

***CHAPTER 3***  
***IMPLEMENTATION PLAN***



## CHAPTER 3 IMPLEMENTATION PLAN

### 3.1 Implementation Plan

#### 3.1.1 Implementation Concept

##### (1) Implementation Method

The Project will be implemented with the following steps on condition that the Project is executed under the Japan's Grant Aid Scheme.

- (a) The Ghana Irrigation Development Authority (GIDA) under the Ministry of Food and Agriculture (MOFA) will be the executing agency.
- (b) When the Exchange of Note (E/N) between the Government of Japan (GOJ) and the Government of the Republic of Ghana (GOG) regarding the detailed design of the Project is signed, the Department of Project Development of GIDA will take care of overall procedures necessary for the implementation of the Project.
- (c) A Japanese consultant, recommended by the Japan International Cooperation Agency (JICA) and entrusted by GIDA after signing the contract, will carry out the detailed design and prepare the tender documents for the Project.
- (d) GIDA will take necessary procedures for land acquisition, house compensation and application required for tree cutting, in parallel with preparation of detailed design.
- (e) After signing of E/N between GOJ and GOG regarding the Project implementation, the Japanese consultant will start the procedures of tender after signing the contract for construction supervision.
- (f) A Japanese contractor, after the contract signing for construction, will undertake the construction works, and the consultant will carry out the construction supervision.
- (g) Prior to the commencement of construction, the Department of Project Development of GIDA will hand over the Project area to the contractor. Therefore, the land acquisition and house compensation shall be completed by this time or the Department of Project Development shall promise the date of hand-over which shall not affect the committed construction period.

- (h) The O&M functions of the Project will finally be transferred to the farmers' organisations after joint O&M of the Project by both the Department of Operations of GIDA and farmers' organisations for appropriate period of time.
- (i) The joint inspection of completed works of the Project is made by a group of GIDA, consultant and contractor, after one year from the implementation of the Project.

## (2) Formation of Construction

In Ghana, several projects were implemented under the Japan's Grant Aid, and three projects by the Japan's Grant Aid are being constructed by three Japanese contractors. These contractors as the main contractor are using the Ghanaian contractors as their sub-contractors. According to the investigation for the basic design study, there are 5 to 8 contractors including foreign ones who are able to be engaged in the implementation of this Project in Ghana. Generally, the form of sub-letting of the construction works is that the main contractor provides the construction machines, equipment and materials for the sub-contractors and that the sub-contractors supplies the required labour force. The characteristics of this Project implementation is that the construction site is scattered over the five areas and that the construction works include both the civil and architectural works. Under these circumstances, it will be necessary to employ some sub-contractors. The Ghanaian sub-contractors will execute the construction works, using the construction equipment and materials (cement, reinforcement bars, pumps, gates, etc.) provided by the main contractor from Japan.

## (3) Necessity of Japanese Experts for the Contractor

The construction of pump stations will require the Japanese experts for the civil works as well as the installation of pump facilities, especially for Kpando-Torkor scheme where the floating type of pumps are required. In addition, the Japanese experts will also be required for the construction and installation of sprinkler irrigation system. Because the construction will be executed, making two or more schemes parallel, furthermore, the Japanese experts will be required to maintain the consistency in preparatory works, construction method, finishing works, etc. at each construction site. The required Japanese experts will be as follows :

- Civil engineer-A for construction supervision of pump stations
- Civil engineer-B for construction supervision of sprinkler system
- Pump/electrical engineers for installation of pumps and related electrical works

- Architect-A for construction supervision of architectural works
- Architect-B for construction supervision of electrical fittings, domestic water supply system and other relevant works

### **3.1.2 Implementation Conditions**

#### **(1) Procedures for Tax Exemption**

Because many of the government agencies as well as MOFA and GIDA are involved in the process of the taxes exemption in Ghana, it will take time for rather complicated application of procedures and to obtain the final approvals from the relevant agencies. Although the procedure for tax exemption will be arranged mainly by GIDA, the contractors should also understand the laws and regulations of Ghana for tax exemption and support GIDA in order to process the tax exemption procedures smoothly.

#### **(2) Construction in Existing Farm Land**

Since the construction includes the rehabilitation works in the existing farmland, the discussions should be made on the suspension of farming activities in the farmland to be rehabilitated between GIDA and the farmers' organisations prior to the commencement of the works. When the discussions have been concluded by both parties, it is necessary to make the arrangement for (i) preparation of construction schedule during the off-farming season or (ii) for continuous farming by providing the temporary works such as diversion canals, roads, etc.

#### **(3) Measures for Environment Impacts during Construction**

The possible environment impacts during the construction will be (i) noises due to the construction, (ii) dusts mainly from the vehicles, (iii) noise and vibration due to operations of heavy machines and (iv) traffic accidents.

There exist no hospitals and schools which are affected by the environment impacts during daytime construction in and around the irrigation schemes. However, the construction works during night time should be prohibited in order to avoid the impacts to the inhabitant around the irrigation schemes. In order to minimize the dusts due to trucks and heavy construction machines, it is recommended to use the sprinkler trucks.

Such measures as (i) limit of driving speed, (ii) periodical training of the drivers for safety driving and (iii) deployment of traffic control offices should be taken to avoid the traffic accidents by vehicles and construction machines.

### **3.1.3 Scope of Works**

#### **(1) Scope of Works to be executed by Japanese Side**

- To carry out detailed design and preparation of tender documents
- To undertake the construction of irrigation and drainage facilities, farm roads, buildings for agricultural use and training facilities mentioned in Sub-chapter 2.3.

#### **(2) Undertaking by Government of Ghana**

- Provision of the land necessary for implementation of the Project
- Construction of transmission lines from the commercial distribution lines to the project boundary for electricity supply to the pumps and building facilities in Aveyme Scheme
- Construction of domestic water supply facilities from the existing supply network to the site
- Budget arrangement and payment for import tax, internal taxes and other levies in Ghana
- Application for architectural works and payment of its costs

### **3.1.4 Construction Supervision**

#### **(1) Tendering**

Immediately after the signing of E/N for the first stage construction, the contract for the consulting services will be concluded between GIDA and the consultant, and the tender documents including tender drawings will be prepared in collaboration with GIDA.

The tender for selection of a contractor for the construction works will be conducted after getting approval from GIDA for the tendering process. The first step is the pre-qualification tender, and the notice of this will be published in the major daily newspapers on construction and economy in Japan on behalf of GIDA.

The pre-qualification documents will be distributed by the consultant to the applicants and the tender documents will be distributed by the consultant to the pre-qualified applicants. The quoted tenders will be received by the consultant and opened in the presence of the representative of GIDA. After the opening, the tender evaluation will be made by the consultant in collaboration with the representative of GIDA, and the draft contract will be prepared by the consultant based on the tender evaluation result.

## (2) Construction Supervision

Once the contract for construction supervision has been concluded for the construction works, the consultant will clarify the construction method and time schedule submitted from the contractor. The resident engineer of the consultant will be assigned to supervise the construction works, with the commencement of the construction and will regularly report the work progress to both JICA Ghana office and GIDA. The resident engineer will also co-ordinate the activities by the government agencies concerned with the Project, including the contractor for smooth implementation of the Project.

Since the Project comprises various kinds of work components, the consultant's civil engineer, pump engineer, architect, etc., in addition to the resident engineer, will be assigned to supervise the construction works for pump stations, headworks, irrigation and drainage system, farm road network and building facilities.

The Project will then be completed on schedule with good results through these arrangements by the consultant.

The scope of construction supervision is summarized as follows :

- (a) Evaluation and approval of construction drawings
  - Evaluation and approval of construction drawings, application for commencement of the works, sample of materials, specifications of the equipment, etc. submitted by the contractor.
- (b) Progress and quality control of construction
  - Checking and guidance on the construction plan and time schedule, progress and quality control of the construction works and necessary inspection of the construction methods.
- (c) Approval for the payment to the contractor
  - Checking and evaluation of the performance of the works necessary for issuing payment certificates and completion certificate to the contractor.

- Attendance at the handing-over of the completed facilities to GIDA after confirming the completion of the works and fulfillment of the contract.

### **3.1.5 Procurement Plan**

Of the equipment and materials to be used for the construction works, those available in Ghana will, in principle, be procured from the local markets. Based on this basic concept, investigation was made on the availability of equipment and materials with the major local contractors and the Japanese contractors who are being engaged in the Japan's Grant Aid Projects and those financed by the loans from Japan in Ghana. It is clarified that the materials for general civil works will be available in Ghana. As for the equipment, heavy and specific equipment such as pumps, generators, sprinkler irrigation sets and large-scale steel gates will have to be imported from Japan or other countries in Europe.

The investigation also shows that most of heavy construction machines such as bulldozers, backhoes, etc. being used in Ghana are the products of Japan and the European countries. The construction machines to be required for the Project implementation will also be available on the rental basis in Ghana.

### **3.1.6 Implementation Schedule**

#### **(1) Implementation Schedule**

The Project will be implemented, dividing the construction works into two stages. At the first stage, the construction of two (2) irrigation schemes at Ashaiman and Okyereko, including the training facilities in Accra, will be executed, and the implementation of Aveyime, Kpando-Torkor and Mankessim irrigation schemes will be carried out at the second stage. The implementation schedule will be as follows :

#### **(a) First stage construction**

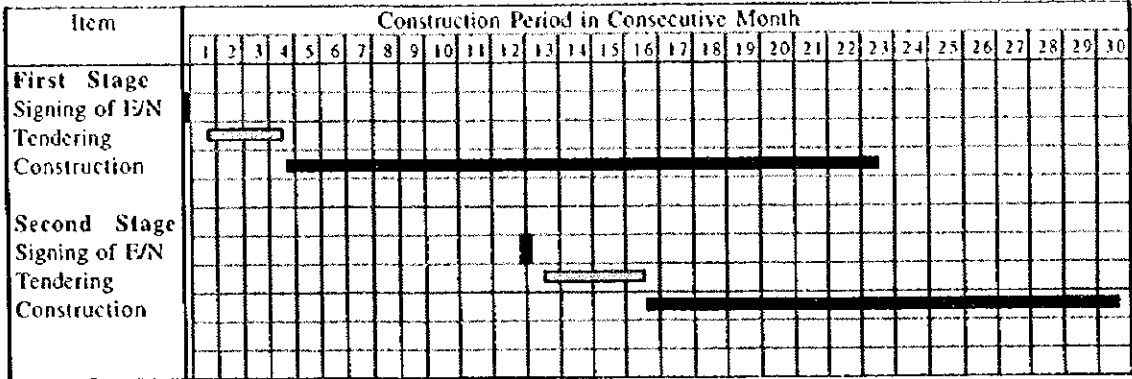
- Preparation of tender documents including the tender drawings and tendering process : 3 months
- Construction : 19 months

#### **(b) Second stage construction**

- Preparation of tender documents including the tender drawings and tendering process : 3 months
- Construction : 14 months



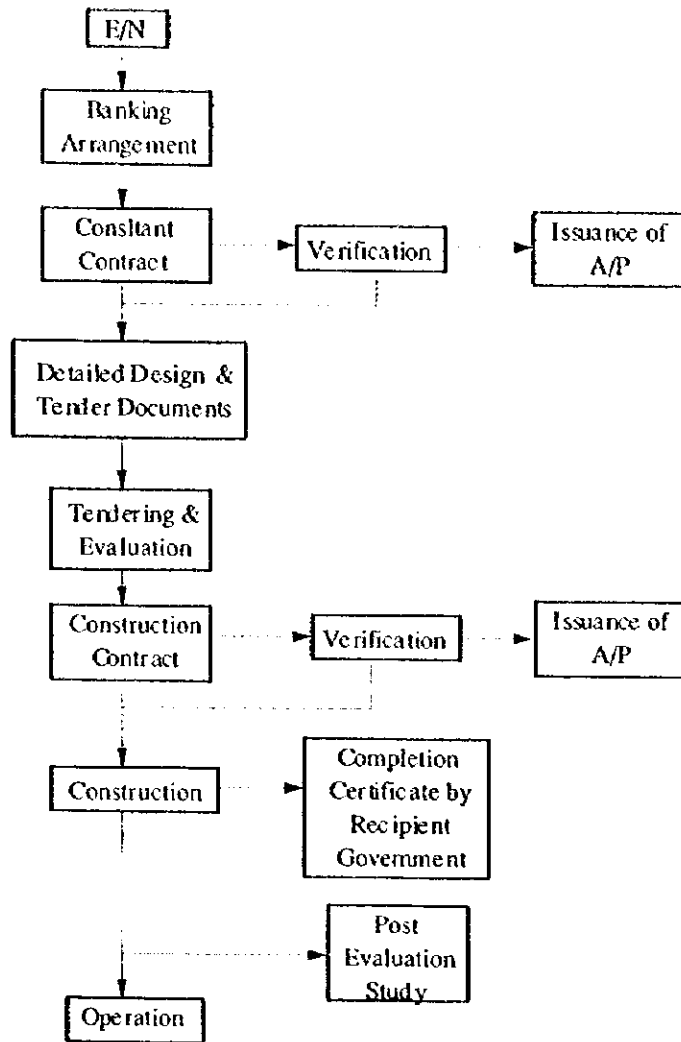
The Project will be completed during the period of 29.5 months after the signing of E/N, as shown below :



(2) Implementation Procedure under Japan's Grant Aid System

The Project shall be implemented as shown below, based on the procedure of the Japan's Grant Aid System :

### Procedure of Japan's Grant Aid System



Note : E/N : Exchange of Note  
A/P : Authorization to Pay

#### 3.1.7 Obligation of Recipient Country

- To provide data necessary for detailed design and implementation of the Project.
- To secure and clear the sites required for the Project prior to the Project implementation.
- To bear commission to the Japanese foreign exchange bank for its banking services based on the Banking Arrangement for payment, namely the advising commission of the "Authorization to Pay" and payment commission.
- To ensure prompt unloading, tax exemption, custom clearance at the port of disembarkation in Ghana and prompt internal transportation therein of the

materials and equipment for the Project to be purchased under the Grant Aid Programme.

- (e) To exempt Japanese juridical and physical nationals engaged in the Project from custom duties, internal taxes and other fiscal levies which may be imposed in the Republic of Ghana with respect to the supply of the products and services under the verified contracts.
- (f) To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into Ghana and stay therein for the performance of their work.
- (g) To provide necessary permission, licenses and other authorizations for implementing the Project, if necessary.
- (h) To assign appropriate budget and staff members for proper and effective operation and maintenance of the facilities constructed under the Project.
- (i) To maintain and use properly and effectively the facilities constructed under the Project.
- (j) To bear all the expenses, other than those to be born by the Japanese Grant Aid with the scope of the Project.
- (k) To provide the services to the farmers' organisations for O&M of the Project

### **3.2 Operation and Maintenance Plan**

#### **(1) Proposed Organisation of GIDA for Operation and Maintenance**

GIDA has a plan to hand over the O&M function to the farmers' organisations already established at each scheme in accordance with the strategy of MTADP. The basic concepts of the handing-over are :

- (a) To gradually train the farmers to take over the management of the irrigation schemes, and transfer appropriate technologies to them through IDC (Irrigation Development Centre) at Ashaiman ;
- (b) To provide extension services to the farmers ;
- (c) To assist the organisations in O&M of the irrigation system and other related structures ; and
- (d) To provide technical advice to farmers' groups, co-operative societies after transfer of project management responsibility.

After completion of the Project, all project facilities will be transferred to the Department of Project Operations under GIDA, which will be responsible for the handing-over of O&M function to the farmers' organisations. The site offices will have direct responsibility for the handing-over at the site under the management and instruction of the Department of Project Operations. The organisation of these two offices should be strengthened in order to ensure successful implementation of the handing-over. The proposed organisational structure and staffing of both offices with supporting agencies involved in O&M are presented in Fig.- 3.1, and briefly described below:

(a) Department of project operations

The proposed organisation consists of two divisions; (i) O&M Division and (ii) Monitoring and Evaluation Division. The O&M Division will have six (6) Subject Matter Specialists for Water Management, Irrigation Facility Management and Farm Machinery, and two (2) Mechanics for pumps and other machines and equipment. This Division undertakes the following activities:

- Overall engineering services for O&M through the site offices ;
- Training of the staff of the site offices and farmers' organisations on O&M ;
- Improvement and dissemination of water management practices ;
- Movable services for pumps and equipment of the schemes, etc.; and
- Monitoring and evaluation of all the project activities for proper O&M of the Project by farmers themselves.

The Extension Division undertakes agricultural extension activities.

(b) Site offices

Two types of organisations and staffing are proposed in accordance with the handing-over process: (i) O&M during the transitional period until the completion of handing-over, and (ii) O&M by the farmers' organisations after handing-over. Joint O&M of irrigation facilities by both the site offices and the farmers' organisations is made during the transitional period (3 years of period is planned). An O&M officer and an extension officer are appointed to each site office during this transitional period. After the handing-over, an O&M officer and an extension officer remain in each site office, in order to support the O&M works by the farmers themselves.

In addition to the above strengthening and reorganisation programmes, it is proposed to establish the following task force and committee to ensure the successful implementation of the Project and handing-over of O&M function.

(a) Establishment of advisory committee

The main objective of this committee is to support and assist the farmers' organisations in O&M of the Project. The members of the committee will consist of a District Director of MOFA, District Assembly, Commercial Banks and District Cooperative Department.

(b) Agricultural co-ordination committee

In order to keep a close co-ordination between the agencies related to the agricultural support services, it is proposed to establish an Agricultural Co-ordination Committee at each scheme site. The membership of the Committee will consist of the representatives of the following agencies: (i) Regional Agricultural Director ; (ii) Farmers' Organisation in the project area; (iii) Site Office of the Project; (iv) District Offices of Agricultural Extension Services; (v) District Office of the Department of Co-operatives; and (vi) Banks. The Department of Project Operations under GIDA will make necessary arrangements to establish this committee and provide technical backup.

(2) Proposed Farmers' Organisation for Operation and Maintenance

The O&M function should be handed over to the farmers' organisations which have already been established in each scheme area, and it is not considered to establish any new organisation, but only to reorganize the existing ones. The strengthening of the existing organisations should be undertaken by GIDA, in co-operation with the Department of Co-operatives of the Ministry of Employment and Social Welfare. The proposed strengthening plan for the existing farmers' organisations is described below :

The main objective of a farmers' organisation is to operate and maintain the irrigation facilities. In addition, other objectives such as marketing and credit services are also included in order to meet the farmers' intention and to improve the present agricultural support services.

Since the present farmers' organisations have no function of O&M of the facilities, they should therefore be reorganized to the organisations which have the functions of O&M with the agricultural support services such as marketing and credits. The proposed organisation consists of Type-A and Type-B. Both types have almost the same structure, and the difference between the two types is as follows :

- (a) Type-A is for small irrigation schemes having less than 100 farmers, and the farmers are linked directly with the committee of management.
- (b) Type-B is for larger irrigation schemes with over 100 farmers. In this type, the farmers are divided into several groups by each irrigation block, and each group is linked separately with the committee of management. Each farmers' group elects a representative who is the member of the committee.

The adoption of these types is entrusted to the organisation. But it is recommended that the size of a farmers' group should be less than 100 farmers so that "face to face" communication between the committee of management and the farmers can be secured as one of the prime requirements to activate the organisation.

The proposed organisational structure of the farmers' organisation at each irrigation scheme is presented in Fig.-3.2. An organisation consists of the following 5 components; (i) general meeting, (ii) committee of management, (iii) audit, (iv) service sections including O&M, agriculture, marketing and credit, and women's group. In addition, irrigation groups are formed under the committee of management. Their main functions and activities are as follows :

(a) General meeting

The general meeting is held at least annually.

(b) Committee of management

The committee of management is composed of the following members; chairman, vice chairman, general secretary, treasurer, and several members who are representatives of the service sections. The main tasks of the committee are (i) to prepare annual management plans and budget, (ii) to instruct and supervise activities which are implemented by the service sections, (iii) to manage complaints and grievances from the farmers, (iv) to arrange and appoint volunteers to work in the service sections, (v) to manage accounting

and general affairs, (vi) to co-ordinate with other agencies and associations, and so on. The committee members take charge of parts or portions of these works. Regular meetings are held monthly for implementing these activities.

(c) Service sections

Under the instruction and supervision of the committee of management, the routine service works are implemented by the following four sections; (i) O&M, (ii) agriculture, (iii) marketing and credit, and (iv) women's group.

(d) Audit section

At present, the staff of an organisation consists of a chairman, a vice chairman, a secretary, a treasurer and several members of the committee as mentioned earlier, but generally no auditor is assigned. In other words, the organisation has no auditing system in its accounting operations, and this is one of the organisation's problems. To solve this problem, it is proposed to establish an auditing system.

(e) Irrigation groups

An irrigation group is formed by each lateral canal for gravity irrigation and each rotational block for sprinkler irrigation, in order to make smooth water management. Each group operates the facilities within the irrigation block divided by the lateral canals or one unit of sprinkler irrigation system. A group selects a leader, and links with the organisation through this leader.

(3) Operation Plan

The rehabilitated irrigation schemes will be operated by the responsible sections of the farmers' organisation under the leadership of the committee of management as well as with technical and managerial supports from GIDA.

The operations of the irrigation facilities are largely divided into two portions: one is to prepare and determine an operation programme of the project facilities for proper water delivery and application, and the other is to execute the operations in line with this programme. In general, the operation programme should be prepared based on the various data and information such as meteorological and hydrological data, actual water distribution,

cropping schedule, monitoring of actual operations of the irrigation facilities, etc., because it should be well-fitted to the local and current conditions. The service section and irrigation group of the farmers' organisations will be engaged in the operation works. For strengthening of the organisations, the effective training by lectures as well as in the field will be made by GIDA in collaboration with the Japanese experts during three years transition period.

The crops to be introduced and their cropping areas will be determined by the service sections of the organisations under the committee of management. For this purpose, monitoring of market prices, storing, transportation, demand-supply situations of farm products will have to be carried out by the sections, and profitable farming programme and schedule should be prepared in collaboration with other service sections as well as by the advice from the Japanese experts.

The activities of the committee of management will also cover (i) estimate and collection of O&M costs from the farmers, (ii) cooperative O&M works for all the project facilities, (iii) purchase and distribution of necessary farm inputs for the member farmers, and (iv) management of the farmers' organisation, under the advice and cooperation of GIDA, the Department of Cooperative and the Japanese experts team.

#### (4) Maintenance Plan

In parallel with proper operation, suitable and sustainable maintenance of the project facilities is indispensable to secure proper and stable function of the facilities as well as to ensure the realisation of their economic life. Basically, the maintenance works will be carried out by the farmers' organisations. GIDA will execute the training of the organisations and farmers during the transition period and should provide the necessary services for the maintenance by the farmers themselves. The following maintenance works will be required on the irrigation and drainage facilities, farm road network :

- Regular maintenance work which is carried out regularly to maintain and improve the project facilities;
- Periodic maintenance work including repair of minor damage;
- Emergency repair work which is conducted to repair the occasional damage of the project facilities caused by flood, heavy rainfall or other causes; and
- Annual maintenance which involves a large work quantity or requires special skills.



The maintenance work at the project level is briefly explained below:

- (a) **Regular maintenance:** Regular maintenance refers to the day-to-day maintenance of the project facilities. It includes routine repair of pumps, pipes, embankment, measuring devices, weeding, filling of holes on the inspection roads with earth and gravel, oiling of gates, etc. Satisfactory implementation requires an intensive daily inspection of the project facilities.
- (b) **Periodic maintenance:** Periodic maintenance is defined as repair of minor damage which does not cause immediate danger to or malfunction of the water supply system. However, the periodic maintenance work should be carried out by skilled workers and mechanics in order to protect the system from further damage. Minor improvements of the water supply system are also included in this periodic maintenance.
- (c) **Emergency repair:** Damage to the project facilities will hamper the normal practices of irrigation. Therefore, repair of damaged facilities should be carried out quickly and effectively under the category of the emergency repair. Since the damage is not predictable either with respect to the time of occurrence or to the scale of damage, the agency concerned should always be ready to confront the occurrence of damage. The damage to the project facilities may result from (a) flood, (b) heavy rainfall, (c) careless operation of the facility, (d) violation of rules, and (e) destruction by animals and vehicles.
- (d) **Annual maintenance:** Maintenance work which involves a large work quantity or requires special skills should be carried out under the category of annual maintenance. This maintenance work may be executed by contractor(s) to be selected through open tendering.

As for the building facilities, the farmers' organisations will have the responsibility for the maintenance of all the buildings with their own budgets. However, the training facilities such office, lecture hall and laboratories at Ashaiman as well as those in Accra will be maintained by GIDA by her own budget.

The O&M equipment, excluding backhoe, motor grader and micro-bus, is maintained by the farmers' Organisations in accordance with O&M manuals for each equipment by their own budgets. The backhoe, motor grader and micro-bus should be maintained in accordance with O&M manuals for each equipment by GIDA with her own budget.

The outline of O&M manuals for irrigation and drainage facilities as well as for the equipment is shown in Annex-1.

(5) Operation and Maintenance Costs

The O&M costs for each of the irrigation schemes would be as follows (refer to Table 3.1 for details) :

(a) Ashaiman scheme	:	22.4 million Cedis
(b) Aveyime scheme	:	24.0 million Cedis
(c) Kpando-Torkor scheme	:	56.9 million Cedis
(d) Mankessim scheme	:	20.7 million Cedis
(e) Okyereko scheme	:	40.8 million Cedis
(f) Building facilities in Accra	:	17.5 million Cedis

**CHAPTER 4**  
**PROJECT EVALUATION AND**  
**RECOMMENDATION**



## CHAPTER 4 PROJECT EVALUATION AND RECOMMENDATION

### 4.1 Project Effect

The implementation of the Project under the Japan's Grant Aid is judged viable for the following reasons :

- (1) The Project is to contribute to the achievement of the key policies in the MTADP by recovering and stabilizing the function and productivity of each of five (5) existing irrigation schemes through the Project implementation.
- (2) The Project is to increase smallholder farmers' income in the Project area as a result of improvement and stabilization of their crop production. Such an increase in their farm income will contribute largely to the improvement of farmers' living standard.
- (3) The Project will create a demand for farm labour due to the increased farming activities, more intensive land use, and increase in agricultural production. In addition, the implementation of the Project will increase employment opportunities in and around the Project area. All these effects will contribute to the activation of regional economy.
- (4) The farmers under the Project will gain more experience, technical know-how and skills in various farming activities as well as operation and maintenance of the irrigation schemes which will be useful for further small-scale irrigation development in the rural areas.
- (5) The marketing activities of farm products in and around the Project area will also be improved and expanded by the Project implementation through increase in crop production and activation of farmers' organisations in marketing.
- (6) The Project will strongly be expected to be a core and pilot scheme for further rehabilitation and development of small to medium-scale irrigation schemes as well as for extension of operation and maintenance of the irrigation schemes by farmers themselves throughout the country.

## 4.2 Recommendations

It is concluded that the implementation of the Project is suitable and viable for Japan's Grant Aid as a result of the field investigation in Ghana and the analysis in Japan, because the Project will largely contribute to the achievement of key policies stipulated in the Medium Term Agricultural Development Programme (MTADP : 1995 - 2005) as well as to satisfying the country's food demand and the improvement of economic status of small-holder farmers in line with the national development policy of irrigated agriculture as already described.

GIDA has a plan to hand over the O&M function to the farmers' organisations already established at each of the five (5) irrigation schemes in accordance with the strategies of MTADP. In line with this plan, the handing-over of O&M function to the farmers' organisations should be realized for effective and sustainable O&M of the Project after implementation by farmers themselves under full technical and managerial guidance and assistance from GIDA as well as the government agencies concerned.

Judging from the circumstances around the five irrigation schemes included in the Project, it is expected that the Project will be implemented smoothly and effectively with due consideration and realization of the following commitments by the concerned parties :

- (a) To carry out land acquisition for rehabilitation/improvement of the project facilities and construction of building facilities.
- (b) To strengthen the GIDA's organisation for handing-over of O&M function to the farmers' organisations.
- (c) To strengthen the farmers' organisations for taking-over of O&M function from GIDA.
- (e) To establish a technical supporting system to the farmers' organisations for effective and sustainable O&M of the Project after handing-over.

## *Table*





**Table 2.1 Monthly Mean Rainfall (1)**

Project : Ashalman  
 Station No. : 23014TEM  
 Station Name : Tema

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
1961	16.8	1.3	76.5	121.2	139.7	398.0	50.0	0.0	112.5	17.0	12.2	15.0	960.2
62	31.0	26.2	55.4	32.0	235.2	530.9	26.7	8.6	1.8	94.7	22.4	29.7	1,094.6
63	13.0	17.3	34.1	124.2	170.9	169.7	97.5	48.3	77.7	76.5	43.2	11.4	884.5
64	0.0	4.1	79.0	159.8	108.5	169.9	0.3	0.3	0.5	5.3	0.0	0.5	528.2
65	10.4	84.1	2.5	160.0	78.0	244.3	120.6	35.6	20.1	66.0	8.6	16.8	847.0
66	1.5	23.1	78.5	99.8	97.0	63.0	51.8	0.5	14.2	66.5	0.0	0.0	495.9
67	36.8	0.0	57.7	102.9	114.6	234.4	7.4	1.3	33.3	17.8	48.8	18.8	673.8
68	39.9	80.0	24.6	61.2	105.9	294.6	469.9	98.8	238.3	183.1	94.0	30.2	1,720.5
69	21.6	5.6	88.4	65.3	78.2	186.7	23.1	7.9	36.3	56.9	79.5	0.3	649.8
1970	19.3	68.1	49.0	66.8	217.2	121.7	13.7	7.4	16.5	81.3	26.2	3.0	690.2
71	0.0	61.7	59.9	89.9	48.8	415.0	83.8	29.0	65.8	2.0	6.4	40.6	902.9
72	0.0	68.8	39.4	233.4	105.7	239.0	1.5	4.1	23.6	53.6	30.5	23.1	822.7
73	0.0	2.3	140.5	49.3	87.9	309.6	54.6	50.5	65.3	60.5	0.0	30.5	851.0
74	11.7	0.0	94.0	59.2	178.8	231.4	95.0	17.3	110.0	45.2	0.0	30.7	873.3
75	0.0	57.2	122.7	96.5	156.2	114.6	75.9	2.5	17.8	44.7	9.1	0.0	697.2
76	0.0	33.9	40.5	209.0	68.3	140.2	1.0	17.6	4.3	30.3	14.0	0.0	559.1
77	0.5	19.8	2.5	72.8	82.0	20.3	11.3	25.2	1.3	84.8	8.9	0.0	329.4
78	2.6	7.4	7.9	86.1	155.3	56.2	13.5	1.3	10.3	36.1	0.0	2.0	378.7
79	0.0	0.0	61.6	59.5	136.2	274.8	37.2	20.4	27.9	169.5	82.6	0.0	869.7
1980	0.0	0.0	66.7	59.5	136.2	274.8	37.2	23.2	28.4	169.5	82.6	0.0	873.1
81	1.5	0.0	40.2	58.0	132.7	206.6	141.0	26.0	68.0	35.9	9.4	1.1	720.4
82	0.8	8.9	104.1	93.5	108.9	288.9	87.2	0.8	0.5	48.0	0.0	0.0	741.6
83	0.3	0.0	1.8	42.4	83.9	154.8	0.0	47.3	0.0	0.0	0.0	0.0	330.5
84	0.0	0.0	17.3	50.5	99.2	48.0	50.3	20.4	79.9	48.9	15.1	31.7	461.3
85	0.3	8.1	57.3	14.0	171.7	94.0	8.6	46.3	23.9	98.2	21.1	0.0	543.5
86	0.0	47.3	28.6	27.9	85.5	63.4	0.8	0.0	5.3	73.2	6.1	29.9	368.0
87	24.0	5.2	42.6	45.5	106.4	3.4	21.2	57.4	297.9	75.7	0.0	14.0	693.3
88	0.0	90.1	52.2	77.3	99.4	172.2	44.8	1.8	72.9	52.4	1.1	65.8	730.0
89	0.0	0.0	17.3	142.2	93.4	169.6	65.0	9.6	15.7	99.5	30.6	0.0	642.9
1990	1.4	16.0	5.5	79.1	114.8	112.3	13.1	0.1	39.2	31.5	18.9	111.0	542.9
91	5.7	17.3	4.7	175.1	189.6	81.0	189.3	12.9	23.3	59.1	0.1	0.0	758.1
92	0.0	0.0	35.7	35.0	254.3	80.0	24.5	1.6	4.6	16.3	5.9	0.0	457.9
93	0.0	5.9	49.3	61.0	86.7	154.1	7.2	13.2	61.5	0.0	54.9	23.3	517.1
94	9.3	23.7	34.0	37.5	127.4	155.1	3.7	7.0	14.8	73.5	14.7	0.4	501.1
95	0.0	0.2	165.1	97.3	135.8	252.0	140.2	10.9	1.1	4.5	32.1	55.8	895.0
Ave.	7.1	22.4	52.5	87.0	125.4	186.4	59.1	18.7	46.1	59.4	22.3	16.7	703.2
Max.	39.9	90.1	165.1	233.4	254.3	530.9	469.9	98.8	297.9	183.1	94.0	111.0	
Min.	0.0	0.0	1.8	14.0	48.8	3.4	0.0	0.0	0.0	0.0	0.0	0.0	

**Table 2.1 Monthly Mean Rainfall (2)**

**Project : Aveyime**  
**Station No. : 07003AKU**  
**Station Name : Akuse**

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
1960	8.4	23.6	128.0	107.4	76.7	263.9	42.2	49.8	191.8	142.5	80.0	36.1	1,150.4
61	19.8	0.5	58.9	158.2	27.7	240.3	140.2	0.3	164.3	146.1	101.1	8.1	1,065.5
62	30.0	48.8	18.9	235.0	227.1	286.0	128.8	64.5	31.5	101.3	90.9	49.5	1,312.3
63	18.3	76.5	77.2	212.3	277.6	244.9	87.6	108.2	150.4	63.2	132.1	2.8	1,451.1
64	10.7	0.0	79.8	186.4	73.6	302.8	42.2	11.9	16.3	62.0	64.5	13.7	863.9
65	12.2	53.1	126.0	207.5	95.8	364.0	144.8	31.0	148.6	105.7	99.3	45.5	1,433.5
66	62.2	0.5	103.1	77.2	149.9	246.6	167.1	35.6	233.9	146.3	58.4	47.8	1,328.6
67	9.1	51.3	167.4	94.5	182.4	329.2	51.3	10.7	232.9	77.2	96.0	28.2	1,330.2
68	2.8	89.4	71.1	337.1	182.1	252.5	284.5	222.5	260.1	178.1	67.1	14.0	1,961.3
69	82.3	19.6	47.5	76.5	143.8	331.5	105.2	63.8	24.4	259.3	90.7	49.0	1,293.6
1970	46.0	104.4	53.1	87.1	392.2	82.6	44.2	3.6	77.0	104.6	182.1	0.0	1,176.9
71	0.5	51.3	84.1	79.8	48.5	96.5	62.7	57.4	156.5	199.4	28.4	9.9	875.0
72	0.0	127.0	93.3	196.6	180.1	259.3	49.5	2.5	45.7	94.7	162.6	45.2	1,256.5
73	0.0	35.6	50.8	118.9	135.1	204.2	30.7	66.0	200.7	179.6	95.3	30.0	1,146.9
74	15.7	49.5	190.2	30.0	164.8	206.5	126.7	41.7	214.6	130.0	43.9	16.3	1,229.9
75	0.0	12.4	126.2	149.9	141.2	191.3	152.9	6.9	69.9	137.9	134.1	6.1	1,128.8
76	44.2	73.1	98.5	121.7	75.4	110.7	3.1	133.5	51.7	156.7	31.5	38.4	938.5
77	21.9	76.9	0.8	30.2	71.8	73.7	11.2	1.0	143.0	88.7	37.6	6.4	563.2
78	2.8	192.9	119.3	269.4	131.3	120.2	2.8	13.5	62.1	192.2	59.6	3.3	1,169.4
79	0.0	93.4	155.5	30.0	139.4	185.4	158.0	44.0	186.8	46.5	93.2	3.8	1,136.0
1980	0.3	39.6	75.6	67.5	198.6	63.2	95.4	111.6	276.7	109.8	116.4	0.0	1,154.7
81	5.1	83.5	54.4	52.3	147.2	320.4	98.7	48.9	189.4	113.4	130.0	7.4	1,250.7
82	8.4	75.8	85.8	123.4	101.8	209.3	57.2	75.2	12.0	111.8	31.3	42.7	934.7
83	0.0	0.0	0.0	87.4	41.4	225.0	12.5	0.0	66.8	85.0	12.8	41.1	572.0
84	2.8	7.9	165.0	108.0	259.3	113.5	135.2	98.8	174.2	139.6	37.2	40.3	1,281.8
85	0.0	30.0	83.1	56.4	121.1	120.3	202.3	63.6	151.5	224.4	38.5	0.0	1,091.2
86	0.8	57.4	123.1	102.3	220.5	79.9	42.0	22.9	113.4	94.5	31.2	0.0	888.0
87	1.3	4.1	117.4	84.4	82.1	60.9	38.6	139.0	187.9	87.6	67.0	12.7	883.0
88	0.3	26.2	49.2	145.4	145.3	174.3	57.8	54.6	122.1	123.0	64.6	44.7	1,007.5
89	0.0	0.3	102.0	116.1	143.5	241.3	117.1	53.5	197.4	164.1	125.3	43.1	1,303.7
1990	15.0	58.2	71.9	116.6	118.2	140.8	51.7	1.3	100.0	93.7	59.1	85.2	911.7
Ave.	14.0	52.1	92.6	128.9	149.9	204.7	91.5	54.6	141.8	132.0	82.1	25.7	1,169.7
Max.	82.3	192.9	190.2	337.1	392.2	364.0	284.5	222.5	276.7	259.3	182.1	85.2	
Min.	0.0	0.0	0.0	30.0	27.7	60.9	2.8	0.0	12.0	46.5	12.8	0.0	

**Table 2.1 Monthly Mean Rainfall (3)**

Project : Kpando-Torkor  
 Station No. : 07017HO  
 Station Name : Ho

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
1961	8.1	10.2	80.3	136.9	196.9	289.3	165.6	23.6	91.9	128.0	83.3	70.1	1,284.2
62	32.8	16.3	40.9	159.8	376.2	374.4	179.8	87.1	24.4	179.1	57.4	22.4	1,550.6
63	96.5	112.0	144.0	163.0	78.2	162.8	425.7	226.1	235.5	312.9	56.9	40.4	2,054.0
64	50.0	29.5	134.4	110.5	289.6	302.5	207.3	15.2	97.5	60.5	45.7	28.4	1,371.1
65	20.6	98.6	282.7	251.0	207.3	267.7	83.3	146.1	157.7	97.0	32.8	26.2	1,671.0
66	23.1	31.0	106.2	83.6	190.2	152.9	132.8	155.4	112.0	103.9	105.4	61.5	1,258.0
67	0.5	20.6	173.0	180.8	105.9	309.9	56.6	77.7	161.5	51.4	37.8	26.2	1,201.9
68	114.3	98.8	99.3	86.6	97.5	315.5	261.4	241.0	254.3	205.7	37.8	9.9	1,822.1
69	0.3	121.2	75.4	72.6	225.0	298.7	133.1	69.9	101.6	245.4	28.4	91.7	1,463.3
1970	15.5	24.4	164.8	133.9	219.5	91.4	58.4	6.4	193.5	233.7	36.1	0.0	1,177.6
71	40.9	58.4	147.6	150.1	153.7	137.9	127.0	153.7	223.8	55.1	29.5	79.8	1,357.5
72	19.1	72.6	108.5	185.2	183.6	141.2	52.6	32.8	51.3	162.3	52.1	97.5	1,158.8
73	6.4	28.2	62.5	101.6	141.5	282.4	71.1	169.7	245.6	134.9	6.4	90.9	1,341.2
74	44.7	17.5	103.9	86.6	197.6	274.3	140.7	76.2	313.7	106.4	15.5	9.7	1,386.8
75	0.0	68.1	120.4	179.1	133.9	195.6	156.5	21.1	123.2	182.1	108.7	6.9	1,295.6
76	3.6	198.9	97.8	80.0	96.6	220.3	39.6	29.6	98.1	204.4	109.4	70.2	1,248.5
77	1.1	33.0	14.0	108.0	155.7	51.5	49.0	42.7	80.8	196.1	14.8	20.2	766.9
78	15.2	102.5	128.6	164.8	136.8	194.2	8.2	51.9	116.8	186.3	77.5	27.2	1,210.0
79	68.3	34.9	122.5	43.8	341.9	193.8	142.4	67.8	125.3	178.5	95.9	0.0	1,415.1
1980	14.1	177.2	24.1	224.0	228.2	117.0	114.2	110.1	134.1	269.4	16.9	0.0	1,429.3
81	39.4	46.9	121.9	73.4	278.6	89.5	101.8	105.0	120.4	319.8	50.0	0.0	1,346.7
82	43.4	137.2	104.0	51.4	93.4	179.7	99.1	87.6	47.5	230.1	30.7	37.1	1,141.2
83	0.0	9.1	20.3	132.0	147.9	155.3	139.0	19.4	163.4	143.8	49.0	31.0	1,010.2
84	0.0	35.3	265.1	6.9	158.4	180.9	189.4	205.5	87.0	154.8	53.3	0.0	1,336.6
85	16.0	6.9	111.7	90.7	126.9	129.5	283.6	179.2	123.6	136.9	130.6	2.8	1,338.4
86	2.1	212.7	100.2	125.7	186.8	117.3	200.6	21.0	62.1	154.1	45.5	0.0	1,228.1
87	8.5	17.1	155.9	119.3	247.5	134.1	110.9	254.1	206.3	124.6	23.0	7.7	1,409.0
88	21.4	77.5	187.8	174.1	148.6	223.1	134.7	40.3	166.3	83.6	44.7	80.1	1,382.2
89	0.0	5.8	215.8	115.4	150.7	346.4	140.2	148.5	142.2	121.3	43.6	8.6	1,438.5
1990	14.6	36.5	23.1	224.7	123.4	115.8	115.1	21.1	203.0	147.9	39.1	103.4	1,167.7
Ave.	24.0	64.6	117.9	127.2	180.6	201.5	137.3	96.2	142.1	163.7	51.9	35.0	1,342.1
Max.	114.3	212.7	282.7	251.0	376.2	374.4	425.7	254.1	313.7	319.8	130.6	103.4	
Min.	0.0	5.8	14.0	6.9	78.2	51.5	8.2	6.4	24.4	51.4	6.4	0.0	

Table 2.1 Monthly Mean Rainfall (4)

Project : Mankessim  
 Station No. : 23022SAL  
 Station Name : Saltpond

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
1961	31.5	8.6	54.9	104.4	414.3	430.5	73.4	1.0	10.7	1.5	70.6	8.1	1,209.5
62	73.9	14.5	32.0	19.6	185.7	839.9	18.3	24.9	38.3	177.0	179.3	54.1	1,657.5
63	37.6	10.7	11.9	197.6	120.9	319.5	392.6	62.2	20.8	68.6	159.5	8.4	1,410.3
64	27.4	26.4	20.6	239.0	247.9	626.1	11.9	16.5	16.0	0.3	10.4	1.5	1,244.0
65	0.0	32.3	24.6	254.0	190.2	248.9	65.0	27.4	36.6	53.9	106.2	37.1	1,076.2
66	6.6	3.3	80.8	129.3	204.9	74.2	200.4	51.6	17.8	31.7	53.9	26.9	881.4
67	20.8	6.6	47.2	89.9	211.8	552.7	5.3	13.5	78.7	13.2	58.7	3.3	1,101.7
68	44.7	56.6	29.7	72.4	132.1	258.8	369.0	167.9	122.2	159.5	80.8	0.0	1,493.7
69	1.5	11.7	82.0	17.5	188.9	342.1	52.8	11.9	23.1	231.1	37.6	74.4	1,074.6
1970	13.2	11.2	48.8	101.3	323.1	225.0	15.2	10.9	10.4	94.7	34.3	10.2	898.3
71	25.4	12.2	44.5	170.9	73.4	546.1	117.9	23.6	16.0	0.0	20.8	12.9	1,063.7
72	0.0	69.6	122.9	154.9	55.4	294.4	19.8	9.1	24.6	48.5	33.5	51.1	883.8
73	1.3	12.7	137.4	72.1	219.7	393.7	78.2	92.7	91.2	105.9	1.3	51.3	1,257.5
74	11.4	61.0	80.0	99.1	260.9	668.5	75.9	80.8	217.9	58.9	5.1	34.3	1,653.8
75	0.0	52.1	81.5	52.3	170.9	231.6	57.9	15.0	4.3	33.0	102.4	4.1	805.1
76	0.0	121.9	59.2	177.1	98.2	85.7	7.0	77.8	4.3	16.3	99.0	5.7	752.2
77	21.9	42.0	21.6	142.5	99.7	199.2	8.1	13.2	10.1	44.9	12.2	0.3	615.7
78	1.4	11.2	10.0	151.6	155.8	105.1	38.4	4.5	21.1	48.1	83.6	18.6	649.4
79	0.0	41.1	65.9	124.9	197.8	378.0	74.3	113.0	74.8	311.3	94.0	3.5	1,478.6
1980	0.4	12.5	90.8	55.6	354.9	133.7	113.9	43.4	60.0	156.7	124.9	0.8	1,147.6
81	4.9	7.4	66.5	27.3	387.6	256.1	33.3	31.0	88.6	79.3	32.2	65.3	1,079.5
82	10.3	35.5	69.4	154.5	338.5	351.3	116.7	10.9	0.6	171.9	10.7	11.7	1,282.0
83	0.0	0.0	0.0	19.0	230.9	86.2	3.7	7.0	26.4	10.0	69.6	17.4	470.2
84	35.3	0.0	7.8	94.0	156.8	88.8	34.0	63.5	66.7	121.0	26.1	11.0	705.0
85	54.6	28.1	63.7	75.1	465.0	321.7	38.2	15.9	24.1	45.4	35.6	0.0	1,167.4
86	4.3	50.7	32.5	72.9	141.0	334.8	32.1	10.3	7.9	87.0	119.3	13.4	906.2
87	9.5	0.0	113.0	42.2	85.0	31.7	67.7	108.9	374.9	217.2	34.1	42.6	1,126.8
88	0.0	18.7	60.9	30.9	176.6	234.1	35.5	11.8	129.2	167.9	20.5	23.9	910.0
89	10.6	5.2	121.8	88.7	195.4	314.1	46.3	16.0	24.4	82.8	2.2	0.0	907.5
1990	7.0	0.6	60.4	53.4	59.5	108.1	25.7	2.4	33.3	120.9	25.1	97.7	594.1
91	39.3	13.5	0.0	118.2	433.8	108.1	259.5	51.3	52.5	57.0	1.0	0.0	1,134.2
92	0.0	5.6	62.0	82.7	136.5	156.3	21.0	5.2	54.6	28.9	24.0	24.8	601.6
93	17.0	27.1	73.9	45.5	57.6	143.9	1.6	21.6	65.6	41.3	44.3	14.6	554.0
94	30.4	27.6	102.0	48.6	275.3	196.1	13.9	11.7	85.5	173.0	80.1	2.5	1,046.7
95	0.0	0.0	93.3	222.9	225.7	242.1	154.9	42.6	22.9	23.5	43.5	4.3	1,075.7
Ave	15.5	23.9	59.2	102.9	207.8	283.6	76.6	36.3	55.9	88.1	55.3	21.0	1,026.2
Max	73.9	121.9	137.4	254.0	465.0	839.9	392.6	167.9	374.9	311.3	179.3	97.7	
Min	0.0	0.0	0.0	17.5	55.4	31.7	1.6	1.0	0.6	0.0	1.0	0.0	

**Table 2.1 Monthly Mean Rainfall (5)**

Project : Okyereko  
 Station No. :  
 Station Name : Okyereko

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
1978	0.0	11.2	3.2	104.2	151.2	112.6	22.6	7.0	6.1	99.8	40.1	22.1	580.1
79	0.0	53.3	70.5	65.5	158.5	304.2	63.3	72.3	68.6	226.1	117.2	22.1	1,221.6
1980	6.9	19.6	36.5	137.7	205.6	227.4	81.5	64.6	69.6	104.8	45.4	9.4	1,009.0
81	13.0	31.6	64.8	95.6	319.1	226.0	20.4	55.9	76.1	44.1	7.5	15.0	969.1
82	23.9	0.0	69.9	173.6	219.4	54.2	92.9	0.0	2.5	99.4	19.9	30.3	786.0
83	0.0	0.0	22.0	47.0	76.2	109.2	0.0	15.9	45.6	0.0	69.1	54.7	439.7
84	31.9	0.0	0.0	128.1	136.9	75.9	60.0	30.3	38.3	110.9	35.6	7.4	655.3
85	16.1	0.0	105.0	3.1	550.7	139.6	172.9	54.6	27.7	88.0	44.7	1.7	1,154.1
86	34.0	5.2	27.6	44.9	137.1	143.7	107.1	0.0	25.0	87.3	24.5	6.3	642.7
87	5.7	0.0	184.4	46.5	110.2	92.1	63.9	154.2	214.0	158.0	4.0	18.7	1,051.7
88	0.0	121.6	39.7	40.2	112.2	165.8	32.2	12.5	50.2	97.4	22.7	14.8	709.3
89	0.0	21.7	66.0	63.3	155.1	231.8	11.4	60.5	42.0	62.8	10.6	0.0	725.2
1990	0.0	31.0	6.0	58.3	14.4	331.8	49.4	3.0	41.0	98.4	21.8	127.8	782.9
91	51.4	52.4	40.5	134.8	289.8	74.8	74.6	232.0	20.9	29.6	53.5	5.2	1,059.5
92	0.0	0.0	4.6	29.2	195.3	43.0	45.0	4.0	53.0	47.0	93.0	28.4	542.5
93	31.4	24.5	2.7	62.4	0.0	170.9	11.5	34.4	100.2	82.7	79.3	18.3	618.3
94	32.5	9.0	48.3	12.7	147.8	255.5	33.0	31.1	67.4	66.1	40.1	0.0	743.5
95	0.0	20.0	45.2	32.1	128.2	189.1	85.5	0.0	0.0	67.0			
Ave.	13.7	22.3	46.5	71.1	172.7	163.8	54.3	46.2	52.7	87.2	42.9	22.5	795.7
Max.	51.4	121.6	184.4	173.6	550.7	331.8	122.9	232.0	214.0	226.1	117.2	127.8	
Min.	0.0	0.0	0.0	3.1	0.0	43.0	0.0	0.0	0.0	0.0	4.0	0.0	

Table 2.2 Monthly Mean Meteorological Data (1)

Project: Ashaiman

Item	Station	Period	Unit	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Tot/Ave.
Rainfall	Tema	1961-94	(mm)	7.3	24.0	48.8	89.6	129.0	178.6	57.8	18.5	49.9	57.4	21.4	16.0	698.2
	Tema	1985-94	(mm)	4.1	21.4	32.7	69.5	132.9	108.5	37.8	15.0	55.9	57.9	15.3	34.4	575.5
	Ashaiman	1992-96	(mm)	3.7	7.6	78.2	75.8	130.6	124.7	57.7	19.0	37.2	59.2	30.9	4.7	629.2
Max. Temperature	Tema	1961-90	(C)	30.4	30.9	31.0	31.0	30.5	28.8	27.3	26.7	27.5	29.2	30.5	30.5	29.5
	Ashaiman	1991-95	(C)	31.7	31.6	31.8	31.4	30.5	28.3	26.8	27.4	28.5	29.9	31.2	31.3	30.0
Min. Temperature	Tema	1961-90	(C)	24.0	24.8	25.0	25.0	24.6	23.7	22.9	22.2	22.7	22.7	22.9	23.4	23.9
	Ashaiman	1991-95	(C)	22.4	24.1	24.4	25.0	24.3	22.9	22.2	22.2	22.7	22.9	23.4	23.1	23.3
Mean Temperature	Tema	1961-90	(C)	27.2	27.9	28.1	28.0	27.5	26.2	25.0	24.7	25.1	26.4	27.3	27.3	26.7
	Ashaiman	1991-95	(C)	24.8	26.0	26.3	26.5	25.9	24.6	23.6	23.5	23.9	24.7	25.3	25.3	25.0
Rel. Humidity	Tema	1965-90	(%)	79	82	82	82	83	86	88	88	87	84	83	81	84
Sunshine Hours	Accra	1961-90	(hours)	6.8	6.9	6.9	7.0	6.9	5.1	4.7	4.9	5.9	7.5	7.9	6.9	6.5
Wind Velocity	Tema	1965-90	(m/s)	2.6	3.1	3.1	2.9	2.8	2.4	2.9	3.1	3.4	3.2	2.8	2.4	2.9
	Ashaiman	1991-95	(m/s)	1.8	2.2	2.4	2.2	2.3	1.9	2.7	2.6	2.5	2.2	1.7	1.6	2.2
A-dan Evaporation	Ashaiman	1991-96	(mm)	172.2	194.2	215.6	180.5	159.6	115.5	111.7	126.6	141.8	168.6	156.0	143.7	1885.7

Project: Aveyime

Item	Station	Period	Unit	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Tot/Ave.
Rainfall	Akuse	1960-90	(mm)	14.0	52.1	92.6	128.9	149.9	204.7	91.5	54.6	141.8	132.0	82.1	55.7	1169.7
	Akuse	1981-90	(mm)	3.4	34.3	85.2	99.2	138.0	188.6	81.3	55.8	131.5	123.7	59.7	31.7	1012.4
	Aveyime	1982-96	(mm)	4.0	35.5	95.6	127.3	149.4	133.3	92.6	32.8	92.0	120.1	53.0	16.7	952.4
Max. Temperature	Akuse	1961-90	(C)	34.0	35.2	34.9	34.1	33.0	31.0	30.0	30.3	31.3	32.2	33.1	32.8	32.7
	Akuse	1961-90	(C)	21.5	23.4	23.9	23.8	23.3	22.5	22.0	21.8	21.9	21.9	21.9	21.3	22.3
Min. Temperature	Akuse	1961-90	(C)	27.8	29.3	29.4	29.0	28.2	26.8	26.0	26.1	26.6	27.1	27.5	27.1	27.5
	Akuse	1961-90	(C)	69	70	73	76	80	84	82	80	81	82	80	75	77
Rel. Humidity	Akuse	1961-90	(hours)	6.5	6.8	6.7	6.7	6.8	5.1	4.5	5.0	6.8	7.5	6.8	6.3	6.1
Sunshine Hours	Akuse	1961-90	(m/s)	0.9	1.3	1.4	1.2	1.0	1.0	1.4	1.5	1.2	0.9	0.8	0.7	1.1
Wind Velocity	Akuse	1961-90	(m/s)	0.9	1.3	1.4	1.2	1.0	1.0	1.4	1.5	1.2	0.9	0.8	0.7	1.1

Table 2.2 Monthly Mean Meteorological Data (2)

Project: Kpando-Torkor																
Item	Station	Period	Unit	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Tot./Ave.
Rainfall	Ho	1961-90	(mm)	24.0	64.6	117.9	127.2	180.6	201.5	137.3	96.2	142.1	163.7	51.9	35.0	1342.1
	Ho	1981-90	(mm)	14.5	58.5	130.6	111.4	166.2	167.2	151.4	108.2	132.2	161.7	51.0	27.1	1279.9
	Kpando	1985-94	(mm)	4.3	21.5	54.2	109.5	122.7	166.8	222.6	177.4	199.3	140.6	46.6	18.9	1284.7
Max. Temperature	Ho	1961-90	(°C)	33.8	34.8	34.0	33.1	32.0	29.9	28.8	29.0	30.0	31.3	32.9	32.8	31.9
Min. Temperature	Ho	1961-90	(°C)	22.1	23.1	23.3	23.4	23.0	22.2	21.6	21.3	21.5	21.9	22.4	22.1	22.3
Mean Temperature	Ho	1961-90	(°C)	27.9	29.0	28.7	28.2	27.5	26.1	25.2	25.2	25.8	26.6	27.2	27.4	27.1
Rel. Humidity	Ho	1961-90	(%)	65	68	73	77	80	85	85	84	83	82	82	76	77
Sunshine Hours	Ho	1961-90	(hours)	7.0	7.1	7.0	7.3	7.5	5.9	4.6	4.2	4.9	7.1	8.3	7.1	6.5
Wind Velocity	Ho	1961-90	(m/s)	0.8	0.8	0.9	0.9	0.8	0.9	0.9	0.9	0.9	0.8	0.7	0.7	0.8
A-pan Evaporation	Ho	4 years	(mm)	191.2	196.9	187.0	170.0	161.2	128.3	97.1	102.3	114.0	143.6	151.0	158.1	1800.8

Project: Okereveko, Mankessijim																
Item	Station	Period	Unit	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Tot./Ave.
Rainfall	Saltpond	1961-94	(mm)	15.9	24.7	58.2	99.4	207.2	284.9	74.3	36.1	56.9	90.0	55.7	21.5	1024.7
	Saltpond	1985-94	(mm)	17.3	17.7	69.0	65.8	202.6	194.9	54.2	25.5	85.2	102.1	38.6	22.0	894.9
	Okereveko	1985-94	(mm)	17.1	26.5	52.5	49.5	171.3	164.9	55.1	58.6	64.1	81.7	39.4	22.1	803.0
Max. Temperature	Saltpond	1961-90	(°C)	30.6	31.3	31.3	31.2	30.3	28.5	27.2	26.6	27.4	29.2	30.8	30.6	29.6
Min. Temperature	Saltpond	1961-90	(°C)	22.9	23.8	23.9	23.9	23.6	23.1	22.5	21.9	22.2	22.8	23.0	22.9	23.0
Mean Temperature	Saltpond	1961-90	(°C)	26.8	27.6	27.6	27.6	27.0	25.8	24.9	24.3	24.8	26.0	26.9	26.8	26.3
Rel. Humidity	Saltpond	1961-90	(%)	83	84	84	84	86	88	89	90	89	87	85	84	86
Sunshine Hours	Saltpond	27 years	(hours)	7.0	7.3	7.2	7.0	6.9	5.0	4.8	4.6	5.4	7.3	8.2	7.2	6.5
Wind Velocity	Saltpond	21 years	(m/s)	1.5	1.8	1.8	1.7	1.7	1.8	1.6	1.5	1.7	2.0	1.6	1.3	1.7
A-pan Evaporation	Saltpond	7 years	(mm)	115.2	133.8	163.4	160.3	155.4	128.0	119.6	115.1	139.5	166.5	170.5	129.7	1697.1

Table 2.3 Potential Evapotranspiration (Etp)

Potential Evapotranspiration (Etp) Estimated by Modified Penman Method

Description	(mm/day)											
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1 Ashaiman	5.0	5.4	5.7	5.6	5.2	4.1	3.8	4.0	4.5	5.3	5.3	4.8
2 Aveyime	4.8	5.6	5.7	5.4	4.9	4.0	3.9	3.3	4.3	4.7	4.8	4.4
3 Kpando-Torkor	5.0	5.4	5.5	5.4	5.0	4.1	3.7	3.7	4.1	4.8	5.1	4.7
4 Mankessim	4.5	5.1	5.3	5.2	4.8	3.8	3.6	3.6	4.0	4.8	4.9	4.4
5 Okyereko	4.5	5.1	5.3	5.2	4.8	3.8	3.6	3.6	4.0	4.8	4.9	4.4



Table 2.4 Water Balance Study for Okyereko Project

Summary of Water Balance Study for Okyereko Project

Irrigation Area 81 ha

Year	Initial (MCM) (1)	Runoff (MCM) (2)	Pump Water (MCM) (3)	Evaporation (MCM) (4)	Loss (MCM) (5)	Irrigation Use (MCM) (6)	Balance (MCM) (7)	Minimum Capacity	Comment
1986	2.860	0.447	1.457	1.290	0.108	1.426	1.940	1.636	O.K.
1987	1.940	0.833	1.457	0.982	0.071	1.544	1.632	0.895	O.K.
1988	1.632	0.515	1.457	0.883	0.061	1.452	1.208	0.733	O.K.
1989	1.208	0.514	1.457	0.749	0.050	1.398	0.981	0.526	O.K.
1990	0.981	0.502	1.457	0.578	0.034	1.341	0.987	0.207	No
1991	0.987	1.659	1.457	0.906	0.073	1.317	1.807	0.367	O.K.
1992	1.807	0.367	1.457	0.923	0.065	1.554	1.090	0.911	O.K.
1993	1.090	0.343	1.457	0.612	0.036	1.520	0.720	0.250	O.K.
1994	0.720	0.496	1.457	0.516	0.030	1.347	0.780	0.141	No
1995	0.780	0.800	1.457	0.626	0.041	1.383	0.986	0.292	O.K.

Note : Effective Dam Capacity 2.610 (2.860-0.250) MCM

(7) = (1) + (2) + (3) - (4) - (5) - (6)

"O.K." means that irrigation is possible for 81 ha.

"No" means that irrigation is not possible for 81 ha because minimum capacity becomes less than effective capacity.

**Table 2.5 Basic Design Drawings**

Plate No.	Drawing No.	Title
<b>I. GENERAL</b>		
1	GN-1	LOCATION MAP
2	GN-2	TYPICAL SECTIONS OF FLUME, DRAIN AND ROAD
3	GN-3	TURNOUT
4	GN-4	DROP
5	GN-5	FIELD INLET
6	GN-6	CULVERT, TYPE-A & B
7	GN-7	CROSS DRAIN, TYPE-A & B
8	GN-9	TYPICAL LAYOUT OF FARM PLOT AND GREEN BELT
9	GN-10	PROJECT OFFICE
10	GN-11	DRY YARD AND SORTER HOUSE
11	GN-12	STORE HOUSE
12	GN-13	GARAGE
<b>II. ASHAIMAN PROJECT</b>		
13	AS-1	PROJECT LAYOUT MAP
14	AS-2	PROJECT LAYOUT MAP
15	AS-3	DIAGRAM FOR IRRIGATION AND DRAINAGE SYSTEM
16	AS-4	PROFILE OF MAIN IRRIGATION CANAL
17	AS-5	PROFILE OF MAIN DRAIN
18	AS-6	TURNOUT NO.7 ON THE MAIN CANAL
19	AS-7	CHUTE
20	AS-8	CAUSEWAY
<b>III. AVEYIME PROJECT</b>		
21	AV-1	PROJECT LAYOUT MAP
22	AV-2	DIAGRAM FOR IRRIGATION AND DRAINAGE SYSTEM
23	AV-3	GENERAL LAYOUT FOR PUMP STATION
24	AV-4	PUMP STATION
25	AV-5	MAIN PIPELINE
26	AV-6	NO.6
27	AV-7	PROFILE OF LEFT MAIN DRAIN
28	AV-8	PROFILE OF RIGHT MAIN DRAIN
29	AV-9	OUTLET AND DISTRIBUTION BOX FOR MAIN IRRIGATION CANAL
30	AV-10	TURNOUT NO.1 ON THE MAIN CANAL
<b>IV. KPANDO-TORKOR PROJECT</b>		
31	KP-1	PROJECT LAYOUT MAP
32	KP-2	DIAGRAM FOR IRRIGATION AND DRAINAGE SYSTEM
33	KP-3	GENERAL LAYOUT FOR PUMP STATION AND HEADRACE
34	KP-4	PUMP STATION (1/2)
35	KP-5	PUMP STATION (2/2)
36	KP-6	SMALL PUMP STATION A
37	KP-7	SMALL PUMP STATION B
38	KP-8	SMALL PUMP STATION C
39	KP-9	PROFILE OF MAIN PIPELINE
40	KP-10	PROFILE OF MAIN CANAL
<b>V. MANKESSIM PROJECT</b>		
41	MA-1	PROJECT LAYOUT MAP
42	MA-2	DIAGRAM FOR IRRIGATION AND DRAINAGE SYSTEM
43	MA-3	PUMP STATION
<b>VI. OKYEREKO PROJECT</b>		
44	OK-1	PROJECT LAYOUT MAP
45	OK-2	DIAGRAM FOR IRRIGATION AND DRAINAGE SYSTEM
46	OK-3	GENERAL LAYOUT OF INTAKE WEIR
47	OK-4	PLAN OF INTAKE WEIR
48	OK-5	TYPICAL SECTION OF INTAKE WEIR
49	OK-6	SECTION OF INLET CHANNEL
50	OK-7	GENERAL LAYOUT OF PUMP STATION
51	OK-8	PUMP STATION
52	OK-9	PROFILE OF MAIN PIPELINE
53	OK-10	OUTLET AND CHUTE
54	OK-11	PROFILE OF LEFT MAIN IRRIGATION CANAL
55	OK-12	PROFILE OF RIGHT MAIN IRRIGATION CANAL
56	OK-13	PROFILE OF LEFT MAIN DRAIN
<b>VII. BUILDING WORK</b>		
57	BW-1	SITE PLAN FOR ARCHITECTURAL FACILITIES AT ACCRA
58	BW-2	TRAINEE DORMITORY
59	BW-3	DINNING ROOM
60	BW-4	STAFF DORMITORY
61	BW-5	SITE PLAN OF BUILDING FACILITIES AT ASHAIMAN
62	BW-6	TRAINING FACILITIES
63	BW-7	SITE PLAN OF BUILDING FACILITIES AT AVEYIME
64	BW-8	SITE PLAN OF BUILDING FACILITIES AT KPANDO-TORKOR
65	BW-9	SITE PLAN OF BUILDING FACILITIES AT MANKESSIM
66	BW-10	SITE PLAN OF BUILDING FACILITIES AT OKYEREKO
67	BW-11	GUARD HOUSE AND GENERATOR HUT

**Table 2.6 Building Facilities**

Building Facilities	Location							Total Area
	Ashaman	Aveyime	Kpando-Torkor	Mankessim	Okyeroko	Accra City		
Office Building	360	150	150	150	150	-	960	
Training Room/ Laboratory	390	-	-	-	-	-	390	
GIDA Staff Training Dormitory	-	-	-	-	-	390	390	
Farmers' Training Dormitory	-	-	-	-	-	320	320	
Dining Room/Kitchen	-	-	-	-	-	290	290	
Store	-	200	200	-	200	-	600	
Souter House	150	100	100	100	150	-	600	
Garage	192	128	128	128	128	-	704	
Dry Yard	-	-	90	20	150	-	260	
Guard House	-	-	-	-	-	7	7	
Shallow Well	-	○	○	○	○	-	4 sites	
Diesel Generator	-	○	○	○	○	-	1 site	
<b>Total : Nos.of Facilities</b>	<b>4 Buildings</b>	<b>4 Buildings</b>	<b>4 Builds.+1Yard</b>	<b>4 Builds.+1Yard</b>	<b>4 Builds.+1Yard</b>	<b>4 Buildings</b>	<b>24Builds+ 3Yards</b>	
<b>Total : Floor Area (m2)</b>	<b>1,092</b>	<b>578</b>	<b>668</b>	<b>398</b>	<b>778</b>	<b>1,000</b>	<b>4,514</b>	

(Note) ○ : to be provided

**Table 3.1 Operation and Maintenance Cost**

(Unit : Million Cedis)

Item	Name of Project / Site					
	Ashiaman	Aveyime	Kpando-Torkor	Mankessim	Okvereko	Accra Dormitory
1 Manning Cost						
Manager						5.8
Clerk	3.2	3.2	3.2	3.2	3.2	3.2
Labour	4.8	4.8	4.8	4.8	4.8	7.2
2 Machinery Cost						
Excavator (Backhoe 90days x 5 hrs	2.9	-	-	-	-	-
Grader	1.5	-	-	-	-	-
Pick-up	2.3	2.3	2.3	2.3	2.3	-
Micro-bus	1.9	-	-	-	-	-
Tractor	2	2	2	2	2	-
Others	1	1	1	1	1	-
3 Power for Pump						
Electricity	-	9.6	-	5.8	-	-
Diesel	-	-	40.9	-	25.3	-
4 Power for Buildings						
	2.1	0.4	1	1	1	0.8
5 Others						
	0.7	0.7	1.7	0.6	1.2	0.5
<b>Total</b>	<b>22.4</b>	<b>24</b>	<b>56.9</b>	<b>20.7</b>	<b>40.8</b>	<b>17.5</b>
(Cost per ha)	0.40	0.30	0.81	0.71	0.50	-

*Figure*



Fig. 2.1 Tank Model Prepared based on Runoff Pattern of Ashaiman Reservoir

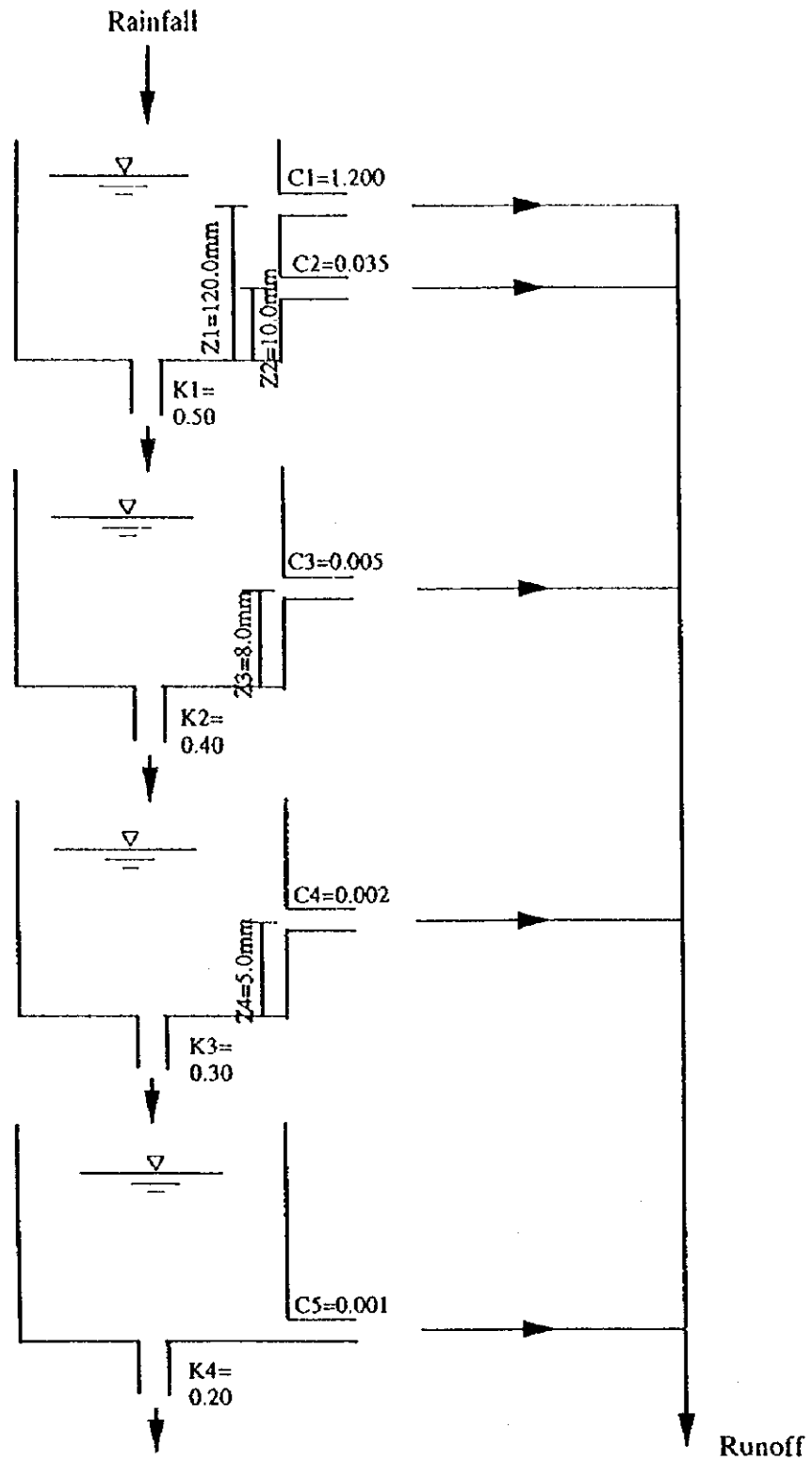
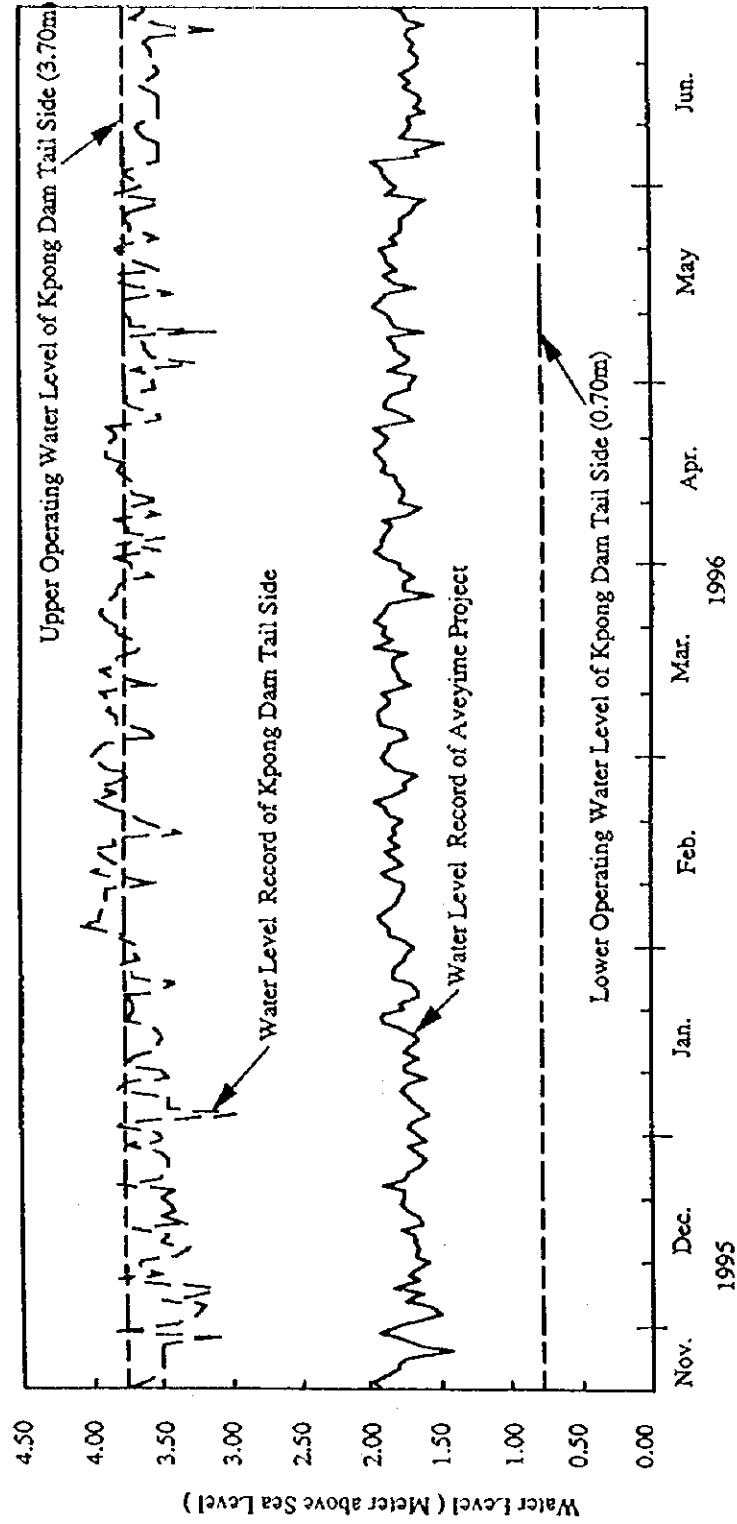


Fig. 2.2 Fluctuation of Water Level at Proposed Pumping Station Site for Aveyime





**Fig. 2.3 Proposed Cropping Pattern (1)**

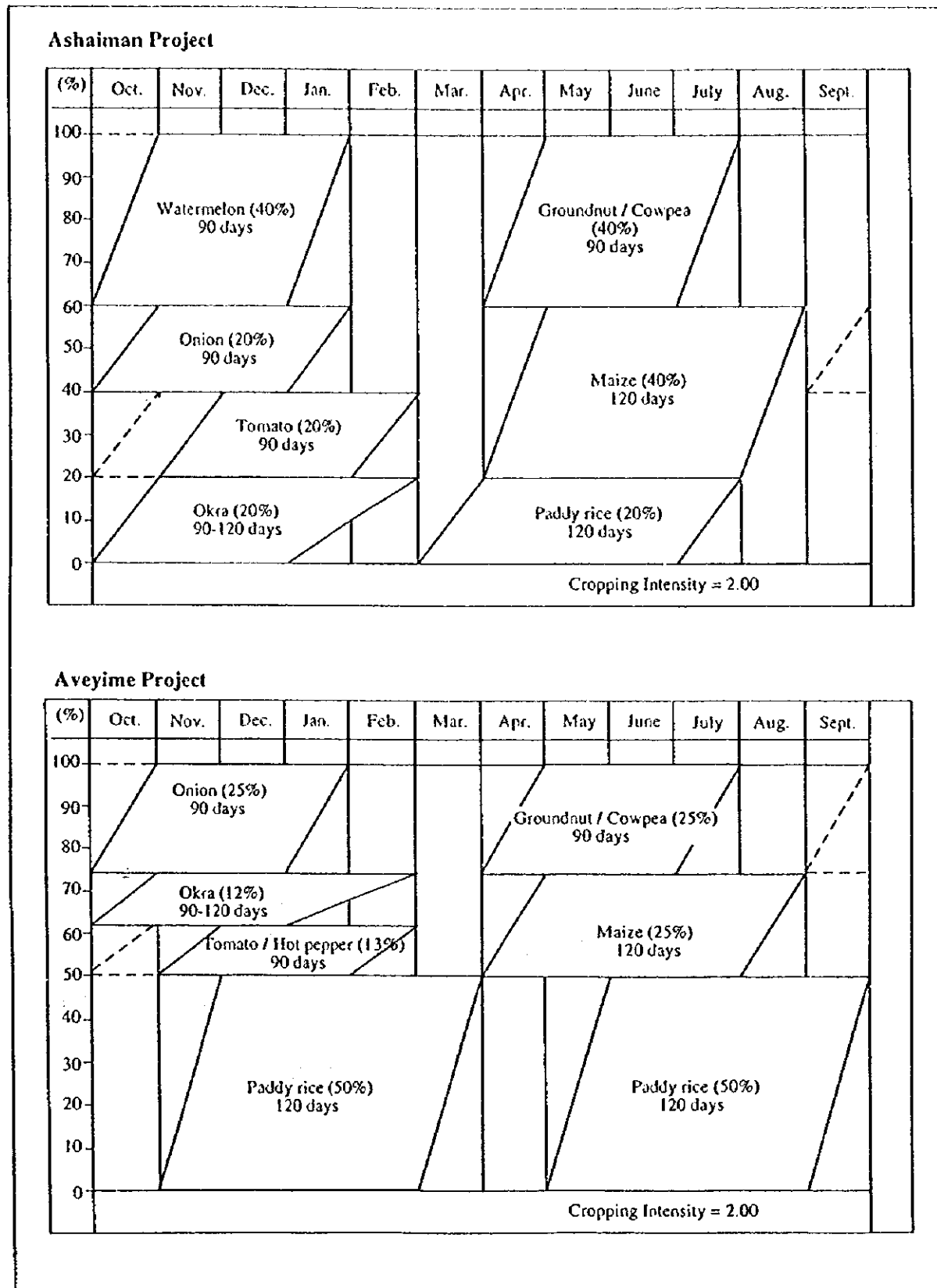
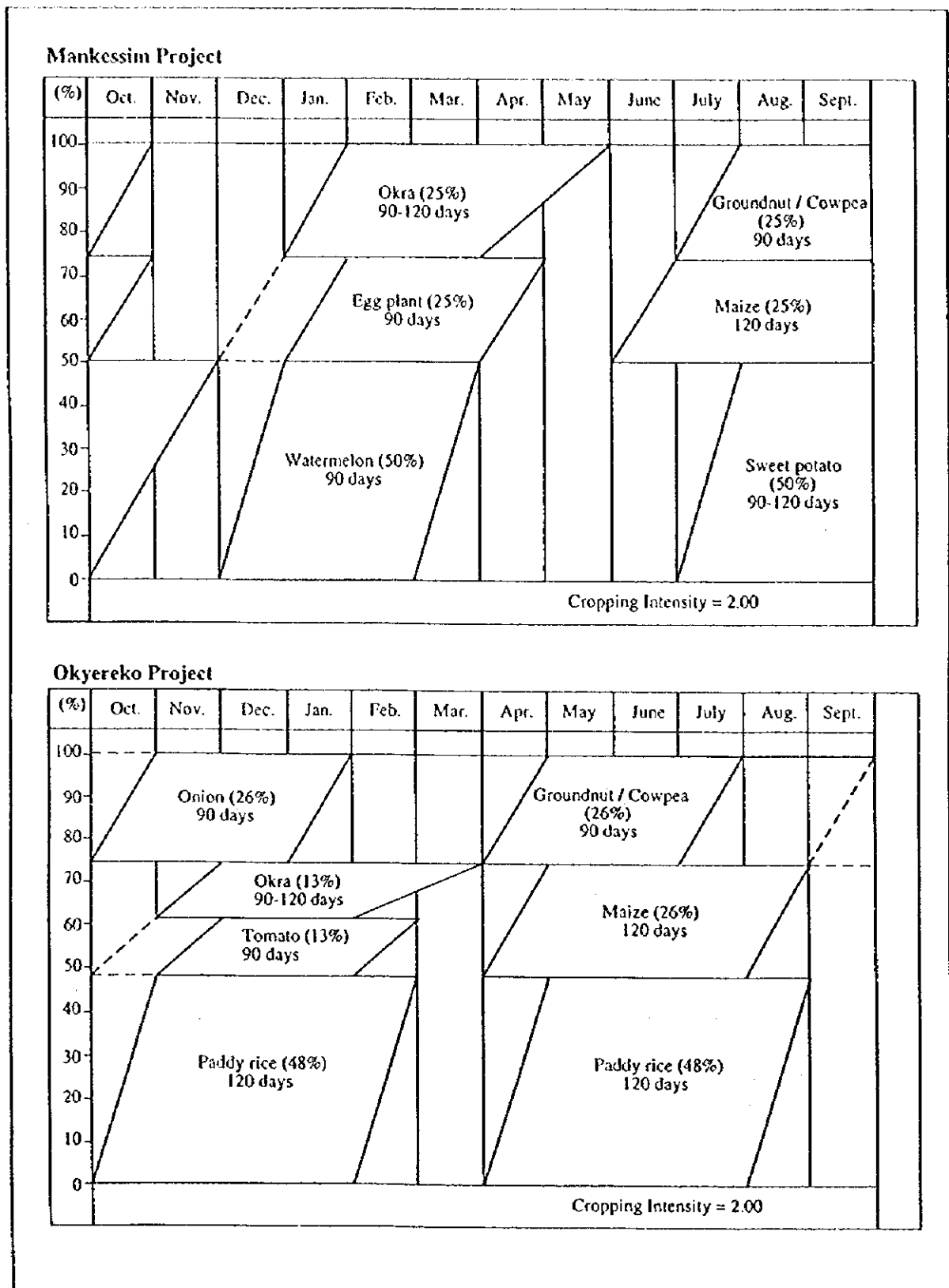


Fig. 2.3 Proposed Cropping Pattern (2)



**Fig. 2.3 Proposed Cropping Pattern (3)**

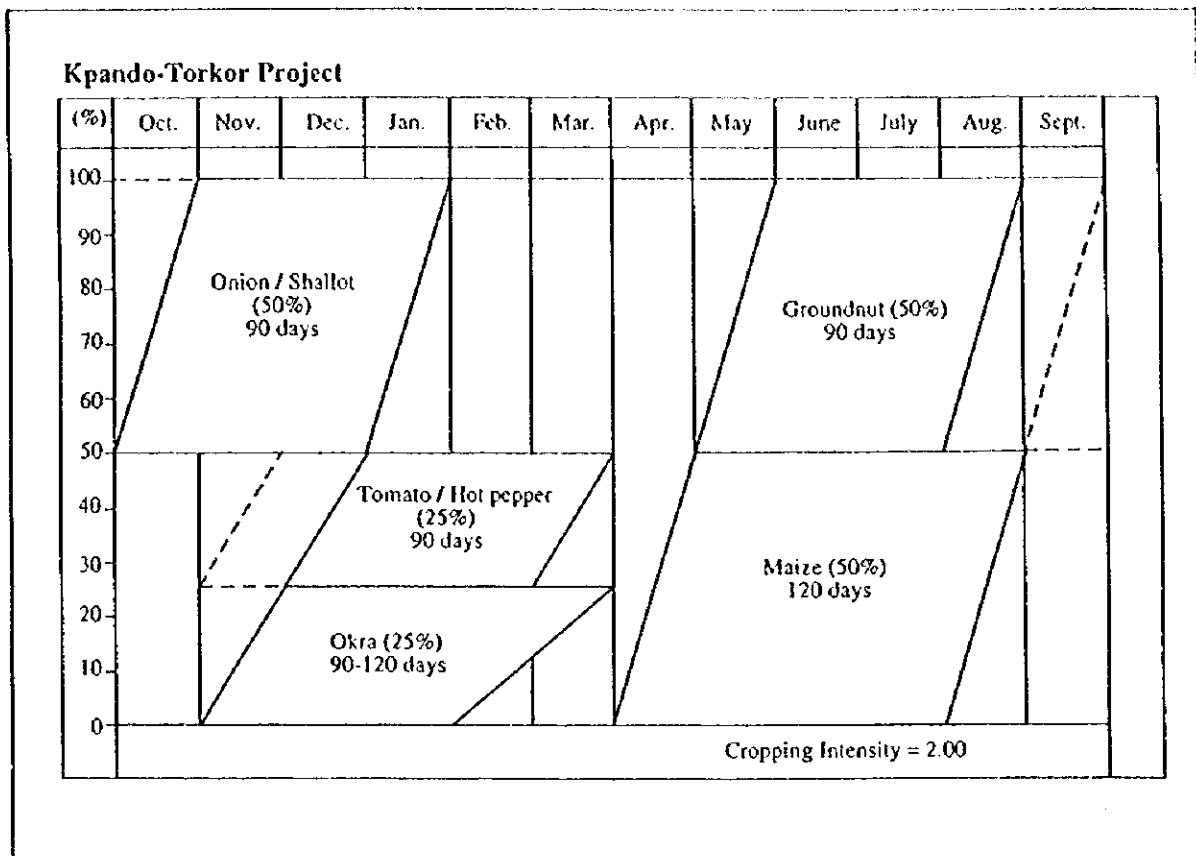


Fig. 2.4 10-day Rainfall and Effective Rainfall

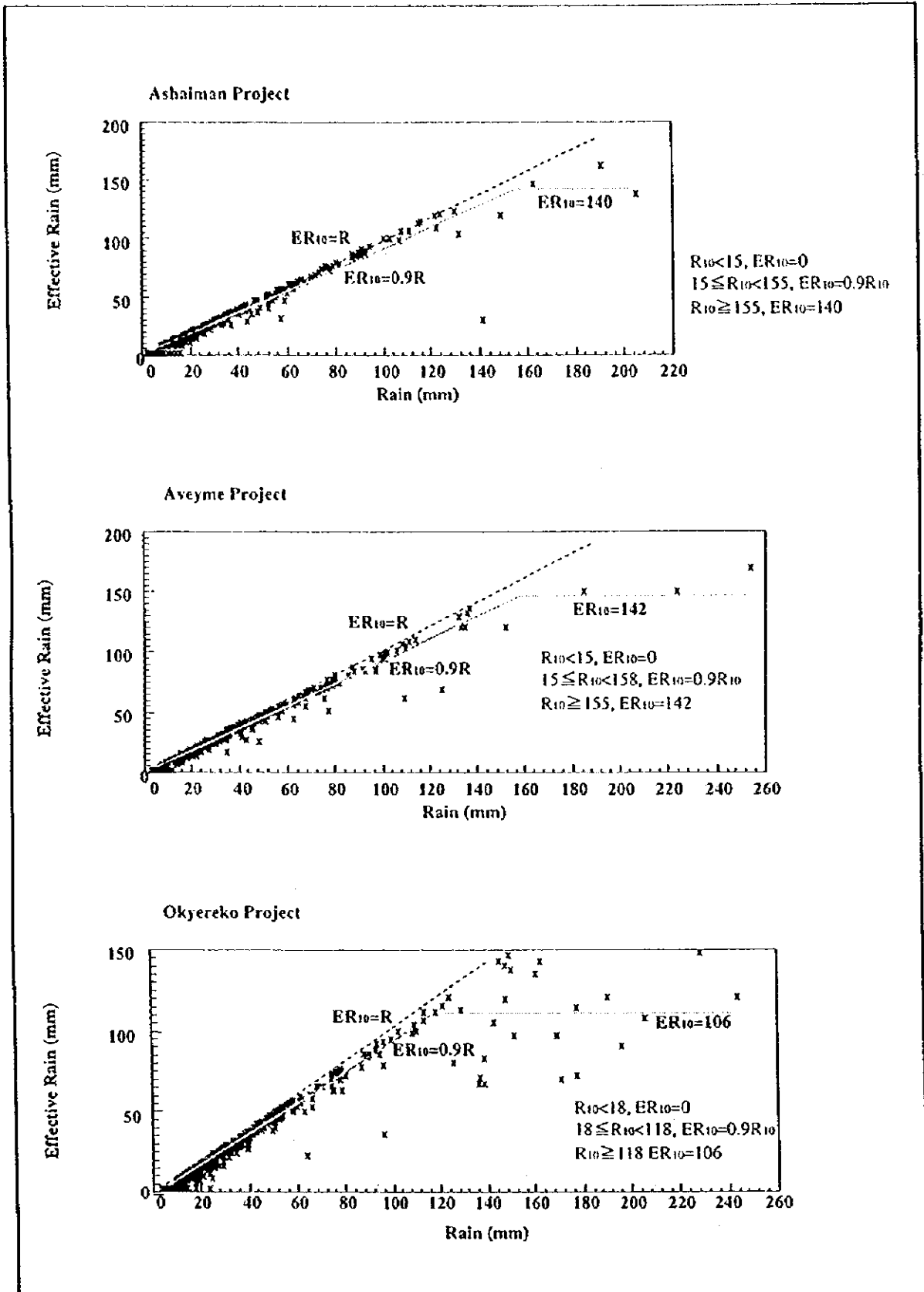


Fig. 2.5 Flood of 10 Year Return Period: The Ayensu River

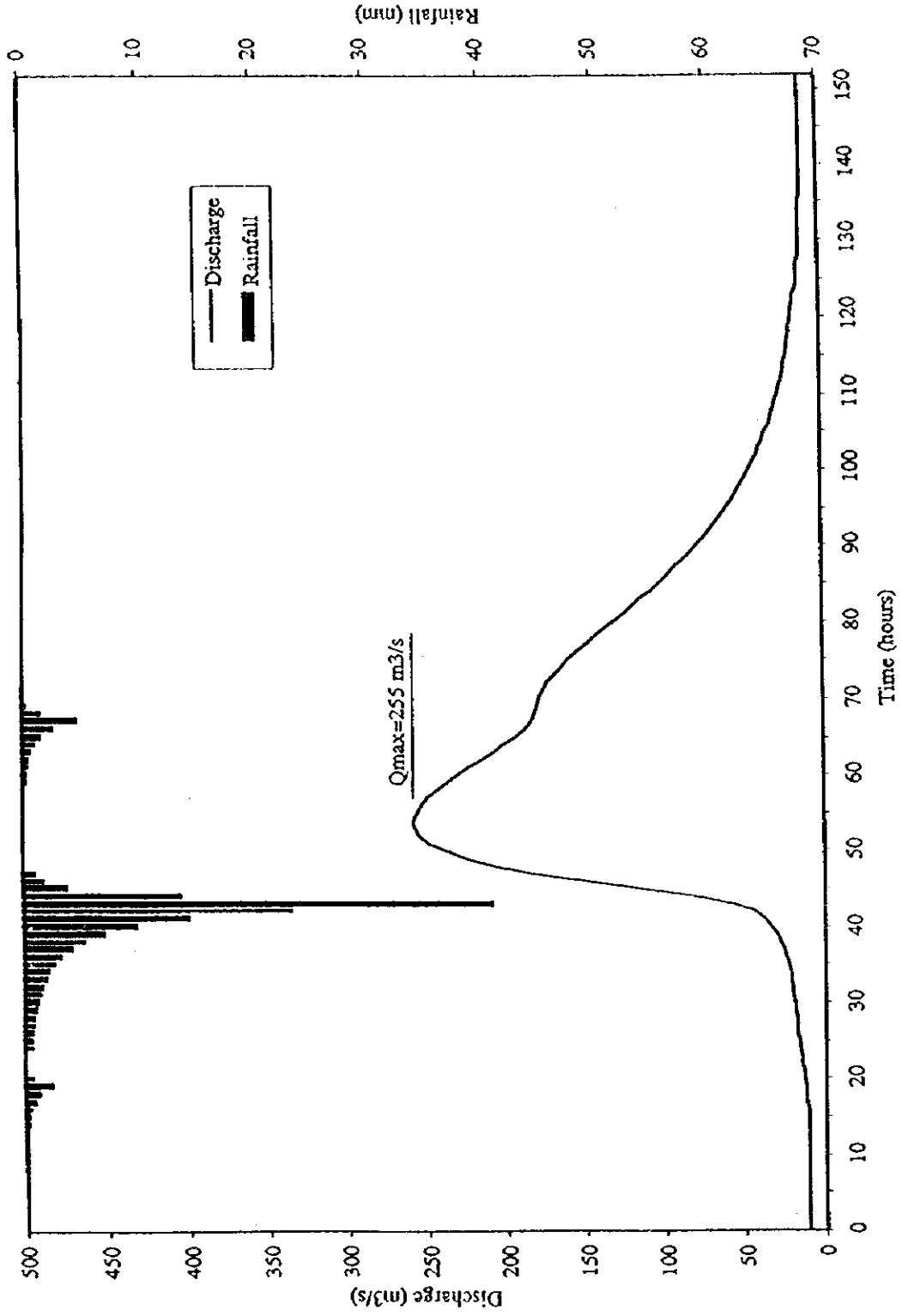


Fig. 2.6 Location of Okyereko Headworks

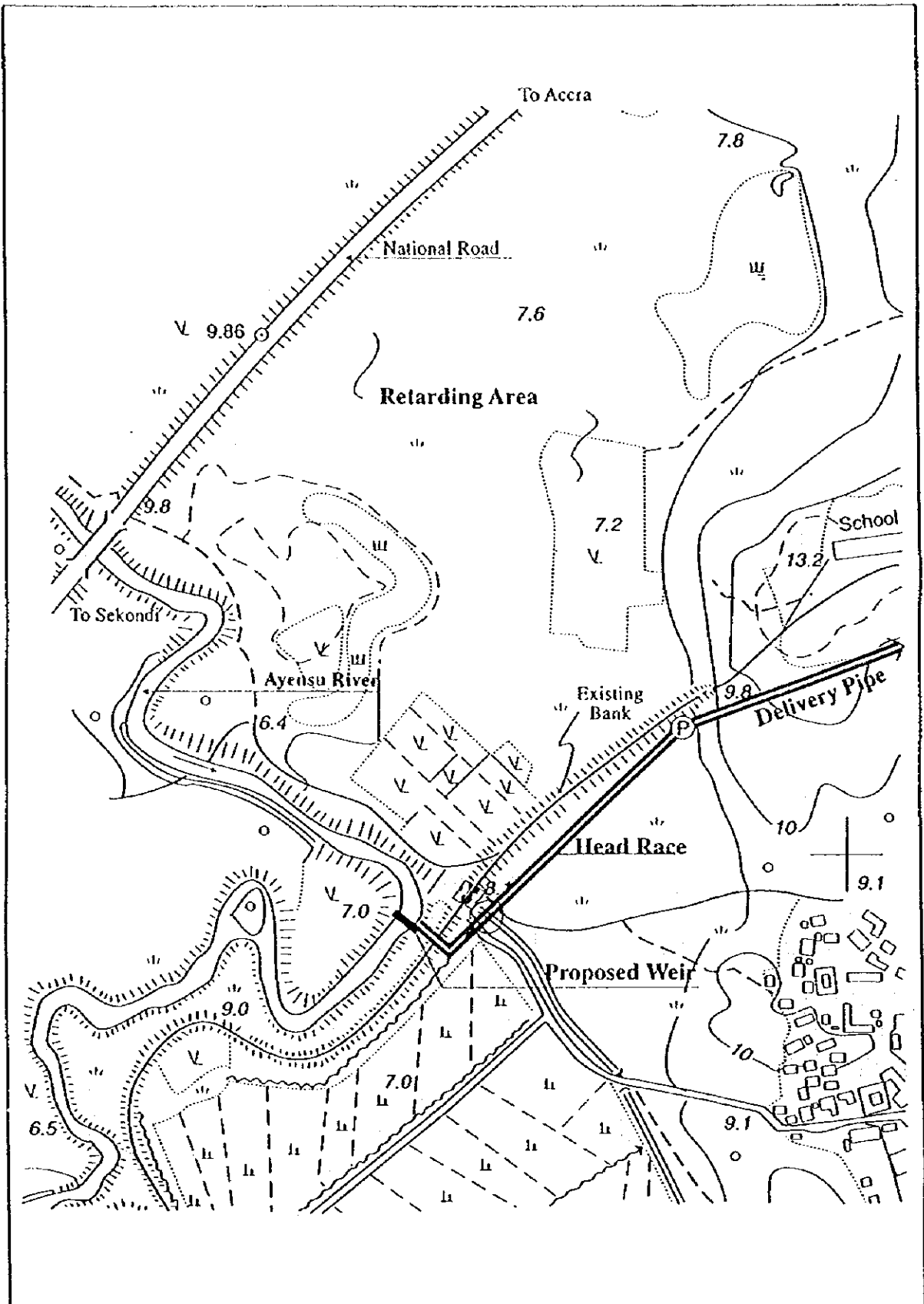


Fig. 3.1 Proposed Organisation of GIDA

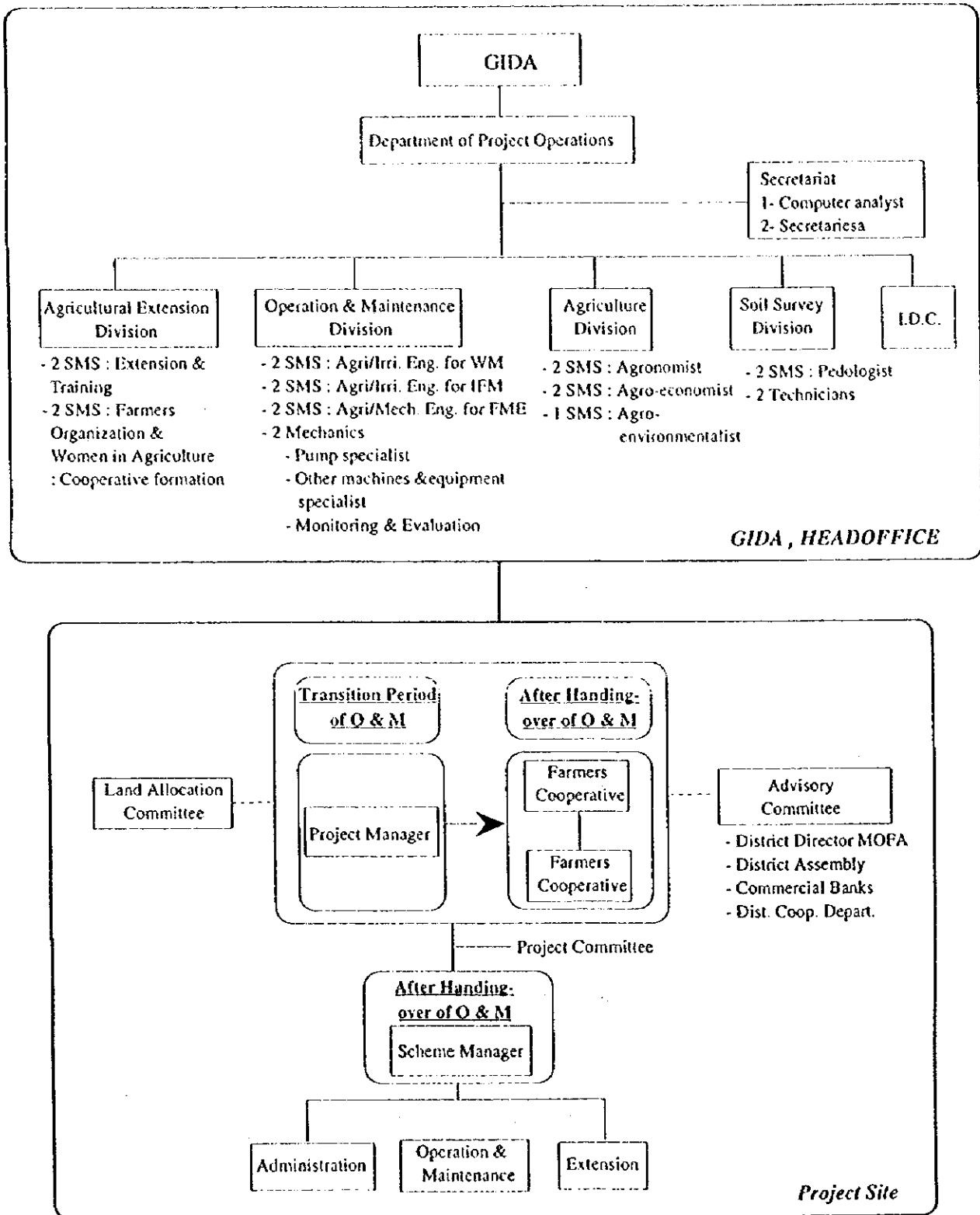
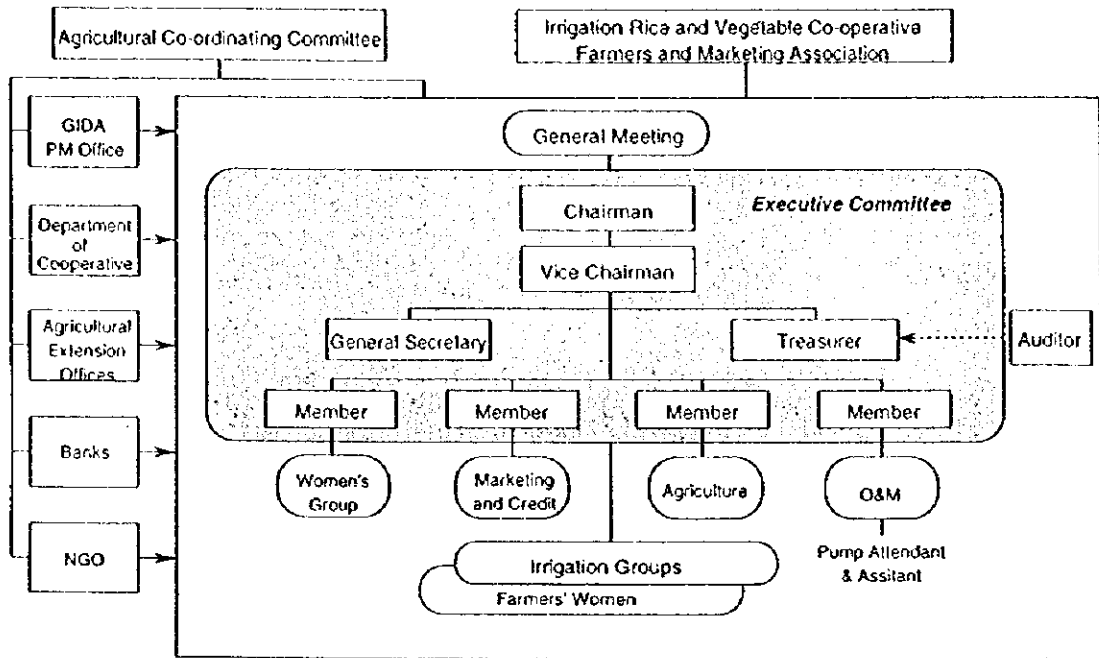
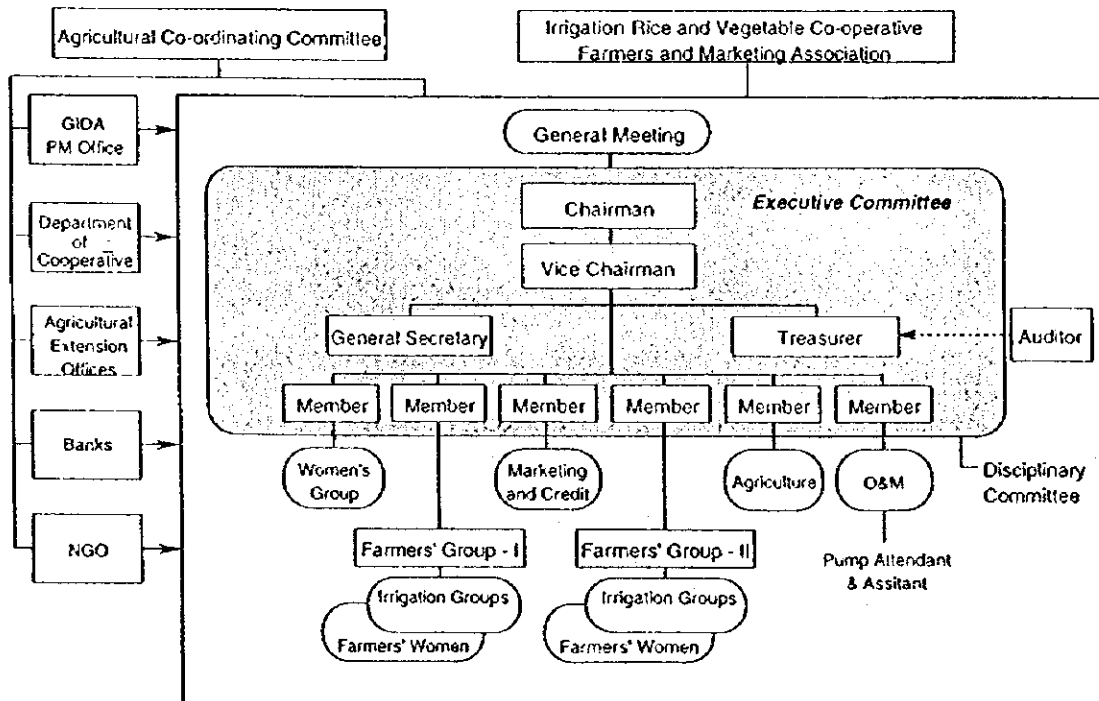


Fig. 3.2 Proposed Organisation of Farmers' Cooperative



Type A



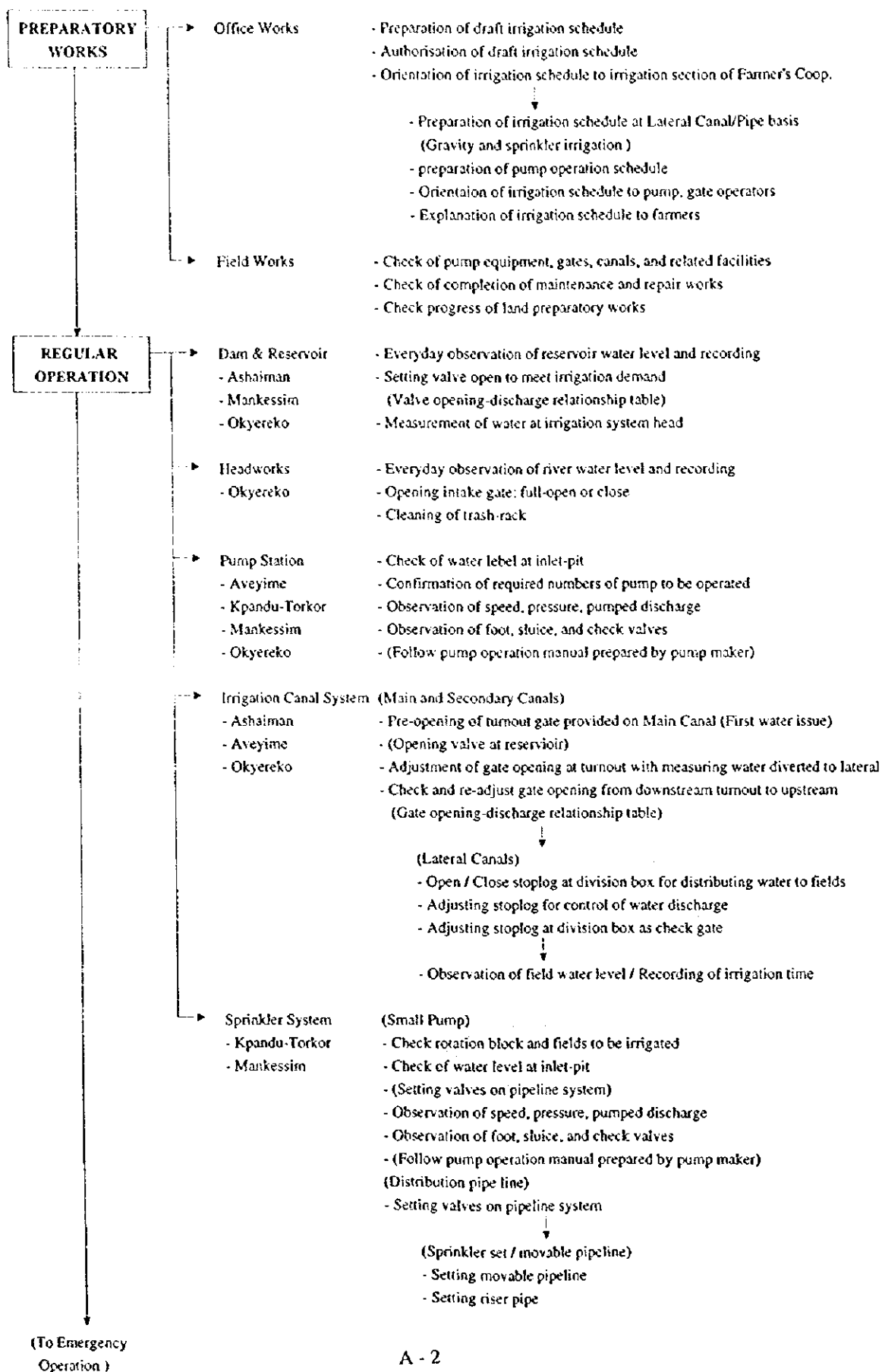
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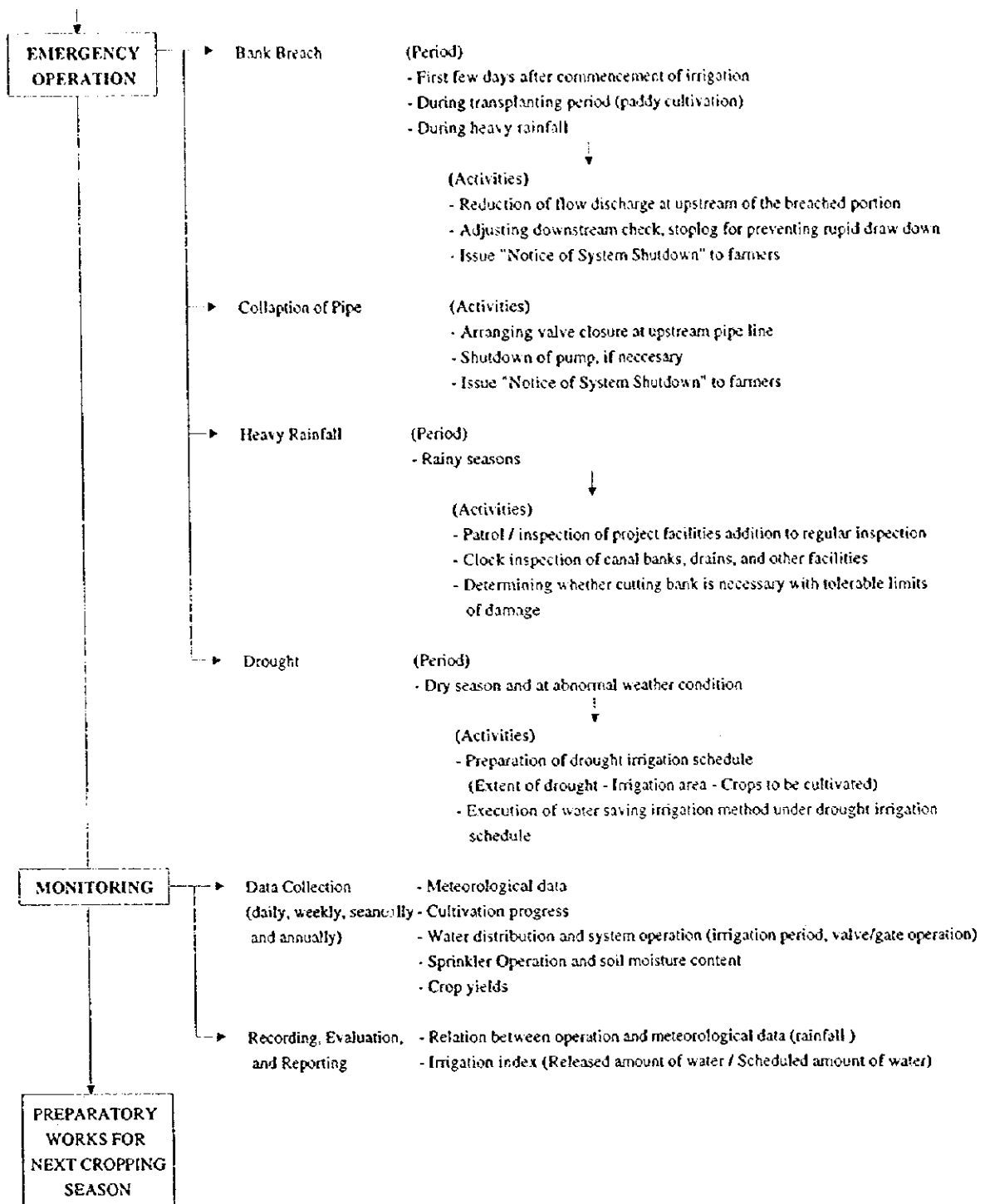


**ATTACHMENT - 1 : OUTLINE OF OPERATION AND  
MAINTENANCE MANUAL**

## OUTLINE OF OPERATION AND MAINTENANCE MANUAL

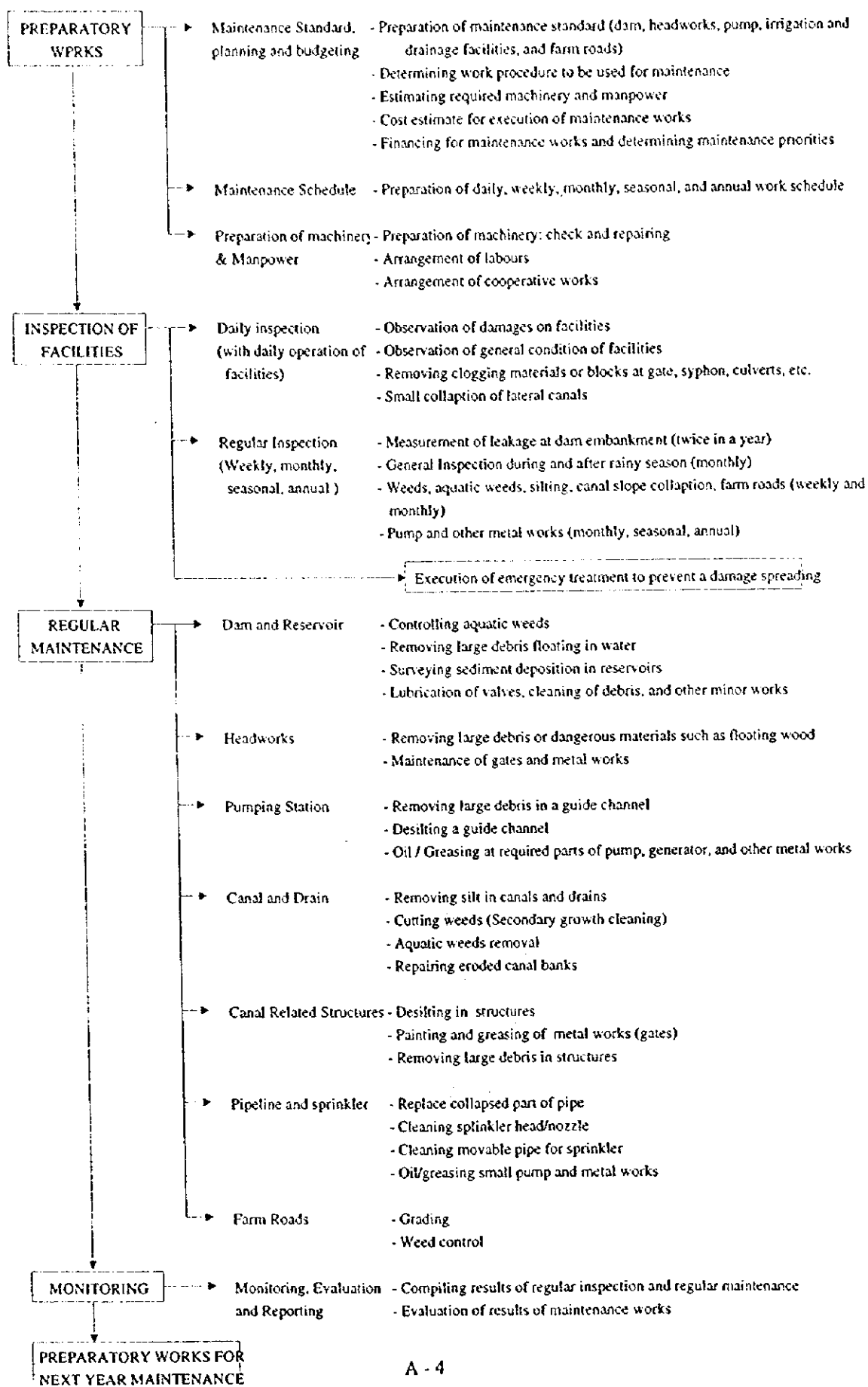
### I. OPERATION



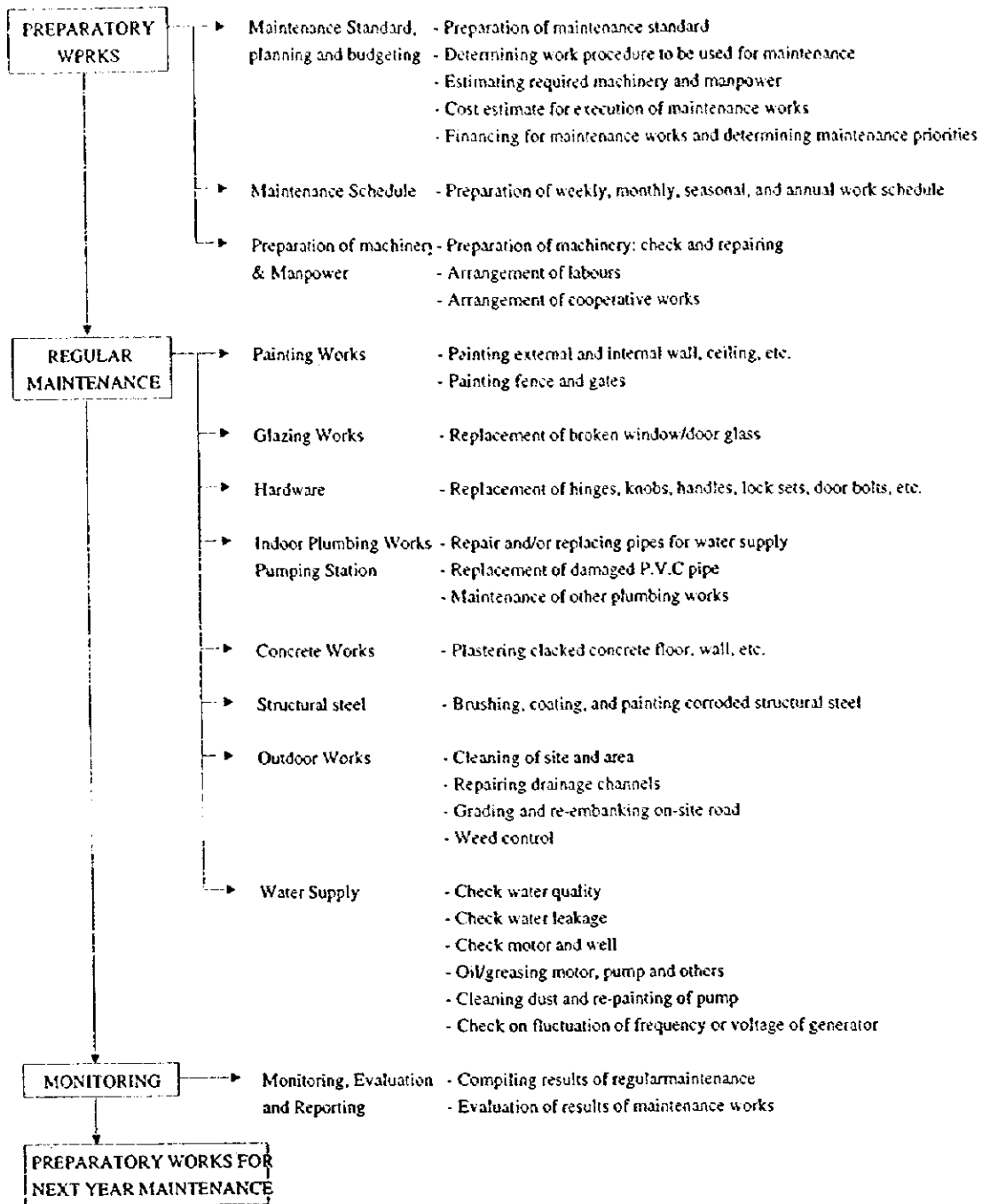


II MAINTENANCE

2.1 IRRIGATION FACILITIES



2.2 BUILDING FACILITIES



2.3 EQUIPMENT AND MACHINERY

to follow O/M manual of each equipment and machinery

## *Appendices*

- 1. Member List of Survey Team*
- 2. Survey Itinerary*
- 3. List of Party Concerned in Ghana*
- 4. Minutes of Discussion*
- 5. Other Relevant Data*
- 6. References*
- 7. Basic Design Drawings*

## ***1. Member List of Survey Team***

## 1 Member List of Survey Team

### Inception Report Explanation and Field Survey Team

Assignment	Name	Position
1. Team Leader	: Katsumi YAMANOME	First Project Study Division, Grant Aid Project Study Department Japan International Cooperation Agency
2. Technical Advisor	: Takashi KATO	Technical Advisor, Ministry of Agriculture, Forestry and Fisheries
3. Chief consultant/ Operation and Maintenance	: Chino IRIE	Nippon Koei Co., Ltd.
4. Facility and Equipment Planner (1) Irrigation and Drainage	: Kiyotaka MIZUSHIMA	Nippon Koei Co., Ltd.
5. Facility and Equipment Planner (2) Building	: Shin HINOMIZU	Nippon Koei Co., Ltd.
6. Cost Estimate and Purchase Planner	: Shigeya OTSUKA	Nippon Koei Co., Ltd.

### The Mission for the Explanation of Draft Basic Design Study Report

Assignment	Name	Position
1. Team Leader	: Masataka NAKAHARA	Director, Agricultural Technical Cooperation Division, Agricultural Development Cooperation Department Japan International Cooperation Agency
2. Coordinator Agricultural Development	: Akihiko SASAKI	Staff, Wage Division Japan International Cooperation Agency
3. Chief consultant/ Operation and Maintenance	: Kunio IRIE	Nippon Koei Co., Ltd.
4. Facility and Equipment Planner (1) Irrigation and Drainage	: Kiyotaka MIZUSHIMA	Nippon Koei Co., Ltd.



## 2. *Survey Itinerary*



## 2. Survey Itinerary

### Inception Report Explanation and Field Survey Team

No.	Date	Movement / Place / Agencies	Station	Activities / Name of Person
1	22-Nov Sat	Narita - Zurich	Zurich	Messrs. Yamanome, Kato, Irie, Mizushima, Otsuka
2	23-Nov Sun	Zurich - Accra	Accra	- do -
3	24-Nov Mon	Japan Embassy / JICA Ghana Office / GIDA / MOFA / MOF	Accra	- do -
4	25-Nov Tue	Accra - Ashaiman - Aveyime - Accra	Accra	Site Reconnaissance to Ashaiman and Aveyime
5	26-Nov Wed	Accra - Okyereko - Mankessim - Accra	Accra	Site Reconnaissance to Ashaiman and Aveyime
6	27-Nov Thu	Accra - Kpando-Torkor - Accra	Accra	Site Reconnaissance to Kpando-Torkor
7	28-Nov Fri		Accra	Discussion at GIDA
8	29-Nov Sat		Accra	Team Meeting
9	30-Nov Sun		Accra	Team Meeting
10	1-Dec Mon		Accra	Discussion at GIDA
11	2-Dec Tue	Leaving	Accra	Signing on the Minutes and reporting the result to Japan Embassy and JICA Ghana Office (Messrs. Yamanome and Kato)
12	3-Dec Wed	London - Accra	Accra	Mr. Hinomizu
13	4-Dec Thu		Accra	Field Survey
14	5-Dec Fri		Accra	Field Survey
15	6-Dec Sat		Accra	Field Survey
16	7-Dec Sun		Accra	Field Survey
17	8-Dec Mon		Accra	Field Survey
18	9-Dec Tue		Accra	Field Survey
19	10-Dec Wed		Accra	Field Survey
20	11-Dec Thu		Accra	Field Survey
21	12-Dec Fri		Accra	Field Survey
22	13-Dec Sat		Accra	Field Survey
23	14-Dec Sun		Accra	Field Survey
24	15-Dec Mon		Accra	Field Survey
25	16-Dec Tue		Accra	Field Survey
26	17-Dec Wed	Accra -	Accra	Mr. Hinomizu
27	18-Dec Thu	London - Narita (19-Dec)	Accra	Mr. Hinomizu
28	19-Dec Fri	Accra -	On board	Reporting the result of field survey to Japan Embassy and JICA Ghana Office
29	20-Dec Sat	London -	On board	Irie / Mizushima / Otsuka
30	21-Dec Sun	Narita		

GIDA : Ghana Irrigation Development Authority  
MOFA : Ministry of Food and Agriculture  
MOF : Ministry of Finance

**Draft Basic Design Study Report Explanation Team**

No.	Date	Movement / Place / Agencies	Station	Activities / Name of Person
1	11-Feb Wed	Narita - Amsterdam	Amsterdam	Messrs. Nakahara, Sasaki, Irie, Mizushima
2	12-Feb Thu	Amsterdam - Accra	Accra	Messrs. Nakahara, Sasaki, Irie, Mizushima
3	13-Feb Fri	Japan Embassy, JICA Ghana Office, GIDA	Accra	Courtesy call
4	14-Feb Sat		Accra	Team meeting
5	15-Feb Sun		Accra	Team meeting
6	16-Feb Mon		Accra	Discussion at GIDA
7	17-Feb Tue		Accra	Discussion at GIDA
8	18-Feb Wed			Signing on the minutes and reporting to Japan Embassy, JICA Ghana Office
		Accra - (Frankfurt - Bucharest) Accra -	On board	Mr. Nakahara Messrs. Sasaki, Irie, Mizushima
9	19-Feb Thu	London -	On board	Messrs. Sasaki, Irie, Mizushima
10	20-Feb Fri	Narita		Messrs. Sasaki, Irie, Mizushima

### ***3. List of Party Concerned in Ghana***

### **3. List of Party Concerned in Ghana**

1. Ministry of Finance  
Dr. William Adote Director  
International Economic Relations Division
  
2. Ministry of Food and Agriculture  
Dr. Samuel K. Dapaah Chief Director
  
3. Ghana Irrigation Development Authority  
Mr. O.K. Gyarteng Chief Executive  
Mr. Kwabena Wiafe Deputy Chief Executive (Engineering)  
Mr. A.Opoku-Mensah Director of Department of Planning  
Mr. H.A. Torgbor Director of Development  
Mr. D.M. Ohemeng Director of Department of Project Operations  
Mr. Toshiyuki Tsuzimoto JICA Expert  
Mr. Kunihiro Masumi JICA Expert  
Mr. Tatsushi Tsuboi JICA Expert  
Mr. Katsumasa Sato JICA Expert  
Mr. Miyuki Yamazaki JICA Expert
  
4. JICA Ghana Office  
Mr. Akio Yatsubayashi Representative of Ghana Office  
Mr. Osamu Kosegawa Deputy Representative of Ghana Office

#### ***4. Minutes of Discussion***





MINUTES OF DISCUSSIONS  
ON  
THE BASIC DESIGN STUDY ON THE PROJECT  
FOR  
REHABILITATION OF IRRIGATION  
IN  
THE REPUBLIC OF GHANA

In response to the request from the Government of Ghana, the Government of Japan decided to conduct a Basic Design Study on the Project for Rehabilitation of Irrigation (hereinafter referred to as "the Project"), and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Republic of Ghana a Basic Design Study Team (hereinafter referred to as "the Team"), which is headed by Mr. Katsumi Yamanome, First Project Study Division, Grant Aid Project Study Department, JICA, and is scheduled to stay in the country from November 23 to December 19, 1997.

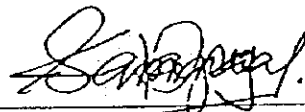
The Team held discussions with the officials concerned of the Government of Ghana and conducted field surveys at the study area.

In the course of the discussions and field surveys, both parties have confirmed the main items described on the attached sheets. The team will proceed to further work and prepare the Basic Design Study report.

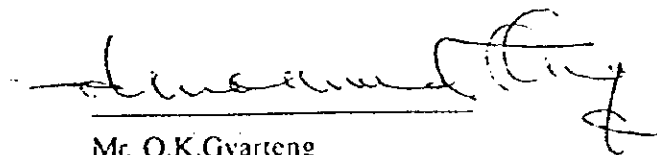
Accra, December 2, 1997



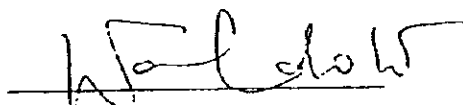
Mr. Katsumi Yamanome  
Leader  
Basic Design Study Team  
JICA



Dr. Samuel K. Dapaah  
Chief Director  
Ministry of Food and Agriculture  
The Republic of Ghana



Mr. O.K. Gyarteng  
Chief Executive  
Irrigation Development Authority  
The Republic of Ghana



Dr. William Adote  
Director  
International Economic Relations Division  
Ministry of Finance  
The Republic of Ghana

## ATTACHMENT

### 1. Objective

The objective of the Project is to increase the area of coverage of 5 proposed irrigation schemes, namely Ashaiman, Aveyime, Kpando-Torkor, Mankessim and Okyereko from 290 ha to 473 ha by rehabilitating irrigation facilities. These 5 schemes will be used as model project for reactivation of other projects. Farmers' training and organization will be built up through this Project including construction of training facilities. Therefore, this Project will activate and increase the productivity of GIDA's existing irrigation area totaling 6,700 ha.

### 2. Proposed Project Area

The Project sites are Ashaiman, Okyereko, Mankessim, Aveyime and Kpando-Torkor (See ANNEX-1).

### 3. Responsible and Executing Agency

Responsible and executing agency are the Ministry of Food and Agriculture and the Irrigation Development Authority respectively.

### 4. Items requested by the Government of Ghana

The items shown in ANNEX-II were requested by the Government of Ghana.

### 5. Major Points of Discussions

- (1) The Ghanaian side maintains that GIDA will not be privatized.

The Study Team emphasized that the Ghanaian side must include the Ministry of Food and Agriculture in addition to GIDA in the operation and maintenance organization, because the facilities are to remain public even if GIDA were privatized. The Ghanaian side agreed with the statement.

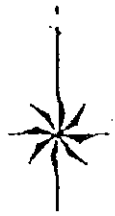
- (2) The Study Team understood the importance of the training facilities from the training plan of the Ghanaian side under Small Scale Irrigated Agriculture Promotion Project (SSIAPP).

5

- (3) Both sides understood that the contents of the request (including the number of areas) shown in ANNEX-II might be changed according to the results of the Study.
- a) The Study Team proposed that the areas of this Project will be determined on the basis of the result of the Study for rehabilitation of facilities and also considering SSIAPP which is now being implemented in 2 areas.
- b) The Study Team emphasized that items of training facilities are to be selected taking into consideration available and convenient site for trainees.
- (4) The Ghanaian side agreed that it is its responsibility to provide the land needed for this Project to be able to implement the Project smoothly and that the land to be rehabilitated with the irrigation facilities should be shared by the Land Allocation Committee.
- (5) The Ghanaian side agreed that it is responsible for any compensation for crops, houses, and others required for construction.
- (6) Both sides confirmed that this Project will be implemented with the active participation of the Japanese Technical Cooperation Team engaged in SSIAPP.
- (7) The Ghanaian side confirmed that the maintenance function of major facilities such as dams and pump stations will have to be controlled by GIDA; but the other operation and maintenance functions will be transferred to the Farmers Associations. GIDA will strongly support the Associations with the budget for the training of the farmers.
- (8) The Ghanaian side agreed that budget and staff for proper and effective operation and maintenance of the facilities constructed under the Project would be assigned and also promised that electricity, water supply, drainage would be provided to the boundary of the sites and that other incidental facilities would be provided in and around the sites (ANNEX-V).

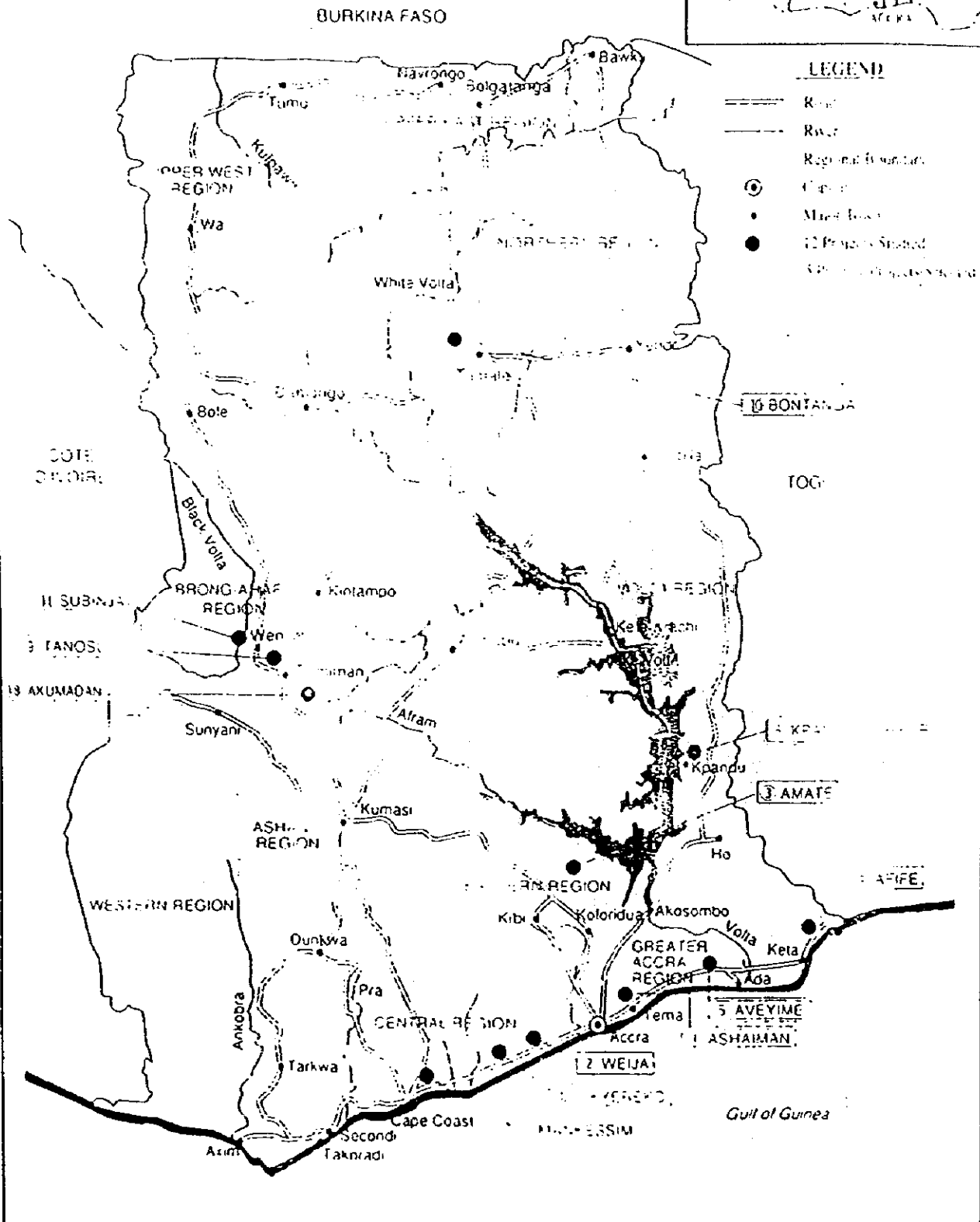
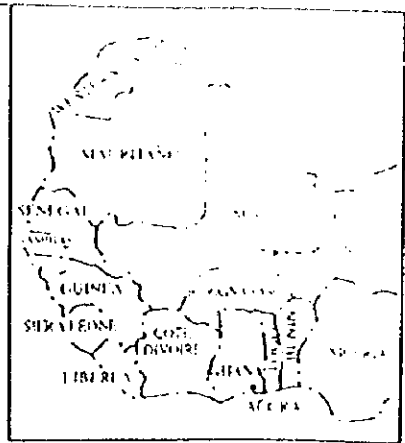
#### 6. Japan's Grant Aid System

- (1) The Government of Ghana has understood the system of Japan's Grant Aid on ANNEX-III as explained by the Team.
- (2) The Government of Ghana will take the necessary measures described in ANNEX-IV for the smooth implementation of the Project on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.



# LOCATION MAP

SCALE 1:500,000  
0 50 100 Km



SPC

1/1

### Major Requested Items

Facilities	Ashaman	Aveyime	K-Torkor	Mankessim	Okyereko
1 Pump station					
(1) Pump	- no(s)	5 no(s)	6 no(s)	5 no(s)	2 no(s)
(2) House	- no(s)	2 no(s)	2 no(s)	2 no(s)	1 no(s)
2 Irrigation system					
(1) Canal					
(a) Head race	- km	0.4 km	- km	- km	- km
(b) Main	1.8 km	3.4 km	- km	- km	2.5 km
(c) Secondary	- km	0.3 km	- km	- km	0.3 km
(d) Lateral	4.6 km	7.8 km	- km	- km	6.7 km
(2) Pipeline system					
(a) Main	- km	1.3 km	2.9 km	1.7 km	- km
(b) Secondary	- km	- km	2.5 km	1.5 km	- km
(c) Lateral	- km	- km	10.8 km	6.3 km	- km
(c) Sprinkler	- sets	7 sets	66 sets	36 sets	- sets
3 Drainage system					
(1) Main	3.5 km	1.3 km	- km	- km	1.8 km
(2) Secondary	- km	1.8 km	- km	- km	1.7 km
(3) Lateral	7.2 km	12.3 km	- km	- km	7.6 km
(4) Collector	- km	- km	4.7 km	4.9 km	- km
4 Related structure					
(1) Outlet	- no(s)	1 no(s)	- no(s)	- no(s)	- no(s)
(2) Distribution box	- no(s)	1 no(s)	- no(s)	- no(s)	- no(s)
(3) Inlet	- no(s)	1 no(s)	- no(s)	- no(s)	- no(s)
(4) Division structure	1 no(s)	1 no(s)	- no(s)	- no(s)	- no(s)
(5) Turnout	11 no(s)	36 no(s)	- no(s)	- no(s)	19 no(s)
(6) Check	11 no(s)	25 no(s)	- no(s)	- no(s)	19 no(s)
(7) Measuring device	13 no(s)	38 no(s)	- no(s)	- no(s)	19 no(s)
(8) Station	- no(s)	- no(s)	- no(s)	- no(s)	1 no(s)
(9) Drop	130 no(s)	70 no(s)	- no(s)	- no(s)	73 no(s)
(10) Energy dissipator	1 no(s)	1 no(s)	- no(s)	- no(s)	- no(s)
(11) Culvert	8 no(s)	15 no(s)	- no(s)	- no(s)	6 no(s)
(12) Field outlet	140 no(s)	238 no(s)	- no(s)	- no(s)	203 no(s)
(13) Cross drain	11 no(s)	11 no(s)	20 no(s)	28 no(s)	6 no(s)
(14) Causeway	2 no(s)	- no(s)	5 no(s)	- no(s)	2 no(s)
(15) Drop for dam	1 no(s)	- no(s)	- no(s)	- no(s)	- no(s)
(16) Protection for spillway	700 m <sup>2</sup>	- m	- m <sup>2</sup>	- m <sup>2</sup>	1,200 m <sup>2</sup>
5 Farm road					
(1) Main	1.6 km	2.9 km	3.3 km	0.9 km	2.2 km
(2) Lateral	4.0 km	7.0 km	10.1 km	8.9 km	7.6 km
(3) Access road	- km	- km	4.3 km	- km	- km
6 Project building					
(1) Office	- no(s)	1 no(s)	1 no(s)	1 no(s)	1 no(s)
(2) Store	- no(s)	1 no(s)	2 no(s)	1 no(s)	1 no(s)
(3) Garage	- no(s)	1 no(s)	2 no(s)	1 no(s)	1 no(s)
(4) Dry yard	- no(s)	1 no(s)	2 no(s)	1 no(s)	1 no(s)
(5) Water house	1 no(s)	1 no(s)	2 no(s)	1 no(s)	1 no(s)
(6) Dormitory for officer	2 no(s)	- no(s)	- no(s)	- no(s)	- no(s)
(7) Lecture hall	- no(s)	- no(s)	- no(s)	- no(s)	1 no(s)
(8) Dormitory for farmers	1 no(s)	- no(s)	- no(s)	- no(s)	- no(s)
(9) Fence for office	500 m	- no(s)	- no(s)	- m	- m
7 Electric line	- km	2.6 km	8.0 km	3.5 km	8.0 km
8 Green belt	- km	- km	9.6 km	2.5 km	- km
9 Supplementary water supply facilities					
(1) Weir	- no(s)	- no(s)	- no(s)	- no(s)	1 no(s)
(2) Head race	- km	- km	- km	- km	0.2 km
(3) Pipe line	- km	- km	- km	- km	0.8 km
(4) Outlet	- no(s)	- no(s)	- no(s)	- no(s)	1 no(s)
(5) Chute	- km	- km	- km	- km	0.3 km

## ON JAPAN'S GRANT AID PROGRAM

### 1. Japan's Grant Aid Procedures

(1) The Japan's Grant Aid Program is executed by the following procedures.

- Application (request made by a recipient country)
- Study (Preliminary Study / Basic Design Study conducted by JICA)
- Appraisal & Approval (Appraisal by the Government of Japan and Approval by the Cabinet of Japan)
- Determination of Implementation (Exchange of Notes between both Governments)
- Implementation (Implementation of the Project)

(2) Firstly, an application or a request for a project made by the recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to see whether or not it is suitable for Japan's grant Aid. If the request is deemed suitable, the Government of Japan entrusts a study on the request to JICA (Japan International Cooperation Agency).

Secondly, JICA conducts the Study (Basic Design Study), using a Japanese consulting firm. If the background and objective of the requested project are not clear, a Preliminary Study is conducted prior to a Basic design Study.

Thirdly, the Government of Japan appraises to see whether or not the Project is suitable for Japan's Grant Aid Program, based on the Basic Design Study report prepared by JICA and the results are then submitted for approval by the Cabinet.

Fourthly, the Project approved by the Cabinet becomes official when pledged by the Exchange of Notes signed by both Governments.

Finally, for the implementation of the Project, JICA assists the recipient country in preparing contracts and so on.

### 2. Contents of the Study

(1) Contents of the Study

The purpose of the Study (preliminary Study / Basic Design Study) conducted on a project requested by JICA is to provide a basic document necessary for appraisal of the project by the Japanese Government. The contents of the Study

are as follows:

- a) to confirm background, objectives, benefits of the project and also institutional capacity of agencies concerned of the recipient country necessary for project implementation.
- b) to evaluate appropriateness of the Project for the Grant Aid Scheme from a technical, social and economical point of view,
- c) to confirm items agreed on by both parties concerning a basic concept of the project,
- d) to prepare a basic design of the project,
- e) to estimate cost involved in the project.

Final project components are subject to approval by the Government of Japan and therefore may differ from an original request.

Implementing the project, the Government of Japan requests the recipient country to take necessary measures involved which are itemized on Exchange of Notes.

## (2) Selecting (a) Consulting Firm(s)

For smooth implementation of the study, JICA uses (a) consulting firm(s) registered. JICA selects (a) firm(s) through proposals submitted by firms which are interested. The firm(s) selected carry(its) out a Basic Design Study and write(s) a report, based upon terms of reference made by JICA.

The consulting firm(s) used for the study is(are) recommended by JICA to a recipient country after Exchange of Notes, in order to maintain technical consistency and also to avoid possible undue delay in implementation caused if a new selection process is repeated.

## (3) Status of a Preliminary Study in the grant Aid Program

A Preliminary Study is conducted during the second step of a project formulation & preparation as mentioned above.

A result of the study will be utilized in Japan to decide if the Project is to be suitable for a Basic Design Study.

Based on the result of the Basic Design Study, the Government would proceed to the stage of decision making process (appraisal and approval).

It is important to notice that at the stage of Preliminary Study, no commitment is made by the Japanese side concerning the realization of the Project in the scheme of Grant Aid Program.

### 3. Japan's Grant Aid Scheme

#### (1) What is Grant Aid?

The Grant Aid Program provides a recipient country with non reimbursable funds needed to procure facilities, equipment and services for economic and social development of the country under the following principles in accordance with relevant laws and regulations of Japan. The Grant Aid is not in a form of donation or such.

#### (2) Exchange of Notes (E/N)

The Japan's Grant Aid is extended in accordance with the Exchange of Notes by both Governments, in which the objectives of the Project, period of execution, conditions and amount of the Grant, etc. are confirmed.

#### (3) "The period of the Grant Aid" means one Japanese fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedure such as Exchange of Notes, concluding a contract with (a) consulting firm(s) and (a) contractor(s) and a final payment to them must be completed.

#### (4) Under the Grant, in principle, products and services of origins of Japan or the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant may be used for the purchase of products or services of a third country origin.

However the prime contractors, namely, consulting, contractor and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means Japanese physical persons or Japanese juridical persons controlled by Japanese physical persons.)

#### (5) Necessity of the "Verification"

The Government of the recipient country or its designated authority will conclude into contracts in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. The "Verification" is deemed necessary to secure accountability to Japanese tax payers.

#### (6) Undertakings required to the Government of the recipient country

In the implementation of the Grant Aid, the recipient country is required to undertake necessary measures such as the following'

- a) to secure land necessary for the sites of the project and to clear and level the land prior to commencement of the construction work,
- b) to provide facilities for distribution of electricity, water supply and drainage and other incidental facilities in and around the sites,



- c) to secure buildings prior to the installation work in case the Project is providing equipment,
- d) to ensure all expenses and prompt execution for unloading, customs clearance at the port disembarkation and internal transportation of the products purchased under the Grant Aid,
- e) to exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts,
- f) to accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified Contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

(7) Proper Use

The recipient country is required to maintain and use facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for their operation and maintenance as well as to bear all expenses other than those to be borne by the Grant Aid.

(8) Rye-export

The products purchased under the Grant Aid shall not be rye-exported from the recipient country.

(9) Banking Arrangement (B/A)

- a) The Government of the recipient country or its designated authority shall open an account in the name of the Government of the recipient country in an authorized foreign exchange bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by Government of the recipient country or its designated authority under the contracts verified.
- b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to pay issued by the Government of the recipient country or its designated authority.

NECESSARY MEASURES TO BE TAKEN BY THE GOVERNMENT OF GHANA IN CASE JAPAN'S GRANT AID IS EXTENDED.

1. To provide data and information necessary for the Project.
2. To secure the site for the Project.
3. To bear two kinds of commissions to the Japanese foreign exchange bank for its banking services based upon the Banking Arrangement (B/A) namely,
  - the advising commission of the "Authorization to Pay (A/P)" and
  - the payment commission.
4. To ensure prompt unloading, tax exemption, and customs clearance at the port of disembarkation in Ghana and prompt internal transportation therein of the materials and equipment for the project purchased under the Grant Aid.
5. To exempt Japanese nationals or a staff from a third country engaged in the project from customs duties, internal taxes and other fiscal levies which may be imposed in Ghana with respect to the supply of the products and services under the verified contracts.
6. To accord Japanese nationals or a staff from a third country whose services may be required in connection with supply of the products and services under the verified contracts, such facilities as may be necessary for their entry into Ghana and stay therein for the performance of their work.
7. To provide necessary permissions, licenses, and other authorization for implementing the Project, if necessary.
8. To assign appropriate budget and staff members for proper and effective operation and maintenance of the facilities constructed under the Project.
9. To maintain and use properly and effectively the facilities constructed and equipment provided under the Project:
10. To bear all the expenses other than those to be borne by the Grant Aid within the scope of the Project.

SKD  
17

1

Major Undertaking to be taken by Each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To secure land		•
2	To clear, level and reclaim the site when needed		•
3	To construct gates and fences in and around the site		•
4	To construct the parking lot	•	
5	To construct roads		
	1) Within the site	•	
	2) Outside the site		•
6	To construct the buildings	•	
7	To provide facilities for the distribution of electricity, water supply, drainage and other incidental facilities		
	1) Electricity		
	a. The distributing line to the site		•
	b. The drop wiring and internal wiring within the site	•	
	c. The main circuit breaker and transformer	•	
	2) Water Supply		
	a. The city water distribution main to the site		•
	b. The supply system within the site (receiving and elevated tanks)	•	
	3) Drainage		
	a. The city drainage main (for storm, sewer and others) to the site		•
	b. The drainage system for toilet, sewer, and city waste, storm drainage and others) within the site	•	
	4) Gas Supply		
	a. The city gas main to the site		•
	b. The gas supply system within the site	•	
	5) Telephone System		
	a. The telephone trunk line to the main distribution frame/panel (MDF) of the building		•
	b. The MDF and the extension after the frame/panel	•	
	6) Furniture and Equipment		
	a. General furniture		•
	b. Project equipment	•	
8	To bear the following commissions to the Japanese foreign exchange bank for the banking services based upon the B/A		
	1) Advising commission of A/P		•
	2) Payment commission		•
9	To ensure unloading and customs clearance at port of disembarkation in recipient country		
	1) Marine (Air) transportation of the products from Japan to the recipient country	•	
	2) Tax exemption and custom clearance of the products at the port of disembarkation		•
	3) Internal transportation from the port of disembarkation to the project site		•
10	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.		•
11	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contracts.		•
12	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant		•
13	To bear all the expenses, other than those to be borne by the Grant, necessary for construction of the facilities as well as for the transportation and installation of the equipment.		•

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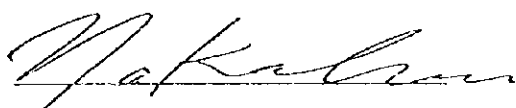
MINUTES OF DISCUSSIONS  
ON  
THE BASIC DESIGN STUDY ON THE PROJECT  
FOR  
REHABILITATION OF IRRIGATION  
IN  
THE REPUBLIC OF GHANA  
(EXPLANATION ON THE DRAFT BASIC DESIGN)

In November 1997, the Japan International Cooperation Agency (JICA) dispatched the Basic Design Study Team on the Project for Rehabilitation of Irrigation (hereinafter referred to as "the Project") to the Government of Ghana. After the assessment of the data and information obtained through the study, JICA has prepared the Draft Basic Design on the Project.

In order to explain and consult with the officials concerned of the Government of Ghana on the components of the Draft Basic Design, JICA sent to the Government of Ghana a Study Team (hereinafter referred to as "the Team") headed by Mr. Masataka Nakahara, Director, Agricultural Technical Cooperation Division, Agricultural Development Cooperation Department, JICA, which is scheduled to stay in the country from February 12 to February 18, 1998.

As a result of the discussions held between the Team and the officials concerned of the Government of Ghana, both parties have confirmed the main items described on the attached sheets.

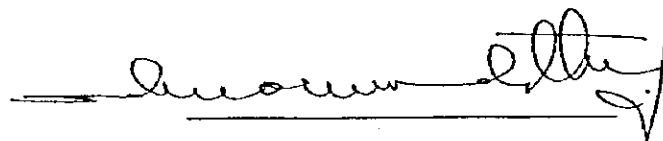
Accra, February 18, 1998



Mr. Masataka Nakahara  
Leader  
Basic Design Study Team  
JICA



Dr. Samuel K. Dapaah  
Chief Director  
Ministry of Food and Agriculture  
The Republic of Ghana



Mr. O.K. Gyarteng  
Chief Executive  
Irrigation Development Authority  
The Republic of Ghana



Dr. William Adote  
Director  
International Economic Relations  
Division  
Ministry of Finance  
The Republic of Ghana

1. Components of the Draft Basic Design

The Government of Ghana has agreed and accepted in principle the components of the Draft Basic Design proposed by the Team.(TABLE-I)

2. Japan's Grant Aid System

- (1) The Government of Ghana has understood the system of Japan's Grant Aid on ANNEX-I as explained by the Team.
- (2) The Government of Ghana will take the necessary measures described in ANNEX-II for the smooth implementation of the Project, on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

3. Schedule of the Study

JICA will complete the final report in accordance with the confirmed items, and send it to the Government of Ghana by April 1998.

4. Other Relevant Issues

- (1) The Ghananian side assured that GIDA and Ministry of Food and Agriculture should be responsible for the maintenance of the constructed facilities of the Project .
- (2) The Team confirmed that the Ghananian side would prepare the needed budget and staff for smooth implementation and maintenance of the Project.
- (3) The team explained the responsibilities of the Ghananian side that they will have to construct the electrical power supply line for the Aveyime Project ,and these responsibilities are to be implemented smoothly not to affect the construction schedule, and Ghananian side understood it.
- (4) The Ghananian side agreed that it should be responsible for the Ghananian side to provide the land needed to implement the Project.

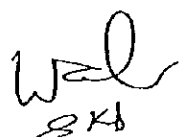


Table - 1 PROJECT COMPONENT AND SCALE

(No.1)

Work Item	Unit	Quantity /Scale		Remarks
		F/S Design (requested)	Present B/D Design	
<b>A IRRIGATION / BUILDING FACILITIES</b>				
<b>1. Ashaiman Project</b>				
<b>1.1 Irrigation Canal System</b>				
(1) Main Canal	km	1.8	1.9	
(2) Secondary Canal	km	-	4.8	
(3) Lateral Canal	km	4.6	-	- including Lateral Canals
<b>1.2 Drainage Canal System</b>				
(1) Main Drain	km	3.5	3.4	
(2) Secondary Drain	km	-	-	
(3) Lateral Drain	km	7.2	12.5	- For smooth drain of surplus water, Lateral Drains are provided along road.
<b>1.3 Farm Road System</b>				
(1) Main Farm Road	km	1.6	4.2	- Road along main drain is to be Main Farm Road with a certain width for maintenance of the drain.
(2) Lateral Farm Road	km	4.0	5.8	- Farm road is linked each other for smooth farm operation and facilities O/M works.
(3) Approach Road	km	-	-	
1.4 Canal and Road Related Structures	L.S.	L.S.	L.S.	- Nos. of related structures are changed depending on quantities of canals and roads.
<b>2 Building Facilities</b>				
<b>2.1 Project Operation Buildings</b>				
(1) Office Building	no.	-	(1)	- Office Building, Training Building, and Laboratory are combined in one (1) building.
(2) Sorter House	no.	1	1	
(3) Garage	no.	-	1	- It is necessary to park new vehicles and machinery.
(4) Fence around Office	L.S.	L.S.	-	- works to be done by Ghana side
<b>2.2 Training Buildings</b>				
(1) GIDA Staff Training Dormitory	no.	2	-	- to construct at Accra City (See sheet No.6)
(2) Farmers' Training Dormitory	no.	1	-	- to construct at Accra City (See sheet No.6)
(3) Dining / Kitchen	no.	1	-	- to construct at Accra City (See sheet No.6)
(4) Training Building	no.	1	(1)	- Office Building, Training Building, and Laboratory are combined in one (1) building.
(5) Laboratory	no.	-	(1)	- Office Building, Training Building, and Laboratory are combined in one (1) building.

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Work Item	Unit	Quantity /Scale		Remarks
		F/S Design (requested)	Present B/D Design	
<b>II Aveyime Project</b>				
<b>1 Irrigation Facilities</b>				
<b>1.1 Pumping Station</b>				
(1) Main Pump	set	4	4	
(2) Small Pumps for Sprinkler	set	1	-	- to omit sprinkler irrigation area
(3) Pump House	no.	1	1	
(4) Small Pump House	no.	1	-	- to omit sprinkler irrigation area
(5) Connecting Pipe Line	m	-	130	
<b>1.2 Irrigation Canal System</b>				
(1) Guide Channel	km	0.4	-	
(2) Main Canal	km	3.4	0.9	- Grade of canals was changed depending on scale of canals and new alignment.
(3) Secondary Canal	km	0.3	4.1	- Total canal length of about 1.2 km is reduced.
(4) Lateral Canal	km	7.8	5.7	
<b>1.3 Drainage Canal System</b>				
(1) Main Drain	km	1.3	2.1	
(2) Secondary Drain	km	1.8	-	- Grade of canals was changed depending on scale of canals and new alignment.
(3) Lateral Drain	km	12.3	18.2	- For smooth drain of surplus water, Lateral Drains are provided along road.
<b>1.4 Pipeline System</b>				
(1) Main Pipeline	km	1.3	-	
(2) Secondary Pipeline	km	-	-	- to omit sprinkler irrigation area
(3) Lateral Pipeline	km	-	-	
(4) Movable Pipeline	set	7	-	
<b>1.5 Farm Road System</b>				
(1) Main Farm Road	km	2.9	1.8	
(2) Lateral Farm Road	km	6.0	13.0	- Farm road is linked each other for smooth farm operation and facilities O/M works.
(3) Approach Road	km	-	-	
<b>1.6 Canal and Road Related Structures</b>				
(1) Power Supply Line	km	L.S.	L.S.	- Construction of Power Supply Line is to be done by Ghana side . Power line inside of Project area is included in item of Pumping Station.
		2.6	-	
<b>2 Building Facilities</b>				
<b>2.1 Project Operation Buildings</b>				
(1) Office Building	no.	1	1	
(2) Store House	no.	1	1	
(3) Garage	no.	1	1	
(4) Sorter House	no.	1	1	
(5) Dry Yard	no.	1	-	- Dry yards are presently available at site.

Work Item	Unit	Quantity/Scale		Remarks
		F/S Design (requested)	Present B/D Design	
III Kpando-Torkor Project				
1 Irrigation Facilities				
1.1 Pump Station				
(1) Main Pump	set	6	3	- to omit Area-C.
(2) Small Pump for Sprinkler	set	-	6	- Work items are changed depending on design change of sprinkler irrigation system.
(3) Diesel Generator	set	-	1	- Generator house is constructed as a part of pump house.
(4) Pump House	no.	2	1	
(5) Small Pump House	no.	-	3	
(6) Generator House	no.	-	(1)	
(7) Guide Channel	m	250	300	- For keeping stability of basement of pumping station, site of station is shifted to high elevated area
1.2 Irrigation Canal System				
(1) Flume Channel	km	-	1.6	- Work items are changed depending on design change of sprinkler irrigation system.
1.3 Drainage Canal System				
(1) Lateral Drain	km	-	16.3	- to provide systematic drainage system in order to prevent soil erosion
(2) Catch Drain	km	4.7	-	- Catch drains are included in item of Lateral Drain.
1.4 Pipeline System				
(1) Main Pipeline	km	2.9	0.4	
(2) Secondary Pipeline	km	2.5	4.7	- to omit Area-C.
(3) Lateral Pipeline	km	10.8	4.0	
(4) Movable Pipeline	set	66	42	
1.5 Farm Road System				
(1) Main Farm Road	km	3.3	2.2	- Farm road is linked each other for smooth farm operation and facilities O/M works.
(2) Lateral Farm Road	km	10.1	10.9	
(3) Approach Road	km	4.3	-	- included in item of Main Farm Road
1.6 Canal and Road Related Structures				
1.7 Land Reclamation	ha	L.S.	L.S.	- Since existing upland fields are deteriorated, reclamation works are required.
1.8 Green Belt	km	-	70	- to omit Area-C.
1.9 Power Supply Line	km	9.6	3.9	- Since construction works of Power Line takes time, power for pumping station is to be supplied by using generator. This item was discussed and agreed with/by CIDA.
2 Building Facilities				
2.1 Project Operation Buildings				
(1) Office Building	no.	1	1	
(2) Store House	no.	2	1	- to omit Area-C
(3) Garage	no.	2	1	
(4) Sorter House	no.	2	1	
(5) Dry Yard	no.	2	1	



Work Item	Unit	Quantity / Scale		Remarks
		F/S Design (requested)	Present B/D Design	
IV Mankessim Project				
1 Irrigation Facilities				
1.1 Pump Station				
(1) Main Pump	set	5	-	
(2) Small Pump for Sprinkler	set	-	3	- to omit Extension Area - 2
(3) Pump House	no.	2	1	
(4) Diesel Generator	set	-	1	
(5) Generator House	no.	-	(1)	
1.2 Drainage Canal System				
(1) Main Drain	km	-	-	
(2) Secondary Drain	km	-	-	
(3) Lateral Drain	km	-	10	- to provide systematic drainage system in order to prevent soil erosion
(4) Catch Drain	km	4.9	-	- No catch drain is required for Extension Area - 1.
1.4 Pipeline System				
(1) Main Pipeline	km	1.7	-	
(2) Secondary Pipeline	km	1.5	1.3	- to omit Extension Area - 2
(3) Lateral Pipeline	km	6.3	1.7	
(4) Movable pipeline	set	36	18	
1.5 Farm Road System				
(1) Main Farm Road	km	0.9	-	- to omit Extension Area - 2
(2) Lateral Farm Road	km	8.9	5.7	
1.6 Canal and Road Related Structures				
1.7 Land Reclamation	ha	-	L.S.	- Land reclamation work is to be executed in a part of existing upland fields and extension area.
1.8 Green Belt	km	2.5	1.6	- to omit Extension Area - 2
1.9 Power Supply Line	km	3.5	-	- Construction of Power Supply Line to project site is to be done by Ghana side. Power line inside of Project area is included in item of Pumping Station.
2 Building Facilities				
2.1 Project Operation Buildings				
(1) Office Building	no.	1	1	- Existing office building is to be used as the store house after construction of new office building.
(2) Store House	no.	1	-	
(3) Garage	no.	1	1	
(4) Sorer House	no.	1	1	
(5) Dry Yard	no.	1	1	

Work Item	Unit	Quantity /Scale		Remarks
		F/S Design (requested)	Present B/D Design	
<b>V Okyereko Project</b>				
<b>1 Irrigation Facilities</b>				
<b>1.1 Intake / Pump Station</b>				
(1) Main Pump	set	2	3	- Capacity of each pump is changed from 6.0 m <sup>3</sup> /min. to 4.1 m <sup>3</sup> /sec.
(2) Diesel Generator	set	-	1	- Since construction works of Power Line takes time, power for pumping station is to be supplied by using generator. This item was discussed and agreed with/by GIDA.
(3) Pump House	no.	1	1	- Generator house is constructed as a part of the pump house.
(4) Generator House	no.	-	(1)	
(5) Headworks	no.	1	1	
(6) Guide Channel	m	0.2	0.2	
(7) Connecting Pipeline	m	800	800	
<b>1.2 Irrigation Canal System</b>				
(2) Main Canal	km	2.5	3.1	
(3) Secondary Canal	km	0.3	1.4	- Since canal layout is changed based on results of field survey, length of canal is slightly elongated.
(4) Lateral Canal	km	6.7	7.2	
<b>1.3 Drainage Canal System</b>				
(1) Main Drain	km	1.8	3.1	
(2) Secondary Drain	km	1.7	1.4	- For smooth darinage of surplus water, Lateral Drains are provided along road.
(3) Lateral Drain	km	7.6	14.9	
<b>1.4 Farm Road</b>				
(1) Main Farm Road	km	2.2	4.5	- Farm road is linked each other for smooth farm operation and facilities O/M works.
(2) Lateral Farm Road	km	7.6	12.9	
<b>1.5 Canal and Road Related Structures</b>				
1.7 Power Supply Line	km	L.S.	L.S.	
<b>2 Building Facilities</b>				
<b>2.1 Project Operation Buildings</b>				
(1) Office Building	no.	1	1	
(2) Store House	no.	1	1	
(3) Garage	no.	1	1	
(4) Sorter House	no.	1	1	
(5) Dry Yard	no.	1	1	
(6) Training Building	no.	1	-	- Training building is integrated in Ashaiman project area.

Work item	Unit	F/S Design (requested)	Quantity /Scale		Remarks
			Present B/D Design		
VI Accra City					
1 Building Facilities					
1.1 Training Buildings					
(1) GIDA Staff Training Dormitory	no.	(2)	1		- Dormitory is designed as one building having 20 -trainees capacity.
(2) Farmers' Training Dormitory	no.	(1)	1		- Proposed site is changed to Accra City; land owned by Ministry of Food and Agriculture.
(3) Dining / Ketchen	no.	(1)	1		- Proposed site is changed to Accra City; land owned by Ministry of Food and Agriculture.
<b>B MACHINERY AND EQUIPMENT</b>					
1 O/M Machinery and Equipment					
1.1 Pick-up Truck	no.	5	5		
1.2 Excavator (Backhoe)	no.	1	1		
1.3 Motor Grader	no.	-	1		- It is required for maintenance of farm roads.
1.4 Tractor with trailer	no.	6	5		- One tractor is delivered to one project.
1.5 Micro-bus	no.	1	1		
1.6 Grass Cutter	no.	16	15		- Three grass cutters are delivered to one project.
1.7 Motor Bike	no.	-	10		- They are required for daily inspection and regular check of facilities.
1.8 Radio Communication Equipment	no.	5	6		- Additional one equipment is to be delivered to GIDA Head Office in Accra.
2 Farm Operation Equipment					
2.1 Type Writer	no.	5	-		
2.2 Printing Machine	no.	5	-		- to be procured by GIDA / Farmers' Cooperative in future
2.3 Copy Machine	no.	5	-		
2.4 (Pick-up Truck)	no.	(5)	-		- 5 pick-up trucks are listed in Item 1.

## ON JAPAN'S GRANT AID PROGRAM

### 1. Japan's Grant Aid Procedures

- (1) The Japan's Grant Aid Program is executed by the following procedures.
- Application (request made by a recipient country)
  - Study (Preliminary Study / Basic Design Study conducted by JICA)
  - Appraisal & Approval (Appraisal by the Government of Japan and Approval by the Cabinet of Japan)
  - Determination of Implementation (Exchange of Notes between both Governments)
  - Implementation (Implementation of the Project)
- (2) Firstly, an application or a request for a project made by the recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to see whether or not it is suitable for Japan's grant Aid. If the request is deemed suitable, the Government of Japan entrusts a study on the request to JICA (Japan International Cooperation Agency).

Secondly, JICA conducts the Study (Basic Design Study), using a Japanese consulting firm. If the background and objective of the requested project are not clear, a Preliminary Study is conducted prior to a Basic design Study.

Thirdly, the Government of Japan appraises to see whether or not the Project is suitable for Japan's Grant Aid Program, based on the Basic Design Study report prepared by JICA and the results are then submitted for approval by the Cabinet.

Fourthly, the Project approved by the Cabinet becomes official when pledged by the Exchange of Notes signed by both Governments.

Finally, for the implementation of the Project, JICA assists the recipient country in preparing contracts and so on.

### 2. Contents of the Study

#### (1) Contents of the Study

The purpose of the Study (preliminary Study / Basic Design Study) conducted on a project requested by JICA is to provide a basic document necessary for appraisal of the project by the Japanese Government. The contents of the Study are as follows:

- a) to confirm background, objectives, benefits of the project and also institutional capacity of agencies concerned of the recipient country necessary for project implementation.
- b) to evaluate appropriateness of the Project for the Grant Aid Scheme from a

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- technical, social and economical point of view,
- c) to confirm items agreed on by both parties concerning a basic concept of the project,
  - d) to prepare a basic design of the project,
  - e) to estimate cost involved in the project.

Final project components are subject to approval by the Government of Japan and therefore may differ from an original request. Implementing the project, the Government of Japan requests the recipient country to take necessary measures involved which are itemized on Exchange of Notes.

(2) Selecting (a) Consulting Firm(s)

For smooth implementation of the study, JICA uses (a) consulting firm(s) registered. JICA selects (a) firm(s) through proposals submitted by firms which are interested. The firm(s) selected carry(its) out a Basic Design Study and write(s) a report, based upon terms of reference made by JICA.

The consulting firm(s) used for the study is(are) recommended by JICA to a recipient country after Exchange of Notes, in order to maintain technical consistency and also to avoid possible undue delay in implementation caused if a new selection process is repeated.

(3) Status of a Preliminary Study in the grant Aid Program

A Preliminary Study is conducted during the second step of a project formulation & preparation as mentioned above. A result of the study will be utilized in Japan to decide if the Project is to be suitable for a Basic Design Study. Based on the result of the Basic Design Study, the Government would proceed to the stage of decision making process (appraisal and approval). It is important to notice that at the stage of Preliminary Study, no commitment is made by the Japanese side concerning the realization of the Project in the scheme of Grant Aid Program.

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### 3. Japan's Grant Aid Scheme

(1) What is Grant Aid?

The Grant Aid Program provides a recipient country with non reimbursable funds needed to procure facilities, equipment and services for economic and social development of the country under the following principles in accordance with relevant laws and regulations of Japan. The Grant Aid is not in a form of donation or such.

(2) Exchange of Notes (E/N)

The Japan's Grant Aid is extended in accordance with the Exchange of Notes by both Governments, in which the objectives of the Project, period of execution, conditions and amount of the Grant, etc. are confirmed.

(3) "The period of the Grant Aid" means one Japanese fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedure such as Exchange of Notes, concluding a contract with (a) consulting firm(s) and (a) contractor(s) and a final payment to them must be completed.

(4) Under the Grant, in principle, products and services of origins of Japan or the recipient country are to be purchased. When the two Governments deem it necessary, the Grant may be used for the purchase of products or services of a third country origin. However the prime contractors, namely, consulting, contractor and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means Japanese physical persons or Japanese juridical persons controlled by Japanese physical persons.)

(5) Necessity of the "Verification"

The Government of the recipient country or its designated authority will conclude into contracts in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. The "Verification" is deemed necessary to secure accountability to Japanese tax payers.

(6) Undertakings required to the Government of the recipient country

In the implementation of the Grant Aid, the recipient country is required to undertake necessary measures such as the following'

- a) to secure land necessary for the sites of the project and to clear and level the land prior to commencement of the construction work,
- b) to provide facilities for distribution of electricity, water supply and drainage and other incidental facilities in and around the sites,
- c) to secure buildings prior to the installation work in case the Project is providing equipment,
- d) to ensure all expenses and prompt execution for unloading, customs clearance at the port disembarkation and internal transportation of the products purchased under the Grant Aid,
- e) to exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts,

f) to accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified Contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

(7) Proper Use

The recipient country is required to maintain and use facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for their operation and maintenance as well as to bear all expenses other than those to be borne by the Grant Aid.

(8) Rye-export

The products purchased under the Grant Aid shall not be rye-exported from the recipient country.

(9) Banking Arrangement (B/A)

- a) The Government of the recipient country or its designated authority shall open an account in the name of the Government of the recipient country in an authorized foreign exchange bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by Government of the recipient country or its designated authority under the contracts verified.
- b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to pay issued by the Government of the recipient country or its designated authority.

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## NECESSARY MEASURES TO BE TAKEN BY THE GOVERNMENT OF GHANA IN CASE JAPAN'S GRANT AID IS EXTENDED.

1. To provide data and information necessary for the Project.
2. To secure the site for the Project.
3. To bear two kinds of commissions to the Japanese foreign exchange bank for its banking services based upon the Banking Arrangement (B/A) namely,
  - the advising commission of the "Authorization to Pay (A/P)" and
  - the payment commission.
4. To ensure prompt unloading, tax exemption, and customs clearance at the port of disembarkation in Ghana and prompt internal transportation therein of the materials and equipment for the project purchased under the Grant Aid.
5. To exempt Japanese nationals or a staff from a third country engaged in the project from customs duties, internal taxes and other fiscal levies which may be imposed in Ghana with respect to the supply of the products and services under the verified contracts.
6. To accord Japanese nationals or a staff from a third country whose services may be required in connection with supply of the products and services under the verified contracts, such facilities as may be necessary for their entry into Ghana and stay therein for the performance of their work.
7. To provide necessary permissions, licenses, and other authorization for implementing the Project, if necessary.
8. To assign appropriate budget and staff members for proper and effective operation and maintenance of the facilities constructed under the Project.
9. To maintain and use properly and effectively the facilities constructed and equipment provided under the Project;
10. To bear all the expenses other than those to be borne by the Grant Aid within the scope of the Project.

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