

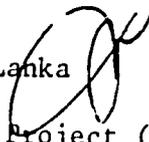
PD-800-0000

UNITED STATES GOVERNMENT

# memorandum

DATE: June 4, 1982

REPLY TO  
ATTN OF: John M. Miller, Program Officer, USAID/Sri Lanka



SUBJECT: Evaluation of the Mahaweli Ganga Irrigation Project (383-0042) ✓

TO: Evaluation Division Chief, Office of Development Planning, Bureau for Asia

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Attached for your information and files is an Aide-Memoire prepared by the joint review (evaluation) mission comprised of representatives from USAID, Canada, United Kingdom, the Netherlands and IDA for the subject project. The evaluation was conducted during the March 4-16, 1982, period.

Attachment: as stated

AID:PRO:PO:JMiller:js

March 18, 1982

SRI LANKA

MAHAWELI GANGA DEVELOPMENT PROJECT II

AIDE MEMOIRE

(March 1982 Project Review)

1. A joint review mission comprised of representatives of the United Kingdom, Canada, United States, The Netherlands and IDA visited Sri Lanka March 4-16, 1982 to review project implementation progress and to assist the Government (MASL) in the decisions and actions to be taken in the further implementation of the project. Members of the Mission included Messrs. Bob Bell, Agricultural Engineering Advisor (ODA), Y. Pan, First Secretary, Canadian High Commission, Henk Saaltink, Canadian Advisor for Mahaweli Development, Jeff Evans, Chief, Mahaweli Development Division, USAID Colombo, John Admiraal, Agriculturalist, The Netherlands Government, Don Clark, USAID, Peter Streng, Economist, and Stanley Baker, Deputy Division Chief (Mission Leader), IDA. Mr. Andy Tainsh, ODA (SEADD), joined the mission during the final stage of the review.
2. Discussions were held with Mr. N.G.P. Panditharatne, Director General, MASL, Mr. Ivan Samarawickrema, Secretary, Ministry of Mahaweli Development, Mr. Mahi Wickremaratne, Executive Director, MEA, Mr. R.U. Fernando, Chairman, MDB, Mr. Lalith Godamunne, Secretary General, MASL, Mr. K.H.S. Gunatilake, Executive Director (Eng), MASL, Dr. Walter Abeygunawardena, General Manager, MDB, and with all senior MDB and MEA office and field staff. The Chairman and GM of MDB and Executive Director of MEA and their senior staff accompanied the mission on the field review and provided the customary close co-operation and assistance throughout the review of the project. The Mission is greatly appreciative of the hospitality and assistance given and provides the following comments on the status of the project and recommendations for actions to be taken.

Implementation Progress

3. MDB Construction Progress. With the exception of Block 419, the construction of irrigation system infrastructure has essentially been completed. Funds provided for MDB during 1982 (Annex 1) may not be adequate to complete all identified remaining work, particularly if additional work is to be taken up, i.e. a significant amount of canal lining (para 9). Additional budget funds and an extension of the credit may be required. The completion of social infrastructure continues to lag behind other works, but construction contracts for all remaining buildings are expected to be awarded by end April for completion in early 1983. The construction of wells for domestic use continues to lag significantly behind schedule but the rate of installation has improved in recent months.

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4. On Farm Development Work (OFD) and Settlement Activities. MEA's work program for OFD (and possibly settlement of some farmers) is expected to continue well into 1983. Delays in this work were anticipated by the last review mission (March/April 1981) due to the changeover of responsibility for such works from MDB to MEA. Contributing to this was the large backup of reclearing, initial ploughing, land preparation and field canal construction work that remained to be done when MEA took over, and considerable work still remains to be completed, although the precise amount of work is in doubt. It appears from the data given in the December 1981 Quarterly Progress Report, that OFD work remaining to be done (in 1982 or later) is substantially in excess of that accomplished in 1981. Adding the work to develop Block 419 to other remaining work in H4 and H5, reveals the following remaining work requirement:

Operation	Work Outstanding	Work Outstanding	Work Accomplished
	Jan. 82 (ha) (from quarterly progress report)	Jan. 82 (ha) (MEA revised estimate)	1981 (ha)
Land Clearing	2500	1290 *	2360
Levelling	6280	1290 *	2250
Bund Marking	2410	1960 *	2360
Initial Tillage	3040	2290 *	2910

The Chief Equipment Engineer MEA estimates (Annex 2 ) that (1) to complete the OFD work within 1982 will require,

18 No. Bulldozers (D4 class) for clearing and levelling,  
 6 No. Ford 515 tractors plus 2 disc ploughs for bund marking,  
 10 No. David Brown 1210 tractors plus disc ploughs or disc harrows for initial tillage, and (1) the land clearing and levelling will be done by contractors who have adequate equipment. These estimates assure greater outputs per machine than has been previously achieved. The Mission recommends that most of the equipment provided for OFD be retained until this work is complete.

5. It should be noted that a serious delay in land levelling would result in poor water management and excessive water use. Hand levelling typically results in small bhyaddas, reducing the prospect of efficient mechanization by tractor or animal power. It is imperative that greater emphasis be given to the completion of land levelling in the project implementation program.

\* These figures do not appear to be reliable in view of the significantly larger figures reported throughout the project implementation period.

### Implementation Schedule for Remaining Work

6. As noted previously, MDB's construction program, with the exception of Block 419 and various buildings (about 580) throughout the H-area, is nearing completion. These remaining works are scheduled to be completed by the end of 1982, but may carry over to early 1983. If a significant canal lining program is undertaken, this work would require two or three construction seasons to complete.

7. The MEA is progressively taking over the project works from MDB as they are completed, and is completing the on-farm development work and settlement of the farmers, as well as undertaking operation and maintenance of the project and all other management and assistance aspects. The Mission would like to stress that a detailed plan should be agreed with MDB as to the specific timing of this shift of responsibilities, on the basis of required work and available resources. The modifications and improvements of the irrigation infrastructure which are required and the estimated cost of such works are shown in Annex 3.

### Acceptability of Completed Work

8. Throughout the duration of project implementation, successive missions have encouraged MDB to maintain the highest possible standards of engineering, both in design and construction of all structures and buildings comprising the irrigation and social infrastructure. The Mission is appreciative of the efforts which have been made in this respect and which have not been without success. Regrettably, however, it must be stated that there are also shortcomings which will be extremely difficult to correct and, unless corrected, will have a detrimental effect on the efficiency of the project and the benefits which can be obtained. The Mission's field review again revealed that the completed irrigation infrastructure, particularly at the distributory canal and field canal level, clearly will not function as planned to enable efficient and equitable irrigation water deliveries to be made. Some structures either are not operable or cannot be used to measure flows without repair or modification, and siltation and erosion problems have altered the hydrological characteristics and useability of the canals. A massive and concerted effort must be made to make the irrigation system responsive and operational. Reference Dr. Corey's report shown in Annex 4. Details of work required are given in the following paragraphs.

9. Irrigation Infrastructure. The main and branch canals and main control structures are operational but some problems are apparent that should be corrected. Where the canals pass through soils having little cohesion, erosion will cause a continuous, significant maintenance problem. Formation of deep gulleys in the canal banks and scouring downstream of control structures is evident in many places and, as a result, erosion material from the sides of the canals is deposited in the bottom to depths of a foot or more, thus modifying the profile and hydrological characteristics of the canals. The Mission recommends that in such reaches the canals be desilted, reshaped and stabilised using, where appropriate, riprap on gravel filters or lining of the canals with concrete. This comment also applies to the distribution canals, where there is also damage to some structures that impairs proper operation. The Mission recommends that the distribution canals be lined with concrete wherever they are constructed in loose, permeable soils subject to excessive erosion or water loss, as a means of preventing such erosion, siltation and water loss. The concrete linings should be constructed carefully and be properly designed to withstand cracking, rapid deterioration and unwarranted maintenance costs.

10. The amount of repair, modification and cleanup work envisaged is substantial, costing in the range of US\$ 1.5 M, and the time available to complete it is limited to relatively short periods between the Yala and Maha irrigation seasons. In order to accomplish this work within 1-1/2 to 2 years, it will be necessary to set up a special construction program, to stockpile materials and initiate construction immediately upon canal closure. It may also be necessary to close some canals during the Yala season to enable such work to be completed expeditiously. The Mission recommends that a special construction unit undertake this work, financed from unallocated project funds. This should be considered as an elite unit, staffed by experienced, capable engineers, and the work undertaken on a crash basis. It necessarily follows that the control structures cannot be considered complete and acceptable until they are fully operational and have demonstrated capability to make measured water issues. With the large number of structures and the considerable repair/modification and rating work necessary, it is clear that this work should be accorded highest priority by MASL to ensure its completion.

11. The condition of the field canals was discussed in the 1981 Aide-Memoire. Random check by the Mission of the tertiary system in several locations again confirmed that although the field canals can deliver water, they are not functional to the degree that equitable and measured water issues can be made to all farmers in the Project area. In a number of cases the Mission noted that regulatory devices had been damaged or bypassed. There were strong indications that at least some of the damaged structures were incorrectly designed or constructed and may not have delivered an adequate supply of water, thus creating reasons for farmers to try to alter them. In any event, when water is rationed in years of short supply, inequitable distribution would cause justifiable complaints from farmers not getting their allocated share, and suffering severe economic hardship as a result. It should again be emphasised that uniformly high yields in the project area cannot be achieved without the means to properly control and monitor the water distribution down to farm level.

12. It will be necessary to enlist the cooperation of the farmers to make the necessary field canal improvements as well as to ensure that the canals are well maintained and efficient use of irrigation water is achieved throughout System H. The field canal improvement work also should fall under the special construction unit. However, the Unit Managers should provide assistance in identifying necessary improvements, in enlisting farmer cooperation, and in arranging work contracts with the farmers on a turnout basis. Continuous contact with the farmers by the Unit Manager and his staff will be required to instill proper water management concepts and gain farmer confidence in the irrigation system and establish their proprietary role in its operational well being.

13. The Mission noted with satisfaction that the procedure recommended by the previous Mission for inspecting and handing over of irrigation infrastructure in H4 and H5 has substantially been implemented. The joint inspection was carried out by MDB and MEA as planned, a check list was made, deficiencies were listed and, presumably, repairs were made. However, some deficiencies may have escaped the attention of the team or all noted deficiencies were not properly corrected. It was agreed, therefore, that a final joint inspection be made in late March 1982 to again ascertain repairs, modification or cleanup necessary to ensure that the irrigation system will function as planned. Canal lining requirements will also be identified during this joint inspection where possible. This inspection will be the basis for determining the modification work identified in the preceding paras to be taken up on a crash basis. It was also agreed that a Hydrological

5

Advisor would be retained for a period of about 6 months to advise on structural modifications required, devise a workable water measurement program and train MEA staff in water measurement procedures. It was further agreed that periodic reports would be submitted on the results of the modification program. MASL also agreed to review modification requirements in H1, 2, 7 and 9, which have been in operation for sometime, and make checklists of deficiencies and repairs to be made under the maintenance program.

14. In view of the extensive deficiencies noted by the Mission bearing on irrigation system serviceability and the considerable work program necessary and agreed to be undertaken on an immediate basis, the Mission feels it would be advisable to conduct a brief interim project review in September 1982 and a full review in January 1983 during the Maha operational season.

15. Buildings. In the course of previous reviews, the buildings constructed by MDB have been found to be functional and generally acceptable. The Mission inspected the new office of the Resident Project Manager in Tambuttegama and found this work also to be of good quality. Some 580 buildings remain to be completed not including the buildings that would be provided for the new proposed Training Centers. The Mission recommends that a final inspection be made jointly by MDB and MASL of all buildings and premises to ensure that the structures are properly finished and that all premises are properly landscaped. The final itemized check list of completed buildings should be provided to the donors, noting the purpose for which each building is being used.

16. Roads. The road system is now nearing completion and is considered adequate for the purposes of the Project. Planting of trees, which will be of great utility to all road users, has started in some areas. The Mission recommends that a strong effort be made to complete this relatively inexpensive part of the work.

17. Water Supply. The Mission has noted that the new covered wells constructed by the Authority and the handpumps provided by UNICEF and the Authority are producing potable water of excellent quality, which should contribute materially to better health conditions in the Project area. Adequate water supply systems are also being provided for the homes and offices of personnel of the Authority and of the various Government Departments. However, the Mission notes with regret that no provisions have been made under the Project for the supply of water (and other services) to other inhabitants in the larger hamlets, villages and towns in the Project area.

#### Project Costs and Budget Allocations

18. Total project costs are now estimated to be Rs. 1,110 M, or Rs. 80 M less than the estimate prepared at the time of the 1981 review mission, the difference being essentially due to the reduction in equipment costs (Annex 5). Actual expenditures through December 1981 amounted to Rs. 813 M, or 73% of the total estimated project cost. Budgeted expenditures for 1982 are Rs. 221 M (20%), leaving a balance of Rs. 76 M to be spent in 1983. Project costs may exceed these estimates, however, because of canal lining, repairs and other improvements recommended to make the irrigation system fully operational and functioning as designed, and the possible inclusion of training facilities and additional equipment.

Current Status of Utilization of Aid Package

19. As of mid-February 1982, a total of US\$ 17 M equivalent (Rs. 358.6 M) of the aid package was undistributed. Of this balance about US\$ 8.5 M equivalent (Rs. 179.4 M) currently is expected to be withdrawn by the closing dates of the aid agreements, resulting in a savings of about US\$ 8.5 M equivalent (Rs. 179.2 M). Most of the projected withdrawals would be for reimbursement of local cost expenditures on civil works. The situation is summarized in the table below, details are given in Annex 6.

Status of Aid Funds (M)

(2/15/82)

	<u>CIDA</u> <u>(Can.\$)</u>	<u>UK</u> <u>(£)</u>	<u>USAID</u> <u>(US\$)</u>	<u>IDA</u> <u>(US\$)</u>	<u>NIO</u> <u>(Hfl)</u>	<u>Total</u>
Remaining Balance	1.56	0.73	1.19	11.16	6.66	
US \$ Equivalent	1.00	1.25	1.19	11.16	2.47	17.07
Rs. Equivalent	21.06	26.28	24.99	234.36	51.95	358.64
Identified Use	0.02	0.12	0.55	5.60	5.86	
US\$ Equivalent*	0.01	0.20	0.55	5.60	2.17	8.53
Rs. Equivalent*	0.27	4.32	11.55	117.60	45.71	179.45
Estimated Savings	1.54	0.61	0.64	5.56	0.80	
US\$ Equivalent	0.99	1.05	0.64	5.56	0.30	8.54
Rs. Equivalent	20.79	21.96	13.44	116.76	6.24	179.19

\* Based on current disbursement agreements.

20. In order to speed up reimbursement of local cost expenditures, the Mission has provided improved formats to MDB and these have been discussed and agreed with the General Manager and Additional General Manager (Finance). The Mission also explored with MDB and MASL, again in the interest of accelerating disbursements, the possibility of using certified statements of expenditures in withdrawal applications for small civil works contracts, and explained that under this procedure the detailed accounts covering such expenditures would have to be audited quarterly or at least semi-annually.

GOSI Recommendation for Utilization of Remaining Funds

21. MASL discussed the possible use of the current aid balance (para 19) with the Mission and indicated that approval would be sought for the following works/procurement:

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Item	Rough Cost Estimate (Rs.M)
(a) Additional O&M and Workshop Equipment	12.0
(b) Modifications to Irrigation System (H4/5)	12.0
(c) Irrigation & Farmer Training Centers (2)	30.0
(d) Teaching Aids at Maha Illupalama Inservice Training Institute	1.5
(e) Allowance for Settlers' Huts (Rs. 500 ea.)	5.8
(f) Canal Lining in H4 and H5	20.0
(g) Debt Relief for 1st Yr. Farmers due to '82 Drought	15.0
Sub-total (a) to (f)	81.3 (US\$ 4.1 M)
Total (a) to (g)	96.3

The Mission discussed these items in detail with MASL and believes items a,b,c,d, and f are clearly justified and that the donors would have no objection to the use of aid funds in support of these items. Item e, additional allowance for settlers huts of Rs. 500 each (additional to Rs. 100 agreed at appraisal), also is believed necessary to provide more adequate initial support for the settlers but this component of the project is not financed by the donors and the use of grant/loan/credit funds may not be possible. The Mission believes the use of aid package funds in support of item g would not be appropriate. This is not to say, however, that such assistance would not be beneficial or justified. GOSL may wish to provide relief for first year settlers in H4/H5 who have lost crops due to adverse conditions in Maha 1981/82 in the form of extended credit for cultivation in the next effective season, or by providing these farmers free cultivation by the tractor hire unit. Care must be taken, however, that such action does not cause further distress to families who rely on hiring out of oxen or tractors for part of their income.

#### Status of Equipment, Utilization and Disposal

22. The Mission requests that a list of construction equipment retained, written off or dispersed be provided to give a clear picture of what equipment has been transferred to other projects, or of the condition of equipment still retained in the project area. Much of this equipment is on hire to contractors.

23. Equipment for OFD and Canal Maintenance. The Mission is pleased to note a substantial improvement in the condition of the equipment based at Mediyagama. The Ford 515 tractors have been equipped with new tires. Apart from 10 tractors awaiting other spares, all the 515's are now operable and available for canal maintenance. Of the 50 David Brown 1210 tractors supplied, 43 are still in H area. Those inspected appear to be well maintained. It was noted that there is a shortage of disc ploughs to match the David Brown tractors for bund marking. In view of the large area yet to receive bund marking and initial tillage (para 4), it is recommended that most of the David Brown tractors be retained in H area until OFD work is complete. Additional disc ploughs and lower links for the tractors are urgently required. Additional heavy duty disc harrows for initial tillage are also necessary. Some other cultivation equipment

might be transferred if required. Of the 50 5-ton trailers, 25 have been dispersed to maintenance units and 10 are scheduled for allocation to other projects. It is recommended that in view of the large quantity of rip-rap likely to be required for repair work the remaining 15 be retained in H area either for use by MASL or for hire to contractors.

#### Equipment Provided for Sale to Farmers

24. The Mission is pleased to note that substantial progress has been made in the dispersal of the 3-1/2 ton trailers, but further effort is required to dispose of the balance of trailers, disc harrows and tine tillers.

25. Of the 300 3-1/2 ton trailers supplied, about 155 have been used by MDB and MASL for project purposes, or transferred to other Government Departments. A total of 50 await transport to the Sugar Corporation. The 95 remaining are being offered for sale at a competitive price through the State Tractor Corporation. It is believed that more rapid dispersal would be possible if other tractor agents were also commissioned to sell the equipment. Approximately 25% of the tine tillers and disc harrows have been used for on-farm development or cultivation hire. Efforts have been made to sell this equipment to the private sector but the commercial officer has not yet reached agreement with potential buyers. The Mission sincerely hopes that the commercial officer will continue his efforts to get this equipment to active use.

26. Of the 200 Ford 3600 tractors supplied, 86 were absorbed by MDB. The 1981 Mission recommended that 60 of these tractors be made serviceable and sold to farmers or contractors. This was not done and it may now be too late to do so. Few of the Ford 3600 were seen but those seen were in good condition. As far as the Mission could determine, 15 tractors are retained in H4/5 for cultivation hire to farmers and 32 tractors are retained at Gainewa for maintenance work and cultivation hire. The Mission was not clear on the role of the tractor hire units, the pricing policy, or the need for this service, taking into consideration the availability of private tractors in the area. Unrealistically low charges currently are made for tractor hire by MEA in order to force down private hire rates. It is feared that this practice will discourage hire of private tractors and buffaloes in the area. The Mission requests that information on the role and performance of the tractor hire units be included in the quarterly reports.

#### Equipment for Operation and Maintenance

27. Current estimates prepared by MEA for operation and maintenance appear to be based on anticipated budget and staff levels rather than on an assessment of work necessary to keep the scheme fully operational. A detailed survey of all channels and structures should be made annually to forecast maintenance needs. Annex 7 shows (a) a list of the equipment already supplied which MASL plans to retain for operation and maintenance, (b) other vehicles and equipment supplied for O&M but not shown in the initial list prepared by MASL, and (c) other equipment which the mission believes may be required for O&M. It is recommended that the necessary specifications and tender documents for the additional equipment needed be prepared without delay so that the equipment can be procured for use as soon as possible.

### Tambuttegama Workshop

28. With the change of emphasis from construction to operation and maintenance, it is recommended that the Tambuttegama workshop be reorganised and equipped for all maintenance operations in the Project area. It may also be desirable to retain its capability for 1st and 2nd line repairs for all equipment on a regional basis. At the very least, equipment and stores for maintenance of heavy equipment should be retained until all on-farm development is complete (probably in 1984). The Mission regrets that the workshop is not yet connected to the electrical power grid and recommends that this be done as soon as possible. To improve facilities for repair of vehicles and structures, the Mission recommends that the following equipment be purchased:

- (a) Overhead lifting device.
- (b) Fork lift truck.
- (c) High pressure washing equipment.
- (d) Equipment for engine overhaul.
- (e) Profile cutting equipment for steel plate.
- (f) Small milling machine.
- (g) Equipment for fabrication of simple sheet metal and wood components for water control structures, project vehicles and buildings.

### Operation and Maintenance

29. The establishment of the Settlement Branch of the MASL (MEA) in the Project Area and the take-over of all operational functions from MDB started at the time of the 1981 project review and is now virtually complete. Maintenance procedures are being worked out and tested. They will need to be refined as experience is gained.

30. As noted in paras 8-14, the physical infrastructure, particularly at the distribution and farm canal levels, is in a poor state of completion or repair. The Mission visited six turnouts in Blocks H4,5,1,2 and found serious deficiencies. Nowhere was a contractor working on any maintenance work. It is now mid-March and with only 6 weeks remaining before planned water issues in early May there is great urgency to get the maintenance and repair work started. The Mission was advised that preparations for the work were completed, contracts had been let, and work will commence as soon as harvesting is finished and workers become available.

31. MEA intends to make two inspections each year to (i) check the physical condition of the irrigation system; (ii) estimate and schedule work to be done; and (iii) establish costs for budgeting and cost control purposes. Until more experience is gained, it was agreed that these inspections will take place immediately after the last water issues in Yala and Maha. Initially, annual budgets for maintenance probably must be based on global estimates and experience, but more accurate cost estimates will be made as contracts for maintenance work are let.

32. The Mission recommends that water management staff at block level be trained to carry out the bi-annual inspections, using standard forms to note the nature and quantity of work to be done. The same forms can be used to inspect the maintenance work as it is completed and before payments are made. The best time for carrying out maintenance work in the main and D channels is after the inspection (immediately after the harvest) when labor is available and the irrigation infrastructure is not in use. The time interval between Maha and Yala is normally short and any major repairs are therefore best scheduled following the Yala season.

33. It is recommended that the Irrigation Engineer make an annual inspection of the system down to farmgate level during the Maha season, when water is being issued, to ascertain that all structures are functioning properly and that issues can be monitored. Any shortcomings can be noted and reported, and provision for corrective action made in the maintenance schedules. Of particular importance in this connection is the maintenance of measuring devices. The Irrigation Engineer should also make spot checks of the field canals to appraise himself of the condition within the turnouts.

#### Agricultural Production, Crop Diversification and Marketing

34. The Mission is pleased to note that the Maha 1980/81 paddy yield reached 80-110 bushels per acre, which exceeds appraisal expectations. The cropping pattern for Yala 1981 causes concern, however, as during a period of water shortage paddy planting exceeded the stated targets by 30% and paddy was also planted on the free draining red-brown earths. The Mission urges MEA to make every effort to increase the percentage of other field crops during Yala seasons.

35. As a result of drought during the second half of 1981 and the first months of 1982, the Maha 1981/82 production has been seriously affected. The first yield estimates for this season, derived from random crop cuttings, indicate that many farmers will not be in a position to repay their seasonal loans. The Department of Statistics indicates that yields in System H will average 52 bushels per harvested acre. The Mission believes that the effect of the drought might have been mitigated if earlier planting schedules had been adopted and proper water management procedures had been followed. Low yields during Maha 81/82 not only will have an adverse effect on loan repayments but will also lead to an increase in the demand for credit to cover the next season's plantings.

36. The assumption that paddy yields are declining in H1 and H2 (Aide Memoire 1981) could not be corroborated from the available data. The project is still too young and seasonal influences are too great to establish such trends. Yield figures, however, should be constantly monitored in order to note such trends if they develop. The stated marketing policy of MEA and their marketing activities in the field do not appear to relate effectively to each other. The Mission suggests that MEA re-examine marketing policies and procedures and define these in sufficient detail for farmers and staff to be able to take appropriate marketing decisions.

Agricultural Credit

37. Loan repayment records have been variable for all banks in System H. Figures received from the Hatton National Bank at Nochchiyagama (H5) illustrate the situation.

Season	Loans Granted	Repayment (Rs100,000)	% Recovery
Yala 80	42	41	98
Maha 80/81	174	157	90
Yala 81	89	55	62

Under poor conditions (Yala 81), the recovery rate dropped dramatically. Inevitably, there will be an increase in defaulters following the drought of 80/82. As over 50% of the farmers in H5 have taken loans there will be a large scale problem of loan repayment in the area. It has been estimated that a farmer has to produce 42 bushels per acre to recover input costs. If through circumstances beyond his control he defaults and his loan is carried forward to the next season, it is highly unlikely that his next crop will cover his old and new loans. The Mission recommends that consideration be given to the phasing of the repayment of input loans where inevitable default arises.

Agricultural Extension and Farmer Training

38. For management and extension purposes the MEA has divided System H into three parts: H4, H5 and H1, 2, 7, 9, each under the responsibility of a Resident Project Manager. There are significant differences in the management organisation in these areas. For instance, in all areas except H5, a Unit Manager is responsible for 250 farmers. He is assisted by 2 Field Assistants, one for water management and one for extension. In H5 the Unit Manager covers 125 farmers and is responsible for both water management and extension activities. Extension officers from the Ministry of Agriculture have been seconded to MEA.

39. While the Mission supports efforts by MEA to achieve an efficient field operation, it is noted with concern that the modified version of the T&V system operating in the areas where seconded agricultural staff are employed, deviates significantly from the T&V practices agreed by GOSL during negotiations for the Agricultural Extension and Research Project. The Mission, and the project donors, have not departed from the need for agricultural extension activities to be carried out in line with the T&V system. As such, the appointed KVAs should not operate as multi-purpose extension agents and should concentrate principally on farmer training and assistance. The Mission requests that MEA clearly define how the agreed T&V concepts will be incorporated under MEA project operation.

40. Although the Farmer Leader Training Program has been proceeding well with the assistance of Mr. Shoaib Sultan Khan of UNICEF, there is increasing concern on how the Farmer Leaders are working in practice. It has been observed that the trained Farmer Leaders have failed to convey their knowledge to the other farmers and do not act effectively as farmers' representatives. It is hoped that this situation can soon be corrected.

Farm Power

41. Farm power reported to be available in H5 and H1,2,7,9 includes:

Item	H5	H1,2,7,9	Local Hire Cost	Remarks
4-wheel Tractors	44	87	Rs. 1125	MEA hire rate (sub-economic)
2-wheel Tractors	34	311	Rs. 1250	
Buffaloes	1720	3600	Rs. 800	Farmer provides labor.
Neat Cattle	1320	3280	N/A	Not traditionally used in paddy.

With the present system for hire of tractors and buffaloes it is estimated that power is available for timely cultivation of only about 30% of the paddy area during Maha. Other tractors would move into the area if hire rates were attractive but the low MEA rates tend to discourage this.

42. Lack of farm power results in extended water issues for land preparation and cultivation, with consequent high water use. Much greater economy of water use could be achieved if more mechanical power were made available, coupled with a reduction of the period of water issue for cultivation - more use being made of rainfall for cultivation. Water use could be further reduced by sequential water issues to separate areas and concentrating farm power to match water issues.

43. It is believed that <sup>4</sup>substantial increase in productivity and reduction of cost of tractor operations could be achieved if farmers wishing to hire power were organized to negotiate group contracts for their cultivation (as has been demonstrated on the Tank Irrigation Modernization Project). This should lead to lower costs to farmers and/or greater incentive to tractor owners to offer services in the area. The Mission recommends that active assistance and encouragement be given to farmers to collaborate in turnout groups for hire of power for cultivation. The Mission also recommends that the hire rates charged by MEA units be increased to encourage migration of private tractor owners to the area or hire of 2 wheel-tractors or buffaloes. It is suggested that in Yala 1982 in H5 area the government-hire tractors be directed to low cost cultivation for first season settlers in need of relief because of the 1981-82 drought (para 21).

44 The Mission believes that increased use of animal draught power should be encouraged but this should be coupled with stringent economy of water use for cultivation. The draught animal farm at Neeraviya produces cattle and buffaloes for sale to farmers with payment spread over 3-5 years. It is reported that 286 pairs of cattle and 44 pairs of buffaloes have been supplied since June 19, 1981. The use of neat cattle for cultivation represents a major break with local tradition. A program to improve animal nutrition by supplementary feeds using rice straw as a base should be encouraged.

45 The Mission re-emphasizes the recommendation made in the 1981 Aide Memoire "that an analysis of farm power needs and a forecast of future demand be made. The analysis should give due weight to the effect of timely cultivation on water consumption, weed control and yields, differentiating between the LHG and RBE soils."

#### Water Management

46 The succession of years with less than normal rainfall and streamflow has underlined the need to strengthen the water management organization of the MASL. The Mission fully supports actions being taken in this respect. An outline of the organization now being put in place is attached (Annex 8). A fully staffed Water Management Secretariat will be established by the end of 1982 in permanent quarters at the Ministry of Mahaweli Development; it will be equipped with computer facilities and will have direct communications to the project area. Arrangements are being finalised with donors for supply of equipment and technical assistance in support of the Water Management Secretariat in Colombo and the water management organisation in the project area. Consultants will be in place in a few months' time.

47. At field level it will be necessary to expand the education and training programs for farmers and for water management staff of the Authority. The Mission fully supports the plans of the MASL to establish two training centres for this purpose and believes that donor financing through the existing credits would be approved for this project.

48. The above measures will strengthen the Authority's capabilities in the long run. Meanwhile there is an urgent need to improve the water management procedures in the short run to cope with the problems of Yala 1982 and Maha 1982/83. The adverse effects of the drought during the 1981/82 Maha season would have been ameliorated if the water management procedures adopted by the MASL had been diligently implemented. Even the limited amount of information that is now being collected and evaluated can be a valuable base for management action, provided that data is processed without delay.

49. The Mission wishes to comment favorably on the work initiated by the newly appointed DRPMs (Water Management). It is evident that they will need more support to function effectively. For instance, the Report prepared by DRPM (Water Management) Galnewa illustrates a good perception of field level water management requirements and contains much useful information. It needs to be upgraded and expanded considerably to become a useful source of management information. The Mission believes that a much broader training program should be followed for water management staff, up to the DRPM level. Excellent courses are available during May through October 1982 which may be of interest to MASL staff. If participation in these courses is desired, arrangements must be made immediately. Financing can be provided for this training under the NIO Credit.

50. Figures on water use going back to 1979 Yala received from the MDB and the MEA indicate that the water issues per acre for each season vary significantly from canal to canal and indicate a lack of day to day monitoring and control. The data are not sufficiently detailed to obtain an accurate picture of overall water use, or an impression of what has happened within the various blocks. Neither is it possible to get a good appreciation of what happens in each turnout, except from the Report prepared by Dr. Corey (Annex 4). The data presented, however indicate that the amount of water received at farm level varies widely.

#### Pipeline Irrigation Project

51. The Mission is pleased to find that the pilot project in Block 404 became operational during Maha 1980/81. The Project Engineer who is monitoring the project reported that damage to the concrete pipes during construction caused considerable leakage when irrigation started but that all the leaks have now been repaired by the contractor. It is unfortunate that one of the elements of the Pilot Project was not completed, namely the installation of a pump to utilize drainage water. The current drought offered a golden opportunity to demonstrate the utility of this feature, as some of the crops in the Pilot Project could have been saved. The opportunity has been lost, to the detriment of the farmers on whose co-operation the success of the Project depends.

52. For reasons outlined in previous Aide-Memoires the Mission continues to attach a high value to this experiment. Therefore, the Mission is pleased that arrangements have been made for Professor Merriam to make an immediate evaluation of the operation of the pilot pipe irrigation system, as well as further periodic evaluations to properly assess the merits and possible modifications of the program.

#### Reporting Requirements

53. The Mission recommends that MDB and MEA submit a joint Quarterly Report rather than separate reports as is the current practice. This would result (indirectly) in a closer coordination between the two agencies and a more accurate reporting of implementation progress. It is further recommended that careful attention be given to reporting details, particularly in regard to work activities and programs identified under the Mahaweli II Project and the approved categories for disbursement. The Mission is aware of the time and effort which goes into the preparation of these

reports and greatly appreciates the efforts expended and the continuing prompt submission of the reports.

54. The unacceptable delays in submitting the Audit Reports for 1979 and 1980 and the continuing adverse evaluation of MDB's financial and management controls were discussed in depth with MASL by the Mission. It was agreed that MASL would ensure that the necessary corrections noted in IDA's February 8, 1982, letter on this matter would immediately be made and that the Audit Report for 1980 would be submitted to IDA for review no later than June 1982 and the report for 1981 by August 1982. The magnitude of MDB's financial and management problems noted in the 1979 Audit Report review is of concern to all project donors and, unless these problems have already been resolved, every effort should be taken to correct them. The Mission is pleased that MASL has agreed to do so. The Mission again reminds that an audit of MASL's accounts and procedures for 1981 also is required.

Project Administration and Staffing

Area H

55. MDB. In November 1981, Mr. R.U. Fernando, the then Director of the Irrigation Department was appointed chairman of MDB. Mr. Fernando brought with him a number of senior staff from the Irrigation Department. Dr. Walter Abeygunawardena remained in the position of General Manager, providing valuable continuity in MDB's operations. Current MDB project staff include 34 professionals and technicians, compared to 68 in 1980-81. As noted by the 1981 mission, there is a continuing shortage of middle management personnel (staff with 10-20 years experience). This may constrain plans to triple development of new lands in the Mahaweli Program area from about 3,000 ha to 10,000 ha per year.

56. As construction work in System H nears an end, MDB is expected to gradually move its personnel and equipment to other Mahaweli development areas, with the exception of personnel and equipment remaining with MEA for operation and maintenance. However, in view of the considerable volume of construction and repair work remaining, particularly if extensive canal lining is to be undertaken, strengthening of MDB staff in the project area may be more in order during the short term.

57. MEA. With the near completion of physical infrastructure, the bulk of the H area is now under MEA administration. MEA is responsible for on-farm development, settlement, operation and maintenance of physical infrastructure, training, extension, provision of inputs and marketing assistance. The maintenance of roads, canals and structures will be undertaken by private contractor under supervision of the Unit Managers. The Mission concurs that it is desirable to have the farmers (where possible, within each turnout area) undertake maintenance of the distributary and field canals in order to develop a feeling of responsibility for such work.

58. The field structure of MEA in System H consists of the Resident Project Managers (RPM) with their staffs, block managers with their staffs, and 42 Unit Managers with assistants. Current MEA staffing consists of a total of professional and technical staff and other ranks. About vacancies are to be filled at various levels. The Mission feels that the O&M and water management staffs should be strengthened considerably. System H will no doubt be a training ground for MEA staff required in Systems B and C. Selection and training of staff on all levels, with a generous margin for those who will leave the organization after training, should have a high priority.

59. The Unit Managers and assigned KVS and JPS staff are the first line of contact between MASL and the farmers. The Unit Managers are expected to meet with all the farmers in the Unit (Hamlet) once a month to deal with technical and socio-economic issues. More intimate meetings with farmers at the turnout level are scheduled every two weeks. This should enable the Unit Managers to build up considerable rapport with the farmers. If this system had been functioning well during the current drought, the Unit Managers might have been able to help avoid the confrontations which actually occurred. In addition, KVS staff are expected to maintain constant contact with farmer leaders under agricultural extension T & V procedures.

#### Cost Recovery

60. The prime vehicle for cost recovery will be the sale of land to the farmers. The State Lands Law was recently amended and the sales will now take place under regulations of the Land Development Ordinance gazetted on December 3, 1981. The MEA has drawn up a schedule for the issue of permits starting May 1982. A total of 22,726 farmers are expected to benefit from this ordinance and eventually receive title to their lands.

61. The O & M costs were to be recovered through water charges levied under the Land Betterment Charge Law. The Mission was advised that the MEA plans to collect the full cost of O&M from the start and not through a gradually increasing rate as agreed with IDA. At present, a charge of Rs. 75 is collected in the old lands in System H. The new policy was planned to go into effect in new areas in September 1982. However, collections may be postponed due to the current crop failure.

#### Community Development

62. The programs of Community Development supported by MASL and UNICEF are reported to be progressing satisfactorily in many respects. The drinking water program, the volunteer health program, the women's programs and the farmer training programs are showing beneficial results. Careful monitoring is required to ensure that these programs remain focussed on and responsive to community needs. The turnout leaders and contact farmers, constituting about 15 percent of the total farmer population, have received extensive training and have clearly benefitted from the knowledge they have acquired, although this knowledge is not being passed on to the other farmers as efficiently as had been hoped. More training and assistance will be required to strengthen the social and economic relationships of the turnout groups.

63. The direction which community development takes will have great political, social, and economic implications, and will to a large extent determine the ultimate success or failure of the Project. The Mission strongly supports the efforts made to achieve a good functioning community and a workable form of interaction between farmers and project staff. The Unit Managers are the key to this program and will require thorough training and support to be fully effective. The Mission believes close and constant contact between the Unit Managers and farm turnout leaders should be encouraged.

#### Settler Stability and Discipline

64. The Mission is concerned over the plight of the newly settled farmers, who are experiencing severe drought and loss of their first year's crops. Some have suffered two successive crop failures and are relatively destitute. These new settlers took bank loans to undertake their initial cultivation and, because they are unable to repay them with proceeds from the recently-failed Maha crop, may not be able to undertake cultivation in the coming seasons without some form of assistance. The Mission concurs with MASL that it find some means of extending further Bank credit to these farmers to enable them to continue cultivation of their farm plots. It may be justifiable for GOSL to underwrite fail-safe crop insurance to mitigate major crop losses in drought years.

65. The Mission is also concerned by the lack of discipline of farmers in System H, particularly rentor tenants and encroachers, who seem to be able to damage irrigation structures and settle within the project area at will without meaningful action being taken by the Government to limit such practices. Community cohesion and farmer co-operation cannot be obtained where this is allowed to repeatedly occur. In order to be able to achieve efficient and equitable water management in the project area, MASL must exercise firm control of the newly constructed irrigation system and water issues. The Mission recommends that this matter receive top priority of GOSL.

66. The discipline in matters related to irrigation should also extend beyond the farmers to all water management personnel. The ditchriders will need constant supervision to ensure that irrigation schedules are implemented and unauthorised deviations of the schedules are not permitted.

67. On the higher level, it may be necessary to abandon the current practice which allows GA's to authorise changes in the irrigation schedules, thus overriding the authority of both the irrigation engineer and the Water Management Panel. The Mission suggests, as an alternative, that the farmers should bring appeals to the GA, who would bring them, on a specified date, to the Water Panel. The Water Panel should decide whether an extension of water issues can be allowed after having reviewed the matter with the Irrigation Engineer.

#### Land Acquisition and Payment

68. Land Acquisition work and payment of compensation in the project area is being done in terms of the Land Acquisition Amendment Act No. 28 of 1964. The normal procedure for land acquisition is complex and takes a long time.

69. For the Mahaweli Accelerated Program, it was necessary to take over possession of lands to be acquired almost immediately. Therefore section 38 A of the Land Acquisition Act, by which the Minister of Land and Land Development has power to acquire the land pending all formal inquiries, was applied. This enables the Government Agent of the respective districts to take possession of the lands immediately and hand them over to MDB or MASL for construction or settlement work. However, normal acquisition proceedings have to be followed for compensation purposes. This takes a considerable amount of time, particularly where there are large numbers of co-owners for even small blocks of land, since all claims have to be carefully investigated and ownership established before payments are made. In most cases the owners do not present themselves for the inquiries, thereby causing postponement of inquiries.

70. The Authority for land acquisition work lies with the Government Agent of the respective District. The MDB provides the necessary funds and the staff to the Government Agent. The current status of land acquisition in System H is given in the following table:

1) The total number of villages to be acquired in the 'H' area	288
2) The total number of villages acquired under section 38 A of the Land Acquisition Act	271
3) Number of villages for which compensation has been fully paid	13
4) Number of villages for which compensation has been partly paid	31
5) The amount of compensation paid to end 1981	Rs 4.1 M
6) Estimated total compensation to be paid	Rs 40.0 M

71. It was found necessary to take certain steps to speed up the payment of compensation in the 'H' area. Action is now being taken to reorganize the Acquisition Branch in the Kachcheri at Anuradhapura. The Mission recommends that continuing attention be given to this matter to enable former owners of acquired land to be paid as quickly as possible.

MDB WORK TO BE DONE IN SYSTEM H & BUDGET FOR 1982

	Estimated Cost (Rs M)
	<hr/>
1. <u>Market Roads</u> (metalling and tarring)	
1.1 H4 Area, 7 mi.	4.9
1.2 H5 Area, 21 mi.	14.7
Sub-total	<hr/> 19.6
2. <u>Bridges on Main Roads</u>	
H7, H9 Areas, 2 nos.	8.0
3. <u>Irrigation Infrastructure</u>	
3.1 H4 Area	
3.1.1 Land acquisition	1.5
3.1.2 Improvements to irrigation system	8.5
3.1.3 Drainage	1.5
3.2 H5 Area	
3.2.1 Land acquisition	1.5
3.2.2 Improvements to irrigation system	6.0
3.2.3 Drainage	1.5
3.2.4 Irrigation works in Block 419	5.7
Sub-total	<hr/> 26.2
4. <u>Social Infrastructure</u>	
4.1 Buildings under construction:	
H1, 5 Nos.	1.0
H2, 14 "	4.3
H7, 28 "	2.0
H9, 17 "	5.4
H4, 24 "	2.6
H5, 18 "	1.5
4.2 New Buildings to be Taken Up:	
H7, 5 Nos.	1.0
H9, 42 "	3.8
H4, 149 "	14.0
H5, 218 "	30.0
4.3 Water supply, Tambuttegnna	12.0
4.4 Electricity supply	8.0
Sub-total	<hr/> 85.0
5. Equipment	20.0
6. Operating Costs	11.6
Total	<hr/> 171.0

Our Ref: PMC/CEE/16.1

17th March, 1982

**MACHINERY REQUIREMENTS TO CARRY OUT THE BALANCE  
OFD WORK IN 'H' AREA.**  
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The balance On Farm Development work to be done in the H Area including Block 419 are as follows:

- 1) Jungle clearing - 1290 Hectares
- 2) Rough Levelling - 1290 Hectares
- 3) Bund Marking - 1961 Hectares
- 4) Initial Tillage - 2287 Hectares

Jungle clearing and rough levelling operations are carried out with Crawler Tractors and we seek the assistance of registered contractors to undertake this work. There are contractors with adequate resources who will do this work for us. It has been assessed that we will require the following number of crawler tractors (D4 Class) to complete the shrub jungle clearing and rough levelling operations before end September 1982.

No. of Machine Hours required	=	$\frac{1290 \times 2 \times 5 \times 7}{2 \times 2}$	=	22575
No. of Machine Hours per day	=	$\frac{22575}{150}$	=	150.5
No. of Machine required	=	$\frac{150.5}{10}$	=	15
No. of Machines required working at 80% servicability	=	18		

We will be deploying 4 to 5 contractors having adequate resources to undertake this work simultaneously in different areas.

Bund Marking - 1961 Plots (Hectares)

No. of Machines required:	
Machine	= Ford 515 Tractor with 2 Disc Plough
Daily Out Put	= 4 Farm Plots
No. of working days available	= 100
$\frac{1961}{4 \times 100}$	= 4.9 Machines
No. of machines required	= 6 Machines

- 2 -

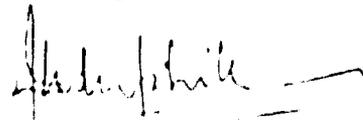
We have over 200 working days to complete this work. However we are programming for only 100 working days due to the prevalent dry weather conditions. We have adequate Ford 515 Tractors and 2 Disc Ploughs to complete this work on schedule.

Initial Tillage - 2287 Plots (Hectares)

No. of Machines required:

Machine	= a) David Brown Tractor with 3 Disc Plough.
	b) David Brown Tractor with Zimba Disc Harrows.
Daily Out Put with	= a) = 2 Farm Plots b) = 4 Farm Plots
No. of working days available	= 100
$\frac{2287}{3 \times 100}$	= 7.62 Machines
	= 10 Machines

We are programming for 100 working days for tillage operations too, although we have over 200 working days left. For assessment of machinery requirements we have taken the average out put for Disc Ploughs and Zimba Harrows. The total number of David Brown Tractors required to complete the balance work in 'H' Area will not exceed 10 Nos.

  
W.W. Udupihilla  
Chief Equipment Engineer  
MAHAWELI AUTHORITY OF SRI LANKA.

/pa.

21

Modification of Irrigation System for Improved Water Management

Systematic and proper water management has become a matter of paramount importance especially in the Mahaweli Project Area on account of the heavy investments made in this regard and the availability of water in relation to the large extents of land developed for cultivation. It has become all the more important to have an efficient system of water management when the cropping pattern and the high percentage of well drained RB soils predominantly available in the 'H' area are considered. Suitable water management techniques are required, together with an efficient system of channels equipped with measuring devices, lined channels where seepage occurs, and required modifications to existing structures to ensure the availability of water for future cultivation.

The irrigation channel system which came into operation from late 1970s by MDB was taken over by MEA on January 1, 1981. A joint inspection at the time of take over has indicated that a high percentage of irrigation infra-structure construction works needs improvements and modifications. The Mission concurs that immediate attention should be paid to this area of operation.

In order to complete the above task the following improvements and modifications have to be carried out on a priority basis:

- (1) Re-location of some channel turnouts, farm turnouts and provision of additional channel structures;
- (2) Modifications to some existing channel structures, provision of retaining walls and riprap protection at badly eroded sections of the channels;
- (3) Provision of additional drainage channels and under crossings;
- (4) Provision of additional crossings for agricultural machines, draught animals, etc. over irrigation channels; and
- (5) Lining of irrigation canals where necessary to limit excessive erosion and seepage.

The above work could be undertaken only within the two closed seasons of one month of each year, unless some canal sections could be closed during one Yala season. The implementation program in respect of Galnewa Division has already been drawn up while the Thambuttegama and Nochchiyagama Divisions are in the process of finalizing these programmes for 82.

Future fund requirements are estimated as follows:-

	1983	1984	Total
Modification Work (Items 1-4)	Rs. 6 M	Rs. 6 M	Rs. 12 M
Canal Lining (Item 5)	Rs. 10 M	Rs. 10 M	Rs. 20 M

22

MAHAWELI II REMAINING IMPLEMENTATION PROGRAM

Cost Estimate  
(Rs M)

	Total Project Cost	Actual Expenditure through 1981	Budget 1982	Balance 1983
<b>1a</b> Irrigation and drainage works <sup>1/</sup>	<u>299.1</u>	<u>264.7</u>	<u>33.6</u>	<u>0.8</u>
- Distribution system, et .	145.6	122.4	23.2	-
- Land clearing and preparation	124.4	117.0	7.4	-
<b>1b</b> Market roads	76.4	56.8	19.6	-
<b>2</b> Social infrastructure & other buildings	<u>265.8</u>	<u>149.1</u>	<u>87.5</u>	<u>29.2</u>
- Reimbursable items	227.5	133.6	64.7	29.2
<b>3</b> Vehicles and equipment	202.4	182.1	20.3	-
<b>4</b> Assistance to settlers, monitoring, technical assistance	38.3	20.3	10.9	7.1
<b>5</b> Engineering, supervision and administration	209.6	140.2	49.4	20.0
Contingencies	19.0	-	-	19.0
<b>Total</b>	<u>1,110.6</u>	<u>813.2</u>	<u>221.3</u>	<u>76.1</u>

<sup>1/</sup> Not including costs of canal lining yet to be identified, or improvements to irrigation system

V'

Foreign Aid Balances as of February 15, 1982  
(in million)

	CIDA (Can.\$)	UK ( £ )	USAID (US\$)	IDA (US\$)	NIO (Hfl)	EEC (AU)
1. Original amount	6.00	4.30	5.20	19.00	13.00	2.00
Less cancellations	-	1.61	-	-	-	-
2. Current amount	<u>6.00</u>	<u>2.69</u>	<u>5.20</u>	<u>19.00</u>	<u>13.00</u>	<u>2.00</u>
3. Allocated for						
(a) Civil works (reimbursement)	0.90	1.06	1.20	13.20	11.00	2.00
(b) Equipment	5.10	1.63	4.00	2.50	-	-
(c) Technical assistance	-	-	-	0.70	2.00	-
Unallocated	-	-	-	2.60	-	-
4. Used for						
(a) Civil works (reimbursement)	0.90	0.30	0.90	5.47	4.46	2.00
(b) Civil works (applications being processed)	-	0.03	-	1.81	1.44	-
(c) Equipment	3.54	1.63	3.11	0.56	-	-
(d) Technical assistance	-	-	-	-	0.44	-
Total 4	<u>4.44</u>	<u>1.96</u>	<u>4.01</u>	<u>7.84</u>	<u>6.34</u>	<u>2.00</u>
5. Balance remaining for						
(a) Civil works	-	0.73	0.30	5.92	5.10	-
(b) Equipment	1.56	-	0.89	1.94	-	-
(c) Technical assistance	-	-	-	0.70	1.56	-
Unallocated	-	-	-	2.60	-	-
Total 5	<u>1.56</u>	<u>0.73</u>	<u>1.19</u>	<u>11.16</u>	<u>6.66</u>	<u>-</u>
6. Identified use of balance for						
(a) Civil works	-	0.12	0.30	5.53	5.71	-
(b) Equipment	0.02	-	0.25	0.07	-	-
(c) Technical assistance	-	-	-	-	0.15	-
Total 6	<u>0.02</u>	<u>0.12</u>	<u>0.55</u>	<u>5.60</u>	<u>5.86</u>	<u>-</u>
7. Balance subject to cancellation ( Savings )	1.54	0.61	0.64	5.56	0.80	-
US\$ equivalent	0.99	1.05	0.64	5.56	0.30	-
Rs. equivalent	20.79	21.96	13.44	116.76	6.24	-
(Exchange rate)	(13.5)	(36.0)	(21.0)	(21.0)	(7.8)	-

EQUIPMENT FOR OPERATION AND MAINTENANCE

- a. List of Equipment already supplied which the Mission believes MASL Proposes to Retain for Operation and Maintenance in System H

<u>Item No.</u>	<u>Description</u>	<u>Number Obtained</u>
1.	Air Compressor Model 400 'Air Comp'	01
2.	Fuel Bowers, Kenworth 2250 gall.	03
3.	Fuel Bowers, Kenworth 2000 gall.	10
4.	Bowers International 1200 gall.	02
5.	Water Bowers, 1250 gall.	04
6.	Chassis only, for 5 Ton Truck	24
7.	Outboard Motor	04
8.	Radio Transreceivers	15
9.	Truck with Concrete Equipment	01
10.	Quality Control Equipment	Lot
11.	Motorized, Grader 'Wabco'	08
12.	Motorcycle	89 (?)
13.	Tools and Workshop Equipment for H.D. Repairs	Lot
14.	Tractors, Ford 515 60 hp	31
15.	Diesel/Electric Welders, 300 amp	02
16.	Gas Welding Equipment W/Cylinders	Lot
17.	Trailers for Vibratory Rollers D16	07
18.	Ditchers	10
19.	Water Monitoring Equipment	Lot
20.	Tractors - 4 Wheel Drive with Disc Ploughs Cultivators, Multipurpose Blade "David Brown 1210"	43 (?)
21.	Trailers, 3- $\frac{1}{2}$ ton Steel Body	50
22.	Trailers, 5 Ton Steel Body	25
23.	Tractors, Ford 3600	96 (?)
24.	9 Tine Tillers	50 (?)
25.	HD Disc Harrows	60 (?)
26.	Scrub Cutters	05
27.	Front Mounted Blade	10
28.	Rear Mounted Blade	10

25

The above list is compiled from Item 7 of MDB document folder prepared for Mission visit March 1982.

b. The above list does not include the following:

- a. Compactor - self propelled vibratory roller )
- b. Pick-up Trucks ) Listed in Table 3
- c. Field Cars ) Annex 6 of Appraisal
- d. Bicycles ) Report
- e. Telephone System )

c. The MEA has determined the following additional requirements for O & M Equipment

		<u>US\$ (approx)</u>
a. Front End loaders (Wheel)	3	90,000
b. Crawler Tractors (75-100 HP with Angle Dostier and Parallogram Rippers)	3	210,000
c. Pick-up Truck (1-1/2 tons)	6	60,000
d. Theodolite (accuracy 20 secs)	5	7,500
e. Levelling Instruments	15	9,500
f. Levelling Staff	15	<u>1,000</u>
		378,000

In view of the large amount of canal repair and modifications anticipated, the Mission feels that the following additional equipment may be required:

		<u>US\$ (approx)</u>
g. Stone Crushing Plant	1	100,000
h. Front Loaders for Tractors	8	12,000
i. Concrete Vibrators	2	3,000
j. Bulldozers 140 hp	4	200,000
k. Transport for Bulldozer	1	30,000
l. Engine Driven Pumps	20	20,000
m. Vibratory Rollers	8	<u>40,000</u>
		<u>405,000</u>

Outline of Systems for Utilization of Water Resources  
in the Mahaweli Project Area

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Following is an outline of the water management system that is intended to achieve optimal use of the water resources of the Mahaweli System as a whole and of each of the major sub-systems individually. First the organization is described, then the operating philosophy.

1. ORGANIZATION:

The description hereunder of the organization of the water management system is intended to give the project consultants a frame of reference for their work. Although neither the Government of Sri Lanka nor the Mahaweli Authority have made specific policy decisions to establish the system as described, it is expected that the system will evolve along the lines indicated hereunder as a result of further studies and operating experience.

- (a) A WATER MANAGEMENT PANEL (WMP) - will be responsible, at the National level, for the management of all water resources in the Mahaweli Project area and in particular for the allocation and timing of bulk water releases from the main reservoirs for purposes of power generation, for purpose of irrigation in the various sub-systems and for other water uses. The Panel will be chaired by the Director-General MASL, and will further consist of representatives of the Mahaweli Authority of Sri Lanka, the Ministry of Lands and Land Development, the Director of Irrigation, the Ministry of Agriculture, the Ceylon Electricity Board, the Government Agents of Anuradhapura, Polonnaruwa, Tincomalee and Matale, and such other members as may be decided from time to time. The Head of the Water Management Secretariat will be the Secretary of the Panel.
- (b) A WATER MANAGEMENT SECRETARIAT (WMS) - an administrative and technical body under the MASL, headquartered in Colombo, will provide technical expertise to the WMP to assist the Panel in making its decisions with respect to the allocation of water and will have responsibility for implementing the decisions of the WMP. In particular the WMS will be responsible for carrying out the following tasks:
- Formulation for approval by the WMP of proposals for water management policies and procedures in consultation with representatives of water panels, CEB and other water users in the Mahaweli Project area.
  - Collection and processing of all relevant climatologic and hydrologic data necessary to forecast and monitor water availability.
  - Collection and processing of all data necessary to forecast and monitor water needs including (i) power demand; (ii) agronomic data, including irrigated acreage and cropping intensities, crop conditions etc., (iii) domestic and industrial water requirements.

- Day to day liaison with technical operating staff of the CEB and the MASL.
  - Using computer simulations of the entire Mahaweli System formulation of alternative strategies and specific plans for system operation for consideration by WMP at the start of each season. Those plans prepared with the assistance of the agricultural production and marketing managers will indicate the cropping intensities that can be achieved in each sub-system and the agricultural benefits and power benefits for the entire system.
  - Implementation of strategies and operating plans approved by the WMP and, for that purpose, co-ordination and control of all bulk water releases in the project area.
  - Formulation for approval by the WMP of emergency flood and drought handling procedures.
  - Collection and processing of all system performance data on daily and weekly basis as appropriate, comparing same with operation targets, and reporting the system performance to MASL. In particular a record will be kept of the accumulated consumption of each major water user.
  - Recalculation at weekly intervals of current, short term and long term water requirements on basis of actual field conditions and adjustment of operating plans as required by circumstances.
  - Operation of a data processing and computer center.
  - Direct the installation of radio telephone communication network that, together with the existing communications network in the area, will meet the requirements of the WMS.
  - Direction of training programmes for all water management operating staff from management level down to field level.
  - Co-ordination of water management training programmes for farmers in the sub-systems.
- (c) **WATER MANAGEMENT COMMITTEES (WMC)** - In each irrigated sub-system, consisting of the Resident Project Manager, the Deputy Project Managers for Agriculture and Maintenance and Operation, a representative of the Department of Agriculture and representatives of the water users, will be responsible for determining water allocations within the sub-system and for the implementation of the water management schedules prepared by the WMS for each of the sub-systems in accordance with guidelines of the WMP.

156

(d) WATER MANAGEMENT UNITS (WMU) - in each sub-system under the Deputy Project Manager, Operation and Maintenance, will be responsible for providing technical back-up to the WMP as required to formulate decisions for water allocation within the sub-system and to develop water management schedules. In particular, the WMU's will be responsible for:

- The operation of a microprocessor which can be used for the analysis of alternative strategies as part of the decision making process.
- The collection of all data as required for the water management program in the sub-system including irrigated areas, cropping intensities, crop water requirements, system losses and field losses.
- The implementation of decisions of the WMC by controlling water deliveries, and the monitoring of the performance of the sub-system and particularly the recording of the accumulated water consumptions in the sub-systems on a block by block basis and on a farm turnout basis.

A proper maintenance and operation of the irrigation infrastructure.

- Encourage, in consultation with the Settlement Branch (MEA), the formation of farmer organizations for water management.
- Co-ordination of farmer training programs in water management.

## 2. OPERATION PHILOSOPHY:

The operating procedures outlined in general terms hereunder have been initiated by the MASL, and will form the basis for a system operating manual. The procedures will no doubt be refined as experience is gained and the specific characteristics of each sub-system and the requirements at the start of each season. The WMS will prepare system operating plans for the Mahaweli Project area on the basis of power demand anticipated by CEB, cropping patterns and planting dates proposed by the Settlement Branch of the MASL (MEA), taking into consideration antecedent soil conditions, water availability in the reservoirs and forecast precipitation, water losses and evapo-transpiration. After review of the plans by the CEB and the Settlement Branch, the plans will be submitted for approval to the WMP and will become the basis for water allocation to each of the sub-systems during the season. At this point, compromises will be worked out by the various major water users. The plans will incorporate schedules for weekly and daily water releases from all major reservoirs and control points in the system and will become the basis for operating and production targets of each of the sub-systems.

The WMS will control all water releases down to sub-system level in accordance with the agreed plan, using macrosystem simulation models as a management tool to monitor the system and to update the plan in accordance with actual conditions of river flow and precipitation as the season progresses. The control of water issues from tanks and reservoirs commanding each sub-system and of water deliveries from main irrigation canals and branch canals to the various irrigation blocks will be delegated to the WMU of the Settlement Branch (MEA) responsible for that particular sub-system (e.g., System H, I<sub>H</sub>, M<sub>H</sub>). These units will have a microprocessor at their disposal, and the computer simulation models of the sub-systems will become a decision and management tool at this level.

At the beginning of each season the micro models will be used to provide input for planning purposes to the Water Management Secretariat. Once the water allocations to each sub-system have been established, a detailed schedule of irrigation releases will be prepared, again based on anticipated flows and precipitations. As the season progresses, actual conditions in the sub-system will be monitored and reported to the WMS so that the irrigation plan can be updated and amended as necessary.

Control of water issues to each unit within a block will be the responsibility of an irrigation officer on the Block Manager's staff. An equitable distribution of water within each unit will be worked out by the Unit Manager and his staff (KVS and JPS) in consultation with water users or farmers' committees.

The operating plans should provide for emergency measures which could arise as a result of extreme weather conditions such as the cyclones or prolonged drought periods.

Accurate knowledge of the operating characteristics of each sub-system, alert monitoring of field conditions and efficient communications are at the heart of the proposed water management system. It is realised at this point, that it may take some years before sufficient experience is gained to say that the operating procedures are satisfactory under all weather conditions and that models accurately simulate actual conditions in the project area and in the sub-system.

The MASL is experimenting with a piped water distribution system which would enable farmers to obtain water on demand from leveltop distribution canals and distribution reservoirs. It is hoped that such a system will lead to more economic water use and if this and other advantages claimed for the system can be substantiated, the piped supply system maybe used widely in Systems B and C. This would simplify water management at the lowest level but it would not materially alter the requirements for instrumentation and staffing of the water management control system outlined above.

10

Several projects having a bearing on water management have been initiated in the Mahaweli Project area. The Japanese Government is financing the establishment of pilot farms in Systems H and C and it is hoped that these projects will provide useful information with respect to farming practices which would diminish the use of water. USAID is financing a water management project in System H with similar objectives. Finally, the Water Management Division of the Irrigation Department in collaboration with the Hydraulics Station and the Institute of Hydrology, both of Wallingford, England, are engaged in water management study in the Kaudulla Irrigation Scheme.

To provide to the Mahaweli System the greatest possible operating flexibility and to minimize the conflicting requirements of power generation and agriculture, it will be desirable to include in the macro simulation model of the Mahaweli System the reservoirs and power plants of the electrical system of the Ceylon Electricity Board outside the Mahaweli area.

March 18, 1982.

31

## CONTROL OF WATER WITHIN FARM TURNOUTS IN SRI LANKA

By: A. T. Corey

INTRODUCTION

Because of the importance of water conservation to the economy of Sri Lanka, a pilot project has been established at Kalankuttiya to study ways of improving the management of water on farms. This project was established by the Mahaweli Authority with the Department of Irrigation as an operating agency and with funding assistance from USAID. The objectives of the pilot project encompass all aspects of water management on farms, including the design and operation of water control structures within turnout areas.

However, because the design of irrigation structures for Sri Lanka has been under consideration for many years by the Department of Irrigation, members of the Steering Committee for the Pilot Project considered that additional study on this subject should not be given a high priority unless it is shown that structures presently in use are not providing satisfactory control. Therefore the Steering Committee has directed that an evaluation of the performance of water control structures in turnout areas be made on irrigation projects throughout Sri Lanka to determine whether or not further development work on structures should be undertaken by the Pilot Project.

At this date, an evaluation of the performance of water control structures has been made in representative turnout areas in several irrigation projects including Mahaweli System H, Mahakandarawa, Kaudulla and Minneriya. This paper is a report on the result of the evaluation to date, with special emphasis on the water control procedures in Mahaweli System H. In this system, detailed observations have been made on all of the structures within 7 turnout areas and less complete observations have been made in several other turnout areas.

- 2 -

## WATER CONTROL PLAN FOR MAHAWELI H

The plan adopted for the control of water within turnout areas in the Mahaweli system H is similar in many respects to that used on other irrigation schemes in Sri Lanka. However, an attempt has been made in system H to provide for the rotation of water within turnout areas under the supervision of leaders elected by the farmers for each turnout area. A somewhat similar plan has been adopted for Mahakandarawa, but the plan of operation in Kaudulla and Minneriya provides for a less complex program of rotation. The plan originally adopted for the Mahaweli Project includes the following features:

1. Turnout areas are selected of such size that it is considered feasible to irrigate an entire turnout area with a stream of water of about 1 cfs flowing for about 3-4 days per week during the cultivation season. Water may be issued for longer periods during land preparation for the Maha season or may not be issued at all during periods of sufficient rainfall. The turnout area is usually about 12-16 hectares divided into allotments of 1 hectare each.
  2. Water is supplied to turnout ditches by diversion structures from distributory channels. Flow into the turnout ditches is controlled by round cast iron gates raised and lowered by screw mechanisms fitted with locks. The keys for the locks are in the possession of Mahaweli Officers, whose job is to ensure that each turnout receives the planned allotment of water. A weir is provided at the head of each turnout ditch to measure the flow at that point.
  3. Water for individual farms from the turnout ditches is intended to be controlled by precast concrete outlet structures placed in the ditches by project contractors. Authorized farm outlets consist of a 6-inch reinforced concrete pipe through the side wall of a concrete head control structure. The head control structure contains vertical slots to hold wooden boards which were intended to serve as control gates to block the flow through the turnout ditch or through the farm outlet.
- 33

4. The plan called for the opening of only two farm outlets at a time for a period of about 12 hours, while the ditch below the two farms receiving water would be completely blocked. Thus each farm was expected to receive about 1/2 cfs for 12 hours, or about 2.4 inches of water per week. It was intended that the farm leader would supervise the rotation of water within the turnout to ensure that each farmer received his allotment of water. Any disputes resulting from the leaders supervision was to be settled by officers of the Mahaweli Authority.
5. The turnout ditches in Mahaweli System H are mostly unlined earth. The unlined portions are mostly in cuts. Troughs made of brick plastered with concrete carry water across low places, compaction equipment and supervisory skill for the construction of earth ditches across low areas not being readily available in Sri Lanka.
6. Drop structures are provided where necessary. These are concrete cast in place, with the number of steps depending on the change in elevation required.
7. Land has been reserved for an access road along onside of each turnout ditch. This roadway, as well as the ditch itself was supposed to be kept free of undergrowth by the turnout farmers under supervision of the farm leader.
8. Maintenance of control structures, i. e., farm outlets, drop structures and dividers, is a responsibility of the project authorities.

#### OPERATION OF WATER CONTROL WITHIN TURNOUTS IN MAHAWELI SYSTEM 'H'

The actual situation in respect to water control in Mahaweli System H was observed in detail on 7 turnouts in Area H-1, Block 305. These turnouts were from the distributory channel D-3 and have been in use about five years. The area investigated included about 119 allotments. Of these allotments only 83 received water this year. The others failed to receive water because, for a variety of reasons, the system as now constructed could not supply water to the remaining allotments.

Observations of the water control situation in the 7 turnout areas mentioned include the following:

1. Not one of the weirs supplied for the measurement of flow in the turnouts was usable. The elevations of most of the turnouts are too low to permit weirs to operate normally. In 4 cases, the weirs were broken, apparently by farmers who regard them as obstacles to the flow of water. The flow of water is being controlled at the turnout gates by turning the gate screw a prescribed number of turns, which experience indicates will provide a suitable flow of water. It was not entirely clear how the "suitable flow" is actually determined.
2. Of the 83 allotments receiving water this year, 40 received water through authorized project outlets. The remainder received water through unauthorized cuts (or pipes) through the ditch bank, or they received only drainage water from other allotments.
3. Boards for controlling the flow of water at outlets were not being used. In about 1/3 of the cases, the slots provided to hold the boards were misaligned or otherwise too slopily constructed to permit use of boards had an attempt been made to do so. When asked why boards were not being used, the project authorities stated that they had been stolen by farmers. The farmers stated that boards had never been issued by the project authorities.
4. The concrete in the head control structures for the farm outlets is of very poor quality. Many of the structures are crumbling or cracking or both. In most cases, outlet openings have been enlarged by farmers hoping to get more water for their allotments.
5. Many of the original farm outlets were placed at too low an elevation to permit irrigation of the land that was intended to receive water from these outlets. Farmers use this situation as an excuse to bypass authorized outlets with unauthorized outlets of their own. Where unauthorized outlets are used, at least in the upper portions of a ditch, a greater than planned water allotment is delivered.

6. Rotation of water, where practiced at all, is done in a haphazard manner by farmers with little supervision. A farmer will often block the ditch with dirt below his outlet to increase the discharge through the outlet. Downstream farmers who feel their water supply has been unduly reduced will remove the ditch block and often will block their neighbors outlets. All such blocking is done with earth removed from the ditch near the head control structures of the farm outlets. In virtually every case in the turnouts observed, this practice has led to damage to the ditches near the outlet structures. In many cases, this has led to leakage around the structure and in some cases to the collapse of the structure.
7. Farmers in some of the turnouts are trying to use a continuous flow system rather than a rotation, but the outlets were not designed for this system of irrigation. The turnouts at the upper portions of ditches remove too much water from the ditch when continuously open, especially when enlarged by farmers. Adequate supervision to partially close these outlets is lacking. Farmers in one turnout now using a continuous flow system said they would prefer a rotation system if it could be properly supervised. However, farmers in areas where rotation is attempted are not satisfied with the results.
8. Farmers near the head of turnout ditches usually are able to complete their necessary irrigation within the first day after the turnout gate is opened. Farmers at the lower end require the entire period to complete their irrigation if they receive any water from the ditch at all. Often they receive only drainage water from the higher paddies. If the outlets at the upper end of ditches are closed at the termination of necessary irrigation, they are often closed by the downstream farmers.

9. In one case, an unauthorized breach was observed to be taking the entire supply of water from a ditch. The downstream farmer said he was not able to obtain water to irrigate his paddies despite having appealed to the farm leader. When asked why he did not close the breach himself, he said he was afraid of being "hammered" by the man who had made the breach. When the farm leader was asked why he permitted this situation to exist, he stated that he had reported it twice to the project authorities but they had taken no action. He said he was afraid to take further action on his own initiative for fear of being "hammered" by the offending farmer. He also said he had brought the matter up at farm meetings and was told that with the present laws it was difficult, if not impossible, to prosecute farmers engaging in such practices. For example, witnesses to the actual breaching must be found and, of course, the breaches are not made in the presence of witnesses. In the case mentioned, the offending farmer is leasing the allotment from an absentee owner, as are half of the farmers in this particular turnout. The farmers in this turnout as well as all other turnouts investigated complained that unsatisfactory cooperation is often brought about by "outsiders" who are leasing the land. Of the 83 allotments receiving water from the D-3 channel, 33 are presently operated by renters.
10. In one case, a turnout ditch was found to be located so that only half of the authorized allotments could receive water. The remaining allotments were not commanded by the ditch, although the project plan for this turnout indicated that these allotments also should receive water. To correct this situation, the project authorities are now constructing a branch ditch starting at the head of the turnout to command the latter allotments.
- 37

- 7
- 1 -
11. Maintenance of structures, as well as ditches and access roads is virtually always poor. Leakage around drop structures started by burrowing animals, for example, is often not corrected before serious erosion (and sometimes collapse) of the structure has taken place. Erosion downstream of drop structures is often found, a situation which probably could have been prevented by riprap deposited at such points. Brush is often found growing in ditches, and access roads are often impassable. Authorities stated that it is impossible to get farmers to clear the ditches more than once a season at the start of irrigation, and then only if the farmers feel that the brush will seriously reduce their water supply.
  12. Concrete in the drop structures, which were cast in place, is usually of better quality than that of the precast head control structures for the farm outlets. However, drop structures are sometimes found to be positioned at either too high or too low an elevation to function properly. When too high, farmers have cut channels around these structures and when too low they have become buried in silt and are not functioning as planned. In two cases, drop structures were found in the middle of paddies surrounded by water. Farmers cultivating the paddies stated that the drop structures had been placed before land leveling had been done. After land leveling, the drop structures were not in a position to function, as the course of the ditch had to be changed.
  13. The problem of water supply for the system as a whole is being aggravated by the practice of issuing water to the turnouts for the purpose of land preparation. Farmers have learned to rely on this supply of water to make plowing and the "mud plastering" of bunds easier. When water is supplied before the bunds are repaired, an enormous amount of water runs directly to the drainage channels and in the process may inundate the lower lying paddies with too much water. It would appear that a greater supply of water for the cultivation period could be available if land preparation started only after a few rains occurred to soften
- 38

## WATER CONTROL IN OTHER PROJECTS

An analysis of the situation in turnouts of projects other than Mahaweli System H has not yet been completed, but some of the more important observations made in these areas are reported below.

The turnout structures for the Mahakandarawa project were modernized two years ago. Since that time water in the main tank supplying these turnouts has been in short supply. In fact, water has been issued to the modernized turnouts for part of one season only. Never-the-less, it is obvious that the designers of the new system have profited from the experiences of other projects and from the operation of Mahakandarawa before it was modernized.

The improvements made include the following:

- (1) Water is not issued until land preparation has taken place with natural rainfall. The shortage of water in this area make farmers agreeable to this practice:
  - (2) The farmers have been indoctrinated by the Department of Irrigation officials so that they are agreeable to the idea of rotating water within turnouts under the supervision of farm leaders elected by them. The farmers claim that with minor exceptions, the rotation system worked well during the short period when water was issued. Boards for blocking the flow from outlets or in ditches were actually used. These boards were issued to the farm leaders at the start of the irrigation season and at other times are stored in locked buildings by the cultivation officers.
  - (3) No case was observed where farm outlets had been placed at elevations too low to supply the land as intended. This situation was made possible by providing troughs of brick plastered with concrete to replace most of the unlined ditches. The troughs make drop structures with the consequent loss of head unnecessary in the turnout ditch.
- 39

This arrangement has obvious advantages. For example, there is no reason for the outlet not to deliver the planned flow of water. Furthermore, the drop structures being in the outlet stream, are required to handle only a fraction of the water in the ditch and, as a consequence, are less likely to give maintenance problems.

- (4) The only serious complaint heard in the two turnouts investigated was by the farm leader who supervised the rotation of water in the two turnouts. He complained that a portion of one of the ditches that is still unlined, about 1/3 of that ditch, gave him more trouble than the rest of the two ditches supervised by him. He is anxious for the remaining unlined portion to be replaced.

The turnouts investigated in the Kaudulla and Minneriya projects are part of older systems, being 11 and 33 years old respectively. No attempt is being made to rotate water among individual farms within turnout areas, although in some cases the water is delivered to only half the turnout at one time.

The continuous flow system is working more smoothly in these older systems than in the Mahaweli System H mainly because the farm outlets were designed for continuous flow. The outlets here are 3-inch rather than 6-inch diameter pipes. Moreover, outlets that might have been placed at too low or too high an elevation to function properly have long since been replaced.

In these areas also, a problem of discipline among farmers within turnouts exists. The farmers here, like those in the Mahaweli System H, blame most of the problem on renters. However, the Irrigation Department officials in the Kaudulla and Minneriya projects have made an effort to prosecute farmers who violate the rules. Consequently, violations are not so open or frequent as in the Mahaweli System H. Here breeches in ditch bunds are less conspicuous, often taking the form of a tunnel through the bund, the opening of which is hidden by weeds or brush. Officials in this area also claim that it is diffi-

A problem in the Kaudulla and Minneriya projects has arisen because farmers have over the years encroached on land not intended for irrigation. This includes land within a band along natural drainage channels and that reserved for access roads along the ditch bunds. Access roads no longer exist within turnouts in these projects. The amount of land being irrigated, according to project officials, is about 1/3 greater than originally authorized. The response has been to issue more water to turnout areas so that the additional land can be properly irrigated.

Because of the increased land area, the tendency of project officials to issue greater amounts of water wherever farmers have complained of shortages of water, and extensions of the original commanded areas, these systems appear to be seriously overloaded. The major canals and distributories are running completely full without the normal free board. Many of the larger structures are endangered by severe erosion problems, apparently because the canals are too full for prolonged periods.

In the Mahakandarawa, Kaudulla and Minneriya projects as in the Mahaweli System H, it is difficult to persuade farmers to clear brush from ditches and ditch bunds more than once a season or more than is necessary to ensure an adequate water supply. Consequently, practically all unlined ditches and ditch bunds are overgrown with weeds and brush.

In all of the projects visited to date, farmers complain bitterly about the lack of cooperation received from temporary renters. It often happens that the original owner of an allotment cannot make payments on his loans. Because of illness, ineptitude or for other reasons he cannot manage the property profitably and is forced to lease it to someone who can pay off the loan. A substantial percentage of the operators in each of the projects are in this category. Such people often are "outsiders" who feel no responsibility for cooperation with their neighbors, and because of present laws they have no prospects of taking ownership and becoming permanent members of the community. Farmers insist that these people fail to do their share of the maintenance work but do most of the sabotage of project structures and often take more than their share of the water.

It was observed also that there is a great variation in the quality of management within particular turnouts. Whereas the allotment of a particular farmer may have paddies well cultivated with bunds in good condition and rice plants green and growing vigorously with few weeds, his neighbor's allotment may often have yellow stunted rice choked with weeds and paddies with bunds that are leaking. It would seem that a very great increase in production and efficiency of water use on irrigation projects in Sri Lanka could be made by changing land tenure laws to encourage the holding of land by those able to manage it effectively.

42