2-2-4 Implementation Plan

2-2-4-1 Implementation Concept

(1) Basic Items

1) The Exchange of Notes (E/N) for the Grant Aid Project shall be concluded between the Japanese Government and the Government of Kenya after the cabinet meeting and decision by the Japanese Government.

2) With the E/N, Japan shall commit itself officially to assist and initiate specific action.

3) After the above-mentioned conclusion, a consultant contract shall be concluded between a consultant of Japanese nationality and the Government of Kenya and detailed design and supervision services shall be started immediately.

(2) Detailed Design Stage

1) For the Detailed Design, full details of facilities and equipment in the Basic Design should be carefully confirmed and discussed with the implementation agency.

2) The consultant shall discuss the technical issues through meetings with the relevant authorities in Japan and Kenya during the detailed design stage.

3) The detailed design will probably require approximately 4 months to complete after the agreement of the E/N.

(3) Tender

1) The tender for the construction of the facility and procurement and installation of equipment shall be conducted in accordance with JICA guidelines.

2) The Contract shall be conducted either as one package with a Contractor or classified in two packages with a Contractor to carry out the construction work and a supplier for the procurement and installation of the equipment necessary for the facility.

3) The Consultant will assist the implementation agency for the contracting of the construction contract in accordance with the guidelines of JICA.

(4) Construction, Supply and Installation of Equipment

1) According to past Grant Aid projects and other similar projects in Kenya, most of the building materials are locally available and considered to be acceptable in

quality and supply. Therefore, use of local building materials are preconditions for cost reduction and easy maintenance. As such, locally procured materials are planned to be used for this project as much as possible. However, ensuring and improving quality is one of the most important items to be noted..

2) Also, for the planning of labour supply, the capability of local contractor and level of skilled and semiskilled labourers are considered to be acceptable with necessary quality control and supervision to them. Since a Japanese contractor shall be the prime contractor who can sufficiently supervise and manage local contractor and his labourers, the quality required for the project should be maintained.

3) Schedule between facility construction and supply and installation of equipment should be appropriately and technically coordinated. In particular, since most of specified equipment will be supplied from Japan or third countries, orders shall be made considering the overall schedule. Also transportation shall be well studied and planned in order that the equipment can be delivered to site on a timely basis.

(5) Implementation Organization

The organizations involved in this project are as shown below:

1) The Ministry of Education, Science and Technology (MOEST) of the Government of Kenya is ministry in charge for this project:

2) The African Institute for Capacity Development (AICAD) is responsible for the execution of the project:

3) The Jomo Kenyatta University of Agriculture and Technology (JKUAT) is responsible for the support of AICAD.

The following diagram shows the relationship between the Government of Kenya, the Japanese Consultant and the Contractor.

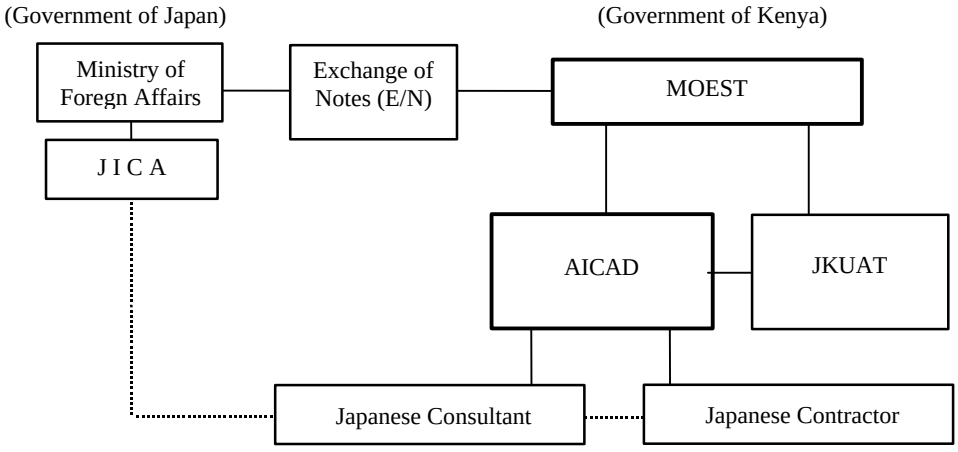


Fig. 2-12 Implementation Organization

2-2-4-2 Implementation Conditions

In the recent 4 or 5 years, Kenyan and Nairobi's, Economic situation has been deteriorating. The state of inadequate servicing and maintenance of its social foundation has become long term. The situation with the construction industry is also bad and there are many instances of construction companies going bankrupt and projects being suspended. Therefore, the lowering of construction execution precision and workers' skills is unavoidable. The state of public peace and order is poor so adequate control and maintenance of safety at construction sites is essential.

(1) Building Contractors

During our site surveys, we inspected JKUAT and other similar facilities and generally we found them to be conspicuous for their low quality. Cracks in floors and walls, peeling mortar, leaks in ceilings and other situations of low quality were found is several places.

With regard to contractors, some 2,000 companies are registered in the Ministry of Public Works ranked in order of scale of work contracted, technical skills and other factors. In this project, facilities of a high quality are expected to be built within the contracted period because the main contractor will be Japanese and will take comprehensive control of production including giving full technical guidance and supervision of local contractors and exercising complete quality control.

(2) Labour Survey

We believe if the local building contractors are high ranking ones with their head offices in Nairobi, they will be able to supply many workers with a relatively high level of skills in both the foundation and main structure building and the finishing work. Also, the technical guidance, construction management and the improvement of technical skills that will be made possible by the condition that the prime contractor will be Japanese are benefits to be gained without additional cost.

(3) Items to be Noted for Construction

Because this will be a construction project within the campus of JKUAT and also the eastern southwest area of the premises lies near a residential area, the following considerations must be given to the adjacent environment in the execution of the project.

1) Construction methods must be adopted that will have the minimum effect on the existing JKUAT buildings, especially the library, dining hall, students' dormitory, and the AICAD office building which will be built in advance by Project Type Technical Cooperation (PTTC), and to the neighboring houses, and noise reduction measures must be taken during execution.

2) A temporary roadway must be planned to make it possible to directly access the site from outside the premises, and safety measures must be taken against the traffic of material and equipment transporting and other construction vehicles. Also, consideration must be given to protecting the existing roads against damage and repairing them, if by chance, they do get damaged.

3) At present, part of the premises is being used as a pathway for students, so safety measures must be taken not to expose the students to any danger during the construction work.

4) Japanese contractor will be the prime contractor in accordance with the Grant Aid program and they will undertake the construction by subletting the works to the local sub-contractor. Local workers would normally be employed by the sub-contractor and supervised. Therefore, it is necessary to employ efficient supervisors, provide suitable labour control and site supervision in order to achieve construction effectively and minimize losses. On the above condition, schedule control should be done most carefully considering the effective arrangement of workers.

5) As for construction planning, particular problems of the rainy season and effect on existing facilities must be considered. The earthworks, substructure and superstructure works should be scheduled and completed during the dry season not in the rainy season.

6) Kenyan laws, codes and standards, should be followed. However, Japanese or British standards are also to be applied considering the local situation.

7) The eastern graded area would be effective as a temporary yard for the site office, material stock yard and workshop. In this regard, it should be discussed and to be agreed that the area can be used for such temporary yard.

8) This project differs from others in these points, together with the construction of facilities of AICAD, it includes the renovation of the existing water and sewage facilities of the JKUAT, and the procurement of IT and other equipment to JKUAT and AICAD. Therefore, close and detailed coordination of schedules is required particularly between the facilities construction work and the period of installation of the various equipment.

2-2-4-3 Scope of Works

The portions to be dealt with by the Japanese side and by the Government of Kenya for the implementation of Japan's Grant Aid Program are shown in Table 2-26. The project cost for the portions to be dealt with by the Kenyan side is as shown in Appendix.

Table 2-26 Extent of Works

Portions by the Japanese Side	Portions by the Kenyan Side
1. AICAD Facility (1) Building Works Structure works, finishing works (2) Electrical Works Power trunk facilities, lighting, power outlets, P/A systems (3) Utilities and Facilities a) Water Supply Construction works for the Water supply from the valve at the water supply meter to the building and all the related internal works for the water supply. b) Sewerage System Sewerage system including piping works up to the connection manhole c) Sanitation facilities (waste water treatment facility), Elevated tank and reserve tank d) Fire-extinguishing facilities e) Electrical supply and transformer system Cabling works from the high tension receiving panel in the transformer room to the facilities. f) Telecommunication system Cabling works from MDF to the facilities, including installation of conduit from the cross connection point at the site boundary to MDF. Installation of MDF, PABX g) Lightning Protection System h) Lighting system in the site (4) Exterior Work Road, path and parking lots within the site (5) Transformer Room, Electric Generator Room, Pump Room	(1) Site Preparation (Site Clearance, etc) (2) External Works Landscaping, planting, fence and approach road beyond the site Renovation of the existing road around the site (3) Utilities and Facilities a) Water Supply Construction of the piping works from the reservoir pond to the site of AICAD b) Sewerage Piping works from the connection manhole in the site to the existing sewerage line. c) Storm Drainage Drainage line from the site to the existing line including the expansion work of the existing drainage line beside the existing building d) Power Supply Cabling works from the existing power supply point to the Transformer room, the installation of receiving panel and connection works. e) Telecommunication Work Apply additional telephone line and connection of cable to MDF f) Office furniture including curtain purchase and installation (4) Application for the approval to the authorities (5) Management, operation and maintenance cost for the new building and facilities (6) Tax exemptions and necessary preferential treatment for the construction staff from Japan or a third country (7) Smooth entry, re-entry and departure to/from Kenya for the Japanese technical staff (8) Any other construction works except portions by the Japanese side
2. JKUAT facilities (Civil work) (1) Main construction a) For water supply - Construction of river improvement and water intake facilities - Construction of surge tanks - Installation of bypass pipe - Rehabilitation of storage pond - Expansion of WPP - Installation of pipe for AICAD till water meter at the boundary of AICAD b) For sewerage - Rehabilitation of existing equipment - Rehabilitation of wastewater treatment plant - Construction of toxic waste storage yard - Installation of sewers from the last manhole of AICAD facilities until a main sewer.	(1) Land acquisition a) Preparation of lands for a new water intake facilities at Ndarugu River, two sites of one way surge tank and river improvement site b) Preparation work of construction sites c) Water supply for construction sites d) Land acquisition of temporally road for construction e) Installation of fences at 2 sites of one way surge tank (2) Construction permission of river improvement and water intake facilities (3) Expansion of water right (4) Removing a part of obstacle fence around existing WPP and installation of fence around a new expanded WPP (5) Installation of power supply for expanded WPP (6) Planting trees around a wastewater treatment plant (7) Implementation of the EIA for the construction works of the sewerage facilities (8) Application for the approval to the authorities (9) Management, operation and maintenance cost for the new building and facilities (10) Tax exemptions and necessary preferential treatment for the construction staff from Japan or a third country (11) Smooth entry, re-entry and departure to/from Kenya for the Japanese technical staff (12) Any other construction works except portions by the Japanese side (13) Establishment of Committee on water supply and sewerage system
3. Equipment (1) Equipment for the activity of AICAD（including the equipment for JKUAT） (2) IT Equipment（including the equipment for JKUAT） (3) Vehicles (4) Furniture (5) Others	(1) Renovation of the existing JKUAT building for the installation of new equipment (2) Application for the approval to the authorities (3) Management, operation and maintenance cost for the new building and facilities (4) Tax exemptions and necessary preferential treatment for the construction staff from Japan or a third country (5) Smooth entry, re-entry and departure to/from Kenya for the Japanese technical staff (6) Any other construction works except portions by the Japanese side

Note: water purification plant = WPP

2-2-4-4 Consultant Supervision

The scope of the supervision works during the construction phase is as follows:

(1) Check and approval of the construction plans and drawings

Checking and approving of the construction plans, construction schedules, working drawings, materials, samples, equipment lists, etc. submitted by the Contractor.

(2) Management of the construction schedule

Giving instructions to the contractor and reviewing the progress report submitted by the Contractor in order to complete the construction work as scheduled. In the event that the construction work being carried out by the Government of Kenya is found to be delayed, the Consultant may urge a faster schedule for the construction work.

(3) Quality control

Checking and giving approval for the quality of materials and construction works in accordance with the specifications. However, the materials which are imported from Japan or other third countries will be checked by architects and engineers in the head office or branch offices of the Consultant.

(4) Checking of the finished product

Checking the finished construction work and confirming the quantity.

(5) Assistance of payment and issuance of certificates

Assisting with the procedures of checking bills, etc., relating to the payment of construction expenditure and issuance of certificates such as the certificate of practical completion, the completion certificate, etc., if necessary.

(6) Check and submission of monthly progress reports

Checking and approving monthly progress, completion documents and photos of works from the contractor and reporting the progress of the construction work to the Government of Kenya and JICA.

The Consultant shall also prepare and submit to the Japanese Government the completion report in accordance with the Grant Aid program guidelines.

(7) Others

Manage and coordinate the schedule and works in order to achieve smooth operation with works executed by the Government of Kenya, if necessary.

2-2-4-5 Quality Control Plan

(1) Basic Policy

The Detailed Design Drawings should be developed based on the studies analyzed for actual circumstances in Kenya, maintenance cost, detailed design for the local materials and local construction methods. The Specification should comply with the Kenyan standards and codes to keep the quality of buildings, utilities and equipments based on Kenya's construction standards, and supplemented by Japanese Regulations, JIS, JASS or British standards.

The construction plan, implementation schedule, shop-drawings which are to be submitted by the Contractor during the construction period, should be examined and approved by the Consultant.

(2) Quality Examination

The Consultant should examine the implementation plan submitted by the Contractor prior to the commencement of each works, and approve it if the construction materials and the execution of work conform to the Specification at the construction site. The Consultant should inspect necessary portions of work based on the implementation plan and specification.

Unexpected inspections of the materials or the execution of work are essential, because most of the construction materials are locally made. The manufacturers' warranty on the products are not sufficient to keep the quality required in the specifications which comply to Codes and Regulations related to developed nations mentioned above.

1) Earth Work

According to the soil investigation report which was made in the basic design study, the geological features of the project site is stable. However, the progress schedule should be arranged to consider the rainy season in order to assure safety and time schedule.

2) Reinforcing-bar Work

The Mill-Sheet showing rebar content is to be submitted by the Contractor and should be confirmed by the Consultant. The inspection is necessary to keep good quality. Also bar strength should be noted to match yield strength in the specification to keep bar quality.

3) Reinforced concrete Work

The batcher plant is to be installed on the construction site to make concrete. Therefore, the quality control through supervision and inspection are essential. The important items for the supervision are as follows:

a) Items to be inspected for concrete material

Material	Item to be inspected	Method of inspection
Cement	Hydration Heat	Dissolution Heat
Sand / Aggregate	Grading	Sieve analysis
	Absolute dry specific gravity	Specific gravity & ration of water absorption
	Alkali reaction	Alkali reaction test
Water	Organic impurities	Quality test of water

b) Items to be inspected for the mixing test

Item to be inspected	Method of inspection
Estimate test for structural concrete	Compression test machine
Slump	Slump cone
Concrete humidity	Hygrometer
Air volume	Manometer
Chloride volume	Measuring instrument for salt

c) Items to be inspected for the concrete placing

Item to be inspected	Method of inspection
Time from mixing to completion of concrete placing	Check for the time of completion of concrete placing (one hr. or less)
Slump	Slump cone
Concrete humidity	Hygrometer
Air volume	Manometer
Chloride volume	Measuring instrument for salt

d) Items to be inspected in the progress schedule (Inspection for the accuracy of concrete placing)

Item to be inspected	Method of inspection
Estimate test for structural concrete	Compression test machine
Accuracy for the openings of door & windows	Measurement
Accuracy for horizontal level of concrete slab	Spirit level & measurement
Status of Finishing	Inspection by the eye

2-2-4-6 Procurement Plan

(1) Procurement Plan for Building Construction

The division of procurement of construction materials is as shown in the following Table. As can be seen, much of the materials can be obtained in Nairobi. Also we believe that, except for certain materials, there is no problem with respect to the quality and production quantity. For this reason, local procurement of material is made a precondition, and the basic policy shall be the reduction of costs and the selection of materials that will have the lowest maintenance costs. With regard to local procurement, based on Kenyan economic situation, we believe metal joinery, waterproofing agents, miscellaneous hardware, paints, sanitary equipment, etc. have tendencies to fluctuate in quality, cost, and deliveries and so would have the effect of adding to construction costs. Also, with regard to other secondary products, etc. liable to large price fluctuations, it is necessary to consider procuring some of them from Japan or third countries in order to heighten reliability by simplifying their control and unifying standards with existing equipment from the aspects of quality, durability and procurement delivery dates. In particular, articles assumed for third country procurement are window and door sashes, hardware, facility equipment/materials, lighting fixtures, sanitary ware, and auxiliary piping and valves.

Procurement of materials used in this project is defined as shown in Table 2-27.

Table 2-27 Procurement Situation of Construction Materials

Name of material	Locally Produced	From Japan	From Third Country	Remarks
Sand/Gravel	○			
Cement	○			
Bricks	○			
Timber	○			
Re-bar	○			
Concrete Blocks	○			
Tiles	○			
Wood Fittings	○			
Metal Fittings	○			
Glass	○		○	
Waterproof Agent		○	○	
Sheeting Plywood	○			
Roof Tile	○			
Roofing Material	○			
Plastic Tiles	○			
Ceiling Board			○	
Paint	○		○	
Miscellaneous Hardware		○	○	
Distribution Panel Board	○			
Lighting Appliances		○	○	
Electric Cable/Conduit	○			
Wiring Equipment	○			
Control Panel	○			
Emergency Generator	○		○	
Transformer	○		○	
Communication Appliance	○		○	
PVC pipes	○			
Sanitary Fixtures			○	
Elevated Reservoir Tank	○		○	
Pumps	○		○	
Air conditioner		○	○	
Fan	○			
IT Fittings		○	○	

Table 2-28 Procurement Situation of Construction Equipment

Name of material	Locally Produced	From Japan	From Third Country	Remarks
Back hoe ($0.6m^3$)	○			with breaker
Shovel loader	○			
Dump truck (4t)	○			
Truck (4t)	○			with boom
Vibrating roller	○			
Rammer	○			
Compactor	○			
Concrete mixer ($0.3m^3$)	○			tilting mixer
Re-bar cutter	○			
Re-bar bender	○			
Mortar mixer ($0.3m^3$)	○			
Concrete Block making machine	○			
Water pump	○			
Generator (35kVA)	○			
Generator (2.2 kVA)	○			
Engine welding machine	○			
Crusher	○			
Tank lorry	○			
Temporary scaffolding	○			
Concrete Dumper	○			for transporting on site
Batcher plant	○			

(2) Procurement plan for Equipment

Equipment procurement category for AICAD and JKUAT is shown in Table 2-29.

1) Local Procurement

Office equipment including photocopy machine and printing machine etc. and computer including peripheral equipment are to be procured locally in consideration of maintenance and follow up services.

Locally available equipment are not so abundant in categories and type, and are deemed to be poor in performance and workmanship and very reluctant including follow up services and quick delivery of spare parts for acceptance among teaching staff in JKUAT. Some special equipment are not in continuous production line, be supplied in order and their firm's financial status are suffering due to country's economic crisis and their total warrantee is also serious consideration for them.

In consideration of this situation, local procurement will be limited to general experimental equipment, workshop tool equipment, glassware, reagents, stationary and furniture etc. as shown in Table 2-29.

Table 2-29 Equipment Procurement Plan

No.	Equipment Category	Locally Produced	From Japan	From Third Country	Remarks
1	Office Equipment	○			
2	PC & Peripheral	○		○	
3	Experiment& Research Equipment	○	○	○	Previous Japanese Grant
4	Analytical Equipment		○	○	
5	General Experimental Equipment	○			
6	Kit type Equipment			○	
7	Workshop Tool	○	○	○	
8	Library	○		○	
9	Audio Visual		○		
10	Glass Ware	○			
11	Reagents	○			Partly Japan
12	Stationary	○	○		
13	Appliances	○			
15	Furniture	○			

2) Japanese Procurement

In general, there is no equipment for designation of Japanese product in consideration of the nature of the Project, but there are favorable tendency for Japanese product due to long time experiences of receiving of Japanese experts and dispatching of teaching staff in JKUAT, and also, previous Japanese grant to JKUAT.

Therefore, detail investigation and collection of information and catalogue for targeted equipment in the market of Kenya is required for determination of specification to avoid unreasonable procurement from Japan and be limited to only several categories of equipment as shown in Table 2-30.

3) Third Country procurement

There are many European product are utilized in students experimental practice and research in JKUAT for their historical reason, prevalence in cost and easy operation nature with manuals services, therefore, many categories of equipment including analytical equipment and personal computer etc. shown in Table 2-30 will be naturally procured from third countries.

(3) Procurement Method

It is concluded that there is no limitation for country of origin and procurement from Japan and third country will require additional one month period in custom clearance and delivery time expeditation will be required for procurement from Kenyan product.

Regarding a custom clearance in Kenya, it is confirmed responsible agency is the Ministry of Finance.

(4) Domestic Transportation Procedure

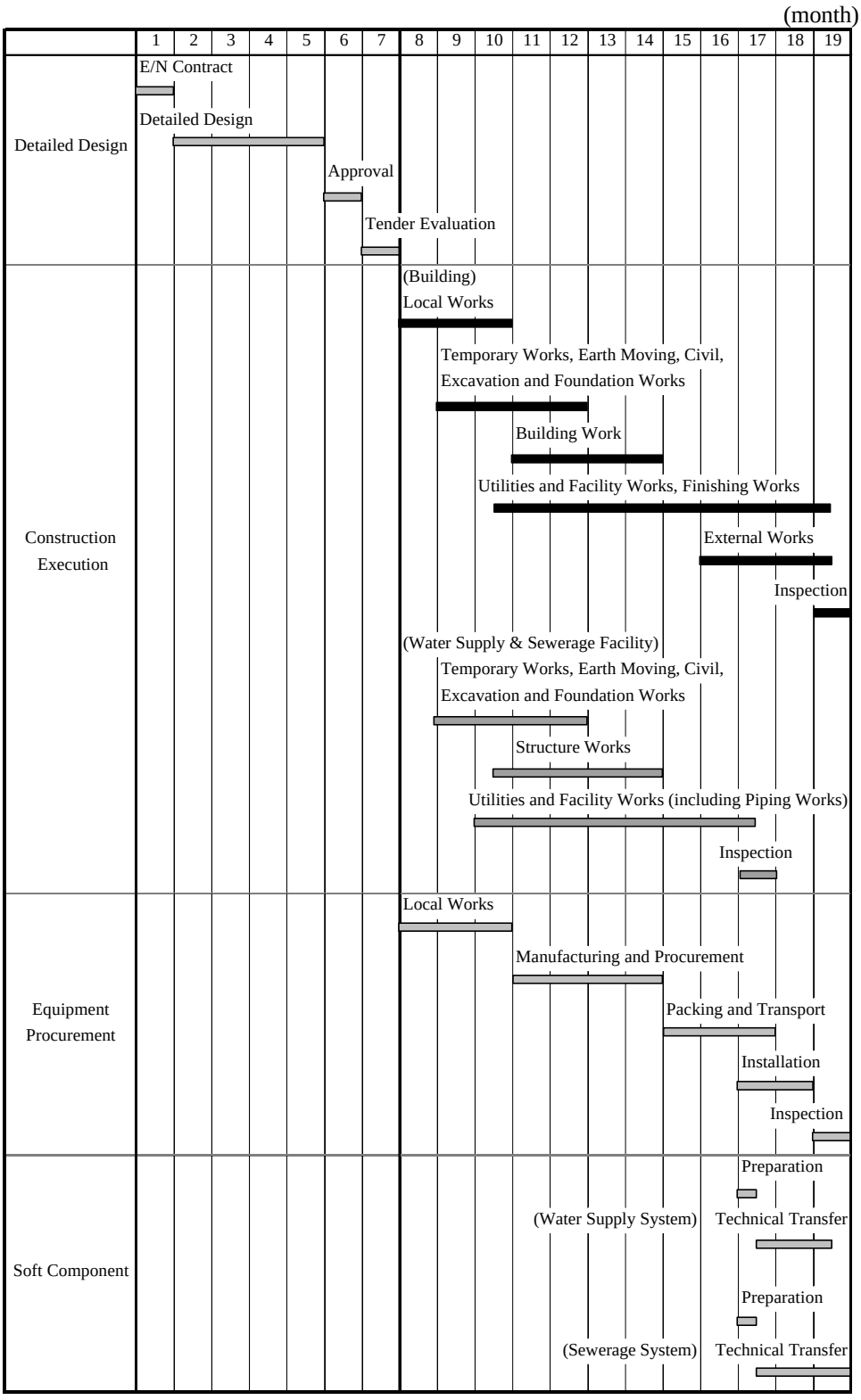
All equipment are shipped to Mombasa port, and custom clearance will be conducted there.

Transportation from Mombasa port to JKUAT campus will be by track in 36 hours drive because there is no bulky or heavy equipment.

2-2-4-7 Implementation Schedule

The tentative implementation schedule for the Project is expected to be as shown in Table 2-30.

Table 2-30 General Project Schedule



2-3 Obligations of Recipient Country

In case the project is implemented, Kenyan side will carry out the following scope of works, and it has been confirmed that Kenyan side is agreed to execution of their scope of works during the Basic Design Study.

(1) Procedure by the Kenyan Side

1) Land Acquisition

- As the construction site for AICAD is already obtained in the existing sports ground of the JKUAT campus, it is not necessary for new land acquisition. And the relocation of the sports ground will be the responsibility of JKUAT. It has been confirmed that the new sports ground will be located at the west side of storage pond and east side of Faculty of Agriculture workshop during the Basic Design Study.

  However, the land acquisition is needed for construction of the new water intake facilities which is located 10m downstream to the existing water intake facilities along the Ndarugu River because the land is required for the water intake facilities. Besides, between the water intake facilities at Ndarugu River and storage pond on campus, 2 One-way Surge Tanks are needed for countermeasure of water hammer, the land acquisition for the One-way Surge Tanks is also needed.

- Water intake facilities of water supply is located along Ndarugu River and outside of JKUAT campus. Under the regulation of Kenya, 10 m of riverbank belongs to government-owned land. As parts of the water intake facilities and river improvement construction site for silt countermeasure belong to a government-owned land, a possession permission of these land is necessary. Besides, part of the water intake facilities land is belongs to private-owned land, and land acquisition of this land is necessary. Lands for the two surge tanks are private owned land along a road and land acquisition of these land is necessary. Those land acquisition and land/road possession permission shall be confirmed before the construction work start.

- Although the sewage treatment facilities (oxidation pond) is located outside the JKUAT campus, the land acquisition is not necessary because this land belongs to the JKUAT. However, the sewers between pump room in the campus to oxidation pond lie underground under the road, the road possession permission is necessary. And during the construction period, a part of the road will be affected by construction work. The explanation negotiation to residents is necessary.

2) Tax Exemption

- Under the Grant Aid Scheme, the equipment and materials purchased for this project shall be tax free. Smooth custom clearance and to secure the transportation within the country shall be well arranged.

- Based on the contract that was certified, the provided equipment and service, and the Japanese who are involved in this project shall be exempt from custom tariff, domestic tax and other financial taxes.

3) Convenience Provision

- Based on the certified contract, the convenience for entry and stay permit in Kenya to the Japanese who will be involved in this project shall be provided.

4) Obtain Building Permits

- As AICAD is recognized as the institution under the direct control of MOEST, the building planning shall be applied to the authority concerned so as to be approved as the public facility.

- An application to receive electric power shall be submitted to KPLC with necessary documents which indicates an estimated demand of power. With an instruction of KPLC, design approval of a transformer, and emergency generator will be done. There are two receiving electric power units for AICAD facilities and on expanded water purification plant.

- An application to receive telecommunication system shall be submitted to the Telephone Department with necessary documents and will indicate the number of telephone lines needed.

- A planning notice for the construction of river improvement and water intake facilities shall be submitted to Thika District Office of Ministry of Water Resources that manages Ndarugu River.

- To submit construction notice related to piping works between the transfer pump room and oxidation pond under the road.

- Notice shall be given to the adjacent residence that dredging work for sludge the treatment plan will have odors that may be produce odors not be suitable for nearby residences for the time of construction.

5) Increasing Water Rights

The current water rights (861m^3/day) is not enough for drinking and irrigation during the dry season, the application to increase water rights for 1,500m^3/day to

Ministry of Water Resources Thika District Office that manages Ndarugu River is necessary.

All notices and applications shall be obtained prior to the construction work implemented by Japanese Side.

6) Establishment of Committee on Water and Sewerage System

JKUAT shall establish the Committee on Water and Sewerage System to achieve the proper operation, maintenance and management of water supply and sewerage system. The committee observes whether the operation and maintenance is properly managed or not, based on the operation report prepared by the execution organization, such as Estate Department and Farm Department. If the committee finds any faults, it shall make the counter measures and advise the execution organization how to maintain and also secure the budget. Under the committee, Water Supply Sub-committee and Sewerage Sub-committee are established.

(2) Portions by Kenyan Side

1) Before Implementation

- Construct water supply pipe for construction work use.
- Construct cabling work for direct circuit telephone to construction work office. These direct circuits are connected with MDF in the new facilities which are constructed by Japanese Side after the construction work completion.
- Construct temporary road for construction work use.
- Remove the fence partially of the existing water purification plant which cause difficulty, accompanied with an expansion construction scheme of the water purification plant.
- Implementation of the E.I.A. and the related expenses for the construction works of the sewerage facilities.
- Measures for upgrading the performance of wastewater treatment plant to higher than approx. 80% of design value, if it is required.

2) During Implementation

- To construct a security fence for facilities of AICAD site (The necessary of the fence shall be studied further by the Kenyan side).
- Landscaping and gardening of AICAD site.
- To purchase and install office furniture, curtain, carpet, etc of AICAD and construct a security fence for water supply plant and two surge tanks.
- Planting trees which surround the sewage treatment plant.

3) After Implementation

For the portions by the Kenyan side, as JKUAT have enough experiences of the Grant Aid Project, and knowledges of the content and schedule of their portions to ensure it is expected that it is expected that they will be during the implementation.

A budget for reallocated sports ground construction was supposed to be prepared with a special budget by MOEST on a fiscal year 2000. However, in order to advance the construction according to a process schedule, it becomes a presupposition, as a work by Kenyan side shall be carried out in accordance with the original schedule. The Basic Design Study Team has also explained this importance. It is necessary to monitor the progress about this matter by Japanese side.

2-4 Project Operation Plan

2-4-1 Project Operation Plan

(1) Maintenance and Management Plan for Facilities

The plan of personal and budget for AICAD has been mentioned in Chapter 3.4 Project Organization, this chapter mainly describe the maintenance and management plan for facilities and equipment. A personal plan for AICAD is shown in Table 3-5, Number of Staff. A principal staffs are expected to be selected from JKUAT, and a concrete list is made for those selected personal. The selected personal either present professor or manager of JKUAT, under the Secretariat, it is included that consideration shall be given during the formation of AICAD to consider every responsible person as the center. Besides, the office management section is formed under head of AICAD, an exclusive staff is distributed, and a plan is prepared for maintenance and management of future AICAD all of which shall be smoothing formed.

Toward the personal plan for principal staff, 5 technical staffs and maintenance staffs for equipment will be selected from now on, and without problems regarding the facilities management. In order for the staff to be able to have responsibility during maintenance and management an activity for these facilities and equipment, an educational training is needed. For large-scale repair, it should be contracted with an outside contractor.

(2) Maintenance and Management Plan for Equipment

As AICAD was planned to be a center for IT training, for this reason, the high-tech equipment with computer relationship and special repair is needed in the equipment that are included in the request. With AICAD, IT specialist, IT engineer will recruit, have enough knowledge about equipment maintenance and management capability. Then can obtain supplies of equipment without any problem. They will also establish a structure which may handle repair and maintenance.

(3) Maintenance and Management Plan for Water Supply and Sewerage Facilities

Work items of operation and maintenance for water supply and sewerage facilities is described in the following section 2-4-2 (2) and (3). The Maintenance has not been properly in times past and it is necessary to improve the management. It has been agreed to establish the Committee on Water and Sewerage System that supervise the operation and maintenance in order to achieve the proper maintenance and management. In the series of the project, technical transfer program would be also applied as soft component in water supply and sewerage system, that assists to improve the maintenance and the management.

2-4-2 Administration and O&M Cost

(1) Expenses Required for AICAD Facilities

The running cost (expenses for water, light and fuel) for the AICAD facilities are calculated as follows:

1) Electricity Charge

a) For newly constructed facilities

The electricity charge system is as follows, according to the Electricity Supply Code of the Power Public Corporation in Kenya:

Basic charge:	600Ksh/month
Power demand charge:	300Ksh/kw
Consumption charge:	5.16Ksh/kwh

On the basis of 420kVA of transformer capacity and 0.5 of demand rate, the contract capacity for this facilities is estimated at some 200kVA.

Estimate of monthly power consumption:

Basic charge:	600Ksh/month	= 600Ksh
Power demand charge:	200kw x 300Ksh/kw	= 60,000Ksh
Consumption charge:	200kw x 720hours/month x 0.3 x 5.16Ksh/kwh	= 222,912Ksh
Total		283,512Ksh

Electricity charge: 283,512 + 40,920Ksh (VAT 18 %) = 324,432Ksh/month

Annual charge

Charge: 324,432Ksh/month x 12months/year = 3,893,184Ksh/year
= 3,900,000Ksh/year
= 49,587US$/year

Thus, the electricity charge for the newly constructed facilities is calculated to be 3,900,000Ksh/year = 49,587US$/year.

2) Water Supply and Sewerage Charge

The water supply charge for the AICAD is 879,000Ksh/year = 11,174US$/year as stated in the Section (2) (O&M of JKUAT Water Supply Facilities).

The sewerage charge for the AICAD is 421,000Ksh/year = 5,355US$/year as stated in the Section (3) (O&M JKUAT Sewerage Facilities).

Accordingly, the charge for water supply and sewerage for the new constructed facilities is 1,300,000Ksh/year = 16,529US$/year.

3) Fuel Charge

The fuel for the private emergency generator is calculated hereunder. The fuel consumption for it is 47lit/hr. Diesel light oil with the unit price of 43Ksh/lit is used for the private emergency generator. Under the assumption that the five (5) hours power failure every week happens, the annual charge is:

47 lit/hr x 5hours x 52weeks/year x 43Ksh/lit = 525,460Ksh/year
550,000Ksh/year
= 6,993US$/year

Consequently, the fuel charge for the newly constructed facilities is 550,000Ksh/year = 6,993US$/year.

4) Telephone Charge

a) For newly constructed facilities

The telephone lines consisting of two (2) direct lines and three (3) relay lines are installed for the AICAD facilities.

The telephone charge system of Telkom Kenya is:
short-distance call (0 ~ 60km) 1.2Ksh/min
long-distance call (over 60km) 28.0Ksh/min

The following calls are assumed:
short-distance call (0 ~ 60km) 800 min/month/line
long-distance call (over 60km) 140 min/month/line

Annual telephone charge is calculated to be:

short-distance call 800 min/month/line x 1.2Ksh/min x 5lines x 12months = 57,600Ksh/year
long-distance call 140 min/month/line x 28.0Ksh/min x 5lines x 12month = 235,200Ksh/year
57,600Ksh/year + 235,200Ksh/year + 52,704Ksh (VAT18%) = 345,504Ksh/year
350,000Ksh/year
= 4,450US$/year

Consequently, the telephone charge for the newly constructed facilities is 350,000Ksh/year = 4,450US$/year.

5) IT Charge

a) For the newly constructed facilities

The IT charge used for the AICAD consists of internet charge (128kbs) with 40,000Ksh/month and microwave charge with 16,000Ksh/month.

40,000Ksh/month + 16,000Ksh/month + 10,080Ksh (VAT)
= 66,080Ksh/month

Annual charge is:
66,080Ksh/month x 12months/year = 792,960Ksh/year
800,000Ksh/year
= 10,171US$/year

Consequently, the internet-related charge for the newly constructed facilities is:

800,000Ksh/year = 10,171US$/year ……a)

6) Total Light, Fuel and Other Cost

From the result of above mentioned calculation, the annual water, light and fuel cost to be expected after this project is shown in Table 2-31.

Table 2-31 Water, Light and Fuel Cost

Items	Amounts (Ksh/year)	Amounts (US$/year)
Electricity charge	3,900,000	49,587
Water supply and sewerage charge	1,300,000	16,529
Fuel cost	550,000	6,993
Telephone charge	350,000	4,450
IT charge	800,000	10,172
Total	6,900,000	87,730

Thus, the budget of some 6,900,000Ksh/year (87,730US$/year) for water, fuel and light expense are required. This amount is almost equivalent to 11.2% of the total budget (56,013,914Ksh) for the fiscal 2003 at the completion year of this project and is regarded as non-problematic expense.

(2) O&M of JKUAT Water Supply Facilities

1) O&M Scheme

The items for O&M of water supply facilities are shown below:

a) O&M for intake facilities and storage pond: daily

b) O&M for water purification plant: daily

c) O&M of storage reservoir for emergency:
when flooding occurs, every six months

d) Inspection of pumps and electrical/instrumental equipment:
weekly, monthly, every six months, yearly

e) Repair and replacement: when needed

A total of twelve (12) exclusive operators are required for the above-mentioned O&M. They consist of one (1) senior technician for administration of the whole water supply facilities, seven (7) technicians (24 hours assignment) for the management of purification plant and water reservoir, and one (1) craftsman for the management of other facilities and pipings from Estate Department. From Farm Department one (1) senior technician and two (2) craftsmen are required for the operation and maintenance of intake facilities and storage pond. Large-scale repair and replacement works will take place, mobilizing other operators besides the nine (9) mentioned above.

2) O&M Cost

The O&M cost of water supply facilities is shown below. The allocation of the O&M cost between the JKUAT and the AICAD is done in proportion to the respective supplied water amount.

Imposed on the AICAD:
Supplied amount for the AICAD / Total supplied amount = 36/744 = 5.0 %

Imposed on the JKUAT:
Supplied amount for the JKUAT / Total supplied amount = 708/744 = 95.0 %

The summary of the O&M cost is show in Table 2-32 and its details are described as follows:

Table 2-32 O&M cost and Water Supply Facilities

Items	Amounts (Ksh/year)	Amount (US$/year)	Remarks
Electricity charge	3,552,000	45,162	
O&M man-hour expense	3,525,000	44,819	
Repair expense	10,000,000	127,145	2% of construction cost
Chemical expense	500,000	6,357	
Total	17,577,000	223,483	
For AICAD	879,000	11,174	5.0%
For JKUAT	16,698	212,309	95.0%

a) Electricity charge

The electricity charge is calculated by using expedient method under the assumption of the unit price 6.0Ksh/kwh.

i) Intake pump for Ndarugu River

37kw x 2units x 4hours/day x 365days x 6.0Ksh/kwh x 1.2 Evaporation at pond x 1.1 WPP work x 0.8 operating rate = 685,000ksh/year

Running hour = 990m^3/day / (4.4m^3/min x 60min) = 4hr

ii) Intake pump for reservoir

(5.5kw + 3.7kw) x 24hours/day x 365days x 6.0Ksh/kwh x 0.8 operating rate = 387,000ksh/year

iii) Water purification plant

(17.8kw+28.1kw) x 0.8 loading rate x 24hours/day x 365days x 6.0Ksh/kwh x 0.8 operating rate = 1,544,000Ksh/year

iv) Water distribution pump

(18.5kw x 11.8hours/day+5.5kw x 1.2hours/day) x 365days x 6.0ksh/kwh x 0.8 operating rate = 394,000Ksh/year

Running hours of the JKUAT = 708m^3/day / (1.0m^3/min x 60min) = 11.8hr

Running hours of the AICAD = 36m^3/day / (0.5m^3/min x 60min) = 1.2hr

Total electricity charge: 3,010,000Ksh/year x 1.18 (VAT 18%)

= 3,552,000Ksh/year

= 45,162US$/year

b) Man-hour expense for O&M

	No. of staff	Unit salary rate (Ksh/year/person)	Amount (Ksh/year)	Amount (US$/year)
Senior Technician	2	375,000	750,000	9,536
Technician	7	300,000	2,100,000	26,701
Craftsman	3	225,000	675,000	8,582
Total	12		3,525,000	44,819

c) Repair expenses (expenses for consumables, repair and replacement of damaged or breakdown goods, etc.)

The construction cost including that of the existing water supply facilities is assumed to be 500,000,000Ksh.

500,000,000Ksh construction cost x 2% = 10,000,000Ksh/year
= 127,145US$//year

d) Chemical expense

The chemical expense is calculated as follows, based on the operation record of the existing water supply facilities:

Chemicals	Unit prices (Ksh/kg)	Dosing rates (mg/L)	Consumption (kg/day)	Amounts (Ksh/year)
Aluminum Sulphate	30	30	30	328,500
Bleaching powder	70	3	3	76,650
Soda ash	25	10	10	91,250
Total				496,400

500,000Ksh/year
= 6,357US$/year

(3) Expenses Required for JKUAT Sewerage Facilities

1) O&M Scheme

The O&M items for the sewerage facilities including the collection and storage of laboratory waste are as follows:

a) Operation and maintenance: daily

b) Transportation and storage of laboratory waste: when necessary

c) Inspection of pumps, electrical and instrumental equipment: weekly, monthly, every six month

d) Repair and replacement: when necessary

e) Dredging of oxidation ponds: every three to five years

A total of four (4) operators (one chief operator and three technicians) exclusively engaged in the sewerage facilities are required for the O&M mentioned above. The staffs to be mobilized besides the regular operators conduct repair and replacement works, as the need arises.

2) O&M Cost

The O&M cost of sewerage facilities is shown below. The allocation of the O&M cost between the JKUAT and the AICAD is done in proportion to the respective supplied water amount.

Imposed on the AICAD:
Supplied amount for the AICAD/Total supplied amount = 36/744 = 5.0 %

Imposed on the JKUAT:
Supplied amount for the JKUAT/Total supplied amount = 708/744 = 95.0 %

The summary of the O&M cost for sewerage facilities is shown in Table 3-33.

Table 3-33 O&M Cost of Sewerage Facilities

Items	Amount (Ksh/year)	Amount (US$/year)	Remarks
Electricity Charge	373,000	4,743	
Man-hour cost for O&M	1,050,000	13,350	
Repair Cost	7,000,000	89,002	2% of total construction cost
Total	8,423,000	107,095	
For AICAD	421,000	5,355	5.0%
For JKUAT	8,002,000	101,740	95.0%

Detail calculations are described below:

a) Electricity charge

The electricity charge is calculated by using expedient method under the assumption of the unit price 6.0Ksh/kwh.

i) Transfer pumps: 11 kw x 0.8 loading rate x 2 units x 6 hours/day x 365 days x 0.8 operating rate = 30,835 kwh/year

ii) Relay pumps: (3.7 + 0.75 + 0.75) kw x 0.8 loading rate x 3 units x 6 hours/day x 365 days x 0.8 operating rate = 21,865 kwh/year

Total electricity charge: (30,835 + 21,865) x 6.0Ksh/kwh x 18 % VAT
= 373,000Ksh/year
= 4,743US$/year

b) Man-hour cost for O&M

	No. of staff	Unit salary rate (Ksh/year/person)	Amount (Ksh/year)	Amount (US$/year)
Senior Technician	1	375,000	375,000	4,768
Craftsman	3	225,000	675,000	8,582
Total	4		1,050,000	13,350

c) Repair expenses (expenses for consumables, repair and replacement of damaged or breakdown goods, etc.)

The total construction of sewerage facilities including the existing facilities is assumed to be 350,000,000Ksh.

350,000,000Ksh construction cost x 2 % = 7,000,000Ksh/year

= 79,002 US$/year

2-5 Scheme of Soft Components

(1) Operation and Maintenance for Water Supply

1) Background

Water supply facilities are essential facilities for activities in JKUAT and will affect the residents of students, staff and the family. The existing water supply facilities have been constructed mainly in the 3 phases by Japanese Grant Aid Projects. Rehabilitation, improvement and extension of the existing water supply facilities are to be planned with new installation of water supply facilities for AICAD facilities in the implementation of the AICAD Project.

Although the technology and the know-how are required for the proper function of water supply facilities, they have been not matured in Kenya yet. Because of this, the existing water supply facilities in the JKUAT have not been adequate to exert its functions to satisfactory expectation. Considering this situation, it is concluded that the technology direction on the Japanese Side for the operation and maintenance of water supply facilities is needed.

2) Purpose

Purpose of the soft component is to educate and train the operation and maintenance technology and the management of the water supply system to the JKUAT staff.

3) Activities

It is necessary to fortify organizations for an achievement of the proper operation and maintenance on water supply system, although there are organizations to implement the operation and maintenance, and committee on water and sewerage in JKUAT at present. It is agreed to establish a committee and organization to supervise, operate and maintain as follows. During fieldwork of the soft components in JKUAT, management of the committee shall be confirmed whether it works properly or not. If it does not work properly, the committee shall be improved with necessary advises.

Supervising Organization

Name: Committee on Water and Sewerage System

Role: It supervises the operation and maintenance of water supply system whether it is conducted appropriately or not. The committee meets twice a year and records of the operation and maintenance are checked. If any problems are found, the committee advises counter measures to the execution organization. The committee shall also meet when the execution organization requests to hold the meeting because of problems that have occurred. Under the committee, Water Supply Sub-Committee and Sewerage Sub-committee are established. They are held every two month and they supervise each operation and maintenance in detail.

Member: Deputy Vice (Administration, Planning and Development - APD), Registrar Water Expert, Public Health Officer, representative of AICAD and Department of Water Resources in Ministry of Environment and Natural Resources

Execution Organization

Name: Estate department and farm department

Role: They operate water supply facilities every day and maintain the facilities periodically, and they record readings of flow meters, water qualities and daily and periodical work, and they store the records. They submit the records to the water committee. If any problems happen, they request the water committee to solve them.

Member: Staff in charge of water supply in estate department and staff in charge of intake facilities in the farm department

Six activities of the soft component are shown in Table 2-34, including the establishment of the organizations and the technical transfer on how to operate and maintain the facilities.

Table 2-34 Activities of Soft Component

Item	Activities	Records
a) Establishment of organization	Establishment of observation team and implementation team	No. of staff, minutes of water committee meetings
b) Training and handling ways of chemicals	Handling ways of chlorine agent, coagulant and alkali agent	Stored amount, consumed amount, purchase day, the amount and the cost
c) Training management of water quality	Jar test, item and frequency of water quality test	Result of water quality at intake and treated water
d) Training of operation and maintenance on water supply facilities	4.1 Water purification plant (WPP) filter: cleaning and replacement of sand 4.2 Intake, conveyance and supply facilities (Intake and others) Maintenance of Pumps, surge tanks, pumps	4.1 WPP Number of backwash per day. 4.2 Intake and others Amount of water taken at river and pond, and supply Condition of pumps, surge tanks and generator Amount of fuel for generator, duration of power failure
e) Publicity of saving water and training of leakage detection	Publicity for saving water, and leakage detection and repairing	Result of leakage detection survey
f) Training for abnormal problems	Counter measures for out break of water bloom and siltation	Progress of the out break of water bloom and measures

The Kenyan side bears the man-power expense for the attendees from the Kenyan side and its related expenses by itself.

4) Schedule

Technology transfer will be conducted for 1.8 months at JKUAT after the completion of renovation on the water supply facilities in the AICAD Project. Preparation for the training will be conducted for 0.2 month in Japan before the technology transfer in JKUAT. Major schedule is described below,

1) Preparation of the training (in Japan)

Programs of the training, review of manual and draft record forms will be prepared in Japan prior to the training in JKUAT.

2) Explanation and discussion on the plan of the soft component (in JKUAT)

Explanation and discussion will be held regarding how to proceed the training, contents of training items, schedule, training sites, trainees and burdens undertaken by Kenyan side.

3) Lecture (in JKUAT)

Lectures will be given to trainees regarding the following:

3.1) Management for water purification plant (WPP)

i) Handling ways of chemicals, ii) management of water quality, iii)operation and maintenance of WPP

3.2) Operation and maintenance of water supply facilities

i) Operation and maintenance of Ndarugu River water intake facilities, one-way surge tanks, facilities of storage pond and pipe, ii) publicity of saving water and leakage detection, iii) counter measures for abnormal problems.

4) Practical training at field sites (in JKUAT)

Based on the lectures, practical training will be held for the operation and maintenance of the water supply facilities. Procedure on record of reading meters and record of daily and periodical operation and maintenance work will be also thought at training.

5) Report to JKUAT (in JKUAT)

Final report will be prepared describing the schedule, contents of training, outcomes, and expected problems in the future, and the final report will be submitted to JKUAT and JICA Kenya Office.

(2) Operation and Maintenance of Sewerage Facilities

1) Background

Although the technology and the know-how are required for the proper function of sewerage facilities, they have been not matured in Kenya yet. Because of this, the existing sewerage facilities in the JKUAT have not exerted its functions to the extent of satisfaction. Considering these situations, it is concluded that the technology transfer/direction of the Japanese Side on the operation and maintenance (O&M) of sewerage facilities (including separate collection of laboratory wastewater) is needed.

2) Target

The target of this soft component is to carry out the proper O&M in the JKUAT sewerage facilities including the collection system for laboratory wastewater and then to materialize stable basic infrastructure to support the operation of the JKUAT and the AICAD

3) Outcome

By the implementation of the soft component, the proper O&M becomes substantiated and the JKUAT sewerage facilities will be able to exert its performance and function. Expected specific outcomes are:

a) The organization of management and execution for the JKUAT sewerage facilities functions properly,

b) The planned treatment performance of the wastewater plant is attained by the proper operation and management,

c) The functions of respective facilities are exerted as planned as the result of the proper maintenance and inspection,

d) The intrusion of toxic chemicals to sewage and the discharge of them into the outside are avoided by the separate collection and storage of laboratory wastewater,

e) Possible abnormal or emergency state in the sewerage facilities can be dealt promptly and properly.

4) Activities

4)-1 Organization for O&M

The following organizational structure consisting of the "Sewerage Sub-Committee" as a supervisory body and the execution units is agreed to establish in order to conduct proper O&M. During fieldwork of the soft components in JKUAT, management of the committee shall be confirmed whether it works properly or not. If it does not work properly, the committee shall be improved with necessary advises.

The Sewerage Sub-Committee: This is chaired by the Vice Chancellor and attended by representatives of administrative department and faculties, and experts specializing in the field of environmental sanitation. This supervises the O&M of the sewerage facilities including the collection of laboratory wastewater from the viewpoint of managerial and technical aspect, having periodical meetings and urgent ones when necessary. The Sewerage Sub-Committee studies countermeasures if the problems arise, and conveys them to the Estate Department. This Sub-Committee consists of the Sewerage Sector for sewerage facilities and the Laboratory Wastewater Sector for collection of laboratory wastewater.

Execution Organization of Sewerage Facilities: The Estate Department is engaged in the O&M of sewerage facilities including the operation and

management, and maintenance and inspection of all facilities (sewage pipes, pumps and wastewater treatment plant), as done presently. The storage of laboratory wastewater transported to the toxic waste storage yard is conducted by the Estate Department, also. A total of four (4) persons including one (1) chief operator and three (3) technicians are assigned exclusively for the O&M of sewerage facilities. The Estate department periodically submits the reports carrying the results of the O&M to the Sewerage Sub-Committee.

Execution Organization of Collection and Transportation of Laboratory Wastewater: Designated toxic handling persons of each laboratory of facilities are responsible for the collection of laboratory wastewater and the transportation of it to the storage yard.

4)-2 Technology Transfer/Direction Items

The items for technology transfer/direction include general knowledge and special technological matters necessary for the proper O&M of sewerage facilities, and also included practical matters like the record-making of the O&M service. To be more specific, the following items are enumerated:

Operation and Management: The frequency, procedure, and record-making regarding the operation and management for sewerage, and also the knowledge necessary for the measure against the abnormal situation are the items for the transfer/direction.

a) Water quality control for the oxidation ponds,

b) Management and disposal of sludge deposited in the oxidation ponds,

c) Operation and management methods of component facilities,

d) General principle of wastewater treatment process,

e) General characteristics of toxic chemicals and relevant knowledge, and

f) Countermeasure against abnormal or emergency status.

Maintenance and Inspection: The frequency, significance and record-making regarding the items for maintenance and inspection of component facilities such as mechanical, electrical and instrumental equipment are the items for the transfer/direction.

4)-3 Participants in Technology Transfer/Direction

The participants in the Technology Transfer/Direction are members of the Sewerage Sub-Committee and the Estate Department, and Toxic Waste Handling Persons.

5) Time Schedule of Technology Transfer/Direction

The technology transfer/direction takes place at the JKUAT, immediately after the completion of construction works for the AICAD Project.

The Kenyan Side bears the man-hour expenses for the attendees from the Kenyan Side and its related expenses by themselves.

CHAPTER 3
PROJECT EVALUATION AND RECOMMENDATIONS

CHAPTER 3 PROJECT EVALUATION AND RECOMMENDATIONS

3-1 Project Effect

In this project, new AICAD facilities will be constructed and the necessary equipment will be procured in order to train various talented people for the purpose of poverty alleviation in Africa. By carrying out joint research of the various themes concerned with poverty alleviation, various conditions should be improved and the community of African countries will realize sustainable development. The poverty in the Republic of Kenya and other African countries will be reduced, and it is thought that this will lead to development of the society.

(1) Effect

The following effects are expected by implementation of this project.

1) Direct Effect

① Research and Development

Capacity development can be supported by cooperation between parties concerned, such as communities, NGOs, public institutions, universities, and the private sector, combining research and development effectively, using as the main theme an improvement of the development.

② Training and Extension

Aiming at improvement of various fields which are common in many African countries, such as agricultural development, small company promotion, poverty alleviation and environmental improvement, Training and Extension would provide support to a community so that it can realize sustainable development.

③ Information

In order that the above-mentioned Research and Development and Training and Extension may be implemented effectively and efficiently, information technology is utilized to collect, accumulate and processes the results of joint research. Therefore, improvement in communication between the parties concerned can be achieved.

2) Indirect Effect

① Promotion of the network between universities

Joint research between the 8 related universities (JKUAT, Nairobi University, Egerton University, Kenyatta University, Moi University, Dar es-Salaam University, Sokoine University of Agricultural, Makerere University) will be promoted, and scientific research will be improved by accumulation and sharing of scientific information.

② Activation of Talented person exchange and information sharing

By carrying out the activities of "Research and Development", "Training and Extension" and “Information", AICAD functions as a core-institution in the East African Network for Information and Human Resources, and exchange of scientific information, expertise, etc., will be promoted.

③ Retention of human resources

African countries have common problems in many fields, and also lack well-educated people. For this reason, it is necessary to share the limited human resources available. Moreover, since less than 1% of people in East African countries are university educated, expansion of university education is essential. In addition, when a university is deeply concerned by the poverty mitigation program, such as the training offered by AICAD, these trained persons can be retained and the loss of trained human resources can be prevented. Consequently, retention of well-educated people needed for promoting business activities is achieved.

④ Activation of local cooperation

In terms of globalization, it will function as a core-organization in East Africa’s information and human resource exchange network. The long term drive towards sustainable development should be strengthened, using the approach such as "Local cooperation and integration".

3-2 Collaboration with Other Donors

The World Bank, USAID and other donors have been involved in university education in Kenya. It is necessary to consider cooperation with those donors. There is no duplication between each individual donor at the moment. However, it is required to understand details of their activities.

3-3 Recommendations

As mentioned above, there are many positive effects expected to be realized due to this project. However, there are some actions the government of Kenya must undertake in order to obtain greater outputs from the project.

1) Future Activity Program

AICAD is an independent institute under the management of MOEST. In order to expedite effectively the activities of AICAD, it is necessary to make an operation plan to strengthen the relationship with other concerned organizations.

2) Establishment of Operation and Maintenance System

The general operation and maintenance of AICAD and JKUAT and the integration of these must be thought out carefully. AICAD must prepare the details of their activities, such as Research and Development, Training and Extension, Information and secure staff for each activity. Also, details of the computer network for information exchange and a review of other related organizations are necessary. Other details are to be examined so as to successfully operate AICAD.

For effective operation and maintenance of the new facilities and equipment, AICAD staff should receive instruction from the equipment suppliers after installation is completed. Establishment of the operation and maintenance system by those who are responsible is strongly required.

3) Secure Funding for Operation and Maintenance

As shown in previous sections, finance of AICAD greatly depends on the government funds. The operation and maintenance of facilities and equipment has a big effect on the execution of activity of AICAD. Therefore, AICAD and MOEST should ensure sufficient budget for the operation and maintenance of the facilities and equipment each year.

4) Effective construction work done by Kenyan side

It is important that construction work of the Kenyan side is smoothly implemented with special budget allocations. In addition, necessary furniture and other facilities that are out of scope of the project, need to be prepared by the Kenyan side in accordance with the implementation of the project.

CHAPTER 4
ROUGH ESTIMATE OF PROJECT

CHAPTER 4 ROUGH ESTIMATE OF PROJECT

4-1 Administration and O&M Cost

(1) Expenses Required for AICAD Facilities

The running cost (expenses for water, light and fuel) for the AICAD facilities are calculated as follows:

1) Electricity Charge

① For newly constructed facilities

The electricity charge system is as follows, according to the Electricity Supply Code of the Power Public Corporation in Kenya:

Basic charge : 600Ksh/month
Power demand charge : 300Ksh/kw
Consumption charge : 5.16Ksh/kwh

On the basis of 420kVA of transformer capacity and 0.5 of demand rate, the contract capacity for this facilities is estimated at some 200kw.

Estimate of monthly power consumption:

Basic charge	: 600Ksh/month	= 600Ksh
Power demand charge	: 200kw x 300Ksh/kw	= 60,000Ksh
Consumption charge	: 200kw x 720hours/month x 0.3 x 5.16Ksh/kwh	= 222,912Ksh
Total		283,512Ksh

Electricity charge:283,512 + 40,920Ksh (VAT 18%) = 324,432Ksh/month

Annual charge

Charge: 324,432Ksh/month x 12months/year = 3,893,184Ksh/year
3,900,000Ksh/year
= 49,586.78US$/year

Thus, the electricity charge for the newly constructed facilities is calculated to be 3,900,000Ksh/year = 49,586.78US$/year.

2) Water Supply and Sewerage Charge

The water supply charge for the AICAD is 1,173,000Ksh/year as stated in the Section (2) (O&M of JKUAT Water Supply Facilities).

The sewerage charge for the AICAD is 523,000Ksh/year as stated in the Section (3) (O&M JKUAT Sewerage Facilities).

Accordingly, the charge for water supply and sewerage for the new constructed facilities is 1,700,000Ksh/year = 21,614.75US$/year.

3) Fuel Charge

The fuel for the private emergency generator is calculated hereunder. The fuel consumption for it is 47lit/hr. Diesel light oil with the unit price of 43Ksh/lit is used for the private emergency generator. Under the assumption that the five (5) hours power failure every week happens, the annual charge is:

47 lit/hr x 5hours x 52weeks/year x 43Ksh/lit = 525,460Ksh/year
550,000Ksh/year
= 6,993.01US$/year

Consequently, the fuel charge for the newly constructed facilities is 550,000Ksh/year = 6,993.01US$/year.

4) Telephone Charge

① For newly constructed facilities

The telephone lines consisting of two (2) direct lines and three (3) relay lines are installed for the AICAD facilities.

The telephone charge system of Telkom Kenya is:

short-distance call (0～60km)	1.2Ksh/min
long-distance call (over 60km)	28.0Ksh/min

The following calls are assumed:

short-distance call (0～60km)	800min/month/line
long-distance call (over 60km)	140min/month/line

Annual telephone charge is calculated to be:

short-distance call 800 min/month/line x 1.2Ksh/min x 5lines x 12months = 57,600Ksh/year
long-distance call 140 min/month/line x 28.0Ksh/min x 5lines x 12month = 235,200Ksh/year

57,600Ksh/year + 235,200Ksh/year + 52,704Ksh (VAT18 %)

= 345,504Ksh/year

350,000Ksh/year

= 4,450.10US$/year

Consequently, the telephone charge for the newly constructed facilities is 350,000Ksh/year = 4,450.10US$/year.

5) IT Charge

① For the newly constructed facilities

The IT charge used for the AICAD consists of internet charge (128kbs) with 40,000Ksh/month and microwave charge with 16,000Ksh/month.

40,000Ksh/month + 16,000Ksh/month + 10,080Ksh (VAT) = 66,080Ksh/month

Annual charge is:

66,080Ksh/month x 12months/year = 792,960Ksh/year

800,000Ksh/year

=10,171.65US$/year

Consequently, the internet-related charge for the newly constructed facilities is:

800,000Ksh/year = 10,171.65US$/year.... ①

6) Total Light, Fuel and Other Cost

From the result of above mentioned calculation, the annual water, light and fuel cost to be expected after this project is shown in Table 5-1.

Table 4-1 Water, Light and Fuel Cost

Items	Amounts (Ksh/year)	Remarks
Electricity charge	3,900,000Ksh/year	
Water supply and sewerage charge	1,700,000Ksh/year	
Fuel cost	550,000Ksh/year	
Telephone charge	350,000Ksh/year	
ITcharge	800,000Ksh/year	
Total	7,300,000Ksh/year	

Thus, the budget of some 7,300,000Ksh/year (92,816.28US$/year) for water, fuel and light expense are required. This amount is almost equivalent to 13.03% of the total budget (56,013,914Ksh) for the fisical 2003 at the completion year of this project and is regarded as non-problematic expense.

(2) O&M of JKUAT Water Supply Facilities

1) O&M Scheme

The items for O&M of water supply facilities are shown below:

① O&M for water purification plant: daily

② Use of storage reservoir for emergency: when water-bloom occurs, every six months

③ Inspection of pumps and electrical/instrumental equipment: weekly, monthly, every six months, yearly

④ Repair and replacement: when needed

A total of nine (9) exclusive operators are required for the above-mentioned O&M. They consist of a chief for administration of the whole water supply facilities, seven (7) operators (24 hours assignment) for the management of purification plant and water reservoir, and one (1) operator for the management of other facilities and pipings. Large-scale repair and replacement works will take place, mobilizing other operators besides the nine (9) mentioned above.

2) O&M Cost

The O&M cost of water supply facilities is shown below. The allocation of the O&M cost between the JKUAT and the AICAD is done in proportion to the respective supplied water amount.

Imposed on the AICAD : Supplied amount for the AICAD/Total supplied amount = 36/744 = 5.0 %

Imposed on the JKUAT : Supplied amount for the JKUAT/Total supplied amount = 708/744 = 95.0 %

The summary of the O&M cost is show in table and its details are described as follows:

Items	Amounts	Remarks
Electricity charge	4,860,000Ksh/year	
O&M man-hour expense	8,100,000Ksh/year	
Repair expense	10,000,000Ksh/year	2% of construction cost
Chemical expense	500,000Ksh/year	
Total	23,460,000Ksh/year	

O&M cost for the AICAD : 1,173,000Ksh/year = 14,914US$/year
O&M cost for the JKUAT : 22,287,000Ksh/year = 283,369US$/year

① Electricity charge

The electricity charge is calculated by using expedient method under the assumption of the unit price 6.0Ksh/kwh.

i) Intake pump for Ndarugu River

37kw x 2units x 4hours/day x 365days x 6.0Ksh/kwh = 648,000ksh/year

Running hour = 990m^3/day / (4.4m^3/min x 60min) = 4hr

ii) Intake pump for reservoir

(5.5kw + 3.7kw) x 24hours/day x 365days x 6.0Ksh/kwh = 484,000ksh/year

iii) Water purification plant

(17.8kw + 28.1kw) x 0.8 loading rate x 24hours/day x 365days x 6.0Ksh/kwh
= 1,930,000Ksh/year

iv) Water distribution pump

(18.5kw x 2 x 12.9hours/day + 5.5kw x 1.2hours/day) x 365 日 x 6.0ksh/kwh
= 1,060,000Ksh/year

Running hours of the JKUAT = 776m^3/day/(1.0m^3/min x 60min)
= 12.9hr

Running hours of the AICAD = 36m^3/day/(0.5m^3/min x 60min)
= 1.2hr

Total electricity charge : 4,122,000Ksh/year x 1.18 (VAT 18%)
= 4,860,000Ksh/year
= 61,793US$/year

② Man-hour expense for O&M

i) Chief operator: 1person x 4,000ksh/year x 300days/year = 1,200,000 Ksh/year

ii) Laborer for purification plant : 7persons x 3,000Ksh x 300days/year
= 6,300,000Ksh/year

iii) Operator : 1person x 2,000ksh x 300days/year = 600,000Ksh/year
Total man-hour expense for O&M : 8,100,000Ksh/year = 102,988US$/year

③ Repair expenses (expenses for consumables, repair and replacement of damaged or breakdown goods, etc.)

The construction cost including that of the existing water supply facilities is assumed to be 500,000,000Ksh.

500,000,000Ksh construction cost x 2% = 10,000,000Ksh/year
= 127,145US$/year

④ Chemical expense

The chemical expense is calculated as follows, based on the operation record of the existing water supply facilities:

Chemicals	Unit prices (Ksh/kg)	Dosing rates (mg/L)	Consumption (kg/day)	Amounts (Ksh/year)
Aluminum Sulphate	30	30	30	328,500
Bleaching powder	70	3	3	76,650
Soda ash	25	10	10	91,250
Total				496,400

500,000Ksh/year
= 6,357US$/year

(3) Expenses Required for JKUAT Sewerage Facilities

1) O&M Scheme

The O&M items for the sewerage facilities including the collection and storage of laboratory waste are as follows:

① Operation and maintenance: daily
② Transportation and storage of laboratory waste: when necessary
③ Inspection of pumps, electrical and instrumental equipment: weekly, monthly, every six month
④ Repair and replacement: when necessary
⑤ Dredging of oxidation ponds: every three to five years

A total of four (4) operators (one chief operator and three technicians) exclusively engaged in the sewerage facilities are required for the O&M mentioned above. The staffs to be mobilized besides the regular operators conduct repair and replacement works, as the need arises.

2) O&M Cost

The O&M cost of sewerage facilities is shown below. The allocation of the O&M cost between the JKUAT and the AICAD is done in proportion to the respective supplied water amount.

Imposed on the AICAD: Supplied amount for the AICAD/Total supplied amount
= 36/744 = 5.0 %

Imposed on the JKUAT: Supplied amount for the JKUAT/Total supplied amount
= 708/744 = 95.0 %

The summary of the O&M cost for sewerage facilities is shown in Table 5-2.

Table 4-2 O&M Cost of Sewerage Facilities

Items	Amount (Ksh/year)	Remarks
Electricity Charge	466,400	
Man-hour cost for O&M	3,000,000	
Repair Cost	7,000,000	2% of total construction cost
Total	10,466,400	
For AICAD	523,320	5.0%
For JKUAT	9,943,080	95.0%

Detail calculations are described below:

① Electricity charge

The electricity charge is calculated by using expedient method under the assumption of the unit price 6.0 Ksh/kwh.

i) Transfer pumps : 11 kw x 0.8 loading rate x 2 units x 6 hours/day x 365 days = 38,540 kwh/year

ii) Relay pumps : (3.7 + 0.75 + 0.75) kw x 0.8 loading rate x 3 units x 6 hours/day x 365 days = 27,330 kwh/year

Total electricity charge : (38,540 + 27,330) x 6.0 Ksh/kwh x 18 % VAT
= 466,400 Ksh/year
= 5,930 US$/year

② Man-hour cost for O&M

i) Chief operator : 1 person x 4,000 Ksh/day x 300 days/year
= 1,200,000 Ksh/year

ii) Operators : 3 persons x 2,000 Ksh/day x 300 days/year
= 1,800,000 Ksh/year

Total man-hour cost for O&M 3,000,000 Ksh/year

= 38,144 US$/year

③ Repair expenses (expenses for consumables, repair and replacement of damaged or breakdown goods, etc.)

The total construction of sewerage facilities including the existing facilities is assumed to be 350,000,000 Ksh.

350,000,000 Ksh construction cost x 2 % = 7,000,000 Ksh/year

= 89,000 US$/year

APPENDICES

APPENDIX-1 Members of the Study Team

APPENDIX-2 Survey Schedule

APPENDIX-3 List of Persons Concerned in the Recipient Country

APPENDIX-4 Minutes of Discussions (2000.12.6, 2001.4.3)

APPENDIX-5 Extent of Works

APPENDIX-6 Local Area Network Specification

APPENDIX-7 JKUAT's Requested Equipment

APPENDIX-8 The contents of research theme and training theme by AICAD and PTTC

APPENDIX-9 Supplementary data of Water Supply Facility Plan

APPENDIX-10 List of Collected Items

Member List of Basic Design Study
on the Project for Establishment of the African Institute for Capacity Development
in the Republic of Kenya

1.	Michio KANDA Team Leader	Managing Director Grant Aid Management Department Japan International Cooperation Agency (JICA)
2.	Masanori KURISU Project Coordinator	First Project Management Division Grant Aid Management Department Japan International Cooperation Agency (JICA)
3.	Tetsuji HATANO Project Manager/Facility Operation and Maintenance Planner	PACIFIC CONSULTANTS INTERNATIONAL
4.	Tomoaki SAWABE Architectural Designer	PACIFIC CONSULTANTS INTERNATIONAL
5.	Ado KAMAGATA Mechanical and Electrical Engineering Planner	PACIFIC CONSULTANTS INTERNATIONAL
6.	Yuichi HASHIMOTO Water Supply Facility Planner	PACIFIC CONSULTANTS INTERNATIONAL
7.	Tadashi SHOJI Sewerage Facility Planner	PACIFIC CONSULTANTS INTERNATIONAL
8.	Akira YUKAWA Equipment Planner	PACIFIC CONSULTANTS INTERNATIONAL
9.	Naotaka KUNITA Cost Estimator/Procurement Planner	INTEM Consulting Inc.
10.	Hiroyuki KANAI Consultant Coordinator	PACIFIC CONSULTANTS INTERNATIONAL

Member List of Explanation Team for Draft Report of Basic Design Study on the Project for Project for Establishment of the African Institute for Capacity Development in the Republic of Kenya

1.	Junsaku KOIZUMI Team Leader	Special Technical Advisor Japan International Cooperation Agency (JICA)
2.	Masanori KURISU Project Coordinator	First Project Management Division Grant Aid Management Department Japan International Cooperation Agency (JICA)
3.	Tetsuji HATANO Project Manager/Facility Operation and Maintenance Planner	PACIFIC CONSULTANTS INTERNATIONAL
4.	Tomoaki SAWABE Architectural Designer	PACIFIC CONSULTANTS INTERNATIONAL
5.	Yuichi HASHIMOTO Water Supply Facility Planner	PACIFIC CONSULTANTS INTERNATIONAL
6.	Tadashi SHOJI Sewerage Facility Planner	PACIFIC CONSULTANTS INTERNATIONAL
7.	Akira YUKAWA Equipment Planner	PACIFIC CONSULTANTS INTERNATIONAL
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9.	Hiroyuki KANAI Consultant Coordinator	PACIFIC CONSULTANTS INTERNATIONAL

Basic Design Study (26/Nov./2000 – 25/Dec./2000)

No	Date	Member & Movement	Activity
1.	Nov. 26 (Sun)	(C, D, E, F, G, H, I, J) NRT→AMS (JL411) AMS→	
2.	Nov. 27 (Mon)	(C, D, E, F, G, H, I, J) → NBO(KL4341)	Courtesy calls on JICA Nairobi office
3.	Nov. 28 (Tue)	(C, D, E, F, G, H, I, J)	Courtesy calls on MOEST, JKUAT & AICAD and Survey of Project Site
4.	Nov. 29 (Wed)	(C, D, E, J, I) (C, D, E, F, G, H, I, J)	Meeting with ICIPE Meeting with JKUAT & AICAD
5.	Nov. 30 (Thu)	(C, D, E, F, G, H, I, J)	Meeting with JKUAT & AICAD
6.	Dec. 1 (Fri)	(C, D, E, F, G, H, I, J)	Meeting with JKUAT & AICAD
7.	Dec. 2 (Sat)	(A, B) LGW→NBO (BA2069) (All Members)	Internal Meeting & Data analysis
8.	Dec. 3 (Sun)	(All Members)	Internal Meeting & Data analysis
9.	Dec. 4 (Mon)	(A, B, C, D, E, I, J) (F, G, H)	Meeting with KISM, JICA Nairobi office and MOF Meeting with JKUAT & AICAD
10.	Dec. 5 (Tue)	(A, B, C, D, E, I, J) (All Members)	Courtesy calls on MOEST and Embassy of Japan Consultation of Minutes of Discussions with MOEST Meeting with JKUAT & AICAD
11.	Dec. 6 (Wed)	(All Members)	Meeting with JKUAT & AICAD Ceremony for signing on M/D at MOEST
12.	Dec. 7 (Thu)	(A, B, C, J) (D, E, F, G, H, I)	Meeting with KWS and KEMRI Meeting with JKUAT & AICAD
13.	Dec. 8 (Fri)	(All Members) (I, J) (A, B) NBO→LGW (BA2068)	Meeting with JKUAT & AICAD Procurement Survey
14.	Dec. 9 (Sat)	(C, D, E, F, G, H, I, J))	Internal Meeting & Data analysis
15.	Dec. 10 (Sun)	(C, D, E, F, G, H, I, J)	Internal Meeting & Data analysis
16.	Dec. 11 (Mon)	(C, D, E, I, J) (F, G, H)	Meeting with WB, Kenyatta Univ., UNESCO and ISK Meeting with JKUAT
17.	Dec. 12 (Tue)	(C, D, E, F, G, H, I, J)	Internal Meeting & Data analysis
18.	Dec. 13 (Wed)	(C, D, E, F, G, H, I, J) (I, J)	Meeting with JKUAT & AICAD Procurement Survey
19.	Dec. 14 (Thu)	(C, D, E, I, J) (F, G, H)	Report to JICA Nairobi office, Embassy of Japan Meeting with KEFRI Meeting with JKUAT& AICAD
20.	Dec. 15 (Fri)	(C, D, E, F, G, H, I, J)	Meeting with JKUAT & AICAD
21.	Dec. 16 (Sat)	(C, E, G, I) NBO→AMS (KQ116) AMS→ (D, F, H, J)	Internal Meeting & Data analysis

No	Date	Member & Movement	Activity
22.	Dec. 17 (Sun)	(C, E, G, I) →NRT (JL412) (D, F, H, J)	Internal Meeting & Data analysis
23.	Dec. 18 (Mon)	(D, F, H, J)	Meeting with JKUAT& AICAD
24.	Dec. 19 (Tue)	(D, F, H, J)	Meeting with JKUAT& AICAD Final report to JICA Nairobi office
25.	Dec. 20 (Wed)	(D, F, H, J) NBO→AMS (KQ116) AMS→	
26.	Dec. 21 (Thu)	(D, F, H, J) →NRT (JL412)	

Remarks;
(JICA) A: Mr. Kanda, B: Mr. Kurisu
(Consultant) C: Mr. Hatano, D: Mr. Sawabe, E: Mr. Kamagata, F: Mr. Hashimoto, G: Shoji, H: Mr. Yukawa, I: Mr. Kunita, J: Mr. Kanai

Explanation Team for Draft Report of Basic Design Study (24/Mar./2001 – 7/Apr/2001)

No	Date	Member & Movement	Activity
1.	Mar. 24 (Sat)	(C, D, E, F, G, H, I, J) NRT→LHR (JL401)	
2.	Mar. 25 (Sun)	(C, D, E, F, G, H, I, J) LHR→	Internal Meeting & Data analysis
3.	Mar. 26 (Mon)	(C, D, E, F, G, H, I, J) →NBO (BA2069)	Courtesy calls on JICA Nairobi office
4.	Mar. 27 (Tue)	(C, D, E, F, G, H, I, J)	Meeting with JKUAT& AICAD
5.	Mar. 28 (Wed)	(C, D, E, F, G, H, I, J)	Meeting with JKUAT& AICAD
6.	Mar. 29 (Thu)	(C, D, E, F, G, H, I, J)	Meeting with JKUAT& AICAD
7.	Mar. 30 (Fri)	(A, B) NBO→LGW (BA2068) (All Members)	Courtesy calls on JICA Nairobi office
8.	Mar. 31 (Sat)	(All Members)	Internal Meeting & Data analysis
9.	Apr 1 (Sun)	(All Members)	Internal Meeting & Data analysis
10.	Apr 2 (Mon)	(All Members)	Consultation of Minutes of Discussions with MOEST
11.	Apr 3 (Tue)	(F, H) NBO→AMS (KL4340) AMS→ (C, D, E, G, I, J)	Ceremony for signing on M/D at JKUAT Report to JICA Nairobi office, Embassy of Japan
12.	Apr 4 (Wed)	(F, H) →NRT (JL412) (C, D, E, G, I, J)	Meeting with JKUAT& AICAD
13.	Apr 5 (Thu)	(C, D, E, G, I, J) (A) NBO→LGW (BA2068)	Meeting with JKUAT& AICAD Report to JICA Nairobi office
14.	Apr 6 (Fri)	(C, D, E, G, I, J) NBO→AMS (KL4340) AMS→	
15.	Apr 7 (Sat)	(B) NBO→LGW (BA2068) (C, D, E, G, I, J) →NRT (JL412)	

Remarks;
(JICA) A: Mr. Koizumi, B: Mr. Kurisu
(Consultant) C: Mr. Hatano, D: Mr. Sawabe, E: Mr. Hashimoto, F: Mr. Shoji, G: Mr. Yukawa, H: Mr. Kunita, I: Mr. Kanai

Basic Design Study (26/Nov./2000 – 25/Dec./2000)

1. Embassy of Japan

Mr. Morihisa Aoki	:	Ambassador
Mr. Hideki Kawato	:	First Secretary

2. JICA Office

Mr. Eiji Hashimoto	:	Resident Representative
Mr. Takeshi Naruse	:	Deputy Representative
Mr. Tomoki Nitta	:	Deputy Representative
Mr. Naoki Takahashi	:	Assistant Resident Representative
Mr. S. K. Kibe	:	Education Specialist

3. Ministry of Education, Science and Technology (MOEST)

Mr. J. C. Kiptoon	:	Permanent Secretary
Mr. J. S. Obonyo	:	Senior Deputy Director of Education (University Education)
Mr. G. K. Lengoiboni	:	Deputy Director of Education
Mr. J. W. Wekesa	:	Chief Finance Officer
Mr. J. M. Njonoge	:	Economist

4. Ministry of Finance (MOF)

Ms. F. Kadasia	:	Deputy Secretary
Mr. J. K. Kanithi	:	Undersecretary

5. AICAD

Dr. J. K. Z. Mwatelah	:	Director
Mr. Joel M. Mberia	:	Deputy Director
Dr. A. Gachanja	:	R & D Coordinator
Mr. Cyrus Kamau	:	Administration Coordinator
Mr. Kennedy Omwenga	:	IN Coordinator
Mr. Samuel Mokaya	:	Training and Extension Coordinator
Mr. H. Kumano	:	Chief Advisor
Mr. M. Iida	:	Project Coordinator

6. JKUAT

Prof. R. W. Michieka	:	Vice Chancellor
Prof. H. M. Thairu	:	Deputy Vice Chancellor
Prof. F. N. Onyango	:	Deputy Vice Chancellor
Dr. C. C. Ochieng	:	Lecturer, Architecture
Mr. M. Anangi	:	Lecturer, Electrical/Electronic Eng.
Dr. K. Makhanu	:	Chairman, Civil Engineering
Dr. J. W. Kaluli	:	Chairman, Agricultural Engineering
Mr. E. M. Cheptumo	:	Deputy Registrar, APD
Mr. K. Ondieki	:	Deputy Finance Officer
Prof. Ngunjiri	:	Director, School of Architecture
Dr. N. Kioni	:	Dean, Faculty of Engineering

Prof. Kangethe	:	Director, CEP
Prof. M. Imbuga	:	Dean, Faculty of Science
Mr. Mengo	:	Director, ICSIT
Dr. Agong	:	Director, IEET
Dr. P. Kutima	:	Director, BPGS
Prof. Kahangi	:	Director, IBR

7. UNESCO Nairobi Office

Prof. Joseph G. M. Massaquoi	:	Senior Programme Specialist in Science and Technology

8. ICIPE

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Mr. Annalee N. Mengech	:	Head of Information Services
Mr. Kamau Gitonga	:	Fleet Manager
Ms. Elie Osir	:	Ag. Director General
Mr. Enoch Alumasi	:	Security Manager

9. Kenya School of Manetary Studies

Ms. Eunice W. Kagane	:	Director of Studies

10. Kenya Institute of Surveying and Mapping

Mr. J. Sogoh	:	Principal
Mr. Hiromichi Maruyama	:	Chief Advisor

11. Kenya Forest Research Institute

Dr. Bernard Kigomo	:	Deputy Director
Mr. Ken Shimizu	:	Coordinator

12. Kenya Medical Research Institute

Mr. Dunstan M. Ngumo	:	Deputy Director of Administration and Finance
Dr. Kazushige Nagai	:	Expert

13. Kenya Medical Training College

Prof. Toshio Yamazaki	:	Chief Advisor

14. Kenya Wildlife Service

Mr. Fumio Kinoshita	:	Wildlife Conservation Education Advisor
Mr. Toshiaki Suzuki	:	Audio Visual Expert

15. Geomaps

Mr. Lenny Kivuti	:	Managing Director
Mr. Lucas O. Koloo	:	Chief Surveyor
Mr. Joseph O. Ekhuya	:	Senior Surveyor
Mr. Khaemba W. Alex	:	Surveyor

16. Photomap

Mr. Nils G. Wiklund	:	Managing Director
Mr. Anders Mattsson	:	Project Manager

Explanation Team for Draft Report of Basic Design Study (24/Mar./2001 – 7/Apr/2001)

1. Embassy of Japan

Mr. Morihisa Aoki	:	Ambassador
Mr. Shigemichi Majima	:	Second Secretary

2. JICA Office

Mr. Eiji Hashimoto	:	Resident Representative
Mr. Takeshi Naruse	:	Deputy Representative
Mr. Naoki Takahashi	:	Assistant Resident Representative
Mr. S. K. Kibe	:	Education Specialist

3. MOEST

Prof. J. Kiptoon	:	Permanent Secretary
Mr. Bomiface Maganga	:	AS/A
Mr. L. K. Chemonges	:	Assistant Director of Education
Mr. V. M. Mwankima	:	Assistant Director of Education
Mr. John M. N. Joroge	:	Economist
Mr. L. K. Chemonges	:	P. A. to P.S.E.D, ADE
Mr. J. N. Kesa	:	A. C. E.

4. AICAD

Dr. J .K. Z. Mwatelah	:	Director
Mr. Joel M. Mberia	:	Deputy Director
Dr. A. Gachanja	:	R&D Coordinator
Mr. Cyrus Kamau	:	Administration Coordinator
Mr. Kennedy Omwenga	:	IN Coordinator
Mr. Samuel Mokaya	:	Training and Extension Coordinator
Mr. H. Kumano	:	Chief Advisor
Mr. M. Iida	:	Project Coordinator

5. JKUAT

Prof. R. W. Michieka	:	Vice Chancellor
Prof. H. M. Thairu	:	Deputy Vice Chancellor
Prof. S. K. Sinei	:	Deputy Vice Chancellor
Dr. Stephen Gaya Agong	:	Deputy Vice Chancellor

MINUTES OF DISCUSSIONS ON THE BASIC DESIGN STUDY ON THE PROJECT FOR ESTABLISHMENT OF THE AFRICAN INSTITUTE FOR CAPACITY DEVELOPMENT IN THE REPUBLIC OF KENYA

In response to a request from the Government of Republic of Kenya (herein after referred to as "Kenya"), the Government of Japan decided to conduct a Basic Design Study on the Project for Establishment of the African Institute for Capacity Development (herein after referred to as "the AICAD") in the Republic of Kenya (herein after referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (herein after referred to as "JICA"). JICA dispatched to Kenya the Basic Design Study Team (herein after referred to as "the Team"), which is headed by Mr. Michio Kanda, Managing Director of Grant Aid Management Dept., JICA and is scheduled to stay in Kenya from November 27th to December 20th, 2000.

The Team exchanged views and had series of discussions with the Kenyan officials concerned and conducted a field survey in the study area.

In the course of discussions and field survey, 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.

Nairobi
December 6, 2000

Mr. Michio Kanda
Leader
Basic Design Study Team
Japan International Cooperation Agency

Prof. Japheth C. Kiptoon
Permanent Secretary
Ministry of Education, Science and Technology
Republic of Kenya

Countersigned by

Mr. Martin L. Oduor-Otieno
Permanent Secretary
Ministry of Finance and Planning
Republic of Kenya

ATTACHMENT

1. Objective

The objective of the Project is to contribute to facilitating the AICAD, described in the Record of Discussions on the AICAD signed on June 16th, 2000 (See ANNEX-1) through construction of buildings, procurement of equipment and rehabilitation of water supply and sewerage system.

2. Project Site

The AICAD will be constructed at Jomo Kenyatta University of Agriculture and Technology (herein after referred to as "JKUAT") and the project site to be covered by the Basic Design Study is shown in ANNEX-2.

3. Responsible and Implementing Agencies

3-1 Ministry of Education, Science and Technology (herein after referred to as "MOEST") is responsible for the implementation of the AICAD Project and Permanent Secretary of MOEST is the Project Director. (See ANNEX –3-1)

3-2 For implementing the project, Joint Coordinating Committee will be established, whose chairperson is Vice Chancellor of JKUAT. (See ANNEX –3-2)

4. Items requested by the Government of Kenya

After discussions with the Team, the items described below are finally requested by the Kenyan side. JICA will assess the appropriateness of the request and will recommend to the Government of Japan for approval.

4-1 Construction of the AICAD facilities (See ANNEX4-1)
4-2 Procurement of equipment for AICAD and JKUAT related to the AICAD activities (The selection criteria of the equipment are shown in ANNEX4-2)
4-3 Rehabilitation of the water supply and sewerage system of JKUAT.

5. Japan's Grant Aid System

5-1 The Kenyan Side understands the Japan's Grant Aid scheme and procedures explained by the Team as shown in Annex-5-1 and Annex 5-2

5-2 The Kenyan side will take the necessary measures, described in Annex 5-2 for smooth implementation of the Project, as a condition for the Japanese Grant Aid to be implemented.

6. Schedule of the study

6-1 The Team will proceed to do further studies in Kenya until December 20, 2000.

6-2 JICA will prepare the draft basic design report in English, which describes the components of the cooperation and the estimation of the Operation and Maintenance cost and dispatch the mission in order to explain its contents in (or around) March 2001.

6-3 In case the contents of the report are accepted in principle by the Government of Kenya, JICA will complete the final report and send it to the Kenyan side in (or around) May 2001.

7. Other Relevant Issues

7-1 The Kenyan side confirmed that AICAD is an autonomous institution with its headquarters at JKUAT and the Permanent Secretary of MOEST is the Project Director of AICAD.

7-3 The Kenyan side shall ensure enough budget and personnel to operate and maintain the facilities and equipment after the completion of the Project. The Kenyan side confirmed that the necessary staff and budget would be provided for with effect from the next financial year starting July 2001.

7-4 Both sides shared the opinion of the importance of the Operation and Maintenance for water supply and sewerage system and treatment of Toxic Laboratory Waste. The Kenyan side agreed to make efforts for these improvements.

7-5 The Kenyan side will submit answers to the questionnaire which the Team handed to the Kenyan side by December 19, 2000.

THE RECORD OF DISCUSSIONS
BETWEEN
THE JAPANESE IMPLEMENTATION STUDY TEAM
AND
THE AUTHORITIES CONCERNED OF THE GOVERNMENT OF THE REPUBLIC OF KENYA
ON
THE AFRICAN INSTITUTE FOR CAPACITY DEVELOPMENT

The Japanese Implementation Study Team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Mr. Shozo Matsuura, Managing Director, Regional Department IV (Africa, Middle East and Europe), JICA, visited the Republic of Kenya for the purpose of working out the basic framework of the technical cooperation concerning the African Institute for Capacity Development (hereinafter referred to as "AICAD").

During its stay in the Republic of Kenya, the Team exchanged views and opinions, and had a series of discussions with the Kenyan authorities concerned in respect of the overall concept of the AICAD and the comprehensive framework for its successful realization.

As a result of the discussions, th Team and the Kenyan authorities concerned agreed to recommend to their respectiv Governments the matters referred to in the document attached hereto.

Nairobi, 16 June, 2000

Mr. Shozo Matsuura
Leader
Implementation Study Team
Japan International
Cooperation Agency
Japan

Prof. Japheth C. Kiptoon
Permanent Secretary
Ministry of Education, Science
and Technology
Republic of Kenya

countersigned by:

Mr. Martin L. Oduor-Otieno
Permanent Secretary
Ministry of Finance and Planning
Republic of Kenya

I Basic Polic, of the AICAD

1. Background

The idea of the Base for African Human Capacity Building (BAHCB) was addressed during the TICAD II conference in October 1998. In the TICAD II conference, the Japanese Government recommended that Jomo Kenyatta University of Agriculture and Technology (JKUAT) be the core institution in the initial stage of the BAHCB, since JKUAT has established sufficient foundation for higher education (undergraduate level) and has brought about substantive results with JICA's cooperation for over twenty years. After consultations between JICA and the Kenyan authorities concerned it was agreed that the name of the base be African Institute for Capacity Development (AICAD).

2. Overall Objective of the AICAD

The AICAD aims at solving various issues concerning poverty reduction and development of the African region (i.e. agricultural development, locally applicable technology development, private sector development, etc.) and bringing its most benefit to the African region. The AICAD shall therefore attempt to evolve the education and research functions of African universities and institutions with more practical perspectives and to accelerate human capacity development of the African region.

3. Functions attached to the AICAD

The AICAD shall embody the following three functions and be charged with the coordination role for regional activities.

(1) Joint Research and Development (R&D)

With sufficient understanding of needs in communities and industries in Africa, practical and/or multidisciplinary R&D activities shall be conducted in the region to promote African social and economic development. The joint R&D programs include pilot studies and testing their results that will have a direct impact on local communities.

(2) Training and Extension

With due consideration to the past cooperation with JKUAT and the outputs from the function (1) above, training activities will be extended widely to the African region through various types of training modalities such as in-country training, third-country (inter-country) training and training in Japan.

(3) Information Network

Information regarding outputs from functions (1) and (2) above, in addition to JICA's experience in Asia and Africa, will be collected and analyzed. The available information will be disseminated within the existing information network.

4. Implementation Plan

(1) Establishment of the AICAD in JKUAT

While the AICAD aims to bring a common benefit to African countries, the AICAD secretariat will be situated at JKUAT. This is because JICA has been implementing its technical cooperation with JKUAT on bilateral basis over twenty years. Since the AICAD is designed as the base for all African countries, implementation of the three functions namely: Training and Extension, Joint Research and Development and Information Network, would benefit many African countries.

(2) Project Set-up

The AICAD requires participation of both governmental and private organizations such as universities, research institutions and communities in Kenya and other participating African countries. JKUAT is expected to manage the AICAD principally as well as to coordinate the joint committee meetings to be organized for the AICAD.

(3) Implementation Schedule of the Project and Its Scale of Cooperation

The first phase (2000-2002) of the Project is set for the planning and preparatory operation of the AICAD. The second phase (2002-2007) is for the full-fledged operation of the AICAD. Based on the experience of the second phase, another phase of five (5) years will be formulated and extension of the AICAD coverage is to be considered, as appropriate.

II Roles of the Participating African Countries

In realizing AICAD objectives, participating countries in Africa will be expected to play the following roles:

1. All the participating countries, through diligently joining the activities of the AICAD, will make maximum efforts in solving socio-economic problems related to the development of the African region and promoting human capacity development for poverty reduction.

2. All the participating countries will ensure that the results gained by the AICAD will be shared by and extended to the local communities, and will contribute to economic and social development of respective countries.

III Japanese Inputs by Technical Cooperation to the AICAD

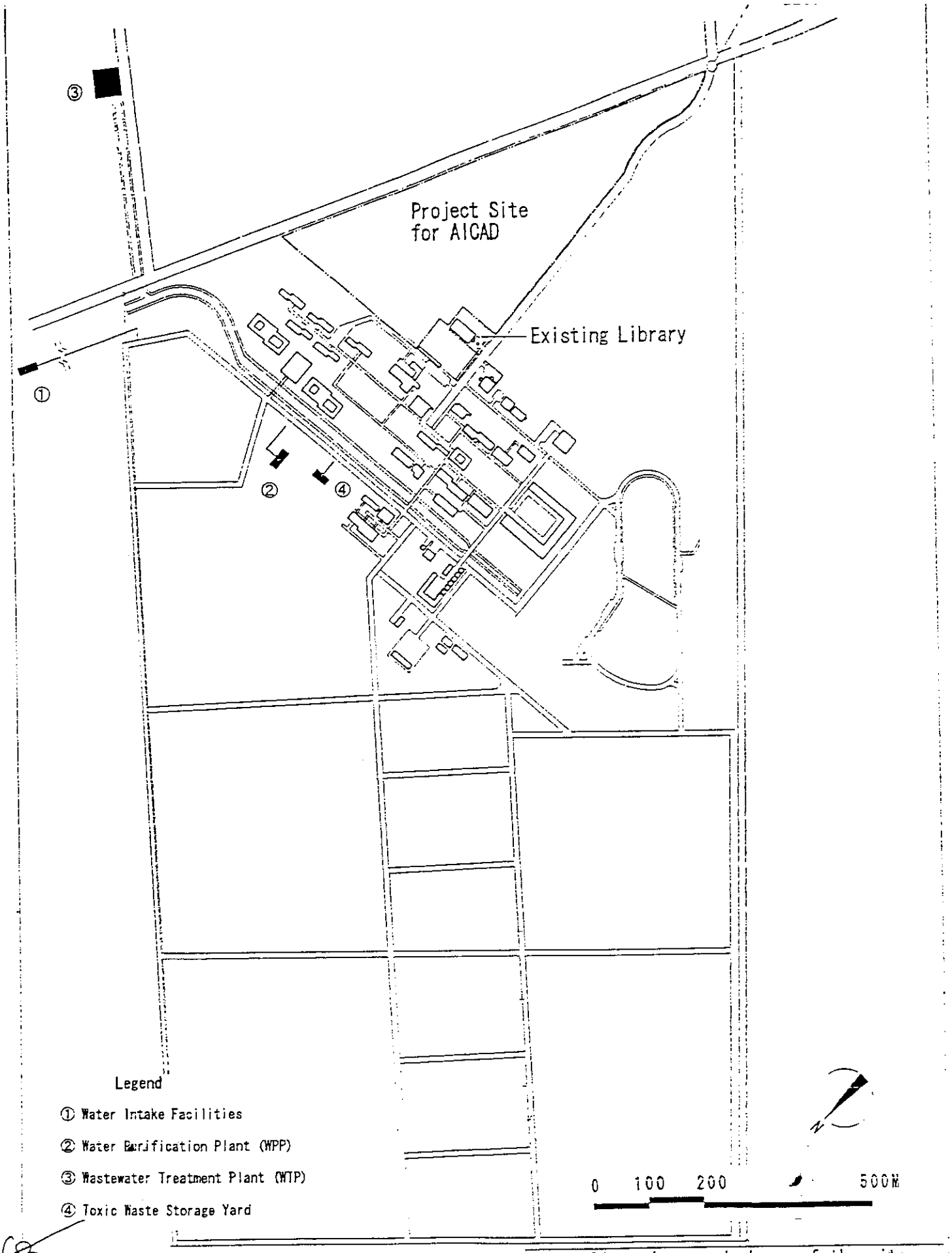
Japanese technical cooperation to the AICAD will be formulated in accordance with the functions of the AICAD as stipulated in I-3 above. Major components of the Japanese technical cooperation are as follows:

1. assignment of Japanese experts;
2. provision of equipment;
3. training in Japan;
4. exchange of resource persons among the participating countries;
5. regional training;
6. joint research.

IV Mechanism of Implementing the AICAD

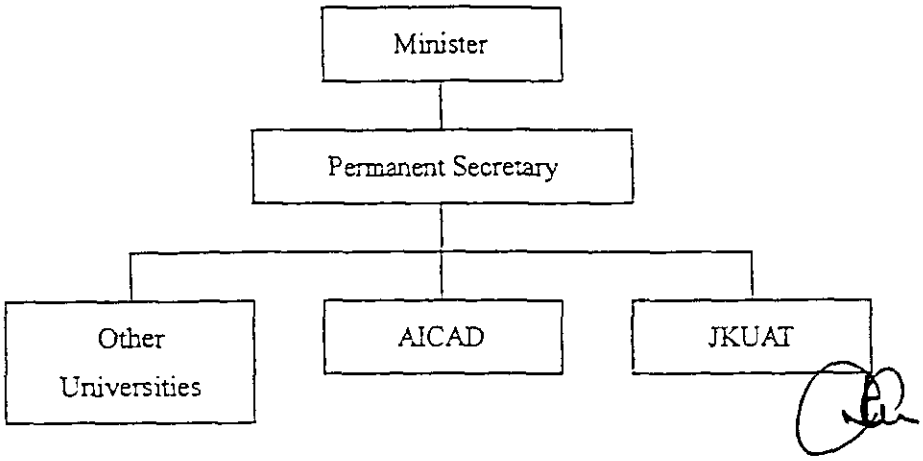
Mechanism for implementing the AICAD is as follows:

1. Each country will benefit from participation in the AICAD, while JKUAT will serve as the core of the AICAD;
2. A joint coordinating committee comprising participating countries will be established for the AICAD;
3. Activities of the AICAD in each country will be decided based on the consultations at the Joint Coordinating Committee meetings of the AICAD;
4. Based on this Record of Discussions (R/D), bilateral arrangements for implementing the Japanese technical cooperation to support the activities of the AICAD in each country will be agreed upon between the respective governments and JICA.

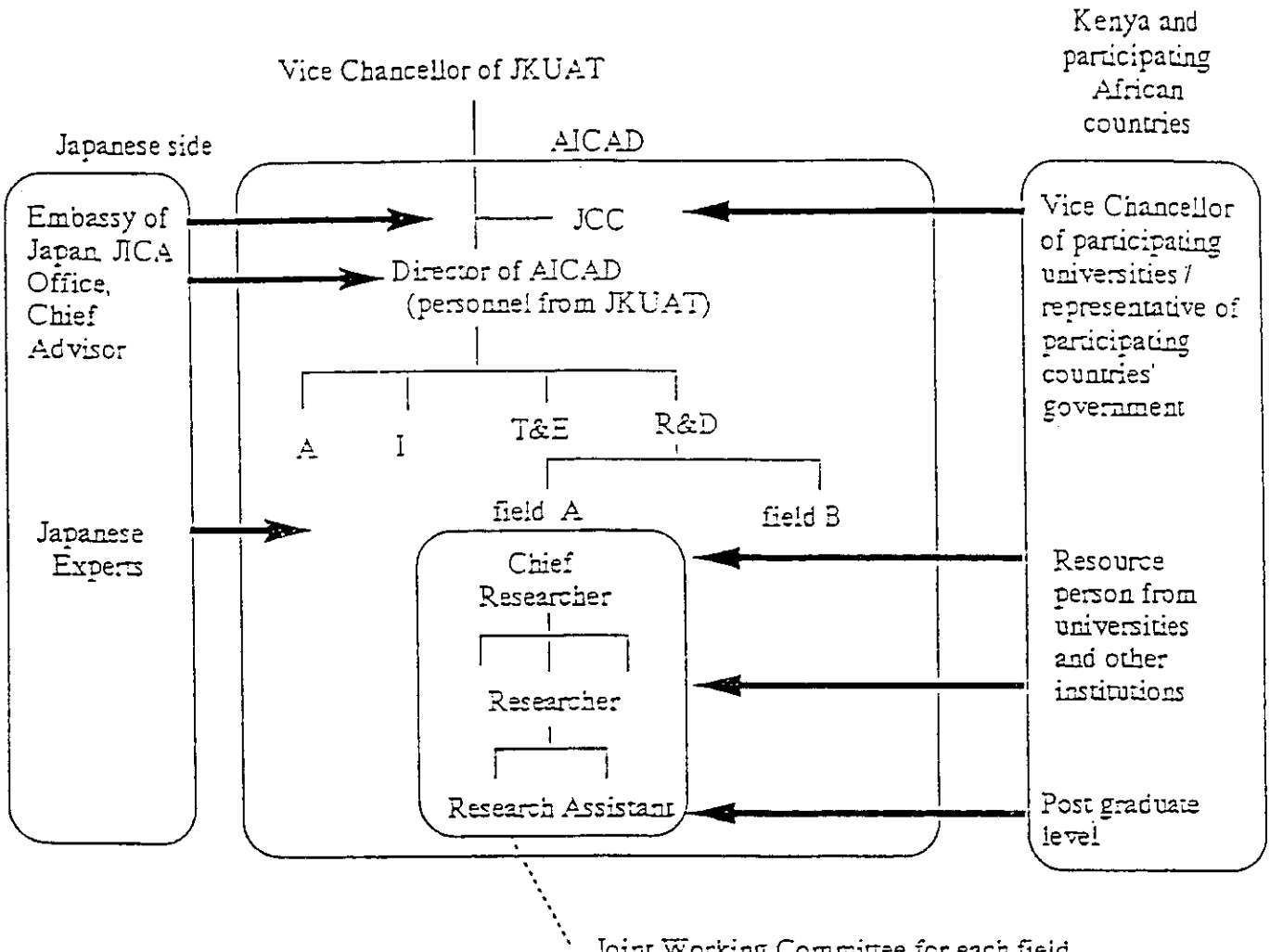

③
Project Site
for AICAD
Existing Library
①
②
④
Legend
① Water Intake Facilities
② Water Purification Plant (WPP)
③ Wastewater Treatment Plant (WTP)
④ Toxic Waste Storage Yard
0 100 200 500M
■: Rehabilitation of the water supply and sewerage system
Note: Dimensions and shape of the site of existing buildings are indicated just for reference

ANNEX 3-1

Organization chart showing MOEST, JKUAT and AICAD



Organization Chart of the Project (tentative)



A: Administration
I: Information Network
T & E: Training and Extension
R & D: Research and Development

Items Requested by AICAD (Building)

The contents of the request finally submitted by the Kenyan side regarding the facilities at AICAD are as follows;

Division	Facilities
1. Administration Unit	1-1 Deputy Manager's Office 1-2 Director's Office 1-3 Chief Advisor's Office 1-4 Deputy Director's Office 1-5 Project Coordinator's Office 1-6 Secretaries' Office 1-7 Audit Section Office 1-8 Meeting Room 1-9 Administration Office 1-10 Maintenance Office 1-11 Others
2. Research and Development Unit	2-1 R & D Coordinator's Office 2-2 JICA Advisor's Office 2-3 Assistant Coordinator's Office 2-4 Secretaries' Office 2-5 Senior Researcher's Office 2-6 Junior Researcher's Office 2-7 Meeting Room 2-8 Others
3. Training and Extension Unit	3-1 T/E Coordinator's Office 3-2 JICA Advisor's Office 3-3 Assistant Training Coordinator 3-4 Assistant Extension Coordinator 3-5 Secretaries' Office 3-6 Computer Laboratory 3-7 Meeting Room (Small/capacity 30) 3-8 Meeting Room (Large/capacity 50) 3-9 Seminar Room (capacity 150) 3-10 Others
4. Information Unit	4-1 Information Coordinator's Office 4-2 JICA Advisor's Office 4-3 Secretaries Office 4-4 Hardware Maintenance Room 4-5 Server Room 4-6 e-contents Room 4-7 Electrical Information Store 4-8 e-laboratory, Internet Room & Library 4-9 Procurement Office 4-10 Printing Room 4-11 Photo Room 4-12 A/V Edition 4-13 Production Store 4-14 Others

5. Accommodation Unit	5-1 Bedroom 5-2 Lounge 5-3 Mini-kitchen 5-4 Administration Office 5-5 Others
6. Garage Unit	6-1 Driver's Room 6-2 Driver Mechanic Room 6-3 Others
7. Guard House Unit and Others	7-1 Head Guard's Room 7-2 Guard's Room 7-3 Entrance Guard House 7-4 Others

Note
1. Each facility mentioned above includes the related common space such as corridors, storage, machine room, the necessary utilities such as electricity, water supply, sewerage, telecommunication, etc. The details of such common spaces and utilities will be discussed further between the Japanese and Kenyan sides.
2. IT system within AICAD will be included to promote the activities of Research and Development and Training and Extension, and to disseminate valuable knowledge and experience from AICAD.
3. The size and capacity of facilities will be determined after further studies.

The selection criteria of Equipment are as follows.

1. Equipment for AICAD including IT equipment

2. Equipment including IT for JKUAT to be used for the second and third countries training

3. Equipment for JKUAT provided by previous Japanese Grant Aid and linked to the AICAD activities which require repairing and replacement

1. Japan's Grant Aid Scheme

(1) What is Grant Aid?

The Grant Aid Program provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. Grant Aid is not supplied through the donation of materials as such.

(2) Exchange of Notes (E/N)

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

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

However in case of delays in delivery, installation or construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended by a maximum of one fiscal year at most by mutual agreement between the two Governments.

(4) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

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

However, the prime contractors, namely consulting, constructing and procurement firms, are limited to "Japanese nationals." (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

(5) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts

shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

(6) Undertakings required of the Government of the Recipient country

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

1) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction.

2) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites.

3) To secure buildings prior to the procurement in the case of the installation of equipment.

4) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid.

5) 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.

6) 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 the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

8) "Re-Export"
The products purchased under the Grant Aid should not be re-exported from the recipient country.

9) Banking Arrangements (B/A)

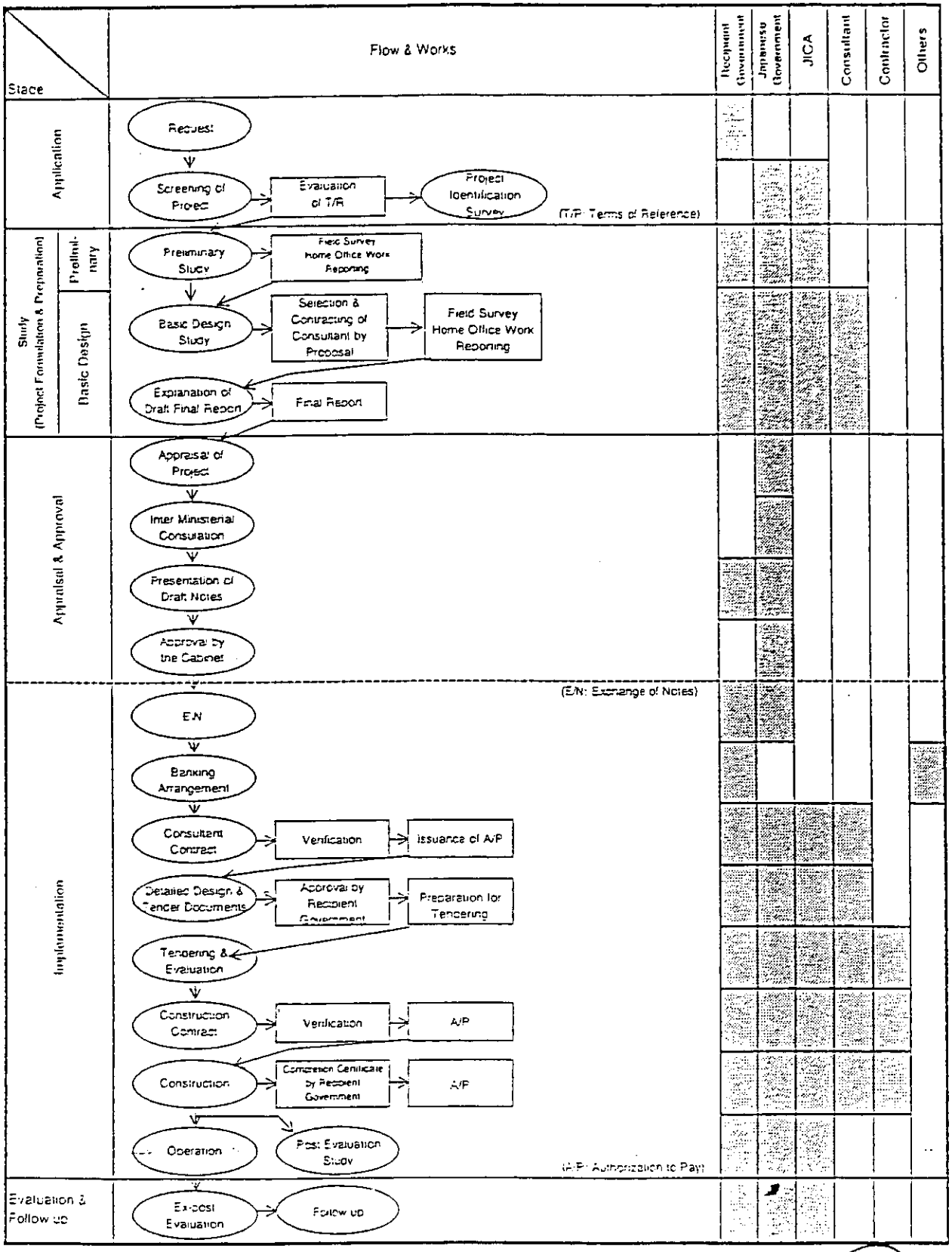
a. The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

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.

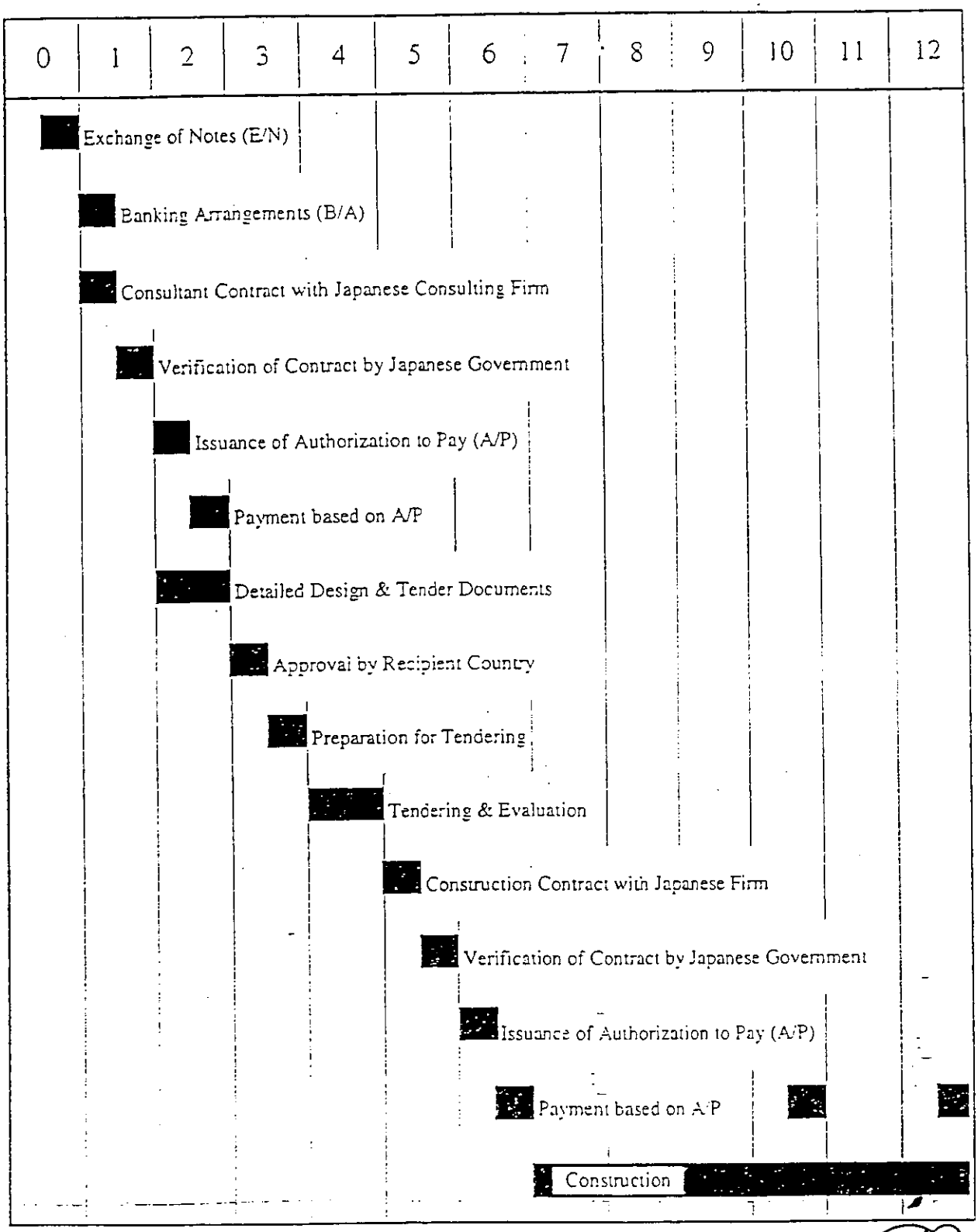
2 Grant Aid Procedures

(1) Procedures

The procedures of Japan's grant aid program are as shown below:



(2) Tentative Implementation Schedule after E/N



Major Undertakings

Major undertakings to be taken by the both Governments are n principle as follows.

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, ordinary 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 contact 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.		●

MINUTES OF DISCUSSIONS
ON BASIC DESIGN STUDY ON THE PROJECT FOR ESTABLISHMENT OF THE AFRICAN INSTITUTE FOR CAPACITY DEVELOPMENT IN THE REPUBLIC OF KENYA
(EXPLANATION ON DRAFT FINAL REPORT)

In November and December 2001, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a Basic Design Study Team on the Project for Establishment of the African Institute for Capacity Development (hereinafter referred to as "the Project") to the Republic of Kenya (hereinafter to as "Kenya"), and through discussion, field survey, and technical examination of the study results in Japan, JICA prepared a Draft Final Report of the study.

In order to explain and to consult Kenya on the components of the Draft Final Report, JICA sent to Kenya the Draft Final Report Explanation Team (hereinafter referred to as "the Team"), which is headed by Mr. Junsaku Koizumi, Special Technical Advisor of JICA, from 24th March to 7th April, 2001.

As a result of discussions, both parties confirmed the main items described on the attached sheets.

Nairobi,
April 3rd, 2001

Mr. Junsaku Koizumi
Leader
Special Technical Advisor,
Japan International Cooperation Agency
(JICA)

Prof. Japheth C. Kiptoon
Permanent Secretary
Ministry of Education, Science
and Technology
Republic of Kenya

Countersigned by

Mr. Mwaghazi Mwachofi
Permanent Secretary
Ministry of Finance and Planning
Republic of Kenya

ATTACHMENT

1. Components of the Draft Final Report

   The Government of Kenya agreed and accepted in principle the components of the Draft Final Report explained by the Team.

2. Japan's Grant Aid Scheme

   Kenyan side understands the Japan's Grant Aid Scheme and the necessary measures to be taken by the Government of Kenya as explained by the Team and described in Annex 5-1 and Annex 5-2 of the Minutes of Discussions signed by both parties on December 6th , 2000.

3. Schedule of the Study

   JICA will complete the final report in accordance with the confirmed items and send it to the Government of Kenya by the end of May, 2001.

4. Other relevant issues

4.1 The Kenyan side shall ensure enough budget and personnel to operate and maintain the facilities and equipment for the Project. The Kenyan side confirmed that the necessary staff and budget would be provided for with effect from the next financial year starting July 2001.

4.2 The Kenyan side shall take the following measures and complete the works, before the commencement of construction of the Project;

(1) Land acquisition and preparation for the construction sites of the Project as follows;
   a) for New AICAD Facilities
   b) for New Water Supply and Sewerage Facilities

   The Kenyan side shall report on the procedure of this land acquisition to Japanese side by June 2001.

(2) The Kenyan side shall expand the water rights to be 1,500 m^3/day to secure the water demand.

(3) Land Reallocation and Preparation for the New Sports

(4) Temporary Power and Water Supply for construction

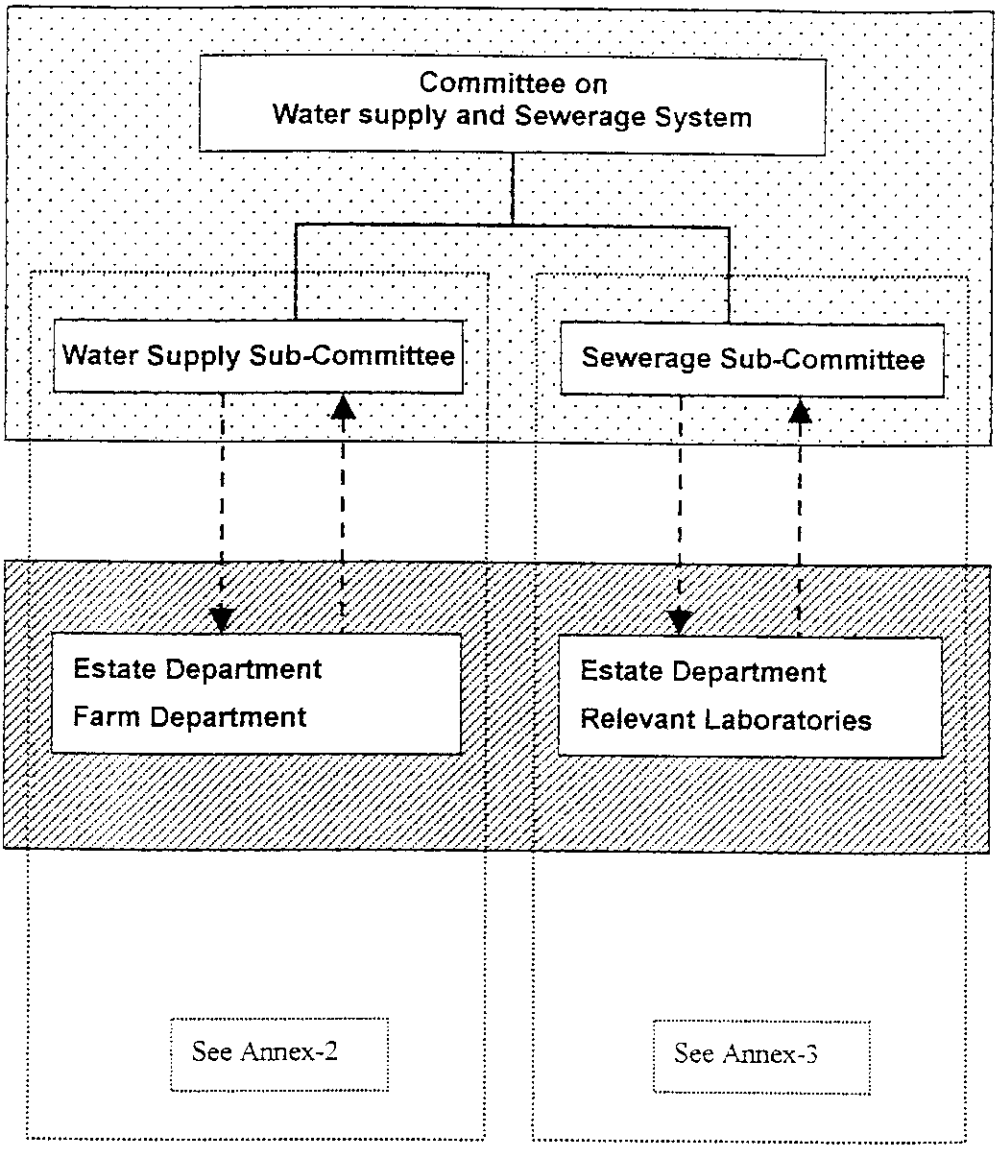
4.3 The Kenyan side requested Technical Assistance for the operation and maintenance for Water Supply and Sewerage System. In order to respond to this request, the Team has proposed to establish "the Committee on Water Supply and Sewerage System" for smooth implementation of the Technical Assistance. The Kenyan side agreed to establish the committee with authorized members as per attached Organization Chart by Annex –1, 2 and 3.

4.4 Both sides agreed that the final contents of the Basic Design shall be approved by the Cabinet Meeting of the Government of Japan.

Annex-1

Overall Organization for O&M of Water Supply and Sewerage System

[Organization]



[Function]

Supervision

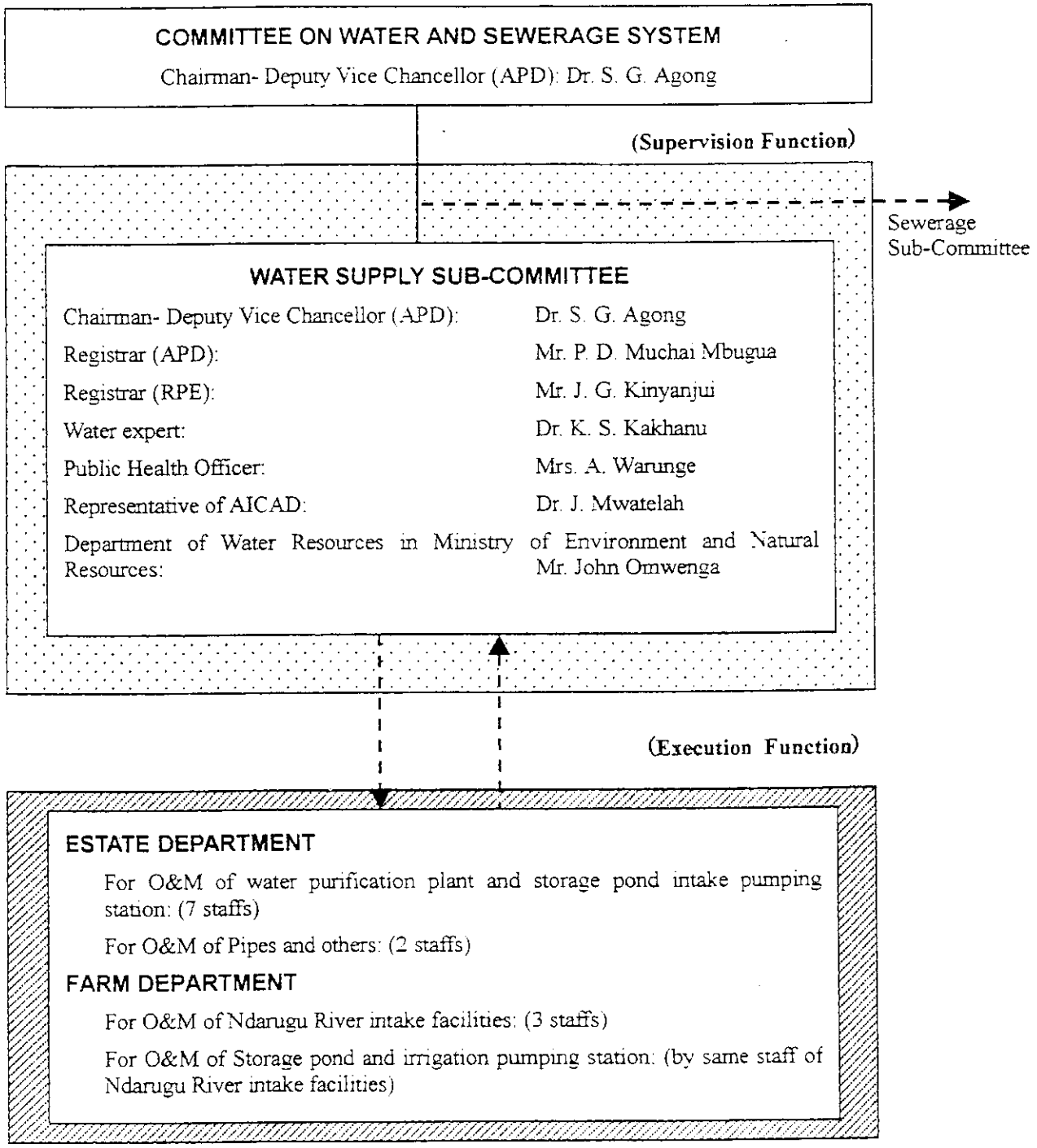
- Supervising O&M
- Committee is held twice a year.
- Sub-Committee is held every two month or more frequently.

Execution

- Executing operation and maintenance (O&M)

Annex-2

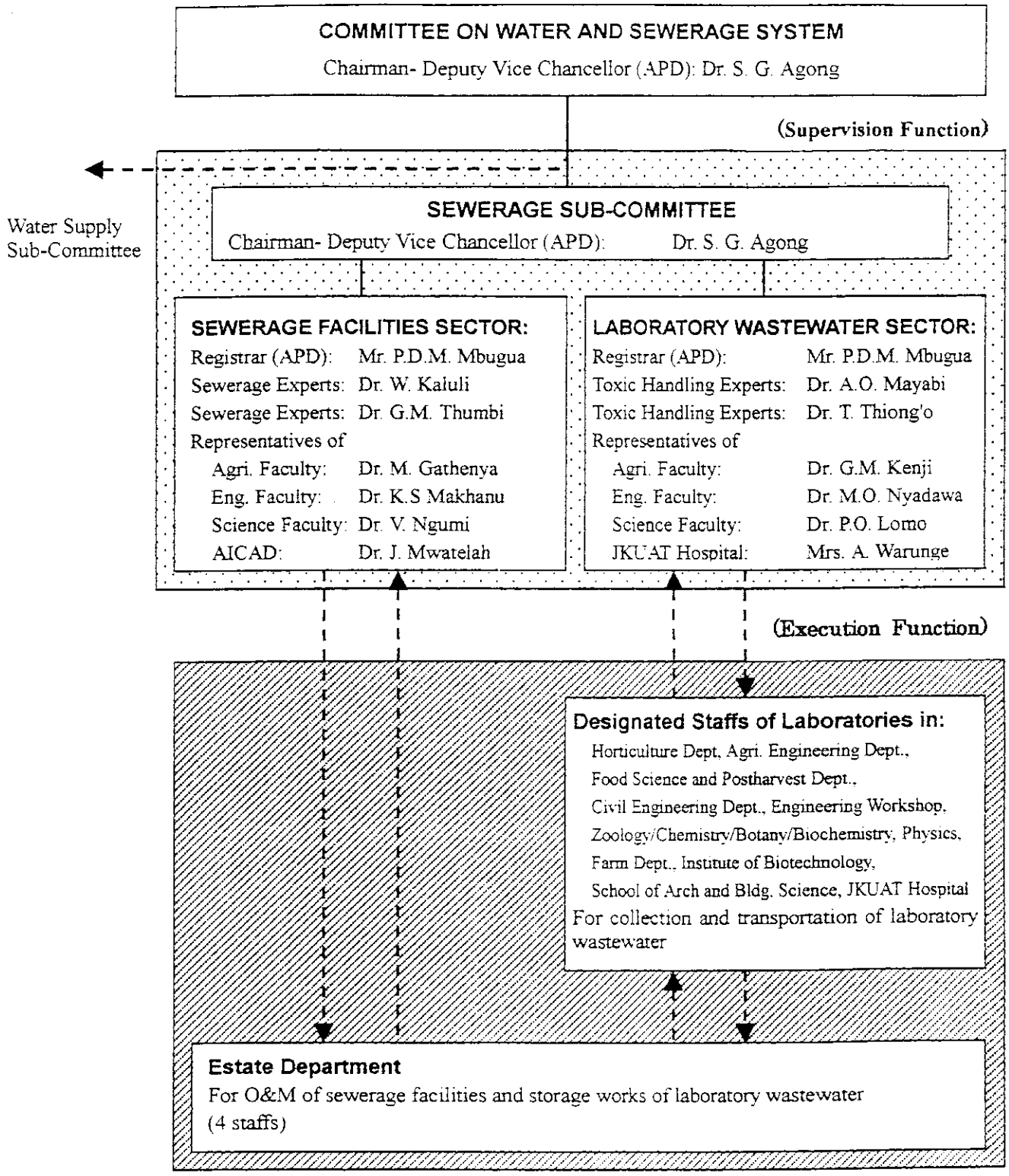
Organization for O&M of Water Supply System



Remark: APD= Administration, Planning and Development
RPE= Research, Production and Extension

Annex-3

Organization for O&M of Sewerage System



Remark: APD= Administration, Planning and Development

Table 1-2 The Project for Establishment of the African Institute for Capacity Development

Extent of Works (DRAFT)

Portions by the Japanese Side	**Portions by the Kenyan Side**	**Budget** **(Rough Estimation, US$)**
(1) Building Works Structure works, finishing works (2) Electrical Works Power, trunk facilities, lighting, power outlets and P/A systems (3) Utilities and Facilities a) Water Supply Rehabilitation, extension or newly installation of an intake facility, water conveyance pipes, a raw water tank, a water purification plant, a reservoir for the existing JKUAT water supply improvement and newly installation of a water supply internal network for new AICAD buildings b) Sewerage system Rehabilitation, extension or newly installation of wastewater collection facilities, a wastewater treatment plant, a pretreatment plant, a toxic waste storage yard for the improvement of the existing JKUAT sewerage facilities and newly installation of a wastewater collection system for new AICAD buildings c) Fire-extinguishing facilities d) Electrical supply and transformer system Cabling works from the high tension receiving panel in the Substation to the facilities. e) Telecommunication system Cabling works from MDF to the facilities, including installation of conduit from the cross connection point at the site boundary to MDF f) Lightning Protection System	(1) Site Preparation a) Pre Construction Works b) Ground preparation works: - Demolition of existing facilities - Grading (current trash disposal area) c) Temporary power and water supply for the construction d) Temporary access road for the construction (2) External Works and Approach Roads - Landscaping, planting, fence, etc within the Site. - Permanent road works around the site (3) Utilities and Facilities a) Water Supply Construction from the main feeder to the water valve at the water supply meter including the water supply meter. b) Sewerage Piping works from the connection manhole in the site to the existing sewerage line including the repair work of the existing ditch. c) Storm Drainage Drainage line from the site to the existing line including the expansion work of the existing drainage line. d) Electrical Work Cabling works from the existing power supply point to the new Electrical room in new AICAD Building. e) Telecommunication Work Cabling work(for Direct/Extension/Public Telephone) from existing MDF/PABX to Point Distribution for new IDF/PABX . f) The provision of gas(LPG) cylinders for the kitchen and Lab.	(1) (1) Site Preparation a) — (include temporary access road) b) — — c) US$400 d) — (2) External Works and Approach Roads —US$16,000 — (3) Utilities and Facilities a) — b) — (include Storm Drainage) c) — d) US$19,000 (Connection Charge us$ /kVA) (Consumer Deposit us$ /kVA) (Stump Duty us$) e) US$400 (Connection Charge 76.4 us$/line·time) f) —

Portions by the Japanese Side	**Portions by the Kenyan Side**	**Budget** **(Rough Estimation, US$)**
g) Lighting system in the site (4) Exterior Work Road, path and parking lots within the site (5) Equipment Equipment for Training and Operation & Maintenance (6) Electric Room, Electric Generator Room, Pump Room	(4) <u>Others</u> a) Governmental works including the application and obtaining Governmental approvals and permissions b) Smooth custom clearance, tax exemptions and prompt internal transportation for the imported construction materials and equipment c) Commissions to the Japanese foreign exchange bank for its banking services based upon the Banking Arrangement namely the advising commission of the "Authorization to Pay" and payment commission (5) Management, operation and maintenance cost for the new buildings and facilities (6) Tax exemptions and necessary preferential treatment for the construction staff from Japan or a third country (7) Smooth entry, re-entry and departure of Kenya for the Japanese technical staff (8) All the expenses, other than to be born by the Japan's Grant Aid within the scope of the Project (9) Office General Furniture	(4) <u>Others</u> a)US$500 b) – c) – (5) US$713,600 (6) – (7) – (8) – (9) US$12,800

LAN Specifications

a) AICAD

i) Backbone Switch

Functions	Back plain capacity	22Gbps and more
	Layer 2 switching	-
	Layer 3 switching	10Mpps and more
Maximum port amount	10/100 base TX	48
	100 base FX	-
	Gigabit slot	2
VLAN	VLAN support	244
	VLAN Trunk support	ISL, 802.1Q
Spanning tree		Support
Control functions		SNMP, RMON
Layer 3 Protocol support		IP, IPX, IP multicast

ii) Sub Switch

Functions	Back plain capacity	22Gbps and more
	Layer 2 switching	-
	Layer 3 switching	10Mpps and more
Maximum port amount	10/100 base TX	48
	100 base FX	-
	Gigabit slot	2
VLAN	VLAN support	244
	VLAN Trunk support	1SL、802.1Q
Spanning tree		Support
Control functions		SNMP, RMON
Layer 3 Protocol support		IP, IPX, IP multicast

iii) Edge Switch

Functions	Back plain capacity	3.2Gbps and more
	Layer 2 switching	3Mpps and more
	Layer 3 switching	-
Maximum port amount	10/100 base TX	12/24
	100 base FX	-
	Gigabit slot	-
VLAN	VLAN support	64
	VLAN Trunk Support	1SL、802.1Q
Spanning tree		Support
Control functions		SNMP, RMON
Layer 3 Protocol support		—

iv) Scope of works

Description	Scope of work	Out of scope
Network Equipment	○	
Installation racks for N. Equipment	○	
Optic Panel	○	
Main optic Cabling work	○	
Optic code	○	
Modular Panel	○	
UTP patch code (panel ~Equipment)	○	
Supporting UTP Cabling work	○	
LAN outlet	○	
UTP patch code (outlet ~ terminals)		○
Internal pipe routing	○	
External pipe routing (Hostel ~ Main building)	○	

b) JKUAT

i) Backbone Switch

Functions	Back plain capacity	22Gbps and more
	Layer 2 switching	-
	Layer 3 switching	10Mpps and more
Maximum port amount	10/100 base TX	48
	100 base FX	-
	Gigabit slot	2
VLAN	VLAN Support	244
	VLAN Trunk support	1SL, 802.1Q
Spanning tree		Support
Control functions		SNMP, RMON
Layer 3 Protocol support		IP, IPX, IP multicast

ii) Sub Switch

Functions	Back plain capacity	3.2Gbps and more
	Layer 2 switching	3Mpps and more
	Layer 3 switching	-
Maximum port amount	10/100 base TX	12/24
	100 base FX	-
	Gigabit slot	-
VLAN	VLAN Support	64
	VLAN Trunk Support	1SL, 802.1Q
Spanning tree		Support
Control functions		SNMP, RMON
Layer 3 Protocol support		-

iii) Scope of works

Description	Japanese Side	JKUAT Side
Network Equipment	○	
Installation racks for N. Equipment	○	
Optic Panel	○	
Main optic Cabling work	○	
Optic code	○	
Modular Panel	○	
UTP patch code (Equipment ~ Equipment)	○	
Supporting UTP Cabling work		○
LAN outlet		○
UTP patch code (Outlet ~ Terminals)		○
Internal pipe routing in the existing building (LAN rack ~ outside)		○
Internal pipe routing in the existing building (LAN rack ~ LAN outlet)		○
External pipe routing (Old library ~ each buildings)	○	

No.	Faculty/Dept.	No. of Equipment Requested	Present Activities and Status of Existing Equipment
1	Faculty of Agriculture Horticulture	Student; 9pcs T/E; 7pcs Research; 6pcs total; 22pcs	- Curriculum; 64 units for BSc. and 16 for MSc. and crop horticulture is more active than fruit and flower in T/E and research. - Existing equipment; General science and chemical equipment, Microscope, Atomic Absorption Spectrophotometer (Old), Gas Chromatography etc. - There are many items needs to be repaired like recharge of coolant, replacement of parts. - Lacking of equipment for student experimental practice, T/E and research
2	Faculty of Agriculture, Agricultural Engineering	Student; 19pcs T/E; 2pcs Research; 40pcs total; 61pcs	- Curriculum; 83 units for BSc. and 36 for MSc. and curriculum covers wide range of many subjects including Fluid mechanics, Engineering, Soil, Irrigation, Agricultural Machinery, Post-harvest. - Existing equipment includes many kind of tractor, soil equipment, food processing/ analysis equipment and equipment for analysis of waste water for students and research use - In state of narrow experiment/research space due to joint use of facilities with Dept. of Science
3	Faculty of Agriculture Food Processing and Post Harvest Technology	Student; 14pcs T/E; 225pcs Research; 55pcs total; 294pcs	- Curriculum; 69 units for BSc. and 26 for MSc. covers Food chemistry, Quality management, Post-harvest technology etc. , specially, and " Applied Food Analysis " training program is very active in Sub-Saharan Africa. - Existing food processing equipment is very abundant, but not so in sophiscated analyzer for further level up in food technology.
4.	Faculty of Engineering Civil Engineering	Student; 25pcs T/E; 4pcs Research; 12pcs total; 41pcs	- Curriculum; 84 units for BSc. and 41 for MSc. and is going to add environmental course and to develop waste water field. - Existing equipment in fundamental civil engineering curriculum is enough. - There are some waste water analysis equipment, but lacking major equipment like COD/BOD/TOC analyzer, Auto sampler, N & P analysis etc. - Repairing work is required due to lack of parts and consumables, loss of coolant and cable wiring work for unutilized equipment
5.	Faculty of Engineering Mechanical Engineering	Student; 63pcs T/E; 8pcs Research; 11pcs total; 82pcs	- Curriculum; 80 units for BSc. and 48 for MSc. and lacking in new course like advanced technology, mechatronics and energy equipment, etc including equipment. - Equipment management and maintenance are in good condition.
6.	Faculty of Engineering Electrical & Electronics Engineering	Student; 72pcs T/E; 5pcs Research; 6pcs total; 83pcs	- Curriculum; 80 units including option subjects for BSc., and experimental practice and/or research theme for advanced or practical fields is required. - Equipment management and maintenance are in good condition - In state of narrow experiment/research space due to joint use of lecture.
7.	Faculty of Architecture	Student; 15pcs T/E; 15pcs Research; 41pcs total; 71pcs	- Being equipped with basic architectural equipment - Lacking of space for student practice and research due to joint use with Dept. - Being projected a lack of student drafting equipment due to establishment of new two departments.

No.	Faculty/Dept.	No. of Equipment Requested	Present Activities and Status of Existing Equipment
8.	Faculty of Science Zoology	Student; 15pcs T/E; 6pcs Research; 9pcs total; 30pcs	- Curriculum ; 43 units including option subjects for BSc. 31 for Msc. and only one unit of experiment as research Bsc. and two units for Msc. - Microscope, Autoclave, Electrophoresis kits, Elisa kits, VIS Spectrophotometer, Centrifuge, Ovens, Incubators Shakers, Egg Incubators, pH meter - In good condition of equipment
9.	Faculty of Science Chemistry	Student; 8pcs T/E; 7pcs Research; 11pcs total; 26pcs	- AAS, AAS (BUCK), Spectrophotometer (VIS), Spectrophotometer, Flame photometer - Only Spectrophotometers are available - Intending to enter environmental research
10.	Faculty of Science Botany	Student; 7pcs T/E; 1pcs Research; 8pcs total; 16pcs	- Curriculum ; 50 units including 29 option subjects for BSc. and 11 specialization areas with 5 to 15 units by course. Student's research option for Bsc. and Msc. are similar to the others. - Phase contrast microscopes, Research microscopes, Dissecting microscopes, Memert incubator, Oven - Equipment management and maintenance are in good condition
11.	Faculty of Science Biochemistry	Student; 5pcs T/E; 1pcs Research; 6pcs total; 12pcs	- Students from Chemistry, Zoology and Botany are allowed to enter from second year/ - Curriculum; 27 units for Bsc. and 11 units for Msc. - pH meter, Incubator, Electrophoresis kit, Freezer, etc. - Spectrophotometer, oven, Autoclave, etc.
12.	Faculty of Science Physics	Student; 3pcs T/E; 2pcs Research; 1pcs total; 6pcs	- Curriculum ; 44 units including 24 option subjects for BSc. and eight specialization areas with four to seven units by course. students research option for Bsc. and Msc. are similar to the others. - Abundant in physics research and experiment like Oscilloscopes, XY Recorder, Single Crystal Silicon Wafers, Portable Multichannel Analyzer, Optical Spectrum Analyzer, etc.
13.	Faculty of Science Maths & Statistic	Student; 0pcs T/E; 4pcs Research; 2pcs total; 6pcs	- Curriculum ; 84 units including 38 option subjects for BSc. and three specialization areas with to 13 to 20 units by course. students research option for Bsc. and Msc. are similar to the others. - Existing equipment; Computer, UPS, Dot matrix printer, Accessories
14.	Institute of Computer Science & Information Technology	Student; 5pcs T/E; 30pcs Research; 0pcs total; 35pcs	- Most active in LAN system and PC technology including training for PC. - Only personal computer are available.
15.	Institute of Energy & Environmental Technology	Student; 0pcs T/E; 14pcs Research; 0pcs total; 14pcs	- Being active in energy and utilization of solar energy development and environment - Amorphous solar energy unit, Drilling machine, Welding set, Water pump, Biogas digester
16.	Institute of Human Resources Development	Student; 0pcs T/E; 6pcs Research; 1pcs total; 7pcs	- Mainly focusing in publication of research paper and opening of seminar relating Manpower development in small and medium enterprises. - Only PC is available
17.	Center of Regional Enterprise Development	Student; 0pcs T/E; 6pcs Research; 0pcs total; 6pcs	- Development project for micro and small-scale enterprises in conjunction with oversea donor projects. - Existing equipment; Computers, Printer, Vehicle

No.	Faculty/Dept.	No. of Equipment Requested	Present Activities and Status of Existing Equipment
18.	Farm Dept.	Student; 0pcs T/E; 30pcs Research; 0pcs total; 30pcs	- There are many agricultural sectors training projects in the fields of horticulture, food crops and stockbreeding - Existing equipment; Crusher, Centrifugal pump, Mortar, TS Hydrant, Iseki tractor, Star rotary tiller, Harvester, Star 2ton trailer, Star disc plough
19.	Library	Student; 28pcs T/E; 0pcs Research; 0pcs total; 28pcs	- Existing equipment; Library, computer
20	Workshops	Student; 16pcs T/E; 15pcs Research; 0pcs total; 31pcs (divided to Students and T/E)	- Existing equipment; Single surface planner, Band sawing machine, Automatic saw sharpener, Bech drilling machine, Orbital sander, Wood moisture meter, Dust Collectors、
	Total	Student; 304pcs T/E; 388pcs Research; 209pcs total; 901pcs	

The contents of 28 training courses to be implemented by AICAD

Details of the training and extension program courses were obtained from AICAD during the basic design study survey. A total of 28 courses are planned. 17 training courses will be held in Kenya and 11 courses in Tanzania. Of the 17 courses to be held in Kenya, 11 courses for Third Country participants and 6 for In-country participants. At present, JKUAT is implementing 8 training courses, and 5 of these existing courses will continue to be implemented by AICAD. Therefore, there will be 12 new courses. The theme of the 12 new training courses categorize the research and development conducted by PTTC, therefore these courses can be implemented easily. The result of research can also be adopted easily to the extension program training course, and the implementation organization and operation budget can be served.

Table：Comparison of research theme and training theme by AICAD and PTTC

	Serial No.	Training course name of AICAD	Considering of research and development theme by PTTC	
			Research category	Research theme
①	14	Postharvest Technology for rural community		
②	17	Development of improved crops using biotechnology	Agricultural development	Better quality seeds, Improvement of standard of cultivation
③	19	Waste management in urban area	Social Development	Treatment of waste
④	21	Push and pull ICIPE method of pest control	Social Development	Research of measures against infection, Extension of inoculations
⑤	26	Using GIS to study and improve rural/urban	Social Development	Improvement of rural life
⑥	27	Improvement study of community based "Grameen Bank"	Social Development	Improvement of farm life, Education for woman
⑦	8	Low cost cement brick for rural housing		
⑧	10	Backing technology using locally development	Social Development	Improvement of farm life
⑨	12	Fabrication of farm machinery for rural communities	Industry Development	Development of agricultural machinery
⑩	15	Rural framing improvement around lake	Agricultural development	Environmentally conscious agriculture
⑪	22	Community based water management methods boreholes	Economic Development	Development of infrastructure in farm areas
⑫	25	Improving access to information technology (IT) in rural areas	Economic Development	Correspondence of IT and networks

Training Programmes to be Implemented by AICAD

No.	Serial No.	Theme	Type	Country	No. of per Year	Duration (days)	No. of Participants
①	1	Applied Food Analysis	3rd Country	Kenya	2	45	30x2=60
②	2	Applied Electrical/Electronic Engineering	3rd Country	Kenya	1	45	30
③	3	Water Pollution and its Analysis	3rd Country	Kenya	2	45	30x2=60
④	4	Applied Plant Propagation Technology (I)	3rd Country	Kenya	2	45	30x2=60
⑤	6	Agricultural Machinery Management (I)	3rd Country	Kenya	1	45	30
⑥	14	Postharvest Technology for Rural Community	3rd Country	Kenya	2	45	30x2=60
⑦	17	Development of Improved Crops using Biotechnology	3rd Country	Kenya	1	45	30
⑧	19	Waste Management in Urban Areas	3rd Country	Kenya	1	45	30
⑨	21	Push & Pull ICIPE Method of Pest Control	3rd Country	Kenya	2	45	30x2=60
⑩	26	Using GIS to Study and Improve Rural/Urban Poor	3rd Country	Kenya	1	45	30
⑪	27	Improvement Study of Community Based "Gramine Bank"	3rd Country	Kenya	2	30	30x2=60
①	8	Low Cost Cement Bricks for Rural Housing	In-Country	Kenya	1	30	60
②	10	Backing Technology using Locally Development	In-Country	Kenya	1	30	60
③	12	Fabrication of Farm Machinery for Rural Communities	In-Country	Kenya	1	45	30
④	15	Rural Farming Improvement around Lake	In-Country	Kenya	1	45	30
⑤	22	Community Based Water Management Methods Boreholes	In-Country	Kenya	1	30	60
⑥	25	Improving Access to Information Technology (IT) in Rural Areas	In-Country	Kenya	2	30	30x2=60
①	5	Applied Plant Propagation Technology (II)	In-Country	Tanzania	1	45	60
②	7	Agricultural Machinery Management (II)	In-Country	Tanzania	1	45	30
③	9	Low Cost Cement Bricks for Rural Housing	In-Country	Tanzania	1	30	60
④	11	Backing Technology using Locally Development	In-Country	Tanzania	1	30	60
⑤	13	Fabrication of Farm Machinery for Rural Communities	In-Country	Tanzania	1	45	30
⑥	16	Rural Farming Improvement around Lake	In-Country	Tanzania	1	45	30
⑦	18	Improving Local Systems for Soil Conservation	In-Country	Tanzania	1	30	60
⑧	20	Waste Management in Urban Areas	3rd Country	Tanzania	1	45	30
⑨	23	Community Based Water Management Methods Boreholes	In-Country	Tanzania	1	30	60
⑩	24	Improving Access to Information Technology (IT) in Rural Areas	In-Country	Tanzania	1	45	30
⑪	28	Improvement Study of Community Based "Gramine Bank"	In-Country	Tanzania	1	30	60

Appendix A	Calculation of Design Water Supply
Appendix B	Hydrogical Study on Ndarugu River
Appendix C	Counter Measures to Water Hammer
Appendix D	Study of Income and Expenditure of Water

Appendix A Calculation of Design Water Supply

Table 1 Population of JKUAT in Past and Future

	Actual past population on JKUAT										Population Projection on JKUAT											
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Students																						
Agriculture	598	626	600	629	650	647	652	644	642	637	670	710	750	790	820	850	880	910	930	960	990	
Engineering	612	653	637	731	758	766	768	772	764	773	780	800	820	840	860	880	910	940	970	1000	1030	
Science	574	675	780	776	785	764	748	740	723	710	710	730	750	770	790	820	850	880	910	940	970	
Computer										85	140	190	220	240	260	280	300	320	340	360	380	
Architecture										110	150	180	230	280	330	360	380	400	420	440	460	
Continuing Education(*)	-	-	-	-	-	85	238	421	453	460	500	600	700	800	1000	1200	1300	1400	1600	1800	2000	
Human Resource Development(*)	-	30	30	12	12	20	20	25	25	35	70	110	150	190	200	220	240	260	280	300	320	
Total	1784	1984	2047	2148	2205	2282	2426	2602	2607	2810	3020	3320	3620	3910	4260	4610	4860	5110	5450	5800	6150	
Residents	1784	1954	2017	2136	2193	2177	2168	2156	2129	2315	2450	2610	2770	2920	3060	3190	3320	3450	3570	3700	3830	
Commuters	0	30	30	12	12	105	258	446	478	495	570	710	850	990	1200	1420	1540	1660	1880	2100	2320	
Staff																						
Teaching only	230	252	267	273	278	278	282	282	281	283	-	-	-	-	-	-	-	-	-	-	-	
Teaching support	143	162	178	188	194	196	195	196	196	196	-	-	-	-	-	-	-	-	-	-	-	
Administrative + support	561	578	622	640	672	647	639	630	624	624	-	-	-	-	-	-	-	-	-	-	-	
Total	934	992	1067	1101	1144	1121	1116	1108	1101	1103	1103	1103	1103	1103	1103	1103	1103	1103	1103	1103	1103	
Residents in staff house	595	595	595	595	595	595	595	595	595	595	595	595	595	595	595	595	595	595	595	595	595	
Commuters	815	873	948	982	1125	1002	997	989	982	984	984	984	984	984	984	984	984	984	984	984	984	

(*): indicates non-resident students
Source: AICAD

Table 2 Population of AICAD in Past and Future

Institute	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Users																						
Researchers (Residents)	0	0	0	0	0	0	0	0	0	0	0	0	80	80	80	80	80	80	80	80	80	
Visitors (Commuters)	0	0	0	0	0	0	0	0	0	0	0	0	350	350	350	350	350	350	350	350	350	
Total													430	430	430	430	430	430	430	430	430	
Staff																						
Total Staff (Commuters)	0	0	0	0	0	0	0	0	0	8	11	23	67	83	94	95	95	95	95	95	95	

Source: AICAD

Reference Table NATIONAL ADMISSIONS RATES (1996 – 2000)

	1996	1997	1998	1999	2000
Total Secondary School graduates	156,873	163,447	166,764	172,549	174,342
Total qualified for university admission	32,846	33,671	34,234	33,692	34,348
Total admitted to national universities (Joint Admissions Board)	8,737	8,804	8,886	8,940	9,136
Jomo Kenyatta University of Agri. & Tech.(*)	638	640	645	644	645
University of Nairobi	2,515	2,521	2,547	2,560	2,620
Kenyatta University	1,802	1,843	1,859	1,870	1,893
Moi University	1,754	1,753	1,756	1,749	1,745
Egerton University	1,444	1,450	1,465	1,480	1,550
Maseno University	584	597	614	637	683

Source: JKUAT
Note:
1: (*) JKUAT includes 170 diploma admissions who meet minimum university entry requirements
2. Numbers admitted are limited by government funding and facilities. Universities have been allowed to admit fee-paying non-resident students where capacity exists. Every university is targeting a 30-50 % fee-paying student population in the future.

Case 1 (Project plan as JKUAT students will not increase in future)

Table 3—1 Served Population

(Unit: people)

Institute	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
JKUAT Students																						
Residents	1784	1954	2017	2136	2193	2177	2168	2156	2129	2315	2315	2315	2315	2315	2315	2315	2315	2315	2315	2315	2315	
Commuters	0	30	30	12	12	105	258	446	478	495	495	495	495	495	495	495	495	495	495	495	495	
JKUAT Staff																						
Residents	595	595	595	595	595	595	595	595	595	595	595	595	595	595	595	595	595	595	595	595	595	
Commuters	815	873	948	982	1125	1002	997	989	982	984	984	984	984	984	984	984	984	984	984	984	984	
AICAD Users																						
Residents	0	0	0	0	0	0	0	0	0	0	0	0	80	80	80	80	80	80	80	80	80	
Commuters	0	0	0	0	0	0	0	0	0	0	0	0	350	350	350	350	350	350	350	350	350	
AICAD Staff																						
Residents	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Commuters	0	0	0	0	0	0	0	0	0	8	11	23	67	83	94	95	95	95	95	95	95	

Table 4-1 Unit Water Consumption Rate

(Unit: m^3/day/people)

Institute	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
JKUAT Students																						
Residents	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	
Commuters	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	
JKUAT Staff																						
Residents	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	
Commuters	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	
AICAD Users																						
Residents	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	
Commuters	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	
AICAD Staff																						
Residents	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	
Commuters	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	

Table 5-1 Water Demand

(Unit: m^3/day)

Institute	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
JKUAT Students																						
Residents	285	313	323	342	351	348	347	345	341	370	370	370	370	370	370	370	370	370	370	370	370	
Commuters	0	1	1	0	0	3	8	13	14	15	15	15	15	15	15	15	15	15	15	15	15	
JKUAT Staff																						
Residents	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	
Commuters	24	26	28	29	34	30	30	30	29	30	30	30	30	30	30	30	30	30	30	30	30	
Laboratory and Training Water at JKUAT	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	
JKUAT Sub Total	478	509	521	540	554	550	554	557	553	584	584	584	584	584	584	584	584	584	584	584	584	
AICAD Users																						
Residents	0	0	0	0	0	0	0	0	0	0	0	0	16	16	16	16	16	16	16	16	16	
Commuters	0	0	0	0	0	0	0	0	0	0	0	0	11	11	11	11	11	11	11	11	11	
AICAD Staff																						
Residents	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Commuters	0	0	0	0	0	0	0	0	0	0	0	1	2	2	3	3	3	3	3	3	3	
AICAD Sub Total	0	0	0	0	0	0	0	0	0	0	0	1	29	29	30	30	30	30	30	30	30	
Grand Total (JKUAT + AICAD) (A)	478	509	521	540	554	550	554	557	553	584	584	585	613	613	614	614	614	614	614	614	614	

Table 6-1 Design Water Supply (Leakage rate(L)= 0.175)

(Unit: m^3/day)

Institute		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Leakage	(B)=C x L	101	108	111	115	118	117	118	118	117	124	124	124	130	130	130	130	130	130	130	130	130	
Design Water Supply	(C)=A / (1-L)	579	617	632	655	672	667	672	675	670	708	708	709	743	743	744	744	744	744	744	744	744	

Case 2 (Supplemental case as JKUAT students will increase in future based on the JKUAT estimation)

Table 3-2 Served Population

(Unit: people)

Institute	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
JKUAT Students																						
Residents	1784	1954	2017	2136	2193	2177	2168	2156	2129	2315	2450	2610	2770	2920	3060	3190	3320	3450	3570	3700	3830	
Commuters	0	30	30	12	12	105	258	446	478	495	570	710	850	990	1200	1420	1540	1660	1880	2100	2320	
JKUAT Staff																						
Residents	595	595	595	595	595	595	595	595	595	595	595	595	595	595	595	595	595	595	595	595	595	
Commuters	815	873	948	982	1125	1002	997	989	982	984	984	984	984	984	984	984	984	984	984	984	984	
AICAD Users																						
Residents	0	0	0	0	0	0	0	0	0	0	0	0	80	80	80	80	80	80	80	80	80	
Commuters	0	0	0	0	0	0	0	0	0	0	0	0	350	350	350	350	350	350	350	350	350	
AICAD Staff																						
Residents	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Commuters	0	0	0	0	0	0	0	0	0	8	11	23	67	83	94	95	95	95	95	95	95	

Table 4-2 Unit Water Consumption Rate

(Unit: m^3/day/people)

Institute	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
JKUAT Students																						
Residents	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	
Commuters	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	
JKUAT Staff																						
Residents	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	
Commuters	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	
AICAD Users																						
Residents	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	
Commuters	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	
AICAD Staff																						
Residents	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	
Commuters	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	

Table 5-2 Water Demand

(Unit: m^3/day)

Institute	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
JKUAT Students																						
Residents	285	313	323	342	351	348	347	345	341	370	392	418	443	467	490	510	531	552	571	592	613	
Commuters	0	1	1	0	0	3	8	13	14	15	17	21	26	30	36	43	46	50	56	63	70	
JKUAT Staff																						
Residents	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	
Commuters	24	26	28	29	34	30	30	30	29	30	30	30	30	30	30	30	30	30	30	30	30	
Laboratory and Training Water at JKUAT	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	
JKUAT Sub Total	478	509	521	540	554	550	554	557	553	584	608	638	668	696	725	752	776	801	826	854	882	
AICAD Users																						
Residents	0	0	0	0	0	0	0	0	0	0	0	0	16	16	16	16	16	16	16	16	16	
Commuters	0	0	0	0	0	0	0	0	0	0	0	0	11	11	11	11	11	11	11	11	11	
AICAD Staff																						
Residents	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Commuters	0	0	0	0	0	0	0	0	0	0	0	1	2	2	3	3	3	3	3	3	3	
AICAD Sub Total	0	0	0	0	0	0	0	0	0	0	0	1	29	29	30	30	30	30	30	30	30	
Grand Total (JKUAT + AICAD) (A)	478	509	521	540	554	550	554	557	553	584	608	639	697	725	755	782	806	831	856	884	912	

Table 6-2 Design Water Supply

給水量(漏水率(L)= 0.175)

(Unit: m^3/day)

Institute		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Leakage	(B)=C x L	101	108	111	115	118	117	118	118	117	124	129	136	148	154	160	166	171	176	182	188	193	
Design Water Supply	(C)=A / (1-L)	579	617	632	655	672	667	672	675	670	708	737	775	845	879	915	948	977	1007	1038	1072	1105	

Appendix B Hydrological Study on Ndarugu River

1. Hydrological Data

Water source of JKUAT is the Ndarugu River running at east side of JKUAT. There are several water level gauge stations along the Ndarugu River and the nearest gauge station from the water intake facilities is 3CB05 that is at about 15km down stream from the water intake facilities. Observation at the station has started in 1956 and the records are obtained for about 40 years. Flow record is converted from the measured river water depth. Water flows at the intake facilities are estimated based on the area ratio of the river basins at the water intake facilities and at the gauge station as shown below.

$$Q_{inlet} = C\ Q_{3CB05}$$

Q_{inlet}: River flow at the water intake facilities (m^3/s)

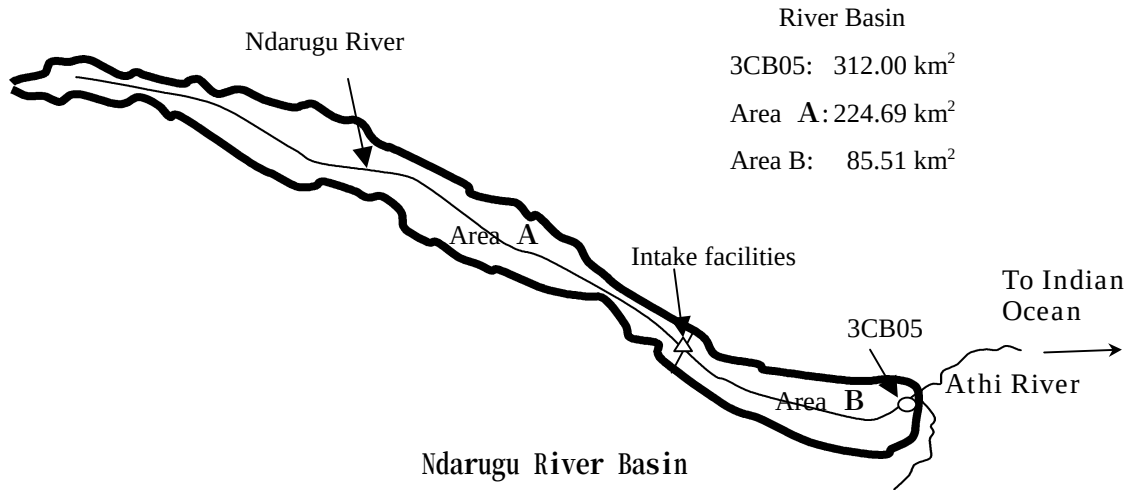
Q_{3CB05}: River flow at the gauge station 3CB05(m^3/s)

C: Area ratio of river basins

The area ratio of the river basins at the water intake facilities and the gauge station is estimated at 0.726 as shown below, and the location of the gauge station and the intake facilities are shown in following.

Basin	Area (km^2)
Gauge station (3CB05)	312.00
Intake facilities (Area A)	226.49
From intake facilities to 3CB05 (Area B)	85.51

Area ratio of the river basins = 226.49 / 312.00 = 0.726



Average monthly river flow at the intake facilities is estimated based on the record measured at the gauge station 3CB05 and the ratio of the river basins as shown below, and the average annual flow is 2.74m³/sec.

Unit : m³/sec

Month	1	2	3	4	5	6	7	8	9	10	11	12
Flow	1.72	1.12	1.18	5.07	10.40	3.81	2.05	1.30	0.92	1.05	3.30	3.40

It is found, river flow is high in April to June and November to December, river flow is low in January to March and August to October. Maximum monthly flow is 10.40m³/s in May and minimum monthly flow is 0.92m³/s in September. Average monthly river flow from 1956 to 1994 is shown in Annex 1.

In past years, maximum and minimum flow at the 3CB05 is 105.376m³/s in 30 April 1963 and 0.04m³/s in 27 January 1979, respectively. Past maximum and minimum flow at the intake facilities are also estimated as follows,

Past actual maximum flow: 76.503m³/s (30/04/63)
Past actual minimum flow: 0.029m³/s (27/01/79)

Daily maximum and minimum flows at the intake facilities are shown in Annex 2. Although the minimum flow is 0.000m3/s in 1984 based on the record as shown in the table, the figure is neglected as most of the original data in 1984 is missing and the figures are not reliable, and it is obtained that minimum water depth is not less than 30cm based on the hearing in the field survey. So, past actual minimum flow, 0.029m³/s, is adopted the figure in 1979 that is the second lowest figure in the record.

2. River Flows of Return Periods

River flows in return periods is calculated by Gumbel method based on the record of Annex 2. The maximum river flow is calculated in 5, 10, 25, 50, 100 years return periods, and minimum river flow is calculated in 5,10 and 25years probability as shown below.

Return periods	Max flow (m³/s)	Min flow (m³/s)
5	42.984	0.166
10	56.481	0.086
25	73.439	0.019
50	86.447	---
100	99.224	---

3. Water Level

Water level is studied in the past actual water level and water level calculated with river flow and river condition such as shape of the cross section and slop.

Past actual maximum water level at the intake facilities is 1504.68m and the minimum water depth is not less than 0.3m based on the hearing in the field survey. The minimum water level is 1500.42m as the elevation of the river bed is 1500.12m.

Water levels are calculated by Manning formula for the maximum flow of 100years return period and for the minimum flow of 10years return period as shown below.

	Maximum water level			Minimum water level		
	Past actual figure	Calculated figures		Past actual figure	Calculated figures	
		Past Max	100years return period		Past Max	10years return period
River flow (m^3/s)	---	76.503	99.224	---	0.029	0.086
Water level (m)	1504.68	1504.69	1505.07	1500.42	1500.32	1500.42

Water level of the average annual flow of 2.74m3/sec is calculated at 1501.2m by the same way. Design water levels are adopted as follow,

	Water level (m)	Remark
HWL	1505.1	Max water level in 100years return period
MWL	1501.2	Average water level
LWL	1500.4	Min water level in 10years return period

Floor level of control panel house at Ndarugu river water intake facilities is to be at elevation of 1507m, taking into account of the HWL: 1505.1m and extra.

Annex 1 Ndarugu River Flow at Water Intake Facilities Unit: m3/s

	Monthly Average River Flow												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave
1956							1.777	1.133	0.769	0.537	1.147	0.744	1.018
1957	0.780	0.859	1.769	2.802	18.351	7.727	2.740	1.569	1.036	0.728	1.189	2.215	3.480
1958	0.869	1.792	2.681	2.405	24.743	8.323	4.297	2.864	1.597	1.068	0.888	0.696	4.352
1959	0.497	0.369	0.384	0.934	3.887	2.771	1.026	0.686	0.540	0.469	1.730	0.901	1.183
1960	0.479	0.364	0.637	3.581	3.849	1.591	0.934	0.611	0.484	0.465	1.420	0.743	1.263
1961	0.409	0.384	0.368	0.678	2.188	0.989	0.837	0.694	0.840	3.284	27.944	19.657	4.856
1962	15.017	3.515	1.562	2.475	15.957	4.863	2.797	1.743	1.286	1.244	1.246	2.073	4.481
1963	2.092	1.867	1.388	10.274	30.013	7.678	3.599	1.872	1.203	0.973	1.877	14.175	6.418
1964	4.971	1.619	2.902	12.369	15.815	5.256	2.342	2.114	1.493	1.389	1.445	2.039	4.480
1965	2.074	1.107	0.696	1.536	3.510	2.518	1.257	0.832	0.538	0.555	3.401	2.739	1.730
1966	1.202	0.967	1.972	12.993	18.073	3.137	1.694	1.167	0.928	0.602	2.451	0.930	3.843
1967	0.455	0.302	0.268	1.453	20.697	8.545	2.941	1.873	1.676	1.935	6.273	4.887	4.275
1968	1.646	0.994	4.891	8.292	12.602	6.355	2.996	1.782	1.067	1.013	9.745	21.257	6.053
1969	2.613	1.819	1.670	1.158	4.432	2.416	1.215	0.882	0.606	1.314	0.560	0.439	1.594
1970	0.430	0.326	0.375	11.407	12.154	5.268	2.309	1.417	0.911	0.595	0.787	0.531	3.043
1971	0.117	0.526	0.349	3.522	11.143	3.824	2.378	1.649	1.620	0.964	0.737	1.468	2.358
1972	0.813	0.543	0.520	0.420				0.846	0.715	2.095	13.306	4.334	2.621
1973	1.583	0.862	0.495	0.647	1.274	1.449	0.761	0.611	0.455	0.432	0.565	0.599	0.811
1974					3.536	1.829	8.302	2.800	1.266	0.914	1.425	0.904	2.622
1975	0.553	0.308	0.308	0.835	4.048	2.047	0.842	2.523	0.828	0.855	2.010	2.027	1.432
1976	0.726	0.358	0.323	2.903	2.474	1.956	0.869	0.432	0.263	0.286	0.319	1.074	0.999
1977	0.326	0.197	0.384	16.130	35.536	5.628	2.391	1.634	0.972	0.773	7.872	6.303	6.512
1978	2.995	2.124	2.794	38.145	18.774	3.199	0.804	0.456	0.552	1.309	5.195	4.828	6.765
1979	0.549	2.624	2.126	8.842	16.929	8.086	4.247	1.192	1.207	0.476	1.705	0.511	4.041
1980	0.488	0.731	0.560	0.926	9.188	5.172	1.090	0.729	0.425	0.624	3.648	2.880	2.205
1981	1.433	0.618	1.129	7.855	15.842	4.360	2.150	1.215	0.609	0.894	1.036	1.244	3.199
1982	0.749	0.454	0.301	1.204	8.055	5.290	1.486	0.674	0.609	1.781			2.060
1983	1.716	1.244	0.476	1.325	11.770	1.064	0.872	1.207	1.299	0.870	0.829	1.708	2.032
1984	0.948	0.363	0.394	0.504	0.154	0.021	0.012	0.002	0.225	1.729			0.435
1985						2.074							2.074
1986							1.661	1.160	0.950	0.806	1.273	1.989	1.307
1987	1.134	0.761	0.483	0.888	1.795	2.700	1.654		0.660				1.260
1988	0.554	0.352	0.460	1.961	4.792	3.486	2.164			0.876	1.547	1.726	1.792
1989	2.253	2.273	1.771	2.481	4.586	3.514	2.319	1.609	1.210	1.052	2.403	3.309	2.398
1990	3.505	1.943	2.664	4.002		3.486		1.400	1.077	1.053	2.282	1.865	2.328
1991	1.248	0.823	0.723	1.007	2.632	3.516	1.856	1.304	0.938	0.923	1.507	0.961	1.453
1992	0.656	0.835	0.710	1.459	3.016	2.115	1.563	1.310	1.263	1.631	1.372	2.174	1.509
1993	3.443	4.227	1.607		1.530	1.109	1.400	1.372	1.073	1.087	0.972	1.506	1.757
1994	0.718	0.558											0.638
Ave.	1.715	1.115	1.181	5.073	10.404	3.810	2.045	1.296	0.922	1.045	3.297	3.395	Ave
													2.735

Annex 2 (1/2) Minimum and Maximum Ndarugu River Flow at Intake Facilities

Year	Minimum Flow (m^3/s)	Minimum Date	Maximum Flow (m^3/s)	Maximum Date
1956	0.371	10/24/56	2.250	07/04/56
1957	0.320	04/02/57	42.225	05/15/57
1958	0.459	02/07/58	60.232	05/14/58
1959	0.255	03/17/59	25.593	11/25/59
1960	0.290	02/23/60	11.964	04/19/60
1961	0.308	01/31/61	55.170	11/18/61
1962	0.897	11/15/62	55.170	01/04/62
1963	0.718	11/11/63	76.503	04/30/63
1964	0.897	11/28/64	50.983	04/28/64
1965	0.368	10/15/65	10.094	04/21/65
1966	0.510	03/14/66	44.844	05/04/66
1967	0.195	03/30/67	42.225	05/09/67
1968	0.718	10/15/68	49.827	12/07/68
1969	0.290	12/29/69	12.636	05/14/69
1970	0.072	11/04/70	31.920	05/12/70
1971	0.086	03/15/71	17.773	12/31/71
1972	0.308	02/01/72	24.867	11/20/72
1973	0.290	10/30/73	2.473	06/21/73
1974	0.347	12/12/74	18.062	07/13/74
1975	0.156	02/18/75	12.865	05/27/75
1976	0.156	03/06/76	12.865	04/18/76
1977	0.095	02/21/77	76.173	05/04/77
1978	0.133	09/01/78	72.742	04/20/78
1979	0.029	01/27/79	46.088	05/11/79
1980	0.029	05/04/80	34.372	05/08/80
1981	0.375	02/18/81	26.786	05/15/81
1982	0.090	03/15/82	25.190	05/29/82
1983	0.272	03/26/83	39.985	05/11/83
1984	0.000	08/29/84	2.105	10/16/84
1985	1.082	06/09/85	3.512	06/13/85
1986	0.659	10/03/86	3.624	12/06/86
1987	0.366	03/10/87	3.136	06/19/87
1988	0.203	02/20/88	4.999	05/18/88
1989	0.708	10/20/89	4.967	06/08/89
1990	0.648	09/19/90	4.934	01/15/90
1991	0.513	03/22/91	4.999	06/03/91
1992	0.422	01/29/92	4.740	05/06/92
1993	0.412	09/30/93	4.901	02/15/93
1994	0.393	01/28/94	1.210	01/01/94

Past Min. Flow = 0.029 m^3/s 01/27/79

Past Max Flow = 76.503 m^3/s 04/30/63

Annex 2 (2/2) Minimum and Maximum Ndarugu River Flow at Gauge Station 3CB05

Year	Minimum Flow (m^3/s)	Minimum Date	Maximum Flow (m^3/s)	Maximum Date
1956	0.511	10/24/56	3.099	7/4/56
1957	0.441	4/2/57	58.161	5/15/57
1958	0.632	2/7/58	82.964	5/14/58
1959	0.351	3/17/59	35.252	11/25/59
1960	0.399	2/23/60	16.480	4/19/60
1961	0.424	1/31/61	75.992	11/18/61
1962	1.236	11/15/62	75.992	1/4/62
1963	0.989	11/11/63	105.376	4/30/63
1964	1.236	11/28/64	70.224	4/28/64
1965	0.507	10/15/65	13.903	4/21/65
1966	0.703	3/14/66	61.768	5/4/66
1967	0.268	3/30/67	58.161	5/9/67
1968	0.989	10/15/68	68.632	12/7/68
1969	0.399	12/29/69	17.405	5/14/69
1970	0.099	11/4/70	43.967	5/12/70
1971	0.119	3/15/71	24.481	12/31/71
1972	0.424	2/1/72	34.252	11/20/72
1973	0.399	10/30/73	3.407	6/21/73
1974	0.478	12/12/74	24.879	7/13/74
1975	0.215	2/18/75	17.721	5/27/75
1976	0.215	3/6/76	17.721	4/18/76
1977	0.131	2/21/77	104.922	5/4/77
1978	0.183	9/1/78	100.196	4/20/78
1979	0.040	1/27/79	63.482	5/11/79
1980	0.040	5/4/80	47.344	5/8/80
1981	0.517	2/18/81	36.895	5/15/81
1982	0.124	3/15/82	34.697	5/29/82
1983	0.374	3/26/83	55.076	5/11/83
1984	0.000	8/29/84	2.899	10/16/84
1985	1.490	6/9/85	4.838	6/13/85
1986	0.908	10/3/86	4.992	12/6/86
1987	0.504	3/10/87	4.320	6/19/87
1988	0.279	2/20/88	6.886	5/18/88
1989	0.975	10/20/89	6.841	6/8/89
1990	0.892	9/19/90	6.796	1/15/90
1991	0.706	3/22/91	6.886	6/3/91
1992	0.581	1/29/92	6.529	5/6/92
1993	0.568	9/30/93	6.750	2/15/93
1994	0.542	1/28/94	1.666	1/1/94

Source: Department of Water Resources in Ministry of Environment and Natural Resources

Past Min Flow = 0.040 m^3/s 01/27/79

Past Max Flow = 105.376 m^3/s 04/30/63

Appendix C　Counter Measures to Water Hammer

1. Water Hammer

Water Hammer happens when operating pumps suddenly stop due to such as electric power failure. When operating pumps stop, water in pipe is still trying to go up by inertia, but sending of water from pumps stops, and negative pressure occurs in pipe.　Next, water going up by inertia looses energy, and the water goes down oppositely, and high positive pressure occurs by crashing of water.

When high negative pressure occurs, water column is separated and pipe might be broken by external force.　When high positive pressure occurs due to crashing of water column, pipe might be broken by internal force.

So, it is necessary to take counter measures to prevent accidents of the pressure pipe system. Typical counter measures are described below.

Counter measures for negative pressure:
Minimum pressure line shall be over the profile of pipe, or the line shall not be lower than 5m to 6m from the pipe profile so as to avoid the separation of water column.

Counter measures for positive pressure:
The strength of pipe shall be higher than the positive pressure occurred in pipe.

2. Evaluation of Water Conveyance Facilities with Existing Facilities

Water conveyance facilities consist of the water intake pumping station, conveyance pipe composed from existing pipe and by-pass pipe and existing one way surge tank.　Water hammer of the water conveyance facilities is studied for the following cases with the existing one way surge tank.

Case1-1: Utilizing existing pressure pipe

Case1-2: Utilizing existing pressure pipe + by-pass pipe

As a result of the study, it is found that both cases result in big negative pressure between the water intake pumps and the existing surge tank, and counter measures are necessary to prevent water column separation.

3. Improvement Plant

As an improvement plan, we install 2 stations of one way surge tank between the water intake pumps and the existing surge tank as shown in Table C-1.

Table C-1 Specification of One Way Surge Tank

Surge tank	Distance from water intake pumping station (m)	Tank volume (m^3)	Water level (m)
Existing	498	1.13	1549.0
Additional No.1	60	0.5	1532.0
Additional No.2	180	0.5	1542.0

Water hammer of the water conveyance facilities is studied for the following cases with the existing one way surge tank and the additional 2 one way surge tanks.

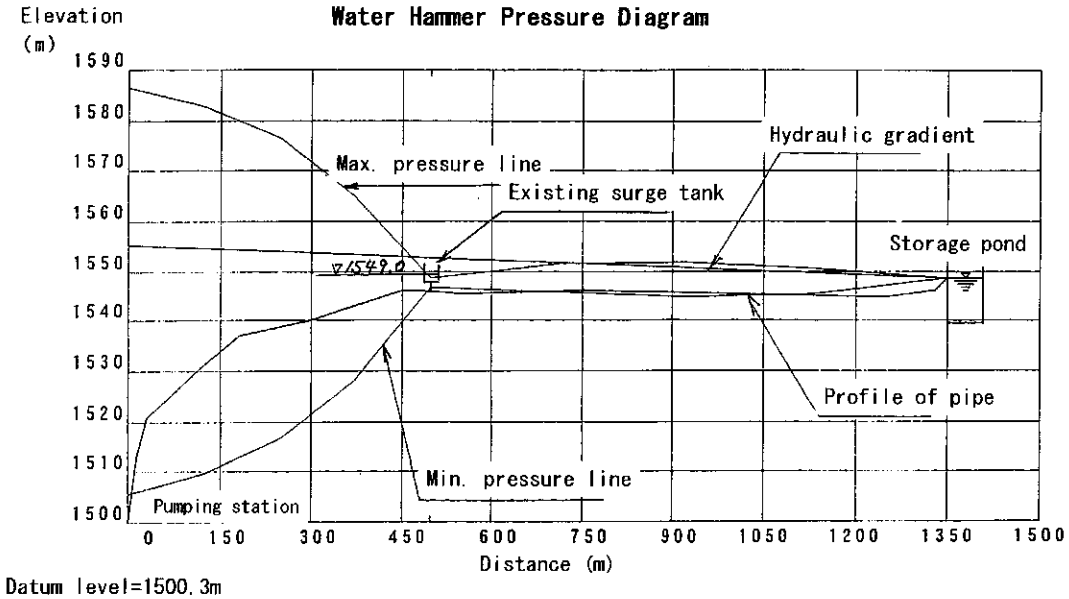
Case2-1: Utilizing existing pressure pipe

Case2-2: Utilizing existing pressure pipe + by-pass pipe

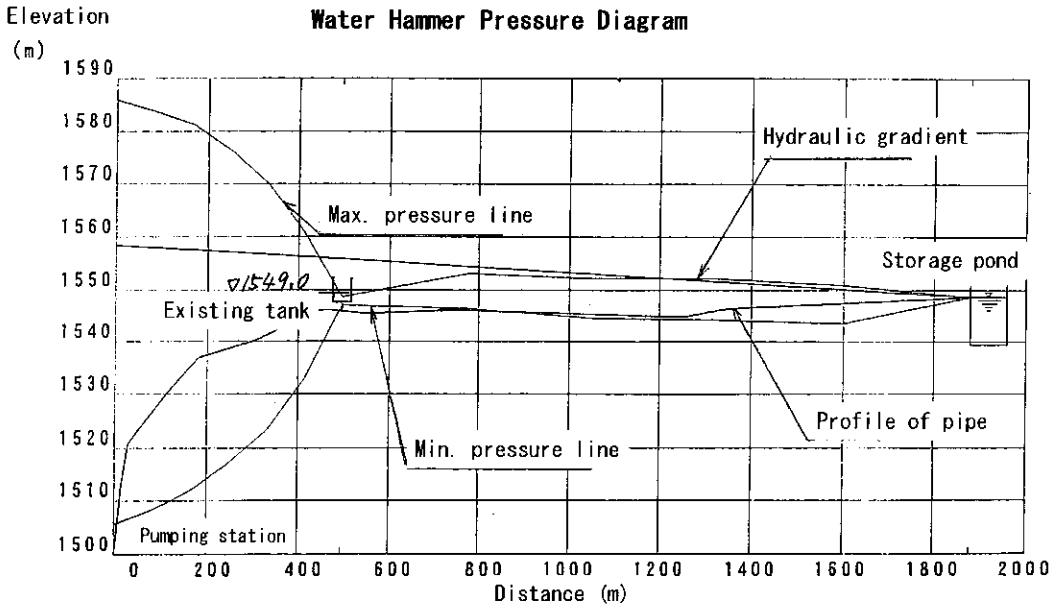
As a result of the study, it is found that both cases result in small negative pressure partially, and water column separation might not happen.

It is concluded that any accidents caused by water hammer can be avoided by installing 2 additional one way surge tanks for both cases of utilizing existing pressure pipe and with by pass pipe.

Case 1-1 (Existing Surge tank(1pc), Existing Pipe)

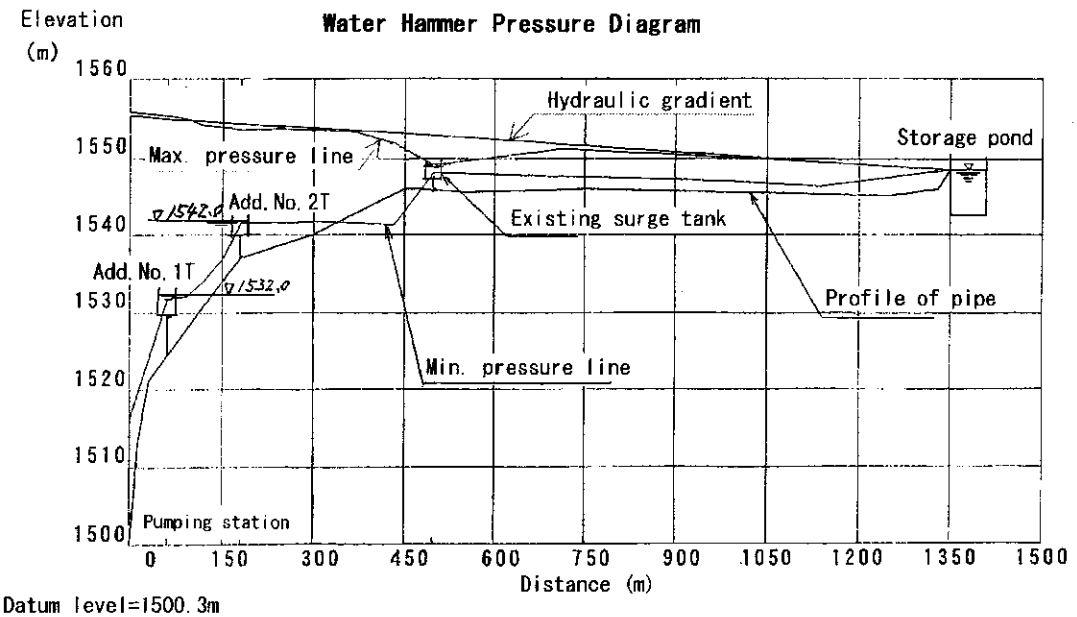


Datum level=1500.3m



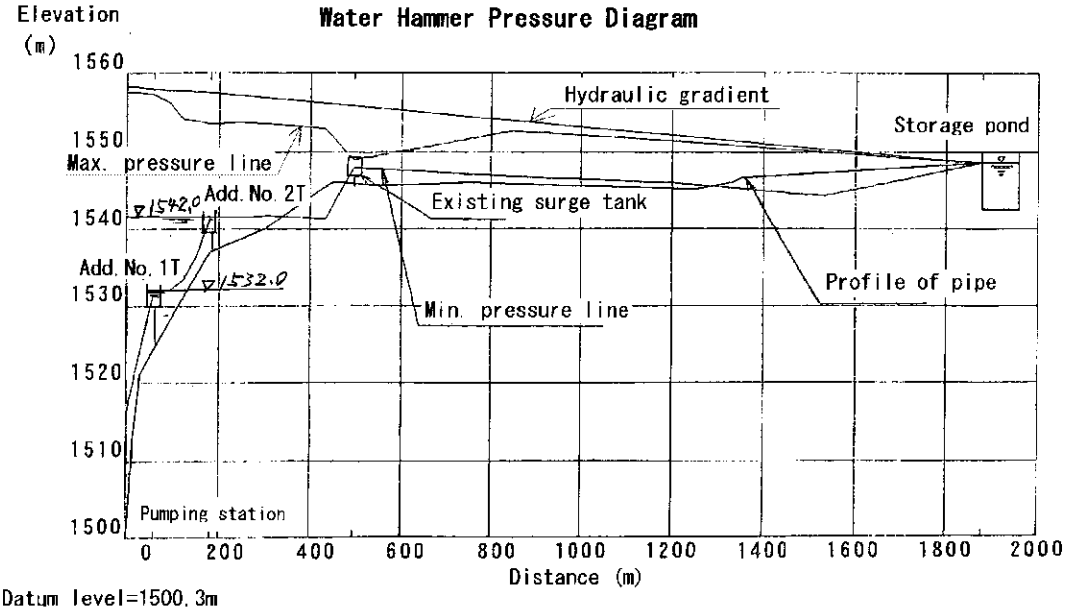
Datum level=1500.3m

Case 2-1 (Existing + Additonal Surge tank(Total 3pc), Existing Pipe)



Datum level=1500.3m

Case 2-2 (Existing + Additonal Surge tank(Total 3pcs), Existing + By pass Pipe)



Datum level=1500.3m

Annex 1 (1/2) Balance Sheet of Water at Storage Pond (Water right as same as 861m^3/day)

Month	Unit	Equation	11	12	1	2	3	4	5	6	7	8	9	10
Reference crop evapotranspiration (ETo)	(mm/day)	A	4.1	4.4	5.5	5.7	5.1	3.7	3.2	2.9	2.6	3.0	4.1	4.8
Crop coefficient (Kc)		B	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
Crop evapotranspiration (ETcrop)	(mm/day)	C = A x B	4.3	4.6	5.8	6	5.4	3.9	3.4	3	2.7	3.2	4.3	5
Crop evapotranspiration (ETcrop)	(mm/month)	D = C x days/month	129	143	180	168	167	117	105	90	84	99	129	155
Effective rainfall	(mm/month)	E	46	53	0	0	0	116	49	11	10	8	11	114
Required water for crop	(mm/month)	F = D - E	83	90	180	168	167	1	56	79	74	91	118	41
Irrigation efficiency	(%)	G	70	70	70	70	70	70	70	70	70	70	70	70
Irrigation water	(mm/month)	H = F / G	119	129	257	240	239	1	80	113	106	130	169	59
Daily irrigated water	(m3/day)	I1=H / days/month x AA	793	832	1,658	1,714	1,542	7	516	753	684	839	1,127	381
Occupancy of the farm	(%)	J	70	70	70	70	70	70	70	70	70	70	70	70
Daily irrigated water (Occu.farm)	(m3/day)	I2 = I1 x J	555	582	1,161	1,200	1,079	5	361	527	479	587	789	267
Drinking water	(m3/day)	K	990	990	990	990	990	990	990	990	990	990	990	990
Evaporation from storage pond	(m3/day)	L	176	184	211	231	240	171	151	131	111	131	180	209
Leakage from storage pond	(m3/day)	M = BB x CC / 1000	21	21	21	21	21	21	21	21	21	21	21	21
Rainfall into storage pond	(m3/day)	N	88	93	0	0	0	258	94	17	20	16	19	225
Consumed water	(m3/day)	O = I2 +K + L + M - N	1,654	1,684	2,383	2,442	2,330	929	1,429	1,652	1,581	1,713	1,961	1,262
Water right	(m3/day)	P	No limit	No limit	861	861	861	No limit	No limit	No limit	No limit	861	861	1,500
Shortage of water	(m3/day)	Q = O - P	No shortage	No shortage	1,522	1,581	1,469	No shortage	No shortage	No shortage	No shortage	852	1,100	No shortage
Daily intake at Ndarugu River	(m3/day)	R1	2,500	3,500	861	861	861	929	1,429	1,652	2,200	861	861	1,262
Monthly intake at Ndarugu River	(m3/month)	R2	75,000	108,500	26,691	24,108	26,691	27,870	44,299	49,560	68,200	26,691	25,830	39,122
Required water at storage pond	(m3/month)	S =Q x days/month	0	0	47,182	44,268	45,539	0	0	0	0	26,412	33,000	0
Required water at storage pond (Summation)	(m3/month)		0	0	47,182	91,450	136,989	0	0	0	0	26,412	59,412	59,412
							> 80,000m3 ,so the storage pond capacity is not enough.							
Daily changing water amount	(m3/day)	T = R1 - O	846	1,816	-1,522	-1,581	-1,469	0	0	0	619	-852	-1,100	0
Monthly changing water amount	(m3/month)	U=T x days/month	25,380	56,296	-47,182	-44,268	-45,539	0	0	0	19,189	-26,412	-33,000	0
Water stored at storage pond	(m3/month)	V	25,380	81,676	34,494	-9,774	-55,313	-55,313	-55,313	-55,313	-36,124	-62,536	-95,536	-95,536
Reference					Low water flow							Low water flow		
Average river flow (1956-1994)	(m3/sec)		3.3	3.4	1.7	1.1	1.2	5.1	10.4	3.8	2.0	1.3	0.9	1.0
Average rainfall (1941-1980)	(mm)		158	70	46	40	111	210	129	25	18	16	22	60
			Rainy season		Dry season		Rainy season			Dry season				Rainy S.

Reference Min. river flow(10 year probabil 0.086 (m3/sec)

Condition Area of farm land (AA) 20 Ha
Area of storage pond (BB) 41000 m2
Rate of leakage from storage pond (CC) 0.5 mm/day

Appendix D Study of Income and Expenditure of Water

Water in storage pond is pumped up by Ndarugu River water intake facilities and is used for drinking water and irrigation. Balance sheet of water in storage pond is shown in Annex1. Water required for irrigation is calculated based on the reference crop evapotranspiration (ETo), crop coefficient (Kc), effective rainfall and Irrigation efficiency, and these figures are estimated by the FAO's procedure. These figures are obtained from data collected at Thika Meteorological Station that is about 10km away from JKUAT.

JKUAT farmland was developed in 1985 with irrigation facilities and the area is 20 ha. But now the occupancy of the farm has been reduced and it is estimated that 70% of the farm will be utilized in the future. The maximum irrigated water is 1079m^3/day occurring in March and the minimum irrigated water is 5m^3/day occurring in April. Intake water for water supply from the pond is 990m^3/day, the capacity of the water purification plant. Amount of water stored in the storage pond is also calculated taking into account of evaporation, leakage and rainfall in the pond.

The current water right to receive water in dry season is 861 m^3/day for drinking and irrigation. The water right is not enough to secure water demand in dry seasons, January to March, even utilizing the storage pond of the capacity 80,000m^3. So, it is necessary to increase the water rights to be 15,000 m^3/day.

The possibility of the expansion of the water right shall be judged by checking whether the river flow (minimum flow of 10 years return period), that is flow after water is taken for water rights, sustain the past minimum actual flow or not. It is found that even after water, that correspond with the expanded water right and other water rights, is taken, the remaining river flow would sustain over the past minimum actual flow as shown below. So, it might be judged the water right expansion to be 1,500m^3/day will be possible.

Possibility of Expanding Water Right to be 1,500m^3/day

Item		(m^3/day)	(m^3/hr)	(m^3/sec)	Remark
Past minimum actual flow	A			0.029	(15/3/1983)
minimum flow of 10 years probability	B			0.086	
Applied water right by JKUAT	C	1500		0.017	
Other water right	D			0.024	
Intake water by Juja City water project	E		20	0.006	（Dec2000）
Remained river flow after water taken	F=B-C-D-E			0.039	＞A(0.029m^3/sec) F is over A, so the expanding water right might be possible.

Annex 1 (1/2) Balance Sheet of Water at Storage Pond (Water right as same as 861m^3/day)

Month	Unit	Equation	11	12	1	2	3	4	5	6	7	8	9	10
Reference crop evapotranspiration (ETo)	(mm/day)	A	4.1	4.4	5.5	5.7	5.1	3.7	3.2	2.9	2.6	3.0	4.1	4.8
Crop coefficient (Kc)		B	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
Crop evapotranspiration (ETcrop)	(mm/day)	C = A x B	4.3	4.6	5.8	6	5.4	3.9	3.4	3	2.7	3.2	4.3	5
Crop evapotranspiration (ETcrop)	(mm/month)	D = C x days/month	129	143	180	168	167	117	105	90	84	99	129	155
Effective rainfall	(mm/month)	E	46	53	0	0	0	116	49	11	10	8	11	114
Required water for crop	(mm/month)	F = D - E	83	90	180	168	167	1	56	79	74	91	118	41
Irrigation efficiency	(%)	G	70	70	70	70	70	70	70	70	70	70	70	70
Irrigation water	(mm/month)	H = F / G	119	129	257	240	239	1	80	113	106	130	169	59
Daily irrigated water	(m3/day)	I1=H / days/month x AA	793	832	1,658	1,714	1,542	7	516	753	684	839	1,127	381
Occupancy of the farm	(%)	J	70	70	70	70	70	70	70	70	70	70	70	70
Daily irrigated water (Occu.farm)	(m3/day)	I2 = I1 x J	555	582	1,161	1,200	1,079	5	361	527	479	587	789	267
Drinking water	(m3/day)	K	990	990	990	990	990	990	990	990	990	990	990	990
Evaporation from storage pond	(m3/day)	L	176	184	211	231	240	171	151	131	111	131	180	209
Leakage from storage pond	(m3/day)	M = BB x CC / 1000	21	21	21	21	21	21	21	21	21	21	21	21
Rainfall into storage pond	(m3/day)	N	88	93	0	0	0	258	94	17	20	16	19	225
Consumed water	(m3/day)	O = I2 +K + L + M - N	1,654	1,684	2,383	2,442	2,330	929	1,429	1,652	1,581	1,713	1,961	1,262
Water right	(m3/day)	P	No limit	No limit	861	861	861	No limit	No limit	No limit	No limit	861	861	1,500
Shortage of water	(m3/day)	Q = O - P	No shortage	No shortage	1,522	1,581	1,469	No shortage	No shortage	No shortage	No shortage	852	1,100	No shortage
Daily intake at Ndarugu River	(m3/day)	R1	2,500	3,500	861	861	861	929	1,429	1,652	2,200	861	861	1,262
Monthly intake at Ndarugu River	(m3/month)	R2	75,000	108,500	26,691	24,108	26,691	27,870	44,299	49,560	68,200	26,691	25,830	39,122
Required water at storage pond	(m3/month)	S =Q x days/month	0	0	47,182	44,268	45,539	0	0	0	0	26,412	33,000	0
Required water at storage pond (Summation)	(m3/month)		0	0	47,182	91,450	136,989	0	0	0	0	26,412	59,412	59,412
							> 80,000m3 ,so the storage pond capacity is not enough.							
Daily changing water amount	(m3/day)	T = R1 - O	846	1,816	-1,522	-1,581	-1,469	0	0	0	619	-852	-1,100	0
Monthly changing water amount	(m3/month)	U=T x days/month	25,380	56,296	-47,182	-44,268	-45,539	0	0	0	19,189	-26,412	-33,000	0
Water stored at storage pond	(m3/month)	V	25,380	81,676	34,494	-9,774	-55,313	-55,313	-55,313	-55,313	-36,124	-62,536	-95,536	-95,536
Reference					Low water flow							Low water flow		
Average river flow (1956-1994)	(m3/sec)		3.3	3.4	1.7	1.1	1.2	5.1	10.4	3.8	2.0	1.3	0.9	1.0
Average rainfall (1941-1980)	(mm)		158	70	46	40	111	210	129	25	18	16	22	60
			Rainy season		Dry season		Rainy season				Dry season			Rainy S.

Reference Min. river flow(10 year probabil 0.086 (m3/sec)

Condition
- Area of farm land (AA) 20 Ha
- Area of storage pond (BB) 41000 m2
- Rate of leakage from storage pond (CC) 0.5 mm/day

Annex 1 (2/2) Balance Sheet of Water at Storage Pond (Water right is expanded to 1,500m^3/day)

Month	Unit	Equation	11	12	1	2	3	4	5	6	7	8	9	10
Reference crop evapotranspiration (ETo)	(mm/day)	A	4.1	4.4	5.5	5.7	5.1	3.7	3.2	2.9	2.6	3.0	4.1	4.8
Crop coefficient (Kc)		B	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
Crop evapotranspiration (ETcrop)	(mm/day)	C = A x B	4.3	4.6	5.8	6	5.4	3.9	3.4	3	2.7	3.2	4.3	5
Crop evapotranspiration (ETcrop)	(mm/month)	D = C x days/month	129	143	180	168	167	117	105	90	84	99	129	155
Effective rainfall	(mm/month)	E	46	53	0	0	0	116	49	11	10	8	11	114
Required water for crop	(mm/month)	F = D - E	83	90	180	168	167	1	56	79	74	91	118	41
Irrigation efficiency	(%)	G	70	70	70	70	70	70	70	70	70	70	70	70
Irrigation water	(mm/month)	H = F / G	119	129	257	240	239	1	80	113	106	130	169	59
Daily irrigated water	(m3/day)	I1=H / days/month x AA	793	832	1,658	1,714	1,542	7	516	753	684	839	1,127	381
Occupancy of the farm	(%)	J	70	70	70	70	70	70	70	70	70	70	70	70
Daily irrigated water (Occu.farm)	(m3/day)	I2 = I1 x J	555	582	1,161	1,200	1,079	5	361	527	479	587	789	267
Drinking water	(m3/day)	K	990	990	990	990	990	990	990	990	990	990	990	990
Evaporation from storage pond	(m3/day)	L	176	184	211	231	240	171	151	131	111	131	180	209
Leakage from storage pond	(m3/day)	M = BB x CC / 1000	21	21	21	21	21	21	21	21	21	21	21	21
Rainfall into storage pond	(m3/day)	N	88	93	0	0	0	258	94	17	20	16	19	225
Consumed water	(m3/day)	O = I2 +K + L + M - N	1,654	1,684	2,383	2,442	2,330	929	1,429	1,652	1,581	1,713	1,961	1,262
Water right	(m3/day)	P	No limit	No limit	1,500	1,500	1,500	No limit	No limit	No limit	No limit	1,500	1,500	1,500
Shortage of water	(m3/day)	Q = O - P	No shortage	No shortage	883	942	830	No shortage	No shortage	No shortage	No shortage	213	461	No shortage
Daily intake at Ndarugu River	(m3/day)	R1	2,500	3,500	1,500	1,500	1,500	929	1,429	1,652	2,200	1,500	1,500	1,262
Monthly intake at Ndarugu River	(m3/month)	R2	75,000	108,500	46,500	42,000	46,500	27,870	44,299	49,560	68,200	46,500	45,000	39,122
Required water at storage pond	(m3/month)	S =Q x days/month	0	0	27,373	26,376	25,730	0	0	0	0	6,603	13,830	0
Required water at storage pond (Summation)	(m3/month)		0	0	27,373	53,749	79,479	0	0	0	0	6,603	20,433	20,433
							< 80,000m3 ,so the storage pond capacity is enough.							
Daily changing water amount	(m3/day)	T = R1 - O	846	1,816	-883	-942	-830	0	0	0	619	-213	-461	0
Monthly changing water amount	(m3/month)	U=T x days/month	25,380	56,296	-27,373	-26,376	-25,730	0	0	0	19,189	-6,603	-13,830	0
Water amount stored at storage pond	(m3/month)	V	25,380	81,676	54,303	27,927	2,197	2,197	2,197	2,197	21,386	14,783	953	953
Reference					Low water flow							Low water flow		
Average river flow (1956-1994)	(m3/sec)		3.3	3.4	1.7	1.1	1.2	5.1	10.4	3.8	2.0	1.3	0.9	1.0
Average rainfall (1941-1980)	(mm)		158	70	46	40	111	210	129	25	18	16	22	60
			Rainy season		Dry season		Rainy season			Dry season				Rainy S.

Reference Min. river flow(10 year probabilit 0.086 m3/sec

Condition
Area of farm land (AA) 20 Ha
Area of storage pond (BB) 41000 m2
Rate of leakage from storage pond (CC) 0.5 mm/day

No.	Name
1	Poverty Alleviation and Development of the African Region - AICAD - Improving the People's way of life
2	Proposal for the Establishment of African Institute for Capacity Development
3	Survey Map of Reservor Pond
4	Survey Map of Oxidation Pond
5	Survey Results of Water Analysis for Water Supply
6	Survey Results of Water Analysis for Sewerage
7	National Development Plan 1997-2001
8	Buildng Code
9	Code of Practice for the Design & Construction of Buildings & Other Structures in relation to Earthquakes (1973)
10	Agreement and Conditions of Contract for Building Works
11	Fluctuation Clause Price List (Revised)
12	Environmental Managemnet and Co-ordination Act, 1999
13	The Customs and Excise Act
14	Cost Information Quarterly
15	National Poverty Eradication Plan 1999-2015
16	Kenya Human Development Plan 1999
17	Economic Survey 2000
18	Statistical Abstract 1999
19	Directory of Grantees and Fellows 1994-1997
20	ICIPE's Business Plan and Research Outlook 2001-2003
21	Annnual Scientific Report - ICIPE - 1998/99