1, 1979. The Project Agreement is expected to be signed by August 31 with the Conditions Precedent to be met by November 15, 1979. The Government has requested that the arrival of expatriate Technical Assistance be expedited so that the consultants can arrive early next year. Therefore, expressions of interest will be sought so a short list can be obtained and the process expedited for Consultant selection enabling the contract to be signed by mid-February, 1980. The consultants would then arrive in April. It is anticipated that the consultancy selection and contract will be by the Host Country (Department of Irrigation) under grant funds provided by this project.

The Government and AID are also planning to expedite the procurement of the construction and other equipment for the project. An equipment specialist is expected to arrive after the Agreement is signed to assist the Implementing Agency and Mission in final selection of initial equipment and to draft the specifications so the IFBs can be issued by November 30, 1979. The orders can then be placed by mid-February with initial equipment arriving by mid August of 1980. Using this approach the equipment should arrive and modernization work should actually begin from 8 to 12 months earlier than it would if the consultant team were to make initial equipment selection. Mission is also planning to expedite the clearance of the IFB through the GSL's Cabinet Tender Board by issuing the general aspects of the IFB as an attachment to Implementation Letter Number 1.

The Implementation Schedule contains all the major aspects of the Project including the preparation of the rehabilitation and modernization plans, training, initiating the farmer/water user organizations, the Master Plans, socio-economic and On-Farm Water Management research. The draft Master Plans for both the Gal Oya and Uda Walawe schemes are expected to be completed by March 1 of 1982 and would form the basis for possible future projects in water management.

B. Description of Procurement:

To facilitate the procurement of all major commodities, it is contemplated that AID will follow usual IFB procedures with tenders being issued, evaluated and awards made through the Sri Lanka Embassy in Washington. The GSL has agreed on this procedure to help expedite procurement. Also, assistance will be required of AID/W to assist the procurement team and approve awards. The Technical Assistance contracting will be done directly by the Irrigation Department and the Government of Sri Lanka. It is currently planned that the awards for commodities and TA consultancy will both be made in Washington in February, 1980.

C. GSL Project Monitoring and Implementation:

As explained in the Administrative Feasibility Section (III-B), the Irrigation Department will have the primary project implementation responsibility. A special Central Support Office will be responsible for much of the implementation of the project and will facilitate other aspects. A Project Field Office will implement the project in Gal Oya and a small office will conduct the research and planning at Walawe. A senior level Steering Committee at the national level will provide overall policy direction, coordination assistance and will monitor project implementation through semi-annual reviews. At the field operations level, a special Project Coordinating Committee chaired by the Government Agent with representatives from the related support departments, will monitor and provide overall policy and operations direction to facilitate implementation in Gal Oya.

D. USAID Project Monitoring:

The Mission has established a new Water Management Division within the Rural Development Office with the primary task of monitoring and assisting with implementation of this project. This office is currently headed by a Water Management Specialist (Agriculture Engineer). The Mission is in the process of hiring a Sri Lankan professional engineer with an irrigation and/or agriculture engineering background to assist the Water Management Specialist. Two other Mission Direct Hire engineers are also being assigned to Sri Lanka and should be on-board by the time the project is started. They will be able to provide additional technical input into the project as required. The mission has also recently been assigned a behavioral scientist/social anthropologist who will work with the U.S. Technical Assistance Consultant and the Government on the difficult issue of farmer/water user organization and related socio/economic research. In addition, the Mission will hire a locally available American sociologist for a short-term consultancy to work with the On-Farm Water Management Project and ARTI. He will assist in the designing and testing of farmer organization models to be used in Gal Oya, Uda Walawe and elsewhere.

IMPLEMENTATION SCHEDULE

"KEY" BENCHMARKS

<u>Action</u>	<u>Responsibility</u>	<u>Approx. Date</u> <u>NLT</u>
1. Loan/Grant Authorization	AID/W	Aug. 1, 1979
2. Project Agreement Signed	USAID/GSL	Aug. 31, 1979
3. Expressions of Interest <u>submitted</u> for completing short list	AID/W	Sept. 15, 1979
4. RFPs for TA Consultants Issued	USAID/GSL/AID:W	Oct. 15, 1979
5. CBD Notice for commodities published	USAID	Oct. 15, 1979
6. Initial Conditions Precedent met	GSL	Nov. 15, 1979
7. IFBs for Equipment and Commodities issued	USAID/AID:W	Nov. 30, 1979
8. "Model" or Test Irrigation organizations defined	ARTI/GSL/USAID	Dec. 1, 1979
9. Closing Date for TA proposals	USAID/GSL	Dec. 1, 1979
10. Aerial Photo Maps completed	GSL	Dec. 30, 1979
11. Consultant Contractor selection made	GSL/USAID	Dec. 30, 1979
12. Bid closing date for equipment	USAID/AID	Jan. 30, 1980
13. Contracts awarded for equipment	GSL/AID	Feb. 15, 1980
14. TA Consultancy contract negotiated and signed	GSL/Contractor/ USAID	Feb. 15, 1980
15. Initial consultants arrive	Consultants	April 15, 1980
16. Work begins on Research Master Plans and Rehab Plans	GSL/Consultants	May 1, 1980
17. Pilot Farmer Organizations formed in various levels and tracts of left bank	GSL/ARTI/ Consultants	July 1, 1980

<u>Action</u>	<u>Responsibility</u>	<u>Approx.Date</u> <u>NLT</u>
18. Training begins at Galgamuwa and Participant Training begins	GSL/Consultants	July 1, 1980
19. Life of Project and first annual work plans prepared by consultant		July 15, 1980
20. Initial Heavy Equipment arrives	USAID/AID:W	Aug. 15, 1980
21. Initial Left Bank Modernization Rehabilitation Plans Available	GSL/Consultants	May 1, 1980
22. Annual Project Impact Assessment Review held in Amparai and implementation plans updated	GSL/Consultants/ USAID	Sept. 15, 1980
23. Modernization of Left Bank begins	GSL/Consultants	Sept. 30, 1980
24. Initial Overseas Training completed	GSL/Consultants	Dec. 15, 1980
25. Courses for Irrigation Extension Workers begin	GSL/Consultants	Jan. 15, 1981
26. All Equip. Maintenance Shops in Gal Oya are fully operational	GSL/Consultants	Mar. 1, 1981
27. Initial aspects of Social Research on Farmer Organization & System Modernization completed	GSL/Consultants	Mar. 1, 1981
28. Annual Project Impact Assessment Review held in Amparai and implementation plans updated	GSL/Consultant/ USAID	Sept. 15, 1981
29. Draft Master Plans for Systems completed	GSL/Consultants	Mar. 1, 1982
30. In-Depth mid-project status evaluation	USAID/GSL/AID:W	April 1, 1982
31. Annual Project Impact Assessment Review held in Amparai and implementation plans updated	GSL/Consultant/ USAID	Sept. 15, 1982

<u>Action</u>	<u>Responsibility</u>	<u>Approx. Date</u> <u>NLT</u>
32. All equipment for Project is in place and operational	USAID/AID:W/GSL	Nov. 1, 1982
33. Replicable Project Activities begin operation in other areas of Sri Lanka	GSL	Jan 1, 1983
34. All Training activities underway	GSL/Consultants	Jan 1, 1983
35. All irrigation organizations operational	GSL	April 1, 1984
36. Annual Project Impact Assessment Review held in Amparai and implementation plans updated	GSL/Consultants/USAID	Sept. 15, 1983
37. Water Management Project officially concludes	GSL/Consultants/AID:W	April 1, 1984

VI. EVALUATION PLAN

Following the major completion of the Gal Oya Irrigation Development Scheme (Primary Infrastructure and Supporting Services) in 1952, the Government of Sri Lanka through the Gal Oya Development Authority conducted annual Project Appraisals and issued annual reports. With the AID-assisted modernization of the project area, the Government of Sri Lanka through the Amparaf District Government Agent's office and the Irrigation Department will re-institute an annual in-depth status appraisal/assessment of the project, primarily focusing on the impact status of the project on the beneficiaries (predominantly the rural poor) and the projects' effect on the economic and social development within the District. Representatives from the involved departments within the Ministry for Lands and Land Development, as well as AID, will participate in the annual on-site Appraisal Reviews.

Additionally, the Agrarian Research and Training Institute with USAID participation will conduct a semi-annual evaluation and initiate other reviews of the direct and indirect impacts of project components as well as conduct additional water management studies. These supplementary and complementary reviews will be conducted for such specific project components as: implementation in Gal Oya, education and training (both applying to farmers, farmer organizations, and technicians); extension activities, central support elements, and social research. Additional studies will be conducted either by ARTI or contracted by them on various water management subjects.

The results of these evaluations, reviews and studies will be integrated into the Annual Project Impact Assessment Review. From the component evaluations and Impact Assessment Review, USAID will compile and submit the annual Project Evaluation Summary (PES),

After the Master Plans have been drafted (March, 1982), AID and the GSL will conduct a major mid-project evaluation in April, 1982. The results of this comprehensive assessment, focussed upon the project's independent viability and status for replication, will provide guidance for any modifications during the last two years of the project to more effectively meet project objectives. Also, this evaluation should provide useful information relevant to possible future assistance in the water management area.

PART VII - CONDITIONS, COVENANTS, AND NEGOTIATING STATUS:

The following are the Conditions Precedent and Covenants that the AID Mission and Government of Sri Lanka have tentatively approved.

A. Initial Conditions Precedent to Disbursement for Loans and Grants

Prior to the first disbursement or to the issuance of the first Letter of Commitment under the Loan or Grant, the Government shall, except as AID may otherwise agree in writing, furnish to AID in form and substance satisfactory to A.I.D.:

1. An opinion of the Attorney General of Sri Lanka or other counsel acceptable to AID that the Loan/Grant Agreement has been duly authorized or ratified by and executed on behalf of the Government of Sri Lanka and that the Agreement constitutes a valid and legally binding obligation of the Government.
2. Designations of the person(s) in the Office of the Director of External Resources Department who will act as the representative(s) of the Government of Sri Lanka and of the Irrigation Department (Implementing Agency), along with a specimen signature of each such person.
3. Evidence that adequate GSL budgetary resources are being made available for 1980 and assurance that further budgets for 1981-84 will provide adequate funding for the Irrigation Department to implement the project.
4. Evidence that the Government of Sri Lanka has prepared an organizational plan that provides for the Central Support Office and the Water Resources Office within the Ministry of Lands and Land Development that will be capable of coordinating, administering, supporting and managing project activities at the national level. Evidence will include assurances that the Government of Sri Lanka will provide the technical, managerial, administrative and other staff required to execute the organizational plan at the national level.
5. Evidence that the Government of Sri Lanka has prepared an organizational plan that provides for a special office within the Department of Irrigation that will be capable of coordinating, managing and implementing project activities at the field level in Gal Oya and Uda Walawe. Evidence will include assurance that the Government of Sri Lanka will provide the managerial, technical, administrative and other staff required to execute the project at the field level.
6. Evidence that the Government has prepared a plan for the provision of complementary activities required for increased productive and remunerative agriculture in the Gal Oya irrigation scheme.

B. Additional Conditions Precedent to Disbursement:

1. For Technical Assistance:

Prior to the first disbursement or issuance of the first disbursing authorization for a Technical Assistance contract(s) or selection of a contractor(s), which must be acceptable to AID, an approved Request for Proposal (RFP) and Terms of Reference/Scope of Work shall be submitted by the Government.

2. For Commodity Procurement:

Prior to the first disbursement or issuance of the first disbursing authorization for a procurement bid award or selection of a bid(s), which must be acceptable to AID, an approved Invitation for Bid (IFB) shall be submitted by the Government.

3. For Socio-Economic Research:

Prior to the first disbursement or issuance of the first disbursing authorization for the socio-economic research component of the project to be conducted by the Agrarian Research and Training Institute, a research plan acceptable to AID shall be submitted by the Government which describes the research monitoring and evaluation plans and timetables; approves the staffing requirements; and appoints a senior research officer to head the unit.

4. For Training:

Prior to first Disbursement or issuances of the first disbursing authorization of loan funds for training, a plan acceptable to AID shall be submitted by the Government which would provide the details of the re-establishment of a Water Management Training School at Galgamuwa and training plans and requirements at the Hardy Institute. This plan shall include sanctioned positions at Galgamuwa including the appointment of a Training Director.

C. Covenants:

1. The Government recognizes that the creation of viable farmer irrigation organizations is a key objective of the project. During the first year of project implementation, different types of models of farmer irrigation organizations will be tested in the field in an effort to arrive at a model(s) that can be appropriately replicated. The Government covenants that it will adopt such legal and institutional changes as may facilitate the development, operation and future viability of these farmer irrigation organizations.

2. The Government recognizes the problems of poor water management throughout the country and covenants to adopt and implement the administrative, legal and other changes required to insure better utilization and management of irrigation water nationwide.
3. The Government recognizes that improved maintenance of existing irrigation systems in the country is of great importance and covenants to:
 - a. Provide maintenance funding as certified necessary by the irrigation technicians in operating and maintaining the systems.
 - b. Provide sanctions in the law for unlawful diversions and other forms of misuse of water within the irrigation systems including the process by which the sanctions will be implemented.
 - c. Implement other changes as required to insure that the newly improved systems under this project are maintained in the future in the condition to which they are rebuilt under this project.
4. The Government covenants that it will execute the plan for the provision of complementary activities required for increased productive and remunerative agriculture in the Gal Oya irrigation scheme as stated in Section A.6 above. The Mission will also include in Implementation Letter No. 1 description of what is to be included in the aforementioned plan including adequate fertilizer and other crop production inputs, small farmer credit, agricultural research and extension, milling storage and marketing policies and facilities, and that the plan will include target, schedules, and base line data in sufficient detail for project evaluation purposes.
5. The Government covenants to continue its policy of allocating reservoir water among the three Gal Oya systems (Left, River and Right) proportioned to their irrigable (asswedumized) acreages.

PROJECT PAPER

WATER

MANAGEMENT

SRI LANKA

JUNE 25, 1979

ANNEXES

UNITED STATES OF AMERICA
AGENCY FOR INTERNATIONAL DEVELOPMENT

American Embassy, Colombo, Sri Lanka.

June 25, 1979

Certification Pursuant to Section 611(e) of
the Foreign Assistance Act of 1961, as amended

I, John R. Eriksson, the Acting Director of the Agency for International Development in Sri Lanka, having taken into account, among other things, the capacity of the Sri Lanka Government and its agencies to properly utilize the commodities being imported under this project as well as the technical assistance and training to be funded do hereby certify that in my judgement Sri Lanka has both the financial capability and the human resources capability to effectively utilize these inputs.

This judgement is based upon the project analysis as detailed in the Water Management Project Paper and is subject to the conditions imposed therein.



John R. Eriksson
Director (Acting)

STATUTORY CHECKLIST

SC(1) - COUNTRY CHECKLIST

Listed below are, first, statutory criteria applicable generally to FAA funds, and then criteria applicable to individual fund sources: Development Assistance and Economic Support Fund.

A. GENERAL CRITERIA FOR COUNTRY ELIGIBILITY

- | | |
|--|---------------------------|
| 1. <u>FAA Sec. 116.</u> Can it be demonstrated that contemplated assistance will directly benefit the needy? If not, has the Department of State determined that this government has engaged in a consistent pattern of gross violations of internationally recognized human rights? | It can be so demonstrated |
| 2. <u>FAA Sec. 481.</u> Has it been determined that the government of recipient country has failed to take adequate steps to prevent narcotics drugs and other controlled substances (as defined by the Comprehensive Drug Abuse Prevention and Control Act of 1970) produced or processed, in whole or in part, in such country, or transported through such country, from being sold illegally within the jurisdiction of such country to U.S. Government personnel or their dependents, or from entering the U.S. unlawfully? | No |
| 3. <u>FAA Sec. 620(b).</u> If assistance is to a government, has the Secretary of State determined that it is not controlled by the international Communist movement? | Yes |
| 4. <u>FAA Sec. 620(c).</u> If assistance is to a government, is the government liable as debtor or unconditional guarantor on any debt to a U.S. citizen for goods or services furnished or ordered where (a) such citizen has exhausted available legal remedies and (b) debt is not denied or contested by such government? | No |
| 5. <u>FAA Sec. 620(a)(11).</u> If assistance is to a government, has it (including government agencies or subdivisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities? | No |
| 6. <u>FAA Sec. 620(a), 620(f), FY 79 App. Act Sec. 109, 114 and 606.</u> Is recipient country a Communist country? Will assistance be provided to the Socialist Republic of Vietnam, Cambodia, Laos, Cuba, Rwanda, Mozambique, or Angola? | No |
| 7. <u>FAA Sec. 620(i).</u> Is recipient country in any way involved in (a) subversion of, or military aggression against, the United States or any country receiving U.S. assistance, or (b) the planning of such subversion or aggression? | No |
| 8. <u>FAA Sec. 620(j).</u> Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction, by any action, of U.S. property? | No |
| 9. <u>FAA Sec. 620(l).</u> If the country has failed to institute the investment guaranty program for the specific risks of expropriation, inconvertibility or confiscation, has the AID Administrator within the past year considered denying assistance to such government for this reason? | Not Applicable |
| 10. <u>FAA Sec. 620(e); Fishermen's Protective Act of 1967, as amended, Sec. 3.</u> If country has seized, or imposed any penalty or sanction against, any U.S. fishing activities in international waters, | |
| a. has any deduction required by the Fishermen's Protective Act been made? | Not Applicable. |
| b. has complete denial of assistance been considered by AID Administrator? | Not Applicable |
| 11. <u>FAA Sec. 620; FY 79 App. Act Sec. 603.</u> (a) Is the government of the recipient country in default for more than six months on interest or principal of any AID loan to the country? (b) Is country in default exceeding one year on interest or principal on U.S. loan under program for which App. Act appropriates funds? | No |
| 12. <u>FAA Sec. 620(s).</u> If contemplated assistance is development loan or from Economic Support Fund, has the Administrator taken into account the percentage of the country's budget which is for military expenditures, the amount of foreign exchange spent on military equipment and the | Yes |

amount spent for the purchase of sophisticated weapons systems? (An affirmative answer may refer to the record of the annual "Taking Into Consideration" memo: "Yes, as reported in annual report on implementation of Sec. 620(a)." This report is prepared at time of approval by the Administrator of the Operational Year Budget and can be the basis for an affirmative answer during the fiscal year unless significant changes in circumstances occur.)

Yes

13. FAA Sec. 620(t). Has the country severed diplomatic relations with the United States? If so, have they been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption?

No

14. FAA Sec. 620(u). What is the payment status of the country's U.S. obligations? If the country is in arrears, were such arrearages taken into account by the AID Administrator in determining the current AID Operational Year Budget?

The GSL is current

15. FAA Sec. 620A, FY 79 App. Act, Sec. 607. Has the country granted sanctuary from prosecution to any individual or group which has committed an act of international terrorism?

No

16. FAA Sec. 666. Does the country object, on basis of race, religion, national origin or sex, to the presence of any officer or employee of the U.S. there to carry out economic development program under FAA?

No

17. FAA Sec. 669, 670. Has the country, after August 3, 1977, delivered or received nuclear enrichment or reprocessing equipment, materials, or technology, without specified arrangements or safeguards? Has it detonated a nuclear device after August 3, 1977, although not a "nuclear-weapon State" under the nonproliferation treaty?

No

8. FUNDING CRITERIA FOR COUNTRY ELIGIBILITY

1. Development Assistance Country Criteria.

a. FAA Sec. 102(b)(4). Have criteria been established and taken into account to assess significant

progress of country in effectively involving the poor in development, on such indexes as:
 (1) increase in agricultural productivity through small-farm labor intensive agriculture,
 (2) reduced infant mortality (3) control of population growth, (4) equality of income distribution, (5) reduction of unemployment, and (6) increased literacy.

Yes

b. FAA Sec. 104(d)(1). If appropriate, is this development (including labor) activity designed to build motivation for smaller families through modification of economic and social conditions supportive of the desire for large families in programs such as education in and out of school, nutrition, disease control, maternal and child health services, agricultural production, rural development, and assistance to urban poor?

Not Applicable

2. Economic Support Fund Country Criteria.

a. FAA Sec. 502B. Has the country engaged in a consistent pattern of gross violations of internationally recognized human rights?

No

b. FAA Sec. 511(b). Will assistance under the Southern Africa program be provided to Mozambique, Angola, Tanzania, or Zambia? If so, has President determined (and reported to the Congress) that such assistance will further U.S. foreign policy interests?

Not Applicable

c. FAA Sec. 609. If commodities are to be granted so that sales proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made?

Not Applicable

d. FY 79 App. Act Sec. 113. Will assistance be provided for the purpose of aiding directly the efforts of the government of such country to repress the legitimate rights of the population of such country contrary to the Universal Declaration of Human Rights?

No

e. FAA Sec. 6203. Will security supporting assistance be furnished to Argentina after September 30, 1979?

Not Applicable

Listed below are statutory criteria applicable generally to projects with FAA funds and project criteria applicable to individual fund sources: Development Assistance (with a subcategory for criteria applicable only to loans); and Economic Support Fund.

CROSS REFERENCES: IS COUNTRY CHECKLIST UP TO DATE?
 HAS STANDARD ITEM CHECKLIST BEEN REVIEWED FOR THIS PROJECT?

A. GENERAL CRITERIA FOR PROJECT

- | | |
|--|--|
| <p>1. <u>FY 79 App. Act Unnumbered; FAA Sec. 633(b); Sec. 634A.</u>
 (a) Describe how Committees on Appropriations of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than \$1 million over that figure)?</p> | <p>A special Congressional Notification will be provided.</p> |
| <p>2. <u>FAA Sec. 611(a)(1).</u> Prior to obligation in excess of \$100,000, will there be (a) engineering, financial, and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?</p> | <p>Yes as provided in the Project Paper.</p> |
| <p>3. <u>FAA Sec. 611(a)(2).</u> If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?</p> | <p>No further legislative action is required.</p> |
| <p>4. <u>FAA Sec. 611(b); FY 79 App. Act Sec. 101.</u> If for water or water-related land resource construction, has project met the standards and criteria as per the Principles and Standards for Planning Water and Related Land Resources dated October 25, 1977?</p> | <p>Yes, see Annex 5</p> |
| <p>5. <u>FAA Sec. 611(e).</u> If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed \$1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project?</p> | <p>Yes</p> |
| <p>6. <u>FAA Sec. 209.</u> Is project susceptible of execution as part of regional or multilateral project? If so why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.</p> | <p>No
 No</p> |
| <p>7. <u>FAA Sec. 601(a).</u> Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.</p> | <p><u>One of the major objectives of project is to establish viable irrigation associations.</u></p> |
| <p>8. <u>FAA Sec. 601(b).</u> Information and conclusion on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).</p> | <p>Not Applicable</p> |
| <p>9. <u>FAA Sec. 612(b); Sec. 636(h).</u> Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.</p> | <p>Are meeting requirement of Sec 110 a.</p> |
| <p>10. <u>FAA Sec. 612(d).</u> Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?</p> | <p>No</p> |
| <p>11. <u>FAA Sec. 601(e).</u> Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?</p> | <p>Yes</p> |
| <p>12. <u>FY 79 App. Act Sec. 688.</u> If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity?</p> | <p>Not Applicable</p> |

B. FUNDING CRITERIA FOR PROJECT

- | | |
|---|--|
| <p>1. <u>Development Assistance Project Criteria</u>
 a. <u>FAA Sec. 102(b); 111; 113; 781a.</u> Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production and the use of appropriate</p> | <p>(a) The rural poor (average 3-4 acre farmer) will be actively involved in this project since they will work with the Government in rebuilding, operating and maintaining their lower level irrigation (field) channels. Also, a U.S. Engineering Consulting firm will assist with technical training and other aspects of project implementation.</p> |
|---|--|

technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries.

b. FAA Sec. 103, 103A, 104, 105, 106, 107. Is assistance being made available: (include only applicable paragraph which corresponds to source of funds used. If more than one fund source is used for project, include relevant paragraph for each fund source.)

(1) [103] for agriculture, rural development or nutrition; if so, extent to which activity is specifically designed to increase productivity and income of rural poor; [103A] if for agricultural research, is full account taken of needs of small farmers;

(2) [104] for population planning under sec. 104(b) or health under sec. 104(c); if so, extent to which activity emphasizes low-cost, integrated delivery systems for health, nutrition and family planning for the poorest people, with particular attention to the needs of mothers and young children, using paramedical and auxiliary medical personnel, clinics and health posts, commercial distribution systems and other modes of community research.

(3) [105] for education, public administration, or human resources development; if so, extent to which activity strengthens nonformal education, makes formal education more relevant, especially for rural families and urban poor, or strengthens management capability of institutions enabling the poor to participate in development;

(4) [106] for technical assistance, energy, research, reconstruction, and selected development problems; if so, extent activity is:

(i) technical cooperation and development, especially with U.S. private and voluntary, or regional and international development, organizations;

(ii) to help alleviate energy problems;

(iii) research into, and evaluation of, economic development processes and techniques;

(iv) reconstruction after natural or manmade disaster;

(v) for special development problems, and to enable proper utilization of earlier U.S. infrastructure, etc., assistance;

(vi) for programs of urban development, especially small labor-intensive enterprises, marketing systems, and financial or other institutions to help urban poor participate in economic and social development.

c. [107] Is appropriate effort placed on use of appropriate technology?

d. FAA Sec. 110(a). Will the recipient country provide at least 1% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or has the latter cost-sharing requirement been waived for a "relatively least-developed" country)?

e. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing, or is the recipient country "relatively least developed"?

f. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental and political processes essential to self-government.

(b) A major objective of the project will be to establish viable irrigation associations, whereby the farmers operate and control the water and participate in project activities.

(c) GSL is providing nearly one-half of project cost.

(d) Since this is an agriculture project, women will be actively involved (see Part III-D of Project Paper for further detail).

(e) Not applicable

Assistance is being provided under Section 103 for agriculture and rural development, since one major objective is to modernize an irrigation scheme whereby reliable irrigation water is provided. Then increased production and incomes are expected for the rural families (3-4 acre size) who live along the system. Indirectly the entire country should benefit from improved water management and increased production through techniques and methods (including farmer organization) developed under this project.

Not Applicable

Yes

Not Applicable

Project specifically designed jointly with the Government taking into consideration the need and desires of the people. Adaptive Socioeconomic and On-Farm Water Management research to be conducted, as well as extensive training to be provided and emphasis on farmer organizations, will ensure effective participation and utilize the country's resources.

g. FAA Sec. 121(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?

Yes, through more effective water management and other aspects, the project will contribute to all of these.

2. Development Assistance Project Criteria (Loans Only)

a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan, including reasonableness of repayment prospects.

GSL has capacity to repay this loan and the prospects of repayment are good.

b. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete in the U.S. with U.S. enterprise, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?

Not Applicable

3. Project Criteria Solely for Economic Support Fund

a. FAA Sec. 531(a). Will this assistance support promote economic or political stability? To the extent possible, does it reflect the policy directions of section 102?

Yes - economic stability.

Yes

b. FAA Sec. 533. Will assistance under this chapter be used for military, or paramilitary activities?

No

Listed below are statutory items which normally will be covered routinely in those provisions of an assistance agreement dealing with its implementation, or covered in the agreement by imposing limits on certain uses of funds.

These items are arranged under the general headings of (A) Procurement, (B) Construction, and (C) Other Restrictions.

A. Procurement

1. FAA Sec. 602. Are there arrangements to permit U.S. small business to participate equitably in the furnishing of goods and services financed?
2. FAA Sec. 604(a). Will all commodity procurement financed be from the U.S. except as otherwise determined by the President or under delegation from him?
3. FAA Sec. 604(d). If the cooperating country discriminates against U.S. marine insurance companies, will agreement require that marine insurance be placed in the U.S. on commodities financed?
4. FAA Sec. 604(e). If offshore procurement of agricultural commodity or product is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity?
5. FAA Sec. 608(a). Will U.S. Government excess personal property be utilized wherever practicable in lieu of the procurement of new items?
6. FAA Sec. 603. (a) Compliance with requirement in section 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 per centum of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed shall be transported on privately owned U.S.-flag commercial vessels to the extent that such vessels are available at fair and reasonable rates.
7. FAA Sec. 621. If technical assistance is financed, will such assistance be furnished to the fullest extent practicable as goods and professional and other services from private enterprise on a contract basis? If the facilities of other Federal agencies will be utilized, are they particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs?
8. International Air Transport. Fair Competitive Practices Act, 1971. If air transportation of persons or property is financed on grant basis, will provision be made that U.S.-flag carriers will be utilized to the extent such service is available?
9. FY 79 App. Act Sec. 105. Does the contract for procurement contain a provision authorizing the termination of such contract for the convenience of the United States?

Yes, usual competitive procedures will be utilized and small businesses can participate, especially in providing small equipment and commodities.

The Loan Agreement will so provide.

Not Applicable

The Loan Agreement will so provide.

The Loan Agreement will so provide.

It is expected that a U.S. Consulting Engineering Firm, with possible participation of a University, will be provided using usual contracting procedures and a host country contract.

Yes

Contract will so provide

B. Construction

1. FAA Sec. 601(d). If a capital (e.g., construction) project, are engineering and professional services of U.S. firms and their affiliates to be used to the maximum extent consistent with the national interest?
2. FAA Sec. 611(c). If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable?
3. FAA Sec. 620(k). If for construction of productive enterprise, will aggregate value of assistance to be furnished by the U.S. not exceed \$100 million?

Yes, (see A-7 above)

Yes

Yes

C. Other Restrictions

1. FAA Sec. 122(a). If development loan, is interest rate at least 7 1/2 per annum during grace period and at least 3 1/2 per annum thereafter?
2. FAA Sec. 301(d). If fund is established solely by U.S. contributions and administered by an international organization, does Comptroller General have audit rights?
3. FAA Sec. 620(h). Do arrangements preclude promoting or assisting the foreign aid projects or activities of Communist-bloc countries, contrary to the best interests of the U.S.?

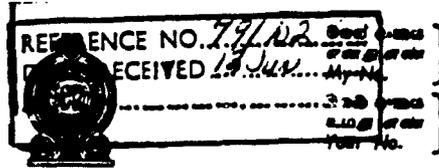
Yes

Not Applicable

Yes

1. FAA Sec. 636(i). Is financing not permitted to be used, without waiver, for purchase, long-term lease, or exchange of motor vehicle manufactured outside the U.S., or guaranty of such transaction? **Yes**
- Will arrangements preclude use of financing:
- a. FAA Sec. 104(f). To pay for performance of abortions or to motivate or coerce persons to practice abortions, to pay for performance of involuntary sterilization, or to coerce or provide financial incentive to any person to undergo sterilization? **Yes**
- b. FAA Sec. 670(g). To compensate owners for appropriated nationalized property? **Yes**
- c. FAA Sec. 668. To finance police training or other law enforcement assistance, except for narcotics programs? **Yes**
- d. FAA Sec. 662. For CIA activities? **Yes**
- e. FY 79 App. Act Sec. 104. To pay pensions, etc., for military personnel? **Yes**
- f. FY 79 App. Act Sec. 106. To pay U.K. assessments? **Yes**
- g. FY 79 App. Act Sec. 107. To carry out provisions of FAA sections 109(d) and 251(h)? (Transfer of FAA funds to multilateral organizations for lending.) **Yes**
- h. FY 79 App. Act Sec. 112. To finance the export of nuclear equipment, fuel, or technology or to train foreign nations in nuclear fields? **Yes**
- i. FY 79 App. Act Sec. 601. To be used for publicity on propaganda purposes within U.S. not authorized by Congress? **Yes**

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 Telex } FORAID
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DEPARTMENT OF EXTERNAL RESOURCES
Ministry of Finance & Planning

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 Ceylinco House (2nd Floor)
 No. 23, P.O. Box 277, Colombo 1
 P. O. Box 277, Colombo 1

11th Jun 1979



Mr. John Eriksson,
Acting Director US AID,
Colombo

Dear Mr. Eriksson,

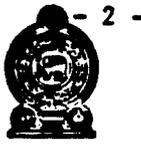
WATER MANAGEMENT PROJECT

I refer to the letter dated 25th May 1979 addressed to the Director, External Resources Department by Secretary Ministry of Lands & Land Development with copy to you on the above Project.

I am writing to request, on behalf of the Government of Sri Lanka assistance from the United States for "Option B" as enumerated in the Secretary's letter referred to above. I believe that a project paper has been finalised and together with this be submitted to the concerned authorities in Washington as a formal request from the Government of Sri Lanka.

Yours sincerely,


 (M.A. Mohamed)
 Additional Director



දුරකථන/දුරකථන/Telephones

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 Director
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 Deputy Director
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 MINISTRY OF LANDS AND DEVELOPMENT



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 P. O. Box } 512

500, ටී. ඩී. ජයා මාවත
 500, T. D. JAYA MAWATHA

කොළඹ 10/Colombo 10
 25th May, 1979.

AID	Action	Info
DIR		Director, External Resources
AD		Ceylinco House, Colombo 1.
PRO		
PS		
CON		
MD		
HR		
RD	<i>NA</i>	
IT		
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Date	<i>Imp</i>	
By	<i>Taka</i>	

WATER MANAGEMENT PROJECT

The report on the above project, prepared by the US Consultant Firm, CH 2M Hill, conceived of an eight year programme for the rehabilitation and modernization of the Gal Oya and Walawe irrigation schemes, at an estimated cost of US \$ 80 million. At the subsequent discussions on the project with both the donor and implementing agencies, it was felt that the project was ~~far~~ too ambitious from the point of view of implementability as well as the availability of funds both from the donor agency and the Government of Sri Lanka (GSL). The donor agency USAID indicated that their contribution to project funding would not exceed US \$ 10 million, at the present time.

It was decided to appoint a group of officials from the Ministry of Lands and Land Development, Ministry of Finance and Planning and USAID, to examine the ways and means of accomodating the project, or an independantly implementable part of it, within the available limit of resources. In particular, the group was requested to examine the possibility of implementing the project in distinct phases over a period of time and the feasibility of effecting cost reductions, especially in the provisions made for contingencies and inflation (42% of total cost) and in the machinery and equipment component.

This group recommended that the implementation of the project should be effected in two phases, each of a duration of between 3 to 5 years. Three options were suggested for the first phase -

Option A: Provided for a three year project with modernization work beginning in both Gal Oya and Walawe, with a govt. contribution of US \$ 5.4 million (Rs. 99 million) and a USAID contribution of US \$ 10.4 million.

Option B: Provided for a four year project with modernization and rehabilitation work for the left bank area of Gal Oya, together with the planning and research components of the Walawe rehabilitation. The Govt. contribution for this Option amounted to US \$ 8.9 million (Rs. 138 million) and the USAID contribution - US \$ 9.8 million.

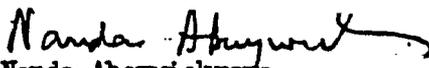
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Option C: Provided for a five year project for the rehabilitation of Walawe together with the planning component for Gal Oya. The Govt. contribution amounted to US \$ 9.9 million (Rs. 154 million) and the USAID contribution - US \$ 10 million.

The above options were placed before the Hon. Minister of Lands and Land Development, who has decided to take up Option B for implementation. The USAID Office has indicated willingness to press AID/Washington for complete grant funding of the technical assistance component of US \$ 2.7 M. out of a total contribution of US \$ 9.8 million under Option B. However, it is not certain whether grant funding would be forthcoming for this amount.

The USAID Office has also indicated that the formal request ~~must~~ for assistance should be sent by you on behalf of the GSL (preferably before June 5, 1979) to enable them to proceed with the processing of the loan. Unless the loan agreement is concluded before the end of their fiscal year (September 30th), the funds voted in their current budget for this purpose would lapse and would not be made available in the following year.

The Government has placed emphasis on the great need for improved water management practices in our major irrigation schemes and has welcomed foreign assistance in this field. The Director, National Planning has indicated that, Option B would be acceptable in principle. A Cabinet - Memorandum seeking approval to proceed with Option B would be submitted by this Ministry shortly. Pending approval by the Cabinet, I wish to request you to send a formal project request, for USAID assistance for the project.


Nanda Abeywickrama
Secretary
Lands & Land Development.

- cc. 1. Mr. Merrick Perera,
Director, National Planning - Requesting formal approval for
Option B.
2. Mr. John Eriksson,
US AID Office.

A/S/29

28/1212 JUL 78

ACTION: AID

FM SECSTATE WASHDC
TO AMEMBASSY COLOMBO 7193
BT
UCLAS SATE 190558

INFO: AMB
DCM
ECON
CHRON

AIDAC

E.O. 11652: N/A

TAGS:

SUBJECT: WATER MANAGEMENT - PID

1. SUBJECT PID WAS REVIEWED AND APPROVED BY APAC ON JULY 19. MAJOR ISSUES APAC FELT SHOULD BE ANALYZED AND RESOLVED DURING PROJECT DEVELOPMENT ARE SUMMARIZED BELOW:
2. WATER LOSS INFORMATION: INFORMATION ON WATER LOSSES (WHERE, WHEN AND HOW) IS CRITICAL TO DESIGNING A WATER MANAGEMENT PROJECT. CURRENT INFORMATION IS NOT ADEQUATE. WE RECOMMEND STUDIES BE STARTED ASAP TO DEVELOP NEEDED WATER LOSS INFORMATION.
3. SELECTION CRITERIA: FOR SELECTING AREAS AND WATER COURSES (TANKS) ON WHICH TO FOCUS THE PROJECT SPECIFICALLY MUST BE DEVELOPED. SUCH CRITERIA COULD INCLUDE PERCENTAGE FARMERS, PUBLIC COOPERATION AND THE ECONOMICS OF SUB PROJECT IN AREAS UNDER CONSIDERATION.
4. PROJECT ECONOMICS: THE PP SHOULD INCLUDE A DETAILED ANALYSIS OF THE ECONOMIC BENEFITS AND COST OF IMPROVED WATER MANAGEMENT AND LAND DEVELOPMENT AS PROJECT PROPOSES IN THE PP. THE MISSION MAY WISH TO USE THE PAKISTAN ANALYSIS AS A MODEL.
5. COST SHARING: UNLESS THE GSL PLANS TO SUBSIDIZE THE PROJECT COSTS TO THE FARMER 100 PERCENT, (WE STRONGLY OPPOSE THIS), THE PROJECT MUST DEVELOP A MEANS OF COST SHARING THEREBY INSURING REQUIRED FARMER COMMITMENT. THIS WOULD PROBABLY INCLUDE LABOR AND CAPITAL CONTRIBUTIONS BY INDIVIDUAL FARMERS OR FARMERS FOR A GROUP. SINCE MOST SMALL FARMERS WOULD NOT HAVE NEEDED RESOURCES OTHER THAN LABOR, CREDIT WILL PROBABLY PLAY A ROLE IN THE PROJECT. MISSION SHOULD URGE THE GSL TO USE COST SHARING BETWEEN THE GSL AND THE FARMER TO THE EXTENT POSSIBLE.

6. COST RECOVERY: THE PID MAINTAINS THAT THE ISSUE OF WATER CHARGES (TAXES) IS SO HIGHLY POLITICIZED THAT AID SHOULD NOT BECOME INVOLVED. THE APAC AGREES THAT THIS IS A DELICATE ISSUE, BUT GIVEN ITS IMPORTANCE TO A NATIONAL LONG TERM WATER MANAGEMENT PROGRAM, WE DO NOT THINK IT SHOULD BE IGNORED. THE ISSUE OF WATER CHARGES SHOULD BE CONSIDERED AS AN INTEGRAL PART OF THE PROJECT AND STUDIED DURING PROJECT DESIGN. FYI: IN OUR CURRENT MAHAWELI LOAN AGREEMENT THERE IS A COVENANT WHICH REQUIRES IMPLEMENTATION DURING 1978 OF MEASURES TO INSURE RECOVERY OF OPERATION AND MAINTENANCE COSTS AND, IF POSSIBLE, CAPITAL CONSTRUCTION COSTS. ASSUMING THE GOVERNMENT IS WELL INTO ITS IMPLEMENTATION OF THESE MEASURES, THE GROUNDWORK SHOULD BE LAID FOR FURTHER EXPANSION DURING THE SUBJECT PROJECT OR HOPEFULLY BEFORE. END FYI.

7. LOCAL PARTICIPATION IS ONE OF THE KEYS TO A SUCCESSFUL PROGRAM. IN PAKISTAN PROBLEMS IN FARMER COOPERATION RESULTED IN SERIOUS PROJECT DELAYS, THOUGH THE USAID, THE GOP, AND CSU WERE ALREADY WORKING ON THIS PROBLEM AT THE TIME THE PROJECT STARTED. LOCAL PARTICIPATION, AND FARMER AND GOVERNMENT ORGANIZATION TO ADDRESS THIS PROBLEM MUST BE ADDRESSED FULLY IN PROJECT DESIGN.

8. PAST EXPERIENCE: THE APAC STRESSED THAT IN DESIGNING THIS PROJECT THE GSL AND MISSION SHOULD TAKE INTO FINAL ACCOUNT THE AID EXPERIENCE IN OTHER COUNTRIES WITH SIMILAR TYPE PROJECTS. CHRISTOPHER

BT

0558

Annex 5

**Proposed Water Management Program for Major Irrigation Schemes
in Sri Lanka by CH2M Hill Consultant - February 1979.**

**Report retained in ASIA/PD and with USAID, Sri Lanka a copy can
be borrowed on request.**

ANNEX 6

Life of Project
From FY 1979 to FY 1984
Total U.S. Funding \$9.8 Mil.
Date Prepared: June, 1979

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title & Number: Water Management -- 383-0057

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<p><u>Program or Sector Goal:</u>(1979-1983)^{1/}</p> <p>Agriculture development that:</p> <ol style="list-style-type: none"> 1) increases domestic food production; 2) expands employment opportunities; 3) improves the small farmers' standard of living. 	<ol style="list-style-type: none"> 1) Increase paddy production from 1.88 to 2.30 million metric tons. 2) Absolute and relative numbers of productively employed people in the Agriculture Sector increased from 2.09 to 2.7 million. 3) Small Farmer incomes increased in real terms by 25%. 	<p>GSL Reports</p>	<p>(Same Assumptions as listed under Purpose)</p>
<p><u>Project Purpose:</u></p> <p>Development of an institutional capability which can be replicated to manage large irrigation schemes in Sri Lanka more efficiently and effectively with active farmer assistance.</p>	<p><u>End of Project Status:</u></p> <ol style="list-style-type: none"> 1) By improvement in the Gal Oya scheme: <ol style="list-style-type: none"> a. Increase in irrigated acreage from 67,000 acres to 85,000. b. Increase in production from 59,400 metric tons (2.84 million bu) to 78,433 metric tons (3.75 million bu). 2) Improve operations and maintenance capability in project areas. 3) Government policies and regulations enacted to insure better water management. 4) Publicity and awareness program for policy makers, officials and farmers to better manage irrigation water. 	<p><u>Purpose:</u></p> <ol style="list-style-type: none"> 1) Yearly joint GSL/USAID Assessments 2) Mid-Project evaluation by April, 1982. 3) GSL Reports. 	<ol style="list-style-type: none"> 1) GSL policy will continue to encourage domestic food production through incentive pricing of commodities. 2) Rainfall will approach historical trends. 3) Sufficient production inputs, such as seeds and fertilizer, and credit are available.

^{1/} 1979-83 is used since verifiable indicators (1 & 2) are taken from the Government's Investment Plan.

	<p>5) Replicable technology developed that can be applied to other irrigation systems. Management capability of irrigation department improved, specifically in maintenance areas.</p>		
<p><u>Outputs:</u></p> <ol style="list-style-type: none"> 1) Organization of farmers to reconstruct, operate and maintain their field channels. 2) Water Management training facility rehabilitated and other WM training including observation tours for policy makers, GSL officials, engineers and others. 3) Research program established for Uda Walawa and Gal Oya. 4) Master plans for Gal Oya and Uda Walawa. 5) Upgrading Extension Service's capability to improve on-farm water management. 6) Rehabilitation of Gal Oya Left Bank irrigation system. 7) Irrigation Department re-organized at both project and central level to better operate and maintain system. 	<p><u>Magnitude of Outputs:</u></p> <ol style="list-style-type: none"> 1) 19,000 farmers organized into irrigation organizations. 2) a. Rehabilitation of one physical facility and training program established. <ol style="list-style-type: none"> b. Seven training staff posted and upgraded. c. Twenty participants per year given short-term observation training. d. By second year of project following officials trained per year. <ol style="list-style-type: none"> (1) 95 engineers, TAs and others given 1-3 months. (2) 160 NDT trainees, Irrigators and other provided 1 week refresher training. (3) 80 people receiving NDT. (4) 150 Work Supervisors, Irrigators and others given 2-4 week Water Management Courses. 3) On-farm field research completed on Unit 21 in Gal Oya (572 acres) and Tract 3 in Walawa (500 acres). 4) Master Plans prepared, approved and distributed to include recommendations on: <ol style="list-style-type: none"> a. Return flow re-use. b. Operation of main canal and tank system. c. Domestic water. 	<p><u>Outputs:</u></p> <ol style="list-style-type: none"> 1) Quarterly GSL progress reports. 2) USAID annual evaluation 3) Consultant regular reports 4) ARTI semi-annual evaluation and other reports. 5) Field trips and inspections 6) Extension Department 	<ol style="list-style-type: none"> 1) Qualified personnel available for senior/mid-level positions. 2) Sufficient lower-level personnel available.

- 5) By second year of project:
 - a. Training of 80 extension agents per year in improved on-farm irrigation
 - b. Training of 80 farm leaders each month in 60 Distributary Irrigation Committees in improved irrigation techniques.
- 6) a. Rehabilitation of:
 - (1) 32 miles of left bank canal.
 - (2) 50 miles of major distributary.
 - (3) 68 miles of minor distributary and field channels.
 - b. Specifications developed, orders placed and 2 excavation and 2 maintenance units arrives and are in full operation.
 - c. Develop and begin water delivery schedule and measurement program.
 - d. Prepare and implement operating and training program for equipment.
- 7) Re-organization takes place with appointment of key and other supporting personnel. Better operations and maintenance procedures established.

Inputs:

1. GSL
 - personnel
 - Commodities
 - Training
 - Local Cost
2. USAID
 - Technical Assistance
 - Commodities and Equipment
 - Participants
 - Other

<u>Inputs</u>	<u>GSL(\$000)</u>	<u>USAID(\$000)^{2/}</u>
Technical Assistance	0	2,530
Commodities	2,080	4,170
Training	230	700
Personnel	1,540	0
Other	2,470	430
Contingencies and Inflation	2,220	2,240
	<u>8,540</u>	<u>9,600</u>

Inputs

Quarterly AID Implementation, Shipping and Financial Reports.

^{2/} USAID provided \$3 million grant for TA, research and evaluation, and \$ 6.8 million loan.

Technical Annex 1/

A. Operational Control of Water

Operational control of water is defined as the ability to deliver prescheduled flows in cubic feet per second per second (cfs) to specified farms, field channels, distributaries, branch canals, and to the operational reaches of the main canal. See attached tables 1 and 2 for additional details. The components necessary to provide this capability are:

- Daily delivery schedules for each field channel. These are developed from individual farm delivery requirements. The releases of water to each field channel, distributary, branch, and main canal regulatories are computed from these schedules.
- A properly sized and maintained irrigation system with control structures and gates that will meet the delivery schedules. Water measurement devices are required to monitor performance, to provide the basis for gate adjustments and to prepare daily, monthly, and annual water delivery records.
- A sufficient number of water management staff adequately trained to manage the system on a 24-hour 7-day-a-week basis during the water issue seasons.
- A maintenance and rehabilitation schedule which is set well in advance and communicated to the farmers and which is designed to minimize water use interference.
- The preparation of an operations and maintenance manual for the ready reference of field offices which sets out rules of water distribution including sanctions for misconduct of officers and water users, and other administrative procedures.

All aspects of the operational control of water should be effectively communicated to farmers, establish an understanding of the rights, duties and responsibilities of both the farmer and the government.

B. Improved Water Use

With the attainment of operational control there will still be a need to reduce return water flows which are now being wasted since they pass directly into the sea. This waste of water is caused by both poor water management practices at the farm levels and the lack of drain recapture and reuse facilities. Although return flow can be reduced through the implementation of on farm water management programs, the emphasis must be on planned drain recapture and reuse.

1/ This Annex was partially taken from Chapter 5 of the CH2M Hill Consultant Report

programs. These will increase the overall efficiency of the entire scheme. While these are some facilities being utilized for this purpose more planning is needed to develop a master plan for the reuse of return flows for every tract or irrigated unit of land.

A second problem inhibiting good water use is the practice of making domestic water deliveries every 10 days during the non-issue season. Large flows are required for this purpose. The use of the open canal system for domestic purposes is of concern to public health authorities. Finally domestic water issues tend to interfere with canal maintenance.

C. Equipment and Commodity List:

The equipment and commodity list for the project are listed in Tables 3-7. This listing will be reviewed in detail by an equipment specialist in consultation with the GSL and USAID prior to procurement. Based on this review, the equipment listing will be finalized, specification will be prepared and the IFB will be prepared and cleared with the GSL prior to issue and procurement. The Implementation Plan in Part V provides additional information on this matter.

Technical Annex 7

Table 1

A suggested partial Operational Control Program for Main, Branches, Distributaries, and Large Field Channels is as follows:

1. Provide for erosion control and silt removal.
2. Repair the existing control gates and provide for water level and gate position indicators at the main bifurcations.
3. Install gates, gauges, and position indicators wherever needed on the main and branch regulators.
4. Provide locking handwheels on the existing branch and distributary takeouts. Add measurement devices to each takeoff considering use of Parshall weir or cutback flumes on the meter gates.
5. Furnish and install new takeoff gates with locking handwheels. Install measurement devices.
6. Identify reaches where excessive water losses are occurring. Determine the feasibility of installing earth, concrete, or other linings.
7. Delineate the actual command area in each tract. Regularize or prohibit encroachment.
8. Prepare delivery schedules (turn on-turn off) for all takeouts for the land preparation period, rotation season, and for domestic water issues. Show the requirement of water at each delivery point provided that the capability to make reliable deliveries does exist at the delivery point.
9. Prepare maintenance and rehabilitation schedule.
10. Establish separate Operation and Maintenance Units within the scheme which has the support of the Water Management Division, Colombo.
11. Adopt a emergency canal maintenance program with and without farmer voluntary/compulsory involvement.
12. Organize training classes in water measurement for the existing staff.
13. Modify recruitment, training, and promotion practices to develop a cadre better adapted and skilled in operations and maintenance work.
14. Develop rules and regulations for the operation and maintenance of the system.
15. Obtain political support for the projects implementation and particularly in obtaining the farmers involvement through water organizations.
16. Obtain authority or administrative action to be taken against violators and expedite procedures for judicial prosecution of violators.
17. Organize and train the Water Management staff at all levels.

Technical Annex 7
Table 2

Operational Control for Field Channels * -----

1. Establish informal or formal irrigation organizations with legal status to help reconstruct field channels, set delivery schedules, and to operate and maintain the channels in the future. These organizations should have the duties and responsibilities relevant to management of their command area.
2. Create a Registry of Organizations at the project or regional level with a companion Registry in the Irrigation Department, Colombo office.
3. Specify the scope and role of irrigation organizations. Determine through evaluation of experience of several pilot organizations, optimal size of organization in terms of number of farmers covered, method of selection and payment of leader(s), functions of leader(s) etc. Include in activities of organization a determination of whether farmers wish to have Irrigators, Cultivation Officers, or some other mediator arbitrate disputes which are not settled at the farm and the field channel level. Also determine the need and interest in a federation of irrigation organizations and use of same as a channel of communication and involvement in water/crop production activities.
4. Conduct the field research necessary for field channel research.
5. Prepare alternate sets of operation rules and regulations and delivery schedules which are compatible with channel design and having majority farmer acceptance.
6. Have irrigator representatives or senior officers present these alternatives to farmers of the irrigation organizations; so as to make decisions which the farmers will honor.
7. Assist farmers in writing the schedules, rules and regulations governing O&M which will apply to their respective field channels.
8. Rehabilitate field channels where ever there is a need to restore the design capacity. Provide at least one access road/path on each field channel. Extend takeouts. Provide berms on the field side if the borrow ditch is excavated for embankment work.
9. Recompact washed-out structures. Extend existing or add new cutoff walls where ever necessary. Add stilling basins where ever needed.

* It is assumed that prior to establishment of farmers irrigation organization the necessary level and administrative changes will be made authorizing formation of such organizations, promoting basic formation guidelines, providing changes or additions to the Irrigation Department's rules for water delivery, and adoption of sanctions and administrative rules, particularly if the necessary judicial and immediate enforcement procedures are not yet established.

Technical Annex 7

Table 3

Communications, and Transportation Equipment *
(U.S. FIC, 1978 Prices)

<u>Item</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Subtotal</u>	<u>Total</u>
<u>Capital Costs</u>				
<u>Communications Equipment</u>				
Base Station UHF-FM 50W with line and tower	1	2,000	2,000	
Repeater VHF FM 60W with line and tower	1	4,000	4,000	
Mobile Radio, Pickups, 50W	15	900	13,500	
Mobile Radio, Motorcycles 15W	10	1,350	13,500	
Portable Radio, 10W	8	1,670	13,360	
Spare Parts and Test Equipment			6,000	
Installation			<u>14,000</u>	
Contingency and Inflation **			21,500	
Total Communications Equipment				87,860
<u>Transportation Equipment</u>				
Motor Cycles	20	1,200	24,000	
Bicycles	240	120	28,800	
Pickups/Jeeps	15	9,000	125,000	
Contingency and Inflation **			<u>51,000</u>	
Total Transportation Equipment				<u>238,000</u>
Grand Total Communications and Transportation Equipment				<u>325,860</u>

* Adjustments in this list may be made in final selection of equipment

** Includes freight and insurance

Technical Annex 7

Table 4

Maintenance Equipment Unit *
(U.S.Dollars) FIC, 1978 Prices)

<u>Item</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total</u>
Dump Truck (5 yd) <u>1/</u>	4	22,000	88,000
Loader & Trailer	1	59,000	59,000
Dozer	1	42,000	50,000
Vibratory Roller	1	14,000	14,000
Road Grader	1	69,000	69,000
Hand Compactor GVR220Y	4	2,500	10,000
Jeep w/Radio	1	9,000	9,000
			<u>291,000</u>
Spare Parts (20% of total)			58,000
Contingency and Inflation **			<u>118,000</u>
Total Cost			475,000

* During the final review of the equipment list it is anticipated that tractors with trailers will be substituted for some of the dump trucks and perhaps other equipment may also be changed.

** This line item also includes freight and insurance.

Technical Annex 7

Table 5

Maintenance and Shop Unit *
(U.S.Dollars) FIC, 1978 Prices

<u>Item</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total</u>
Lube/Fuel Truck	1	20,000	20,000
Shop Utility Truck (4-wheel drive)	1	30,000	30,000
Portable Welder	1	5,000	5,000
Jeep w/Radio	1	9,000	9,000
Machine and Miscellaneous Tools		20,000	<u>20,000</u>
			84,000
Spare Parts (20% of Total)			17,000
Contingency and Inflation **			<u>32,000</u>
Total Cost			<u>133,000</u>

* Adjustments in this list may be made during final selection of equipment.

** Includes freight and insurance.

Technical Annex 7

Table 6

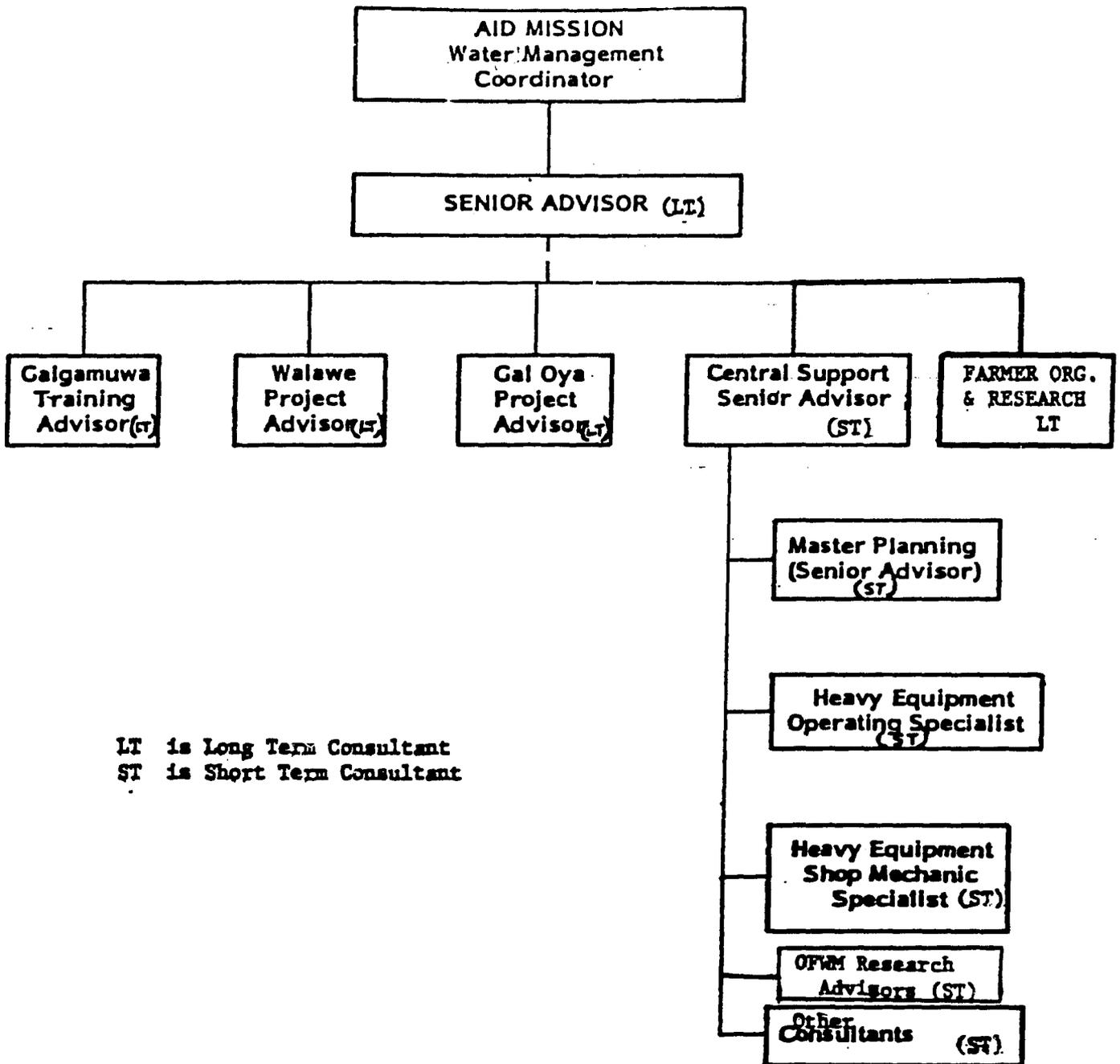
Excavating Unit *
(U.S.Dollars FIC, 1978 Prices)

<u>Item</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total</u>
1 cu yd Dragline	1	115,000	115,000
Backhoe	1	134,000	134,000
Rubber-Tired Backhoe/Loader	1	60,000	60,000
Lowboy Transport Truck	1	50,000	50,000
Jeep w/Radio	1	10,000	<u>10,000</u>
			369,000
Spare Parts (20% of total)			74,000
Contingency and inflation **			<u>145,000</u>
Total Cost			<u>588,000</u>

* A small dredge may be substituted for the dragline and other changes may be made based on preorder investigations.

** Includes freight and insurance.

TECHNICAL ASSISTANCE ORGANIZATION
SRI LANKA WATER MANAGEMENT PROGRAM



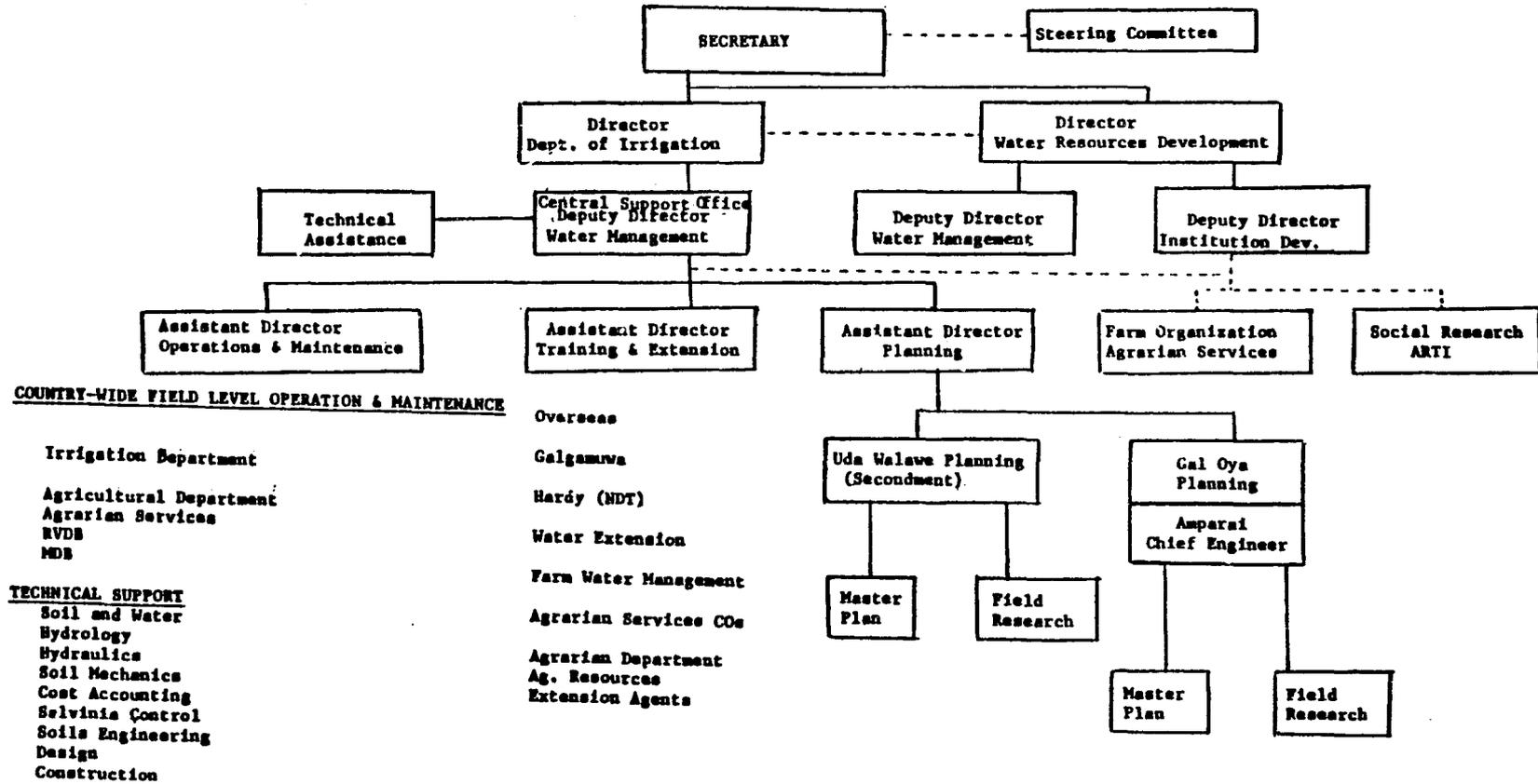
LT is Long Term Consultant
ST is Short Term Consultant

Program Facilitation
Extension Movie
Gal Oya Master Plan
Walawe Master Plan
Overseas Training
Equipment Selection
and Procurement
Facilities Engineering
Aerial Photomapping

GSL ORGANIZATION FOR WATER MANAGEMENT

ANNEX 8

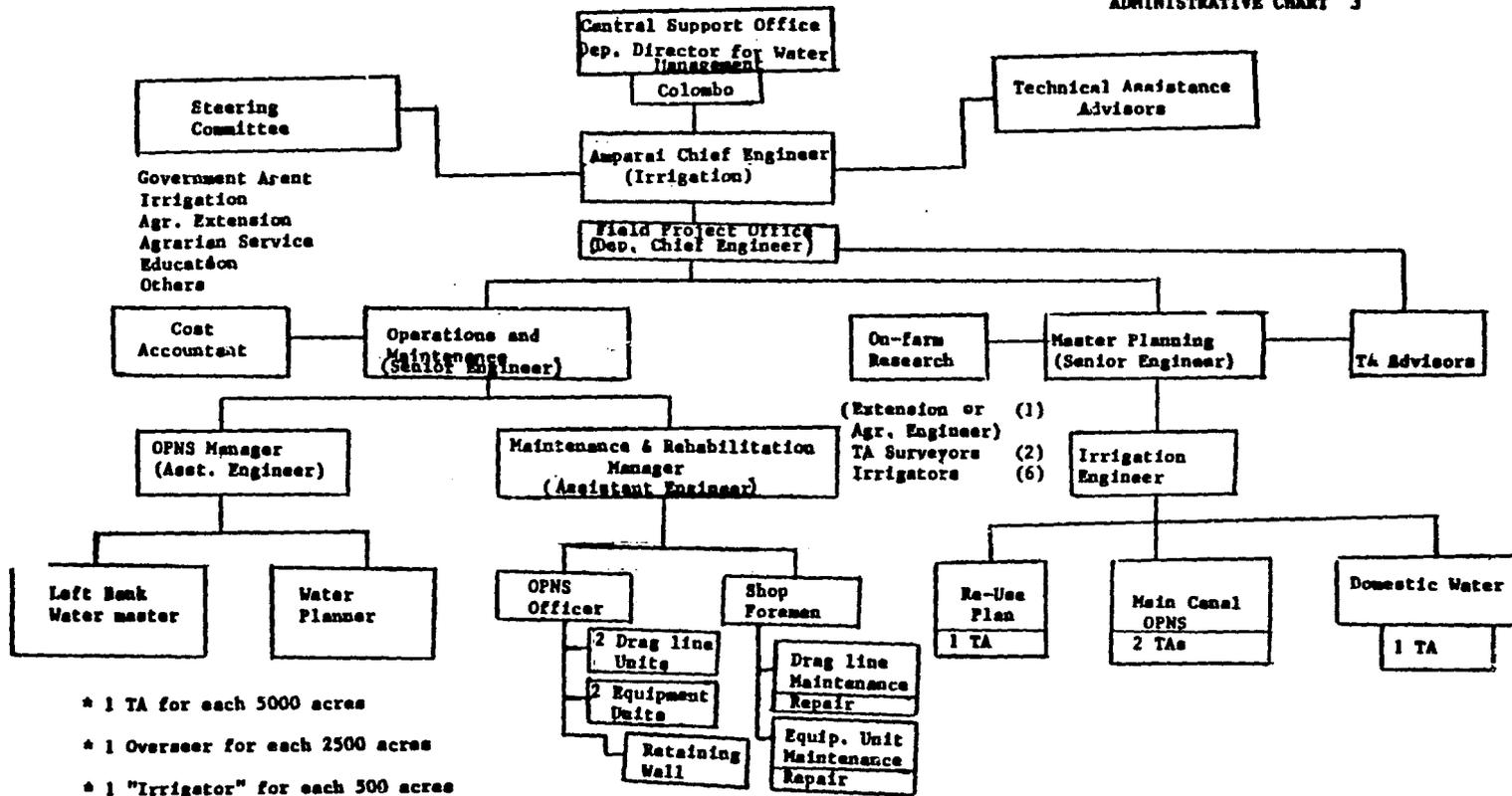
ADMINISTRATIVE CHART 2



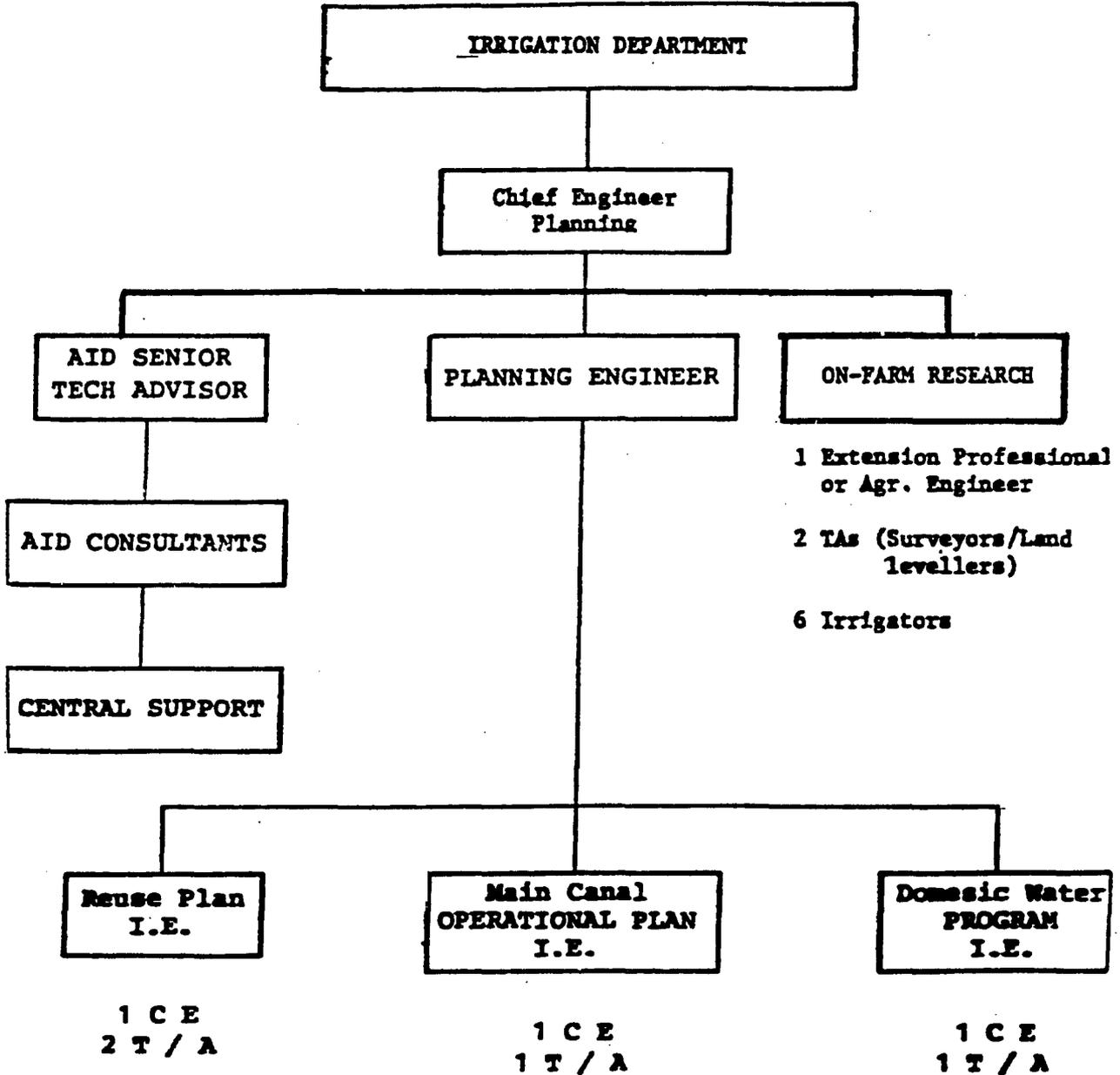
GAL OYA FIELD PROJECT ORGANIZATION

ANNEX 8

ADMINISTRATIVE CHART 3



ORGANIZATION FOR MASTER PLANNING & RESEARCH
WALAWE



ASPECTS OF RFP FOR TECHNICAL ASSISTANCE

(Water Management Project — Sri Lanka)

- A. Introduction: The GSL/USAID encourages the utilization and joint collaboration between a Firm (consulting engineering or other) and a University in submitting a proposal. This should be the best means of providing the optimum quality of technical assistance to the project.
- B. Scope of Work for Consultant Team:
1. Assist the Government's Irrigation Department and farmers to modernize and rehabilitate (check, redesign as appropriate, de-silt, and reconstruct) the Left Bank irrigation system of Gal Oya, which includes 32 miles of left bank canal, 50 miles of major distributary and 68 miles of minor distributary and field channels.
 2. Assist the Government to upgrade, improve and conduct its irrigation and water management related training programs in the Country. This will include:
 - a. rehabilitate and upgrade irrigation training institutes in Galgamuwa and in Amparai (Hardy Institute);
 - b. assist with various types of water management training for designated personnel connected with the project from the policy makers and officials levels down to the farmers; and
 - c. assist with arranging all participant training and observation tours including programming, orientating and handling all funding of the participants.
 3. Assist the Irrigation Department in the preparation of three Master Plans for Gal Oya and Uda Walawe during first two years of project as follows:
 - a. Operation of main canal and tank system plan;
 - b. Return Flow Use Plan; and
 - c. Domestic Water Plan.

4. Assist the Government and farmers with on-farm-water-management research in both Gal Oya and Uda Walawe which includes a program to establish a revised and improved field channel layout with on-farm levelling. Also, assist the Government (Irrigation Department and Agrarian Research and Training Institute) with various types of socio-economic research to include a benchmark survey of Gal Oya, establishing different types of irrigation organizing on a pilot basis, bi-annual evaluations, and special socio-economic water management research.
5. Assist the Government in testing various models of irrigation associations and then replicate the model (s) widely so that all 15,000 farmers on the Left Bank system are organized into viable irrigation associations.
6. Assist the Government with preparing all equipment/commodity lists required for the project and to assist with the final selection, establishing specifications, procurement, clearance at port, utilization of heavy equipment including operations and maintenance, and specialized training courses. (Major items include dredges or draglines, dozers, backhoes and various types of transport equipment).
7. Assist with all other aspects of project implementation such as photo-mapping and usage, and investigations and facilities engineering which will be required by Project Director and Central Support Staff and Project Field Staff.
8. Provide supervision/management/logistics in Sri Lanka for all expatriate personnel under the contract.
9. Develop Life of Project and Annual Work Plans in collaboration with the GSL Project Director and Staff to delineate the responsibilities of both Consultants and the GSL personnel. The plans will be based on operational requirements and modified as conditions and operational requirements of the project require. All work plans will be subject to approval by the USAID.
10. Participate as required in-depth technical evaluations in conjunction with the GSL and the USAID at specified junctures during the project.

C. Estimated Level of Effort:

Position/Location	Specialized Field	Person-Month	Cost <u>1</u> /(000)
<u>Long-Term Consultants</u>			
1. Team Leader in Colombo	(Civil or Agricultural Engineer, spec. in Irrigation or Water Resources)	48	400
2. Training Advisor/Galgamuwa	Water Resources	36	300
3. Socio-Economic/Research Advisor in Colombo	Social Anthropologist	12	100
4. Institutional Advisor <u>2</u> / Colombo or Gal Oya	Farmer Organization Specialist	36	300
5. Water Management Advisor/ Gal Oya	Civil/Agriculture Engineer	48	400
6. Planning and Research Advisor/Walawe	Social Scientist	36	300
<u>Short-Term Consultants</u>			
1. Equipment Operation Specialist	Heavy Equipment Operations	18	126
2. Maintenance Specialist	Heavy Equipment Mechanic	18	126
3. Planning Specialist	Irrigation Engineer/ Economist/Water Resources	18	126
4. Training Consultant	Curriculum Design/ Education	6	42
5. Extension Specialist	Agronomy-Extension	12	84
6. Economist	Agriculture Economist	6	42

(contd.)

1/ Cost data would not be included in RFP. Cost for each consultant does include firm overhead, all travel cost including vehicles, housing, education and other cost.

2/ Socio-Economic Research Advisor may continue as Institutional advisor if he is qualified to actively assist the GSL in establishing irrigation committees.

7. Socio-economic Research	Rural Sociologist	8	56
8. Land Levelling/Farm Layout	Agriculture Engineer	12	84
9. Miscellaneous Consultants		15	105
<u>Miscellaneous (Budget) 3/</u>			<u>109</u>
			<u>\$ 2,700,000</u>

D. Logistic Support and Cost:

While in Sri Lanka, Contractor's personnel will be provided with office space, office equipment and interpreter/secretarial services by the Cooperating Country. All other required logistic support items will be the responsibility of the Contractor.

It should be noted that all persons, except citizens and permanent residents of Sri Lanka, involved in the implementation of this project, will, under present Sri Lankan law, be exempted from the payment of income taxes and personal property tax on articles destined for their private use (including vehicles and furniture). Duty free imports will be allowable for personal property, consumable goods and for goods subsequently withdrawn upon departure. Goods which are sold in Sri Lanka will be subject to GSL regulations.

Also the following is provided for costing purposes:

Housing or Quarters Allowance: Colombo at \$9,000/annum, other locations at \$5,000/annum.

Differential - 20% for all Sri Lanka posts

	<u>At Post</u>	<u>Away from Post</u>
Educational Allowance	\$ 150	\$ 7,100
Unlisted Posts-Areas	700	700
Colombo	700	7,100

Per Diem for Short-Term Personnel: Colombo not to exceed \$60/day and other locations at \$15/day.

3/ To include books, etc., for the Irrigation library, miscellaneous commodities and travel cost of GSL.

E. IMPLEMENTATION PLAN FOR WATER MANAGEMENT

(TECHNICAL ASSISTANCE REQUIREMENTS PERSONS-MONTHS)

	<u>Year 1 (80)</u>				<u>Year 2 (81)</u>				<u>Year 3 (82)</u>				<u>Year 4 (83)</u>				<u>Year 5</u>			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
<u>Long Term</u>																				
1. Team Leader								48												
2. Training Advisor						24						6		3		3				
3. Socioeconomic Research Advisor			12																	
4. Institutional Advisor											36									
5. Water Management Advisor								48												
6. Planning and Research Advisor						24						6			6					
<u>Short Term</u>																				
1. Equipment												3		3						
2. Maintenance							3		3		3		3							
3. Planning			9				3		6											
4. Training		2					2				2									
5. Extension/Agronomy		2			2	2		2				2				2				
6. Economist			2				2			2										
7. Socioeconomic Research								2			2			2		2				
8. Land Levelling/Farm Layout			2		2		2		2		2			2						
9. Miscellaneous (15 Person-Months as required)																				

PROJECT AUTHORIZATION AND REQUEST FOR ALLOTMENT OF FUNDS

PART II

Name of Country: Sri Lanka

Name of Project: Water Management

Number of Project: 383 - 0057

Pursuant to Part 1, Section 103 of the Foreign Assistance Act of 1961, as amended, I hereby authorize a Loan and a Grant to Sri Lanka the "Cooperating Country" of not to exceed five million, nine hundred thousand United States Dollars (\$5,900,000) the ("Authorized Amount") to help in financing certain foreign exchange and local currency costs of goods and services required for the project as described in the following paragraph. The project will modernize and rehabilitate the left bank of the largest irrigation system in Sri Lanka (Gal Oya), develop master plans and conduct on-farm water management research at both Gal Oya and Uda Walawe (the second largest irrigation scheme in Sri Lanka), conduct other socioeconomic water management research, provide an improved irrigation training program, improve central support to be provided by the Irrigation Department in maintenance and operation, improve the extension program, and assist the Government to formulate irrigation organizations whereby farmers will participate in the rebuilding, operation and maintenance of field channels, (hereinafter referred to as the "Project"). Of the Authorized Amount, five million four hundred thousand dollars (\$5,400,000) ("Loan") will be loaned to the Cooperating Country to assist in financing certain Foreign Exchange and local currency costs of goods and services required for the Project.

I approve the total level of A.I.D. appropriated funding planned for this Project of not to exceed nine million eight hundred thousand United States Dollars (\$9,800,000) assistance of which \$6,800,000 will be Loan funded and \$3,000,000 Grant funded including the funding authorized above, during the period FY 1979 through FY 1981. I approve further increments (beyond those authorized above) during that period of assistance funding up to \$3,900,000, subject to the availability of funds in accordance with A.I.D. allotment procedures.

I hereby authorize the initiation of negotiation and execution of the Project Agreement by the officer to whom such authority has been delegated in accordance with A.I.D. regulations and Delegations of Authority subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate:

a. Interest Rate and Terms of Repayment

The Cooperating Country shall repay the Loan to A.I.D. in United States Dollars within forty (40) years from the date of first disbursement of the Loan, including a grace period of not to exceed ten (10) years. The Cooperating Country shall pay to A.I.D. in United States Dollars interest from the date of first disbursement of the Loan at the rate of (a) two percent (2%) per annum during the first ten (10) years, and (b) three percent (3%) per annum thereafter, on the outstanding disbursed balance of the Loan and on any due and unpaid interest accrued therein.

b. Source and Origin of Goods and Services

Goods and services financed by A.I.D. under the grant portion of the Project shall have their source and origin in the Cooperating Country and in the United States and for the loan portion of the Project in the cooperating country and countries included in A.I.D. Geographic Code 941 except as A.I.D. may otherwise agree in writing.

Assistant Administrator
Bureau for Asia

SOCIOECONOMIC PATTERNS IN THE GAL OYA REGION

The following information on socioeconomic patterns was collected during a series of unstructured field interviews with a very small random sample of farmers living within the Gal Oya Scheme.

I. Data from Villages at the Head of the Irrigation System

A. The Sinhalese Buddhist Villages of Paragahakella and Wawinna,

(Amparai District, on the right bank of the Gal Oya River)

1. Socioeconomic Characteristics: Data in these villages were collected from groups of Sinhalese Buddhist farmers of varying ages (between 31 to 73 years of age), all of whom were colonists who had been relocated into the area from other places. (those in Paragahakella had been relocated from Badulla District while some in Wawinna were from other parts of the Gal Oya region). They were from very poor backgrounds, and they pointed out that while some colonists were forced to relocate, others were lured to the Gal Oya with promises of ideal living conditions.

The Case of A.M. Sundarbanda: In Badulla District, Sundarbanda shared $\frac{1}{4}$ acre with his elder brother, but he earned his livelihood working as a laborer. In 1952 he joined the colonists from the district in the move to the Gal Oya. The GSL gave him three acres of paddy land, although it was covered with scrub growth (as was most of the region at that time). He also was given two acres of "highland" land (apparently a reference to non-irrigable land) on which his farmstead was located. The GSL provided him with a three-room masonry house with a tile roof, farm implements (a traditional long-handle hoe, axe, crowbar, etc.), a pair of boots, and seeds.

First Crop: Sundarbanda's first crop was planted in the "high land" surrounding his farmstead using the chena technique which involved cutting down trees and scrub brush, which was burned prior to the maha rains. Using his hoe, he then turned the soil and planted maize, manioc, and various vegetables. During this period he purchased rice to feed his family.

First Paddy Crop: Preparation of paddy fields was done with the help of kin and neighbours -- a system of mutual aid that appears to be common in this area. Using their implements, they cleared the site, levelled the fields and arranged bundings. By the maha season in 1953 (irrigation water was now available), Sundarbanda was ready to plant his first paddy crop of H-4 long white variety which matured in four months. He broadcast his seeds, irrigated, and his yield was 40 bushels per $\frac{1}{4}$ acre (or around 240 bushels for the 3 acres).

2. Current Water Management Problems:

- (a) There has been neglect of the system with main channels becoming silted up and the sluice gates being broken.
- (b) Normally there is available irrigation water in the maha season but insufficient supply in the yala season. Several causes can be identified:

(1) Population increase is an important factor. When the colonists first arrived there was no problem of irrigation water availability. The village of ParagahaKella initially had only 152 families and now has 700 families. This figure has increased not only by a high child birth rate but by other kin and friends arriving and often encroaching on available land.

(2) Lack of cooperation among farmers is an equally important factor. Given the population increase and the uncertainty of water availability during the yala, cooperation among the farmer is essential, but unfortunately it is lacking. Two contributing factors are:

(3) The breakdown of the Vel Vidane System. The Vel Vidane was a local farmer, traditionally chosen by the farmers in a given tract, and his authority was recognized by the government (including the British colonial administration). The system was weakened when the role of the Vel Vidane became appointive (making him a government civil servant), thereby eliminating the participation of the farmers. More recently the role of the Vel Vidane was officially abolished when it was replaced by the role of the Cultivation Officer.

(4) Uncoordinated Planting Schedules. Farmers in this area tend to vary their planting schedules. At any time during the season there will be farmers preparing fields while others are irrigating or preparing to harvest. Some of the factors related to this are the unreliable availability of irrigation water and competition for tractors, draft animals and labor which occur if all farmers observed the same schedule. Lack of coordination in planting schedules, however, has resulted in a wastage of irrigation water. It also leads to lack of cooperation in keeping irrigation channels cleared for someone in another part of the tract who is in need of irrigation water. In the absence of the Vel Vidane, there is no one to bring pressure on these and other negligent farmers to maintain their portion of the irrigation system.

3. Other Related Farm Problems:

Diminishing Yields. It was noted above that when farmer Sundarbada first began to farm paddy in 1953 his yield was around 40 bushels per $\frac{1}{4}$ acre (of H-4 long white rice). One 31-year old farmer complained

that his current yields were down to 30 bushels for 3 acres. Other farmers reported that their average yields were between 6 - 10 bushels (90-2 variety rice) per $\frac{1}{2}$ acre. They attributed this drop to several factors, one of which is the problem of available irrigation water noted above. Other factors include:

- (a) Declining Soil Fertility. Farmers note that when the colonists first arrived, the soil of the area was fresh and unfarmed, but with the population increase (152 families in Paragahakella village in 1952 and 700 at the present time) the soil is being constantly worked, resulting in diminishing fertility. One farmer pointed out that rotation of paddy land would help ameliorate the situation.
- (b) Pests. All of the farmers interviewed complained of pests, explicitly noting that they have become worse since the hybrid varieties of rice have been introduced. Some farmers observed that the uncoordinated planting schedules contributed to the persistence of pests because pesticides were used at varying times by the farmers, allowing the pests to thrive in unsprayed fields.
- (c) Lack of Extension Support. The colonists had received considerable support from the GSL when the Gal Oya Project was first implemented in the 1950's. There had been tractor stations for maintaining tractors which the farmers could rent, but around 1965, the stations were all closed. None of the tractors in the area are now functioning. Except for a few wealthy farmers who rent their tractor most farmers have reverted to using buffalo and bulls for their plowing.
- (d) Marketing Problems. All of the farmers interviewed complained of the marketing situation. They normally sell their paddy soon after harvest because they need the cash. Often the coop will not accept the paddy, claiming that there is a lack of storage space, no cash for payment or a shortage of gunny sacks. Private paddy dealers usually pay the farmers around Rs 10 less than the government rate of Rs. 40 per bushel.
- (e) Suggested Solution to the Problems. One young farmer who has been experiencing diminishing yields of 90-2 variety rice (currently he gets around 30 bushels for his 3 acres) summarized his solution to the problems as follows:
 - A. Regularize irrigation water availability, which would permit farmers to coordinate their planting schedules;
 - B. On-time delivery of fertilizers and pesticides; and
 - C. Rotating of paddy crops to avoid exhaustion of the soil.
 - D. Provide varieties that are pest resistant.
 - E. Let the farmers have a greater voice in how the system is managed.

4. Observations.

(a) There is a definite problem in water management in the Sinhalese villages at the head of the irrigation system. One of the principal causes at the local level is the disruption in the traditional social organization of irrigation that was embodied in the Vel Vidane system. When this system was abolished in the 1960's, there was insufficient social cohesion in the communities to provide any continuing order in maintaining the local irrigation system. This has resulted in-kind of local anarchy in the social organization relating to irrigation systems.

(b) The Sinhalese colonists received considerable support from the government when they were settled in the Gal Oya region. They may have developed an over-dependency on the government to satisfy many of their farming needs.

II. Data from Villages in the Middle Zone of the Irrigation System

A. The Muslim (Tamil-speaking) village of Irrakaman (Amparai District)

located close to the Irrakaman Tank on the right bank of the Gal Oya River.

1. Socioeconomic Characteristics:

Irrakaman village is an old settlement that has been established on this location for "many generations". Prior to the implementation of the original Gal Oya Irrigation Project in the early 1950's, the farmers in this area relied on rain water for their paddy cultivation, so they normally only had a maha crop. With the new irrigation system there came various changes:

- a. New Settlements: A "colony" of settlers was established nearby, but most of the settlers were landless people from Irrakaman;
- b. Irrigation Water: This brought about double-cropping and the need to organize the local people into a water management system; the Vatta Vidane system (see below); and
- c. Sugar Corporation Estate: As part of the Gal Oya Project, 10,000 - 15,000 acres were given to the Sri Lanka Sugar Corporation for an estate. This corporation continues to lease some land (1500 acres in 1978) from villagers.

2. Population and Land Holdings:

The present population of the village is around 1000 families, most of whom are engaged in paddy farming. The average holding is around 3 acres (maximum holdings are around 25 acres while the minimum are about $\frac{1}{2}$ acre). Most villagers also have some dry

land that they farm using the chena method.

3. The Social Organization of Irrigation:

With the implementation of the original Gal Oya Irrigation System there arose a need for the farmers in the village to organize their use of water. They instituted the traditional Vatta Vidane role which had long been in use in other irrigated areas and is identical to the Vel Vidane role of the Sinhalese communities. A Vatta Vidane was elected for each of the ten tracts in the village. Usually he was 40 - 45 years of age, and an experienced farmer. One of them was A.M. Meeralebbe; now 55 years of age; a farmer who owns a sizeable shop in the center of the village. He also is a leader in the village mosque society. He was responsible as the Vatta Vidane for a 500 acre tract (that now is part of a large sugar cane estate), and everyone recognized his authority. If he could not get a negligent farmer to clear his field channel, he would hire laborers to do it and then charge the farmer whatever it cost. For his services, Meeralebbe was paid by each farmer in the tract at the rate of 8 rupees per acre annually.

In the 1960's, the role of Vatta Vidane was abolished. Recently this role was partially replaced by an Agrarian Services Officer called the Cultivation Officer (CO). There is one CO for each of the five, one-thousand acre tracts). Nonetheless, Meeralebbe continues to arbitrate water problems, usually in conjunction with the Cultivation Officer (who happens to be a Tamil-speaking Muslim from the village). If a channel is blocked, Meeralebbe is informed, and he confers with the Cultivation Officer (who is primarily a liaison officer). Together they bring pressure on the errant farmer to make him clear his channel. If a dispute ensues, the Cultivation Officer does the mediation.

4. Cultivation Patterns and Problems:

Prior to the original Gal Oya Project, farmers in the village only had one crop (Maha) with yields of around 60 bushels per acre. Since irrigation was introduced, most of these farmers now have had two crops (BG-11, BG-94-2, and BG-94-1 varieties rice), and realize yields of 125-150 bushels per acre annually.

- a. Planting Schedules: These schedules are relatively well coordinated but this raises the problem concerning the availability of tractors (five in the village, all privately owned) and buffalo. There is no problem however with obtaining enough laborers because they come in from other areas. Many of them are recruited by "bodyshop" contractors.

- b. Irrigation Problem: As is indicated above, the social organization of irrigation is relatively effective in this village because the Vatta Vidane continues to function. In the Yala season, however, there is still a shortage of water for some farmers. There are also problems with some of the sluices and some of the main channels need dredging. Farmers reported that they require at least 4-6 inches of water in order to avoid "dry spots" because of their uneven fields. In two tracts (each of 1000 acres) there are irrigation problems caused by the water being averted into the nearby Sugar Corporation fields. This could be solved, they pointed out, by damming the Salva River).
- c. Other Farm Problems: Pests are a problem throughout the village area. Marketing also is a problem, and the Cooperatives lack storage space and often insufficient funds to buy paddy.
- d. Changes Brought by Gal Oya Irrigation System: Living standards of the community have improved considerably as a result of the increased production due to the Gal Oya Irrigation Scheme. Double cropping has increased incomes. Masonry houses and shops were constructed, more consumer goods were purchased (including radios and sewing machines, farm equipment and some tractors). Schools were improved, and a new mosque was constructed. Health improved with better food -- particularly meat and fish (the villagers do not eat many vegetables). Farmers complained that production costs have recently increased, notably the price of fertilizer and pesticides.
- e. Observations: Irrakaman appears to be a relatively well-off community with no signs of dire poverty. It is a long-established village, and its social cohesiveness is manifest in the well-organized way in which the local irrigation system is managed. The Vatta Vidanes continue to exercise authority, and appears that farmers have no problems in receiving available water supplies. The cohesiveness of the community is reinforced by the strong adherence to Islam and the existence of a strong mosque society; the leaders of which are farmers.

B. The Sinhalese, Buddhist village of Weeragoda (Amparai District)

located on the left bank of the Gal Oya River:

The informants were a young farmer, B.M. Piyarantini (20 years), and an older farmer, Bodapala (62 years) who were working in their fields. The younger farmer and his friend were plowing a paddy field using two bulls and a traditional plow. He explained that he and his friend assist one another in keeping with the mutual aid tradition that characterizes his community.

Their village, Weeragoda, was founded by colonists who came to this area in 1952 from the Teldeniya-Victoria area east of Kandy.

When the young farmer's parents migrated they had 3 children (two sons and a daughter) and now there are nine in the family. The father died in 1971, and although the young man is the seventh child since his older brothers have moved away from the village, - he has assumed responsibility for the family farm. It consists of 4 acres of paddy land and 2 acres of highland land.

Bodapala, the older farmer, came to this area with his wife and four children from Peradeniya in 1954 as one of the Sinhalese colonists. He, like the other colonists, had no land in his natal village, and the government gave him 4 acres and some cash to purchase two bulls.

1. Farming Patterns and Problems:

- a. Preparing Fields: The young informant reported that his father had rented one of the seven tractors available in the village to prepare his fields, but since 1977 the costs have been prohibitive (currently Rs. 150 per acre and four acres can be plowed in one day). Both informants noted that the preference now was to purchase (not rent) bulls at the cost of Rs. 2000 - 3000 depending on their quality. In 1977, the younger informant's family purchased their own pair of bulls. For those who rent tractors there is the problem of availability because farmers try to coordinate their schedules to make the best use of available irrigation water, thus many farmers need the tractors at about the same time.

Most farmers in this area are currently cultivating the BG-94 variety of rice. Most broadcast their seeds, although some prefer the transplanting method. Labor is provided through a system of mutual aid, hence there is little hiring of workers.

- b. Irrigation: Both informants noted that there were numerous problems related to water management.

- (1) Sand Soil is found throughout the area, which permits a too-rapid drainage of water from paddy fields.
- (2) During the maha there were sufficient supplies of water, but there usually was a shortage during the yala.
- (3) There also has been a continual problem of siltation in the main irrigation channels and with destroyed sluice gates. The optimum water level is 4 inches, but with drainage due to the sandy soil this is difficult to maintain. To make matters worse, the regulators at the head of the field channels are gone, (destroyed) so it is difficult to maintain the flow of irrigation water. They receive water from the feeder channel and acknowledge that water should be regulated so that their neighbours can also receive the water they need.

- (4) The informants claim that the water is too alkaline.
- (5) The older informant, Bodapala, had served as a Vel Vidane. He had been elected by the farmers in his tract and he received a percentage of the agrarian tax paid by the farmers. He dealt with farmers who failed to maintain their field channels, and if further arbitration was needed, he took the case to the Agrarian Service. In 1977, the role of the Vel Vidane was officially abolished, and his responsibilities were taken over by the newly appointed Cultivation Officer. In this village, however, the Cultivation Officer is a Tamil, and thus far the villagers have had no contact with him. As a result, the farmers will contact Bodapala when problems concerning irrigation water arise.

(6) The 1978 cyclone damaged the irrigation system.

2. Other Production Problems:

Two problems were emphasized:

- (1) Fertilizer prices are too high for many farmers;
- (2) Pesticides also are costly, so farmers dilute what they use. Pests are a serious problem.

3. Yields:

The informants contend that their yields have been very poor with some farmers harvesting only 10-12 bushels per acre and plant hopper losses often exceeding 75% of the crop.

4. Marketing:

The two farmers said that this was one of their worst problems. The cooperative often rejects the paddy which the farmers bring to them, claiming (1) it is mixed paddy; (2) it contains sand or other foreign matter; (3) or that the moisture content is too high. They claim that the personnel at the cooperative often under-weigh the paddy or offer a price that is too low.

5. Extension Services:

This is almost non-existent. Currently farmers in the area are experiencing a serious shortage of seed paddy.

The Sinhalese Buddhist Village of Udepura on the Left Bank of the Gal Oya River.

1. Socioeconomic Characteristics:

Informant is the son of a colonist from Kegalle who came to area some 25 years ago. The father received 2½ acres of paddy

land and about 1 acre of highland. There were some 20 other families from Kegalle who came to settle here; most of these were from the same village. The father had been a farmer but at the time of immigrating was landless. The son is currently encroaching on 4 acres of land. There appears to be no problem because water is plentiful here.

Houses in this area are modest and self-constructed. Most are brick and mortar with tin or tile roofs and earthen floors unlike the mud wattle of the upper system colonists).

2. Planting Patterns and Problems:

- a. Preparation of Fields: Most colonists in this area use buffalo power since it is cheaper and more readily available. There is a definite constraint regarding the availability of plow power and this leads to staggered cultivation which in turn results in water-use inefficiencies. Encroachers generally do not own buffalo, and this contributes to the problem of availability of tractor/plows. The hiring rate for buffalo is Rs. 125/ac.
- b. Irrigation: Farmers say that water from the Irrigation Department is to be issued for ten days, with a gap of ten days between issues. However, schedules and availability is sporadic. The farmers have organized themselves to clear the branch canals. These organizations are "informal" and receive assistance from the Cultivation Officers. The Vel Vidane system is not operable. These informal farmer groupings do not cover the entire 500 acres in a colonist "tract". Organization is by sub-unit, with little or no cooperation (or concern) with down-land farmers. Since the "system" does not include field side channels, it relies on flow from paddy to paddy from top to bottom. This makes non-cooperation a "disaster" for farmers at the end of the system.. Farmers admit to the waste and misuse of water and are concerned only about their own property - there is no concern for needs of those down-land,.

III. Data from Villagers at the Tail of the System:

A. The Hindu, Tamil-speaking Village of Karatayu (Amparai District)

on the left bank of the Gal Oya River.

1. Socioeconomic Characteristics:

The village of Karatavu is populated with Tamil-speaking Hindus. Long established in this location, the settlement pattern is characterized by densely grouped farmsteads, each of which is surrounded by an enclosure. The paddy fields of the residents are on the other side of the coastal road, and much of the village is actually within the bounds of the town of Sainthamaruthu. The population of the village is 1200 families (or about 10,000 people).

The Tamils in this community trace descent through the female line (matrilineal descent) and the preferred marriage is either with the mother's brother's daughter or the father's sister's daughter (cross-cousin marriage) so that there are inter-locking kin groups throughout the village, giving rise to strong social cohesiveness. The informants included three farmers (with 6½ acres, 10 acres, and 22 acres), and a practitioner of traditional Tamil medicine.

2. Farming Patterns and Problems Most of the farmers plant more or less on the same schedule, but this creates a problem in hiring tractors. The current rental is Rs. 250 per acre, but the price has been rising continually. Around 80 percent of the farmers hire tractors while the remaining 20 percent either own or rent bulls. Labor is no problem because contractors supply teams of workers which are brought into the area from the outside. The teams hire out for Rs. 200 - 300, depending on the acreage involved. Some 98 percent of the farmers broadcast seed while 2 percent use the transplanting method. Rice varieties currently used are Bg 90-1 and 90-2.
3. Irrigation Water management is a problem here, reflecting very graphically the tail-of-the-system pattern.
 - a. Flooding: is a major problem. During the maha, some 30 percent of the fields are flooded. This is a long standing problem and much of it is due to the placement of field channels. A tract of 400 hundred acres, for example is flooded first, and drainage from that tract irrigates the next tract of 300 acres. Flooding of around 100 acres in the larger tract occurs when the smaller tract is flooded, but there is no place for all of the water to go, so it remains in the lower portion of the larger tract. This could be resolved by arranging field channels to handle each tract separately.
 - b. Insufficient Irrigation Water is a problem during the yala. The Irrigation Department informs them in advance that they will not get water during the yala. The farmers say that the water goes to the Sugar Corporation estates. They also emphasized that the Sinhalese colonists at the head of the system are given preference ("we lack water while they waste it, bathe in it and wash their clothes in it".) They indicated that being Tamils had something to do with it. Their annual acreage tax is Rs. 6 per acre.
 - c. The Social Organization of Irrigation has been interfered with by the ruling political parties. The informant with 22 acres has served as Vatta Vidane between 1956 and 1968. He has been chosen by 112 farmers who cultivate land in a 468 acre tract. At the outset of the planting season he would call a meeting of the farmers ("Farmers' Day") to discuss general preparations for planting and such things as fence-mending. They would decide on the dates they desired irrigation water, and there was a

discussion about the condition of the channels. Should a farmer refuse to clear his channels, the Vatta Vidane will have it done and charge him for the cost of the work.

Around 1971, the role of the Vatta Vidane was affected by formation of the new Agriculture Production Committee, composed of between six and twelve members (six must be farmers). This was the program of the Sri Lanka Freedom Party (SLFP). To add to the present confusion, the United National Party (UNP), which came to power in 1977, created the role of Cultivation Officer. His role absorbed those formerly assigned to the Vatta Vidane. The Assistant District Agrarian Director appoints the Cultivation Officer largely on the basis of political considerations. The farmers note that the CO is a young man with no particular qualifications and often not even a farmer. The Cultivation Officer for this village is a Tamil and a local farmer, but people still look to the former Vatta Vidanes for advice and assistance.

- d. Pests: are a serious problem. The farmers pointed out that prior to the advent of hybrid varieties of rice they farmed traditional paddy which brought smaller yields, but there was no pest problem. They say "Now we have all of the British and American diseases". They are convinced that the new strains brought the pests, and they expressed their view that pesticides they used were not effective and they must be diluted. (Note: Brown Leaf Hopper has been a problem in this area since 1926).
- e. Marketing: is also a problem. The personnel at the Cooperative and the PMB* are said to be corrupt. At the PMB the farmers must bribe the employees to get them to load or unload the sacks of paddy. (* Paddy Marketing Board)

B. The Tamil-speaking village of Chawalakadai (Amparai District) on the left bank of the Gal Oya River:

1. Socioeconomic Characteristics:

The informant is a 44 year old Muslim, who is a farmer (with 3 acres) and also a vernacular teacher. Farmers in this area live in Muslim or Tamil villages along highway A-4, which runs along the coast. They farm fields located some 5 - 7 miles inland to the west.

Ethically this is a Muslim area. The residence after marriage is uxori-local. Women receive a dowry (usually land and a house) and the men come to live in the matrilineal homesteads with their wives. There is an individual called a Chief Trustee, who is the religious leader of the area. In some areas, this individual plays a number of leadership roles (e.g. Vel Vidane, lineage head, etc.,).

2. Planting Patterns and Problems:

The farmer interviewed claimed to be unable to cultivate during the Yala because of lack of irrigation water. His yield in the previous maha was 35 bu/acre. According to the interviews the major problem was timeliness water distribution. The irrigation system is continuous gravity flow from one field to the next lower field. There appears to be no means by which the individual farmer can control the water in the field channel.

The average holding in this tract varies between 2 and 10 acres. This farmer listed the following problems: (a) the channel needs to be maintained (by the government); (b) the lands need to be levelled by the government; and (c) the fertilizer needs to be subsidized by the government. This appears to be another case where once the government does something for the people, they expect continuous assistance. When it is not forthcoming, they are unable to do it themselves. Fertilizer is already heavily subsidized, maintenance of the canals is handled up to the distribution canal by the government and the farmers' responsibility is at the lower end, and the farmers elsewhere have levelled their own fields.

C. The Tamil-speaking Hindu village of Naipaddamunai (Amparai District)

located on the left bank of the Gal Oya River:

1. Socioeconomic Characteristics:

This is a Hindu settlement scarcely distinguishable from the Muslim villages nearby. The paddy fields are located some 3 miles inland in the Anamalai area.

2. Planting Patterns and Problems:

Maha cultivation is always carried out, the yala varies according to the availability of water. The informants claimed getting low yields during the maha of about 35 bu/ac. There are approximately 850 acres in their tract which is not irrigated during the yala; the tract is between 1,000 and 1,250 acres. The reasons cited for the lack of water were: lack of maintenance on channels, lack of repair of irrigation structures, and the need to build/replace certain sluices and anicuts. These problems appear to be related to the actual opening and closing of sluices, i.e., there is poor control within the system and efficiencies of use are very low. In some areas, there is an absolute shortage of water and the sluice cannot build up a sufficient head to irrigate certain portions of the tract.

Complaints were voiced that funding constraints led to poor timing of insecticide application. This resulted in ineffective

control of insects and pests since they merely move to untreated fields. Small holders and those with low yields attempt to make ends meet by pursuing off-farm employment. Employment periods were usually between 5 and 10 days per year. Certain other crop inputs were needed including fertilizer at the right time. Complaints were made that the Paddy Marketing Board was cheating on prices, delaying payments etc. The biggest problem appears to be with agriculture loans. Most of these were received after the needs for inputs has passed, and this contributes to staggered cultivation and the difficulty in repayment of the loans. The Vel Vidane of this area reported that he controlled 500 acres which were irrigated by a tank. During the yala only 200 acres were irrigated. Even during maha he reported that only 300 acres were irrigated because some 200 acres were flooded due to poor drainage within the tract and could not be cultivated. He said that sluices gates were not maintained and that Irrigation Department personnel had removed sluice planks and had not replaced them. It appears that they were removed to prevent theft! The Vel Vidane claims that there is good cooperation among farmers and that they maintain their own field channels, etc.

ORGANIZING FARMERS FOR WATER MANAGEMENT IN SRI LANKA

BY DR. GEORGE E. RADOSEVICH*

Introduction

Agriculture is the backbone of the economy in Sri Lanka and irrigated agriculture the lifeblood of food producer and consumer alike. Yet this sector of the economy is most vulnerable to changing geoclimatic, economic and political conditions and foreign exchange considerations. Although irrigation has been practised for centuries on this island country, the farmers have not had a legal and uniform system of self-organization for operation and maintenance of common irrigation channels and water management activities. The customary system of appointing one person as irrigation headman (Vel or Vatta Vidane) with the responsibility for ensuring proper delivery of water and maintenance of field channels was abolished in the early 1960's. Since that time, numerous representative bodies, such as Agricultural Productivity Committees and Cultivation Committees, have been organized under law to deal with the important topic of increasing irrigated agriculture production, including water management at the farm level. The efforts to date have not been successful.

Role of Irrigation Associations

The Government of Sri Lanka has recently placed great emphasis upon the need to develop a concerted and coordinated effort of appropriate officials and farmers to solve the problem of water distribution and management that persist and rob the country of its true productive capacity.^{1/} In addition to ongoing development of irrigation schemes, efforts are underway to revise the irrigation ordinance, improve agency organizational structures and operations, and focus on the farmers role in resolving these water problems.

To successfully implement a program of improved water management at the local level, it is essential to enhance or introduce an institutional structure to represent the irrigators and enable them to assume responsibility for use of this public resource. In many countries this local organization is referred to as Water User Association, Irrigation

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^{1/} See A. Maheswaran, "Engineer's Role in Water Management", Jalavrudhi, Journal of the Irrigation Department Vol. 1, No. 2, P.48, Dec. 1976 and CH2M Hill, Proposed Water Management for Major Irrigation Schemes in Sri Lanka, Feb.1979, for discussions on water problems.

Association, Community of Irrigators or some like term. It is important when translating the name into the national language that it convey the organizations' purpose and connote the importance of the resource to society. In Sri Lanka such a name might be "Jala Sampath Palaka Sabahawa" (Council for Administering Treasured Water Resources), and abbreviated J.S.P.S. It is proposed that a system of farmer organization be considered in Sri Lanka as hereinafter provided with the testing of deliberate variations in organization forms and internal operations.

Generally, the basic objectives of local water organizations are to operate, maintain and rehabilitate the water distribution system at the farm level in an efficient and effective manner as possible and promote proper application and conservation of water on the farm. Specifically the J.S.P.S. in Sri Lanka might include:

1. To properly improve and maintain field channels.
2. To insure that water will be equitably distributed among farmers throughout the field channel and from distributary to field channel.
3. To operate the delivery system in such a fashion so as to prevent unnecessary loss and waste of water.
4. To serve as a channel of communication between water users and water controllers (i.e. Irrigation Department) particularly on such important matters as irrigation and crop scheduling, water supply conditions, and rotation schedules of distributary channels.
5. To resolve disputes among farmers within the organization command area, and if necessary to assist in enforcement of sanctions against offenders unwilling to correct their action.
6. To encourage adherence to cropping patterns that maximize the use of water under the particular soil and delivery conditions.
7. Where possible, to obtain domestic water from ground water or other alternate sources, in an effort to reduce the extensive losses from current practices of requiring domestic water to run through field channels during non-irrigation periods.
8. To possibly expand the benefits of cooperation and collective action into other related activities common to the irrigators within the immediate delivery system, e.g. setting realistic cultivation schedules, cooperating in renting or purchasing of certain agricultural implements (sprayers) and production inputs (seed, weedicides, etc.,).
9. In general, to promote improved water management, equitable distribution of available supplies, and conservation of water.

What is happening in other Countries?

Problems of water supply in arid areas are similar throughout the World e.g. more land that can be cultivated than water to irrigate, conveyance and application losses and disputes between competing water users. Water laws in almost all countries attempt to set out the policy for water use, basis and method of allocation of water, distribution requirements and use conditions.

At the local level, countries with the more successful irrigated agriculture have adopted some form of Water User Association. And, although many of the physical problems are similar, a review of the approaches taken provides wide variety of examples to examine in light of the conditions in Sri Lanka. The organizations generally occur either from spontaneous or independent action of the water users and hence develop over time and become recognized as having customary law significance; or are government influenced or induced. When they can be traced to being sanctioned by the government, they may be created either the top-down approach, which is mandatory formation through some development scheme; or bottom-up approach, which is a voluntary organization of water users at some level according to a law or regulation, specially providing for their creation. The organization may range from private to public, simple to complex and single to multi-purpose.

Although a number of irrigation organization approaches were examined for applicability of their features to Sri Lanka²/only the approaches of two countries, Spain and Philippines, will be briefly discussed here.

Spanish Community of Irrigators

The hierarchy of the irrigation association begins with a very simple entity serving a small area from a lateral or sub-watercourse to a federation of irrigation associations on the river. At the base of the hierarchy is the simple community (simple comunidad). The next level is the general community (comunidad general) which takes on very formal organizational characteristics and consists of simple communities and users served from a public canal and diversion works. The general community must defend the interests of the simple communities within their water delivery area. They are also responsible for the control and distribution of the community waters.

The communities may be organized voluntarily by action of water users of a common canal or watercourse, or by direction of the Comisario de Aguas in the basin.

When the waters are granted to a community it is charged with the control of the distribution of the water among its members. It administers the waters. If a person leaves the community he loses his right because he is leaving the lands. The right to use the water rests with the members of the community. The community, even when granted the water, performs only a distributive function.

²/For approaches of other countries see: Water Users Organization for Improving Irrigated Agriculture; Application to Pakistan, Radosevich, G. Colorado State University, Colorado, 12/75.

The organic structure of the community of irrigators illustrates a logical functional diversion of activities particularly relevant to water control and management. It consists of three organs:

1. Junta general (general assembly).
2. Sindicato de Riego (board of directors).
3. Jurado de Riego (jury of water users).

Each members of the community must pay the assessments allocated to him according to the quantity of water delivered. Although the water is not metered, a "duty of water" for various types of crops is established by the sindicato. That quantity is distributed through canal outlets calculated to deliver a certain flow for a certain period of time. The junta approves the budget and fees charged to the members.

There are four basic concepts of the association which enable local control and self-imposed management.

- (a) An association's existence is justified by a need to deliver water to a specific parcel of land in a more efficient and effective way.
- (b) Concept of proportional distribution, theoretically favours no man, but rather provides to each irrigator a portion of water according to the size of the holding.
- (c) Concept of individual responsibility to community for maintenance of his part of the watercourse and duty not to waste water makes each irrigator unique and significant. Infractions may result in fine or non-delivery of water.
- (d) Concept of collective responsibility through internal organs of the association placed the capability and success of effective control and management upon the irrigators themselves.

One final feature of the Spanish system of water users associations is their method of resolving disputes. When the Moors invaded the Iberian Peninsula in 892, they brought with them the Islamic principles of water use, the system of local administration, and the Islamic custom of resolving disputes at the entry of the mosque. The principles of community property and equitable apportionment of water are reflected in the community of irrigators as well as local self-determination. To resolve disputes, the presidents of the community of irrigators of Valencia (there are eight) would meet before the entry of the mosque or just inside, at noon on every Thursday, and listen to complaints, accusations and rebuttles from the irrigators. This "Tribunal of Waters" would decide the disputes expeditiously and fairly before the eyes and ears of God.

When the Spanish Christian conqueror, El Cid, recaptured Valencia in 1232, he was so impressed with Muslim practices, that he decreed they should be adopted. The mosque was however, replaced with the Apostles Cathedral and the "Tribunal of Waters" moved to the door of the Cathedral for its weekly "trials". Today, over one thousand years later, the Tribunal of Waters meets every Thursday at noon of every week to hear complaints and other problems of water use and to resolve these disputes.

Philippine Irrigation Service Associations

The Spanish system has been tried and tested for over ten centuries and has stood well, serving as a model for many countries in North and South America. In 1975 the Philippine government created an autonomous organization, the Farm Systems Development Corporation (FSDC) to implement a government policy of increasing self-reliance and productivity of the small farmer and to expand his participation in country development.^{3/} A program called Barangay Irrigators Service Associations (BISA) was adopted with two major components--improve the efficiency of communal gravity flow irrigation systems and introduce small pumps, properly located to provide supplemental water supply or in some cases, the sole source.

To implement the program, approximately 70 farmers in an area of 100 to 200 acres could voluntarily create an Irrigator Service Association (ISA). The ISA was eligible for loans and grants to carry out the work, with the irrigators providing at least 10% of the cost of sharing through labour or cash, and repaying the loan over 10 years after a 10 year period of grace.

Formation of the ISA is voluntary, but once agreed upon by a fixed % (i.e. 70 or 80%) of shareholders, membership is mandatory. All irrigators, whether land holders or tenants, are members. The members make up the General Assembly. Every 70 farmers along a lateral elect a representative to the Executive Board. The ISA is legally constituted and is registered with the Securities and Exchange Commission. At first the ISA is single purpose, i.e., delivering water, but can later expand to obtaining credit and purchasing sprayers, seed, fertilizer, etc. Ditch tenders and pump operators are employed and the ISA is responsible to operation, maintenance and rehabilitation of the watercourses.

It was difficult to get the program started the first year because the FSDC staff had no examples to show the farmers the benefits of the program, often the pumps were late arriving or didn't work and it was a new experience also for the staff. The staff had to persuade the farmers to participate on faith and trust. By December 1977, 40,000 farmers were organized into 600 ISA's, however.

^{3/}Summarized from: Project Paper-- Philippines-- Small Farmer Systems, USAID, Philippines, March, 1978,

Creating Irrigation Associations

Several key issues must be addressed simultaneously in developing structural models for irrigation associations. They are: nature and structure of the organization, levels of formation, and functions to be performed. To insure long-term success of the Government's efforts to increase agricultural production through improving water control and management, it is highly recommended that formal and legal recognition be granted the creation and existence of the irrigation organizations. Many de facto and ad hoc forms of farmer organizations exist in Sri Lanka, often with great success in achieving limited and local goals. The appointed farm leader conception in Uda Walawe Scheme represents an impressive attempt by the River Valleys Development Board (RVDB). Permanency selection rather than election and lack of multiple representatives from the field channel seem to be the major drawback to this organizational scheme. To introduce a program nation-wide for irrigated areas, it is essential to establish a certain degree of uniformity and perpetual continuity. It is timely to incorporate a section on formation of irrigation organizations (J.S.P.S.) in the current revision of the Irrigation Ordinance or preparation of a comprehensive Water Code.

The level of formation and structure of the association depends largely upon the system of irrigation supply channels. It is important to form the organization at the lowest possible common level of water supply to the farmers served, but high enough on the channel system so that it can be effective in carrying out its functions. The primary emphasis of the J.S.P.S. must therefore focus on water and the constraints and confines of the hydrologic and hydraulic characteristics of the systems, and not upon political or agrarian service boundaries, or performing a multitude of other agricultural activities.

In Sri Lanka the irrigation supply channels are classified into 4 types, in order of water conveyance from the tank (reservoir) to farm plot. They are: ^{4/}

1. Main Channel - The principal supply channel from a tank with no direct issue to the field plots.
2. Branch Channel - An offshot from the main channel, used generally in larger irrigation schemes as a feeder to distributaries and generally with no direct issue to field plots.
3. Distributary Channel - Takes off from a main or branch channel and supplies field channels but may also make a few individual

^{4/} S. Arumugam, Development of Village Irrigation Works, Government Press, Ceylon, 1957. P.31

issues through pipe outlets to farm plots.

4. **Field Channels** - These are the lowest level of water supply making direct issue to farm field plots.

Upon examination of the distribution systems in Gal Oya and Uda Walawe project areas, it found this system of classification in fairly standard. Some reclassification of channels from names currently provided may be useful, but in general, this scheme of channel designation is understood by officials and farmers.

Based upon the examination of two irrigated schemes, discussion with numerous farmers and government officials and drawing heavily upon the authors' examination of water user associations laws and practices in 37 other countries,^{5/} a form of local farmer organization is proposed consisting of one organization with two integrated bodies (See Figure 1). The legally sanctioned organization or J.S.P.S. would be formed at the distributary channel level, (or whatever channel feeds the field channels in a particular system) and represent all irrigators receiving water from this channel. The J.S.P.S. would consist of an executive committee (E.C.) at the distributary level and field channel committee (F.C.C.) for each field channel.

The following details for the internal structure of the J.S.P.S. are provided as guidelines in the legal formation of the farmer organization, and reflects a heavy emphasis upon the physical versus the human aspects of irrigation in Sri Lanka. The author does not wish to de-emphasize the importance of village structure, customs and cultural idiosyncrasies in the creation of local organizations. It is presumed, that in addition to the information provided from discussions with farmers and written documents, the recommendations will be evaluated in more detail by social scientists. However, it is considered imperative that some organizational benchmark be proposed from which to progress. The use of traditional Vel (Vatta) Vidane is not recommended partly because numerous individuals (farmers and officials) remarked that respect for elder leadership and tradition has changed among the younger generation of farmers.

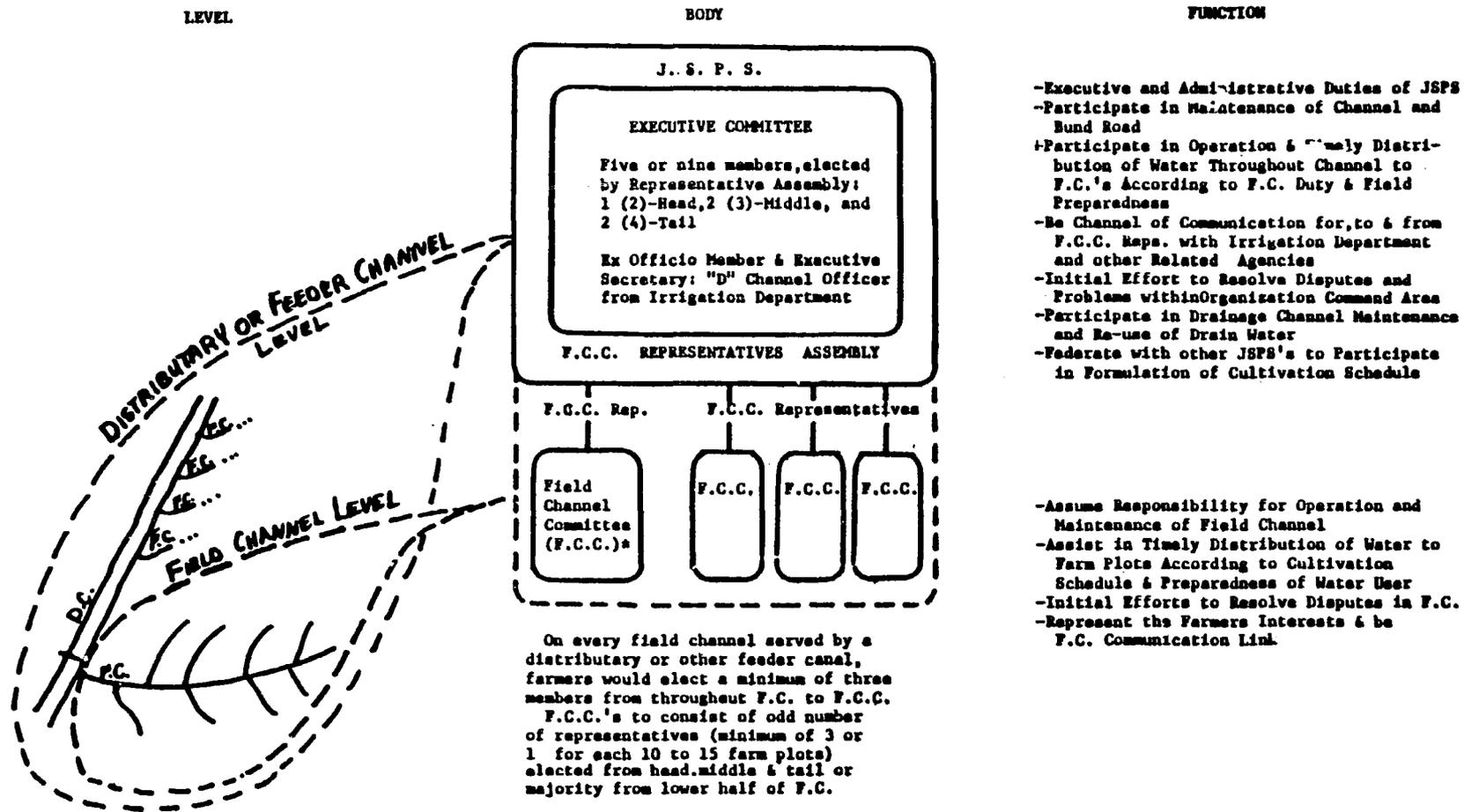
Field Channel Level - Field Channel Committee

On every field channel served by a distributary (or other F.C. feeder canal) the farmers would elect a committee. The F.C.C. would consist of a minimum of three representatives or an increasing odd number of representatives for every 10 to 15 farm plots. If only three representatives are elected they should come from either: head, middle and tail region or one from upper half and two from lower half of the field channel. In the case of representatives elected from each group of 10 to 15 farm plots going down the channel, a greater number should come from the lower middle and tail end of long F.C.'s. Within irrigation schemes the average F.C. serves 50 to 70 acres of 15 to 20 farmers

^{5/} Radosevich G. Improving Agricultural Water Use: Organizational Alternatives, Resource Admin. & Development, Inc., Fort Collins for TAB/RD, USAID Washington D.C. Contract No. 3158408, 1977.

FIGURE 1
IRRIGATION ASSOCIATIONS FOR SRI LANKA

"JALA BAMPATN PALAKA SARAHAWA"



Prepared by:
George E. Radosevich

cultivating 3 acres. However, this may vary widely and thus the need for flexibility in F.C.C. formation.

The F.C.C. would elect a Chairman from their group. It is recommended that the F.C.C. be elected every year and that no Chairman succeed himself for 2 years. This will introduce the rotating chairmanship concept to theoretically provide more equitable representation. Theory, can be circumvented in any case if desired.

The Field Channel Committee would have specified basic functions to perform. It is recommended that four primary functions be:

1. Assume the responsibility for operation and maintenance of the F.C. and F.C. right-of-way. This would include scheduled cleaning and rehabilitation of F.C. and farm plot outlets.
2. Provide timely distribution of water to farm plots according to ability of the farmer to properly use the water (preparedness of the irrigator to use water under cultivation schedule) and to ensure equitable distribution of water to irrigation in all portions of the F.C. This function would include pre-determining which farmers are ready to receive water under the cultivation schedule (some farmers may be delayed in plot preparation and planting) and informing the Irrigation Department local officer (Overseer or Irrigator) on how much water to turn into the F.C. or how many acres will or will not be needing water at the present time. This should lead to considerable conservation of water and assist the farmers in cooperating to obtain other agriculture inputs that will enable adherence to the cultivation schedule.
3. Make initial efforts to resolve problems and disputes within F.C. This function is a key to local water management on the F.C. Every effort should be made to avoid protracted litigation.
4. Represent the farmers interests and be the communication link with executive committee, and Overseer, or Irrigator.

Distributary level - Executive Committee

Every F.C.C. will provide a representative to the F.C.C. Representatives Assembly. The F.C.C. representative should be the F.C.C. Chairman. The primary purposes of the Representative Assembly are to elect the Executive Committee and be the communication link between the committee and F.C.C.

It is suggested that an Executive Committee of 5 or 9 members be elected from within the Assembly members, depending upon the distributary channel or F.C. feeder canal length and total acres served. Again, because of the similarity between F.C. and distributary problems of delivering water to the lower half or tail end, the Executive Committee should be elected from distributary representing the three regions in the following manner: for 5 or (9)-1 (2) head, 2 (3) middle and 2 (4) tail. The Executive

Committee should elect from among itself a Chairman and vice-Chairman as well as other officials considered necessary to carry out its tasks.

Further, it is suggested that the Irrigation Department official (Irrigator or Overseer) responsible for the particular distributary or F.C. feeder canal, be designated as ex officio member of the Executive Committee, without voting rights and serve as the committee's executive secretary. Due to the capability of this official to take minutes and keep records in addition to providing technical advice and carrying out his duties relative to the operation of this portion of the distribution system, he is the most logical and potentially valuable influence upon the farmers in promoting a successful water management program. Also, any complaints that farmers have about the condition of channels under jurisdiction of the Department or supply deliveries can best be discussed and resolved by him.

The activities of the executive committee can be divided into two major categories. The first is to manage the organization according to the legal requirements, e.g. convening meetings, elections, adopting by-laws keeping records, etc. Many of these organizational functions will become routine and the executive secretary can be of invaluable assistance.

The second major activity is to carry out the duties and responsibilities of water management contained in enacting law and organization by laws. The primary water management functions would include the following:

1. Assume or participate in maintenance and rehabilitation of the distributary or feeder channel and right-of-way including road.
2. Participate in operation and timely distribution of water from distributary or feeder channel to F.C.s according to F.C. water duty set by the Irrigation Department and the farmers stage of preparedness to effectively utilize water delivered to them.
3. Represent the farmers needs, views and interests, and be the channel of communication with Irrigation Department and other government agencies.
4. Undertake the initial effort to resolve water problems and disputes that occur in the organization's command area.

Several secondary functions are suggested based upon the review of documents and conversations with officials and water users. They are:

1. Be designated by Revenue Department to collect the water rates. Accrued water rates prior to Jan. 1978 have been released from collections, but subsequent to Jan. 1978, water rates will be levied and collectable by the Revenue Department. The Revenue

Department can approve any person or body to collect the rates and they receive a percentage of fees collected. Should the irrigation organization through the F.C.C. representative or designated collector elect to undertake this activity, the percentage received could defray the collection costs and remainder used for maintenance or other needed expenditures.

2. Assist in preventing encroachments. This is considered a major problem in providing adequate water supplies to the designed acreage of a project or water supply area. Any encroachment adversely effects existing farm lands by reducing both distributable quantity and often system delivery capability.
3. Assume or assist in maintenance of drainage channels and cooperate with Irrigation Department in presenting ways to re-use the drain water.

In areas where farm plot sizes are fairly uniform each landholder cultivator or tenant cultivator should have one vote. A graduated voting system may be considered for areas where farm sizes vary considerably.

Registration Requirements

It is suggested that all associations be registered with the Range Office of the Irrigation Department, or other level of Irrigation Department offices as determined by the Director, Irrigation Department. In addition the organizations may need to comply with registration requirements of the Societies Ordinance.

Hierarchy of Associations

Under present operation practices, cultivation meetings are held prior to each irrigation season to determine the cultivation schedule. This meeting sets the first and last day of water delivery and sowing of crop. The Irrigation Department participates in this meeting along with other governmental officials. However, the schedule is seldom adhered to by the irrigators due to inability to obtain other agricultural inputs or a variety of other reasons. It is proposed that pursuant to results of F.C.C. meetings on cultivating scheduling either the Chairman of the executive committee or entire committee, depending upon the irrigated area included, meet with the appropriate political and government officers to realistically construct a cultivation schedule that can be followed by the majority of farmers. The level of the meeting may be a federation of all associations on a main or branch channel and the purpose, time and format for the "cultivation meeting" become a standard procedure.

Summary

Irrigation associations or J.S.P.S.'s can become one of the most important instruments of change in Sri Lanka to improve the water management practices of farmers and implement adaptive technologies and techniques. They can, as they have done in many other countries, be the unifying element between a government's allocation and delivery of water and the efficient distribution and use by the farmer under varying conditions and constraints. For them to operate efficiently, however, it is also necessary for the Irrigation Department to properly carry out its duties and responsibilities and to appreciate the myriad of problems faced by the farmer in the total cycle of crop production. Seminars and workshops for field staff and farmers on changes in the law, new regulations and functions of irrigation associations is mandatory. Perception and attitude are key ingredients.

Efficient and effective water control and management is important to Sri Lanka. These factors, plus timely provision and proper use of other inputs, makes a nation's agricultural sector viable.

INITIAL ENVIRONMENTAL EXAMINATION

Project Location Gal Oya and Ula Walawe, Sri Lanka
Project Title Water Management
Life of Project FY 79-84
Funding (\$000) GSL: \$8540 USAID: \$9800

IEE Prepared by Jane E. Stanley Date July 18, 1979

Environmental Action Recommended: Negative Determination

Decision of the Assistant Administrator:

Approved: *John H. Sullivan*

Not Approved: _____

Date: 7/18/79

INITIAL ENVIRONMENTAL EXAMINATION

I. Background

Sri Lanka is an island about 66,000 square kilometers in area lying off the southeast coast of India. With a 1977 per capita income level of \$160 U.S., Sri Lanka is a very poor country in overall economic terms. It is predominately an agricultural and rural country, with fifty percent of its labor force involved in agricultural pursuits and almost eighty percent of its population classified as rural.

One constraint to higher agricultural production, hence higher income, in many of the country's rural areas is poor water management. One problem is that all major irrigation systems in the country are releasing more water for irrigation and other purposes than is actually required or desirable. For example, a Government survey of 15 irrigation schemes showed the water duty to average 12 acre-feet whereas successful cultivation was possible with only 8 acre-feet. Another report concluded that, during an average year, an amount of water equivalent to 80% of the irrigation water released to crops was escaping from the areas studied by surface or subsurface drainage.

Most of the country's water management problems stem from lack of operational control of irrigation facilities and excessive water use on the farm, especially by farmers at the head of a system who can physically take excessive amounts of water. Lack of operational control means the system cannot deliver pre-scheduled flows of water to a farmer's field. Therefore, when farmers can do so, they will take more water than they need since they are not sure of timing nor the amount of the next water delivery. This practice is not good for their crops nor does it leave sufficient water for farmers at the tail end of the system. In addition, much water, which could be partially re-used through a planned drain recapture and re-use program, is wasted.

II. Description of the Project

This Water Management Project will directly increase production on the Left Bank of the Gal Oya irrigation system (a major irrigation system involved in rice production located in the Eastern Region of Sri Lanka). Production will be increased through (1) improving water management

and (2) improving the institutional capacity of the GSL Irrigation Department to manage large scale irrigation schemes in a more efficient manner. More specifically the project will: (1) modernize the Left Bank of the Gal Oya irrigation system; (2) develop master plans and conduct on-farm water management research both at Gal Oya and Uda Walawe (a major irrigation project located in Southern Sri Lanka); (3) provide an improved irrigation training program; (4) improve the extension program; (5) improve the central support provided by the Irrigation Department in maintenance and operation; (6) provide socioeconomic evaluation and research; (7) assist the Government to establish irrigation organizations whereby farmers will participate in rebuilding, operating and maintaining field channels. With all these project elements, operations and maintenance procedures and other techniques will be developed which can be replicated throughout Sri Lanka. All project elements will be coordinated and directed not only to benefit the farmers in the specific irrigation system but to assist in other areas of the country.

III. Identification and Evaluation of Environmental Impacts

As indicated in the attached Impact Identification and Evaluation Form most impacts of the project's proposed activities range from neutral to highly positive. Impacts shown on this form were largely derived from an "Environmental Soundness" evaluation performed by CH₂M Hill as part of their feasibility study for the project. This evaluation focused on the following specific issues:

Increase in the incidence of malaria. This is a possible effect in the present program due to a wider distribution of water than at present. The presence of more water, especially at the tail end of projects may increase the number of mosquito breeding places. This may be offset by removal of excessive water in upper portions of the system, and the expanded GSL anti-malaria campaign which, with USAID assistance, will cover such major irrigation schemes as the Gal Oya.

2. Increase in water-borne disease. Increased population density in settlement areas can oftentimes increase the probability of waterborne disease. In the case of the present program, population density is not likely to change much and, therefore, this would not be expected to be a factor. The proposed domestic well program (expected to start around mid-project) should have a pos-

itive effect--that is, reduce the incidence of water-borne disease because of the provision of higher quality drinking water.

3. Increased risk of pesticide residues through increased use of agrochemicals. This is a possible consequence of the proposed program due to greater use of weedicides as water levels are reduced and general increase in use of agrochemicals because of higher incomes.

4. Increased soil loss through erosion. Soil erosion is likely to be reduced because of more proper water applications and less incidence of large quantities of flowing water through fields.

5. Increased waterlogging of soils and salinity buildup. It is expected that water application will be less or no more than present. Therefore, water logging of soils and salinity buildup will likely be lessened because of better water distribution and reduced quantities of water in areas which are presently watered excessively.

6. Decline in variety and number of birds and animals.

This is a possible slight effect because of more intense agricultural production, particularly at the tail ends of projects. Since little or no additional agricultural land will be diverted from natural uses, this effect is expected to be minor.

7. Energy loss and greater demand for energy. This is not a likely effect because no significant increase in population is expected, and increased production will be labor-intensive.

8. Changes in stream flows. No effect. The program does not suggest any changes in stream flows. The timing in level of flows in canals will be changed, however.

Other project impacts include:

9. Negative impacts on air and water quality caused by the rehabilitation and repair work on the Left Bank canal system. Such impacts are unavoidable, but will be short-term in nature.

10. The highly positive socio-economic impact the project

will have on approximately 19,000 farm families that use the Left Bank Gal Oya system. Over the long run agricultural production will increase, thus raising farm incomes and raising the standard of living for many people. It is anticipated that the relatively poorer families at the tail ends of field channels and the system as a whole, who currently receive little or no irrigation water, will benefit most. Increased agricultural production will also increase the demand for farm labor, thus increasing the income of both those who work full-time as laborers as well as small farmers who work as laborers part-time to supplement their income.

11. The social impact of reduced water use at the head of the system. Farmers at the head of the system, who will have their water supply reduced, may resist system changes in the beginning. However, this resistance should disappear as they become assured that more efficient use of less water will not only increase their production and incomes but also increase their returns.

12. The beneficial economic impact outside the project area. Modernization and reorganization of the Gal Oya Irrigation system will create numerous employment opportunities for administrative personnel, technicians and both skilled and unskilled laborers. Some of these personnel will receive the benefits of special training programs both in Sri Lanka and overseas.

Also, as farmers increase their production they will begin to purchase more farm goods and consumer goods, thus boosting the economy of surrounding market towns.

IV. Conclusion and Recommendations

The preceding analysis demonstrates that the Water Management project will create many beneficial impacts on the human environment of both the Left Bank of the Gal Oya irrigation system and on the entire country of Sri Lanka. Especially within the project area, incomes and employment opportunities will increase and a higher quality of life will be achieved. The project may indirectly create one significant adverse impact: the increased risk of pesticides residues through increased use of agrochemicals. This impact cannot be avoided as farmers' incomes increase. Increase in agrochemicals use should be evaluated as part of the projects evaluation activities so that adverse impacts from such use can

be identified early and mitigated.

Since nearly all project activities will not have a significant negative impact on the environment, the Mission recommends that the project be given a Negative Determination.

IMPACT IDENTIFICATION AND EVALUATION FORM

Impact Areas and Sub-areas

Impact Identification and Evaluation

Land Use

- | | |
|--|----------|
| 1. Changing the character of the land through: | |
| (a) Increasing the population | None |
| (b) Extracting natural resources | None |
| (c) Land clearing | None |
| (d) Changing soil character | None |
| 2. Altering natural defenses | None |
| 3. Foreclosing important uses | None |
| 4. Jeopardizing man or his works | None |
| 5. Reducing soil erosion | Positive |
| 6. Other factors | None |

Water Quality

- | | |
|---|-----------------|
| 1. Physical state of water | Slight Negative |
| 2. Chemical or biological states | Slight Negative |
| 3. Ecological balance | None |
| 4. Reduction of leaching of chemical
fertilizers | Positive |
| 5. Other factors | None |

Atmospheric

- | | |
|--------------------|-----------------|
| 1. Air additives | Slight negative |
| 2. Air pollution | Slight negative |
| 3. Noise pollution | Slight negative |
| 4. Other factors | Slight negative |

Natural Resources

- | | |
|--|---------------|
| 1. Diversion, altered use of water | Some, neutral |
| 2. Irreversible, inefficient commitments | None |
| 3. More efficient use of water | Positive |
| 4. Other factors | None |

Cultural

- | | |
|---------------------------------------|----------|
| 1. Altering physical symbols | None |
| 2. Dilution of cultural traditions | None |
| 3. Enhancement of cultural traditions | Positive |
| 4. Other factors | None |

Socio-Economic

- | | |
|--|-----------|
| 1. Changes in economic/employment patterns | Positive. |
| 2. Change in population | None |
| 3. Others | None |

Health

- | | |
|---|---------------|
| 1. Changing natural environment | Some negative |
| 2. Eliminating an ecosystem element | None |
| 3. Providing more and better domestic water | Positive |
| 4. Other factors | None |

General

- | | |
|---------------------------|---------------|
| 1. International impacts | None |
| 2. Controversial impacts | Some, neutral |
| 3. Larger program impacts | None |
| 4. Other impacts | None |