Ministry of Education
Republic of Kenya

PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR THE UPGRADING AND REFURBISHMENT OF THE CENTRE FOR MATHEMATICS, SCIENCE AND TECHNOLOGY EDUCATION IN AFRICA
IN
REPUBLIC OF KENYA

AUGUST 2011

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MATSUDA CONSULTANTS INTERNATIONAL CO., LTD.
INTEM CONSULTING, INC.

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to the consortium of Matsuda Consultants International Co., Ltd. and INTEM Consulting Inc.

The survey team held a series of discussions with the officials concerned of the Government of Kenya, and conducted a field investigation. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the Project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Kenya for their close cooperation extended to the team.

August, 2011

Nobuko Kayashima

Director General,
Human Development Department
Japan International Cooperation Agency

SUMMARY

Summary of the Recipient Country

The Republic of Kenya (hereinafter "Kenya") is located in the eastern part of Africa, facing the Indian Ocean. Its land area stretches across the equator, from latitude 5 degrees south to 5 degrees north and from longitude 34 degrees to 42 degrees east. It borders Somalia to the east, Ethiopia to the north, Sudan and Uganda to the west and Tanzania to the south. The land area is about 1.5 times that of Japan, totaling 580,000km^2 with a population of 39.8 million (2009, World Bank). Kenya has a range of geographical features. The landscape varies greatly from the plains in the eastern part to the highlands rising to over 1,000m in the western part. In the central part of the country towers Mt. Kenya, the highest mountain in the country, reaching 5,199m. The western part of Kenya overlooks Lake Victoria, which has the largest lake area in Africa. Kenya is also multimodal in terms of climate, ranging from a savanna climate along the eastern coast to a steppe climate and tropical rainforest climate.

The capital of the country, Nairobi, where the planned site of this Project is located, is on high land at an altitude of 1,700m in the temperate climate zone. The planned site is located to the southeast of Nairobi City, about 20km from the downtown area. According to the records from a weather station closely located to the site, the monthly average lowest temperature is between 12.0°C to 15.3°C, while the monthly average highest temperature is 21.4°C to 26.4°C (the data is the average for the past 7 years, same for the followings), indicating that the area surrounding the planned site has a very comfortable and cool climate throughout the year. The annual rainfall is 1,275mm on average and it varied between 775mm and 2,440mm depending on the year during the same period.

Nominal GDP in 2009 in Kenya was US$29.39 billion, which corresponds to a nominal GDP per capita of US$912 (J-File, JETRO). The country's industry is composed of primary industry (28.1%), secondary industry (20.0%), and tertiary industry (51.9%) (World Development Indicators, World Bank). On a long-time basis, Kenya is shifting from primary to tertiary industry, but it still is an agricultural country mainly producing coffee, tea, and garden crops and about 60% of its working population is engaged in agriculture (Country/Region Data: Republic of Kenya; Ministry of Foreign Affairs of Japan). The country is not rich in natural resources and, for energy, it depends on imports of oil, gas and coal. However, it has abundant tourist resources such as wild animals, making Kenya one of the major tourist countries in Africa.

In the latter half of the 1990s, Kenya suffered severe damage to its agricultural products and infrastructure by drought and heavy rainfall caused by El Nino. Also, because the country's public order deteriorated, economic growth slumped. After 2003, however, Kenya enjoyed stable economic growth (5.8% in 2005, 6.1% in 2006 and 7.0% in 2007). In 2008 and later, Kenya's industries, particularly the agriculture and tourist industries, were heavily devastated by the post election violence at the end of 2007, the emergence of internally displaced people, drought and the global financial crisis, which together caused the country's economic growth to drop to 1.7% in 2008. Recently, the economy has shown signs of gradual recovery (a growth rate of 3.0% was recorded in 2009) driven by the strong tourist and construction industries.

(Country/Region Data: Republic of Kenya; Ministry of Foreign Affairs of Japan)

Background and Summary of the Project

In its long-term development plan (Vision 2030), Kenya has established a national goal to develop an industrialized economy and realize higher living standards, international competitiveness and economic prosperity by 2030. For this purpose, Kenya positions education as an important field to develop human resources equipped with international competitiveness that will contribute to the sustainable development of the country. In the Kenya Education Sector Support Programme (hereinafter "KESSP I") which specifies the implementation strategy for Vision 2030, the importance of improving the quality of teachers on a continuing basis is advocated so that the quality of education will be improved, while priority investment projects which include "in-service training of teachers in primary education" and "in-service training of teachers in secondary mathematics and science education" are established. These priority investment projects are carried over into KESSP II (planned) aimed at enhancing the capabilities of teachers on a continuing basis through high-quality training programs so that the quality of education will be improved.

In the Kenya Education Sector, Free Primary Education was introduced in 2003, followed by Free Day Secondary Education in 2008. As a result of the expansion of access to education through these efforts, quantitative enhancement of education has advanced, with improvement in the net primary school enrollment ratio from 68.8% (1999) to 91.4% (2010) and the net secondary school enrollment ratio from 13.7% (1999) to 32.6% (2010) (EMIS, MOE). On the other hand, academic performance in the examinations for the certificate of primary or secondary education, particularly in the subjects of mathematics and science, remains stagnant and the qualitative improvement of education has not made progress. In the above-mentioned KESSP, it was pointed out that the low ratio of possession of school textbooks was one of the reasons for the poor academic performance in secondary mathematics and science education, and there was also the problem of the teaching skills and understanding of the teachers.

In order to advance the qualitative improvement of education under these circumstances, since 1998 Kenya has been promoting in-service trainings of teachers through a series of technical cooperation projects by Japan, including "Strengthening of Mathematics and Science in Secondary Education (hereinafter SMASSE)," "SMASSE Phase 2" and "Strengthening of Mathematics and Science Education (hereinafter SMASE)" for greater qualitative improvement of mathematics and science education in both Kenya and other African countries. These technical cooperation projects have been implemented mainly at the Centre for Mathematics, Science and Technology Education in Africa (hereinafter CEMASTEA or the Centre), founded in 2003. It is necessary, however, to further expand the Centre in order to offer more abundant training opportunities to in-service education and training (hereinafter INSET) trainers, school principals and educational officers, so that education will be improved in quality. As the demand for training has increased, CEMASTEA is unable to offer adequate training programs because of such constraints as lack of an assembly hall for general sessions and the limited capacity of the lecture rooms and laboratories. CEMASTEA is also expected to become a center for training trainees from international

organizations such as the African Union and the Association for the Development of Education in Africa, who will then be expected to train teachers of mathematics and science in Africa. Since the expansion of the facilities of the Centre is an urgent issue not only for Kenya but for Africa as a whole, the Government of Kenya developed a plan to expand the functions of the Centre and requested Japan for assistance in implementing the "Project for the Upgrading and Refurbishment of the Centre for Mathematics, Science and Technology Education in Africa."

To provide a support to CEMASTEA in response to the request from the Government of Kenya (FY2003), the Japan International Cooperation Agency (hereinafter JICA) implemented a preliminary study (August 2005) and a basic design study (May 2006, hereinafter "previous Project"). Although the previous Project was conducted and E/N was later concluded, through the process of the environmental impact assessment (hereinafter EIA) conducted by the Government of Kenya, it was found that the previous Project was not in conformity with the neighboring environment and, as a result, the previous Project was not implemented. Later, the Ministry of Education of Kenya revised the plan reflecting the local development plan of the neighboring community and made a renewed request for support for the Project to the Government of Japan. At the same time, the Ministry of Education of Kenya obtained the EIA license from NEMA to implement the Project according to the revised plan in April 2010.

Summary of Survey Results and Content of the Project

In response to the above request from Kenya, JICA sent a survey team to Kenya from January 8 to February 4, 2011, to hold discussions with the parties concerned on the Kenyan side, including CEMASTEA and the Ministry of Education, and conducted a field survey based on the content of the request which was confirmed between the two sides through the discussions. Later, the survey team returned to Japan and conducted an analysis based on the results of the field survey and developed an outline design of the Project, compiled a draft Preparatory Survey Report which describes the selection process of the prioritized and indispensable facilities and equipment for implementing the planned training programs. Following this, from May 21 to June 1, 2011, the explanation mission was conducted to have discussions with the parties concerned in Kenya. Based on the discussions, this Preparatory Survey Report was compiled.

A summary of this Project based on discussions with the counterpart is as follows:

(1) Scope, Components and Scale of Cooperation

CEMASTEA has two functions: 1) to act as a central training center offering INSET service to INSET trainers and educational officers through a cascaded INSET system for improvement of mathematics and science education in Kenya; and 2) to act as a regional center for the third country training program. In this Project, based on the above understanding of the roles of CEMASTEA, facilities will be constructed and equipment will be procured to expand the capacity of the Centre from the current 92 trainees to 200 trainees, on the assumption that the existing facilities will continue to be used. This Project will be implemented in accordance with the collateral conditions of the EIA license issued by the National

Environmental Management Authority (hereinafter NEMA).

The component of the facilities requested under this Project can be grouped into three: 1) training facilities composed of a lecture hall for general sessions, lecture rooms and laboratories for group sessions by subjects, ICT laboratory and library; 2) administration facilities for developing and running the training programs and curricula; and 3) a dining hall and a kitchen to serve every meal to the trainees staying at the Centre. Each of these components is indispensable to offer the training to 200 trainees and it can be said that the necessity for cooperation is strong enough to implement the Project according to the appropriate scale of the Project.

Therefore, based on the condition that the existing facilities will continue to be used, the scope of cooperation under this Project will include the following three groups of components: 1) necessary training facilities to enable running of the training programs planned by CEMASTEA for 200 trainees; 2) administration facilities to provide the workplace for the planned number of staff at CEMASTEA to develop the training programs and curricula as well as to operate the Centre; and 3) expansion of the existing dining hall and kitchen to prepare and serve meals for up to 200 trainees and the staff.

(2) Facilities Plan

a. Floor plan

The necessary rooms required for the operation of the Centre were selected in consideration of the curricula, personnel plan and present utilization status of the existing facilities. In addition, a zoning and a circulation plan were developed in view of the functions of the Centre and maintenance, and the area of each room was determined in view of economical efficiency. For example, regarding the office, a capacity of 100 staff members (20 persons x 5 rooms) was originally requested but the scale was reduced to 75 (15 x 5) based on the personnel plan to be implemented after completion of the Project. For the laboratories, the original requested capacity was 150 trainees (50 trainees x 3 rooms (1 each for physics, chemistry and biology)), but the plan was streamlined to 90 (30 x 3) on the assumption that the existing laboratories will continue to be used.

b. Layout plan

The layout of the facilities in this Project was designed to enable effective liaison between the existing lecture rooms and laboratories and the planned facilities on the precondition that the existing trees will be preserved and not be cut down as far as possible. In addition, in order to lay out the buildings to suit the sloping land features of the planned site, the buildings will be constructed separately by function, and each will be furnished with side corridors. The buildings, however, will be connected by covered access corridors since the trainees will often have to move between rooms and squalls are frequent. In accordance with the laws of Kenya, a barrier-free design should be adopted for the training facilities.

c. Facilities design

The height of each story was designed to keep three meters which is appropriate for the training facilities,

and the two-story design was adopted for all the buildings applicable in view of economical efficiency. Since Kenya is located in an earthquake zone, seismic-resistant designs will be applied in accordance with the seismic-resistant design standard of Kenya, while incorporating some of the Japanese standards. Reinforced concrete, which is used for common structures in Kenya, will be applied to the structure and nonbearing stone walls will be built between columns. The ceiling height, the width of the corridors and doors, the stairways for evacuation, installation of the slopes and the firefighting equipment were planned based on the building code of Kenya and guidance from the Ministry of Public Works.

(3) Equipment plan

In accordance with the policy and approach of the training programs at CEMASTEA "to teach scientific principles effectively using materials readily available in the daily environment," an equipment plan was developed, keeping the equipment to the minimum necessary to meet the requirements of the training programs. The quantity of the planned equipment was determined while keeping it to an adequate amout to enable running of the training programs, depending on the quantity of the existing usable equipment and the training methods (demonstrations, group practice and individual practice).

The content and scale of the facilities and equipment in this Project are shown in Table 1 and Table 2, respectively.

Table 1 Summary of Facilities Plan

Building	Structure nos. of stories	Details	Gross floor area
A. Administration building 1	RC, 2 stories	Director's room, deputy director's room, printing room, toilets, etc.	299.12m^2
B. Administration building 2	RC, 2 stories	Offices (15 staff members x 5 rooms), meeting rooms and boardroom, toilets, pantry, storage room and entrance	762.17 m^2
C. Lecture hall	RC/1 story	Hall (capacity of 200 trainees), stage, storage room and toilets	397.48 m^2
D. Lecture building	RC, 2 stories	Lecture rooms (50 trainees x 4 rooms)	562.91 m^2
E. Laboratory building	RC, 2 stories	Laboratories for physics, chemistry and biology (capacity of 30 trainees each), ICT laboratory, library and toilets	763.87 m^2
F. Dining hall	RC/1 story	Dining hall (capacity of 112 trainees), toilets and hand washing basins	226.68 m^2
G. Connecting hall	Steel/1 story	Covered access corridor between the existing dining hall and the new dining hall	33.60 m^2
H. Kitchen	RC/1 story	Kitchen, food storage and staff room	50.40 m^2
I. Transformer building	RC/1 story		36.54 m^2
J. Generator building	RC/1 story		55.44 m^2
Covered access corridor			161.20 m^2

Exterior structure		Wastewater treatment plant, storm drainage, etc.	
Total area			3,349.41 m^2

Table 2 Summary of Equipment Plan

Category	Equipment	Usage	Quantity
Equipment for mathematics and science education	Physics equipment (13 items including electronic precision balance, galvanometer, resistance box, oscilloscope, etc.)	For physics experiments	1 set
	Chemistry equipment (11 items including rotary vacuum pump, electronic table balance, molecular structure model inorganic, burner, etc.	For chemistry experiments	1 set
	Biology equipment (6 items including microtome, prepared slide set, digital microscope, model set, etc.)	For biology experiments	1 set
	Mathematics equipment (geometric model set, blackboard instrument, geoboard with plastic pegs)	For teaching mathematics	1 set
Equipment for Lecture Support	AV equipment (projector, visual presenter, video camera, DVD player, screen)	For creation of teaching materials and for demonstrations	1 set
	Bus	For transportation of trainees	1 unit
Equipment for ICT	Computer	For ICT training	51 unit
	Networking equipment (switching hub, printer)	For networking	1 set
Equipment for the lecture hall	AV equipment (sound equipment, projector, screen)	For general sessions and ceremonies	
Education furniture	Education furniture for lecture rooms (white board portable)	For teaching in lecture rooms	1 unit
	Education furniture for laboratories (laboratory central experimental tables for physics, chemistry and biology, laboratory table for lecturers, draft chamber)	For teaching in laboratories	1 set
	Shelves for library	Bookshelves	8 unit
	Education furniture for meeting rooms (table set and chairs for meetings)	For meeting rooms	1 set
Equipment for hostels, kitchen and dining hall	Equipment for hostels (ironing roller, trolleys for dry linen and wet linen)	For hostels	1 set
	Equipment for kitchen and dining hall (28 items including stock pot stove, potato peeler, mixing machine, refrigerator, etc.	For kitchen and dining hall	1 set

Construction Period and Summarized Cost of the Project

To determine the construction period based on the possible constraints arising from the construction scale, weather conditions and local construction circumstances, 3.5 months will be scheduled for the development of design and tender document, 3.0 months for tendering, and 13.0 months for construction of the facilities and procurement of the equipment, corresponding to a total of 19.5 months. The costs borne by the Government of Kenya under this Project is estimated to be ¥25 million (23.75 million Ksh)

Project Evaluation

(1) Relevance

This Project, through upgrading and refurbishment of the training facilities of CEMASTEA, aims at enhancing the quantity and quality of the training programs intended to enhance capabilities of the persons concerned in mathematics and science education in both Kenya and other African countries and, thereby, at contributing to the qualitative improvement of mathematics and science education in Kenya and other African countries. In order to improve education qualitatively, it is an urgent issue to enhance capabilities of the persons concerned in the education field through an expansion of accessibility to training for such people including teachers of mathematics and science education and educational officers. However, since CEMASTEA is currently unable to offer sufficient trainings due to a lack and deterioration of the existing training facilities, it is urgently necessary to upgrade and refurbish the facilities.

In this Project, the direct beneficiaries will be the educational officers and INSET trainers in local districts, while the indirect beneficiaries will be the teachers of primary and secondary mathematics and science education, school principals and students at primary and secondary schools around the country. At the same time, teachers and students of other African countries will also benefit from this Project, as capabilities of the INSET trainers in those countries will be enhanced through WECSA/TCTP (Third Country Training Program). In this way, this Project will benefit people of both Kenya and other African countries.

In its long-term development plan “Vision 2030”, Kenya strives to develop an industrialized economy, improve living standards and international competitiveness and achieve economic prosperity by 2030. This Project will contribute to one of the strategies of Vision 2030, which is to ensure “Kenya will provide globally competitive quality education, training and research to her citizens for the development and enhanced individual well-being” through development of the core facilities to improve the quality of teachers on a continuing basis, thus contributing to the achievement of the national development goal.

In addition, the content and goals of this Project conform to Japan’s basic policies for ODA for Kenya.

(2) Effectiveness

[Quantitative effect]

Through the implementation of this Project, the following quantitative effect will be expected:

- When this Project is implemented and the facilities of CEMASTEA such as training rooms and laboratories, ICT laboratory and lecture hall are newly constructed, it will be possible to develop more efficient training programs through effective use of entire facilities including the existing facilities. As a result, the number of training courses offered annually will increase from 18 (2010) to 33 (2016), which will lead to an expansion of training opportunities.

- When this Project is implemented, the capacity of the training facilities will be expanded and the number of people who can be trained simultaneously at CEMASTEA will increase from 92 (2010) to 200 (2016). As a result, the number of INSET trainers and principals who can be trained annually will increase from 964 (2010) to 5,539 (2016). The baseline number 964 was referred to the actual record of 2010 and the targeted number 5,539 was calculated based on the training programs planned by the Centre.

Table 3 Expected Quantitative Effect

Indicator	Reference (2010)	Target (2016)
Number of trainees per year	964	5,539
Number of training courses per year	18	33

[Qualitative effect]

It is expected that the implementation of this Project will bring about the following qualitative effect:

- Through the construction of the training rooms/laboratories and integration of the administrative functions, the training environment will be improved, thereby improving the quality of the training.
- CEMASTEA will be developed and enhanced as a center for training mathematics and science teachers not only in Kenya but also in Africa which will contribute to the improvement of mathematics and science education in Africa.

This Project can be expected to bring about the above-mentioned effectiveness as well as to support the qualitative improvement of education through enhancement of the quality of teachers on a continuing basis at which the Government of Kenya targets. Thus, this project can contribute to the achievement of a sustainable development which is the overall goal of Vision 2030 through development of globally competitive human resources, while it can be similarly conducive to the development of Africa as a whole. Based on the above perspective, it is highly relevant to implement this Project with the Japanese Grant Aid Scheme, while this Project can also be deemed to have a sufficient effectiveness.

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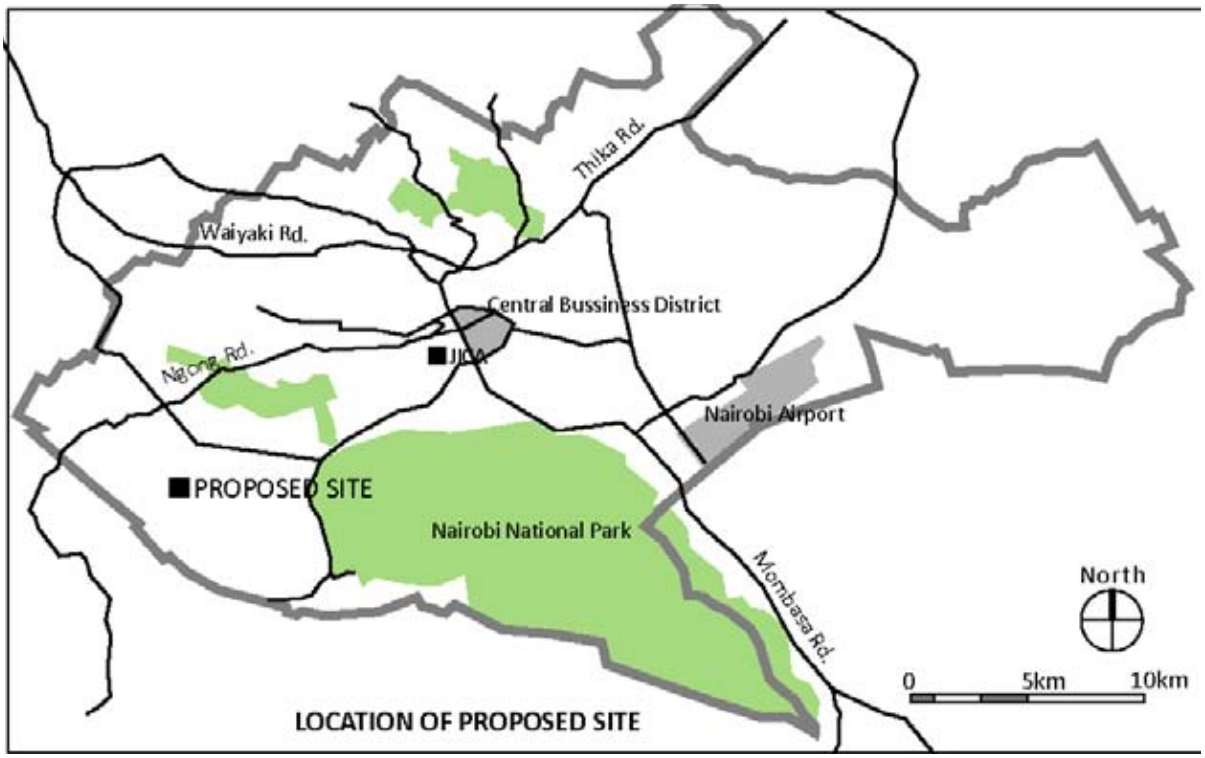
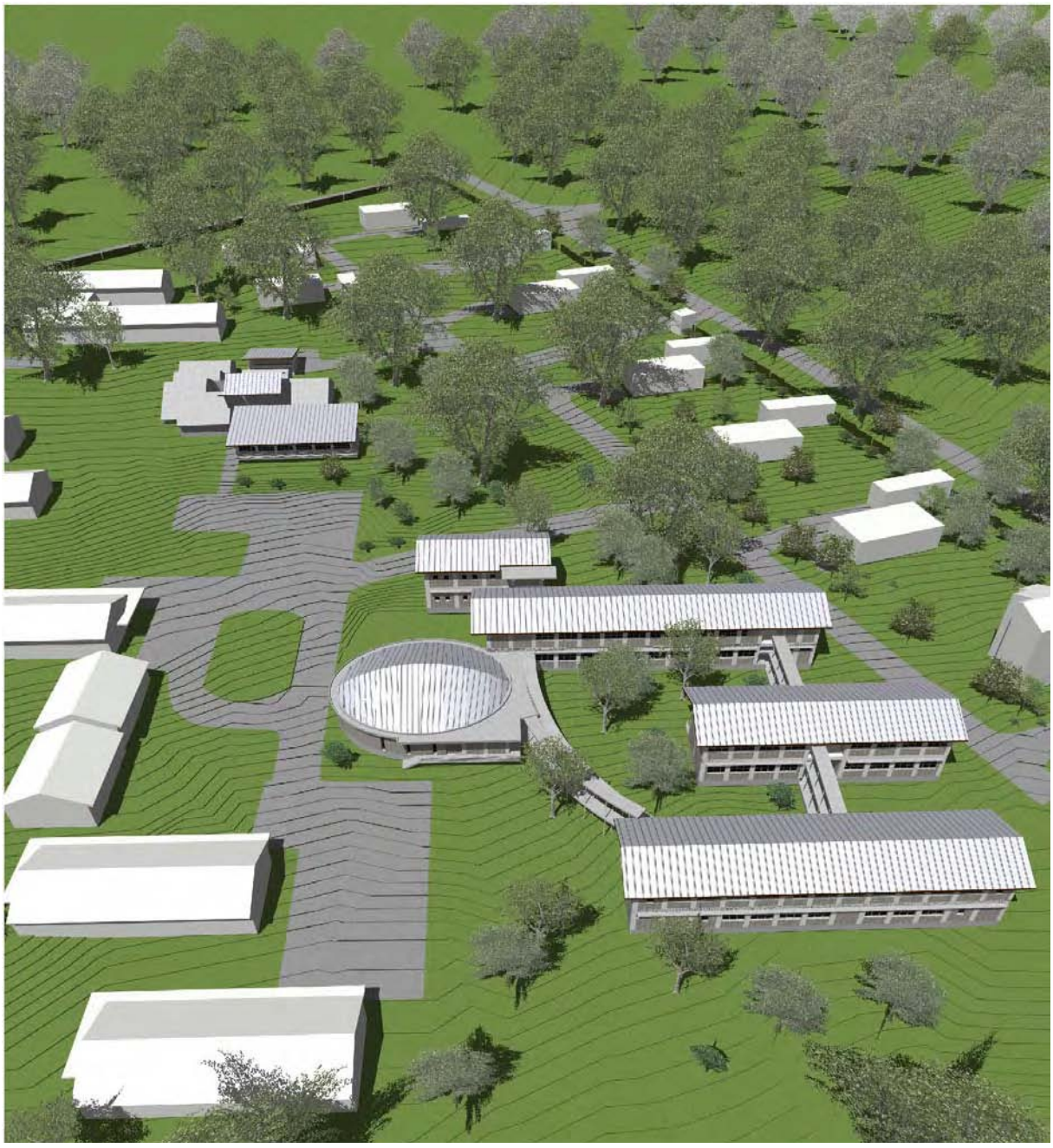
LOCATION MAP



PERSPECTIVE



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Abbreviations

A/P	Authorization to Payment
AICAD	African Institute for Capacity Development
ASAL	Arid and Semi-Arid Lands
ASEI/PDSI	Activity, Student-Centered, Experiment, Improvisation/ Plan, Do, See, Improve
AV	Audio-Visual
AVR	Automatic Voltage Regulator
B/A	Bank Arrangement
BOD	Biochemical Oxygen Demand
BS	British Standard
CEMASTEA	Centre for Mathematics, Science and Technology Education in Africa
CIDA	Canadian International Development Agency
DFID	Department for International Development
DPC	District Planning Committee
E/N	Exchange of Note
EFA	Education for All
EIA	Environmental Impact Assessment
EMCA	Environmental Management & Coordination Act
EMIS	Education Management Information System
EN	European Norm
FTI	Fast Truck Initiative
GDP	Gross Domestic Product
GL	Ground Level
HIV/AIDS	Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome
ICT	Information and Communication Technology
IMF	International Monetary Fund
INSET	In-service Education and Training
JICA	Japan International Cooperation Agency
KCPE	Kenya Certificate of Primary Education
KCSE	Kenya Certificate of Secondary Education
KEBS	Kenya Bureau of Standard
KESSP	Kenya Education Sector Support Programme
KEMRI	Kenya Medical Research Institute
KLDA	Karen and Langata District Association
KLPDP	Karengata Local Physical Development Plan
kN	Kilo Newton

KPLC	Kenya Power & Lighting Company
KS	Kenya Standard
KSTC	Kenya Science Teachers College
LAN	Local Area Network
LPG	Liquefied Petroleum Gas
MDGs	Millennium Development Goals
MOE	Ministry of Education
MOPW	Ministry of Pubic Works
NCC	Nairobi City Council
NCWSC	Nairobi City Water & Sewage Company
NEMA	National Environmental Management Authority
O & M	Operation and Management
P/Q	Pre-Qualification
PA	Public Address
PC	Personal Computer
PS	Pipe Space
PTTC	Primary Teacher Training College
PVC	Polyvinyl Chloride
QASO	Quality Assurance and Standards Officer
SMASE	Strengthening of Mathematics and Science Education
SMASSE	Strengthening of Mathematics and Science in Secondary Education
TAC	Teacher Advisory Center
TCTP	Third Country Training Program
TICAD	Tokyo International Conference for African Development
TSC	Teachers Service Commission Kenya
TTC	Teacher Training College
VAT	Value Add Tax
VVOB	Flemish Association for Development Cooperation and Technical Assistance
WECSA	Western, Eastern, Central and Southern Africa
WRMA	Water Resource Management Authority
WS	Workshop

Chapter 1 Background of the Project

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1-1 Background and Summary of the Grant Aid

In its long-term development plan (Vision 2030), Kenya has established a national goal to develop an industrialized economy and realize higher living standards, international competitiveness and economic prosperity by 2030. For this purpose, Kenya positions education as an important field to develop human resources equipped with international competitiveness that will contribute to the sustainable development of the country. In the Kenya Education Sector Support Programme (hereinafter "KESSP I") which specifies the implementation strategy for Vision 2030, the importance of improving the quality of teachers on a continuing basis is advocated so that the quality of education will be improved, while priority investment projects which include "in-service training of teachers in primary education" and "in-service training of teachers in secondary mathematics and science education" are established. These priority investment projects are carried over into KESSP II (planned) aimed at enhancing the capabilities of teachers on a continuing basis through high-quality training programs so that the quality of education will be improved.

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and the Association for the Development of Education in Africa, who will then be expected to train teachers of mathematics and science in Africa. Since the expansion of the facilities of the Centre is an urgent issue not only for Kenya but for Africa as a whole, the Government of Kenya developed a plan to expand the functions of the Centre and requested Japan for assistance in implementing the "Project for the Upgrading and Refurbishment of the Centre for Mathematics, Science and Technology Education in Africa".

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In response to the above request from Kenya, JICA sent a survey team to Kenya from January 8 to February 4, 2011, to hold discussions with the parties concerned on the Kenyan side, including CEMASTEA and the Ministry of Education. In the original request made by Kenya, ineligible components for the Japanese Grant Aid Scheme such as workshop on technical education and parking lots were included. Through the discussion between the two sides, however, it was agreed that these ineligible components would be removed from the Project. In addition, since the original request list of equipment was made based on the previous Project, a new request list was submitted by CEMASTEA during the discussion. The final request list of equipment was drawn up and confirmed by both sides through the investigation on the existing equipment and the discussion on priorities for each of the equipment.

1-2 Natural Conditions

(1) Topographical Conditions and Surrounding Environment of the Planned Site

Topographically, the planned site is a rectangular-shaped area stretching about 300m north to south and 200m east to west. The site area totals approximately 54,700 square meters (measured on a topographic map) and it lies on a gentle slope descending from the northeast corner to the southwest corner. The difference of elevation is 19m, the diagonal length is about 360m and the average gradient is 1/19. The inclination is not uniform and the central part of the planned site where construction works are planned has an average inclination of 1/12 with a maximum inclination of 1/8.

The planned site is surrounded by low-rise and low-density residential districts, which are sectioned into large plots with well maintained plants and trees as well as beautiful hedges. The site is bordered

by Karen Road to the east (road width 5.5m) and Mbagathi Ridge Road to the north (road width 5.5m), both surfaced roads. To the north of the site are the extensive premises of the Karen Blixen Museum across the road. To the west, the site is bordered by a private road partly paved with stones. The main gate of the site is located on the east side, while a sub-gate exclusively for the staff dwellings is located on the north side. The planned site is adjacent to a private property on the south across a fence.

(2) Geological and Soil Conditions

The planned site is located on the gentle slope of Ngong Hill and geologically the soil is mainly composed of tuff and trachyte, which are usually found in volcanic regions. The base layer of the soil is weathered or crushed tuff and trachyte. The field study was conducted on the planned site in the form of a geological survey to obtain technical information necessary for the foundation design of the planned buildings. This survey was subcontracted to a geological surveyor in Nairobi and the following results were obtained. More detailed results are attached at the end of this report.

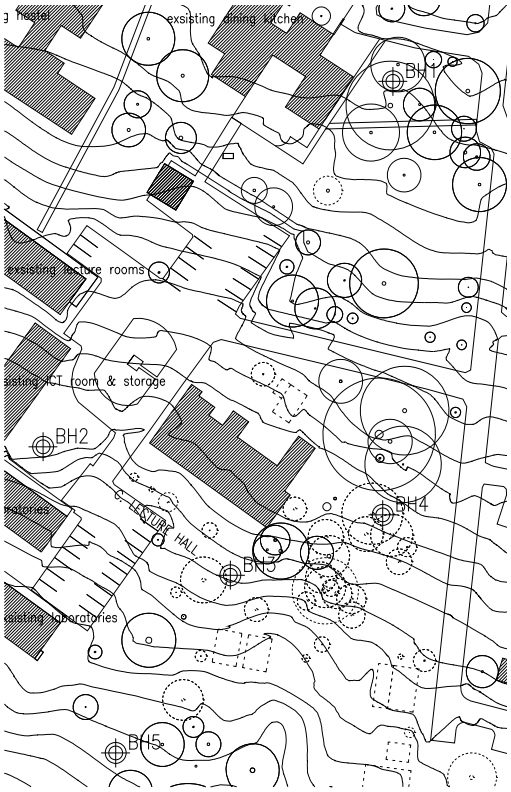


Figure 1-1 Location of Survey Points

Content of the Survey

- Test boring, standard penetration test (hereinafter SPT): At a total of five locations (to a depth of 10m or to the base rock), more than three times at each bore
- Sampling, laboratory test: Particle size distribution, specific gravity, water content, liquid limit, triaxial compression test
- Preparation of report: Borehole log, test results, technical advice on the foundation design of buildings

Location of Survey Points

As shown in Figure 1-1, survey points were selected in the planned construction area and in the surrounding areas. For designing of the dining hall and the kitchen, the survey results obtained at point BH1 will be referred, and for designing of the administration and lecture buildings, those obtained at points BH3 & 4 will be referred. Therefore, in the following paragraphs, BH1, 3 & 4 will be discussed as trial boring points for the planned construction area. In order to understand the overall features of the site, BH2 & 5, a little farther away from BH3 & 4, were also selected as survey points.

Soil Composition

The soil at survey points BH1, 3 & 4 is composed of red or bronze-colored silty clay in the first layer from the ground surface to a depth of 2.2-2.5m, and sand or gravel-mixed clay in the second layer to a depth of 3.4-5.0m. The layer below these is the base rock of basalt. At BH5, a little farther away from the planned construction area, the layer under the ground surface is a bed of clay to a depth of 10m.

Soil Bearing Capacity

It can be said that the soil in the area is highly rigid and of high quality, since the N value of SPT exceeds 20 for the layer from the ground surface to a depth of 1.5m at each of the survey points. The allowable bearing capacity estimated from the N value is 167-200kN/m^2. At BH5 which is located outside the planned construction area, the soil can be said to be rigid with an N value of 10 and its bearing capacity is estimated to be 83kN/m^2.

(3) Vegetation

On the vacant land of the planned site, there are a number of trees of diverse kinds growing and some of these trees have trunks of over 2 meters in diameter and of 30 meters in height. The ground surface is covered with turf, creating a serene environment.

(4) Weather Conditions

Nairobi, where the planned site is located, is situated at latitude 1°19' south, almost right on the equator. With a high altitude of approximately 1,700m, however, Nairobi is in the temperate climate zone. The monthly average high temperature is highest in March at 26°C and lowest in July at 21°C. The monthly average low temperature is highest in April at 15°C and lowest in July at 11°C. This means that Nairobi has a rather mild climate throughout the year. The daily range of the temperature is between 9°C and 12°C, while the annual range of the temperature is smaller at between 4°C and 5°C. (The above data were all sourced from the meteorological data between 2004 and 2009 obtained at the Dagoretti Weather Station located near the planned site.)

There are two rainy seasons, the major rainy season around April and the minor rainy season around November. Rain often falls heavily for a short period of time and the annual average rainfall varies from year to year. In the period from 2004 to 2009, the lowest annual rainfall recorded was 775mm while the highest was 2,440mm. The wind mostly blows from between the northeast and the southeast, although it varies slightly depending on the season. The average wind scale is mild at 2 to 3 (1.6～5.4m/s). According to the data from 2007 to 2009, the maximum instantaneous wind velocity was 20 knots (approx. 10m/s).

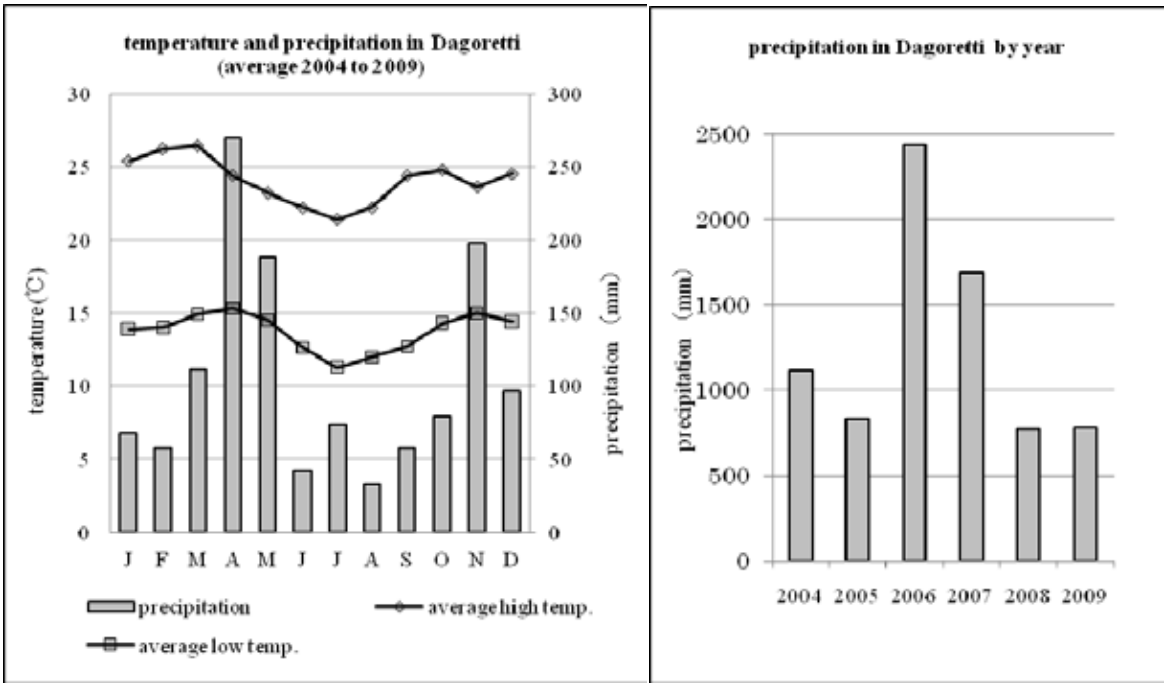


Figure 1-2 Meteorological Data of Dagoretti (2004 – 2009)

Source: Dagoretti Weather Station

(5) Earthquakes

To the west of Kenya, the Great Rift Valley, a huge crustal plate boundary in Africa, runs from north to south where earthquakes often occur when crustal movements occur. As it is located right on the east side of the Great Rift Valley, particularly, the planned site is vulnerable to earthquakes.

Since 1965, earthquakes have occurred as shown in the figure on the right. Around Nairobi, earthquakes at magnitude 4 have occurred three times. Although there has been no record of damages caused by earthquakes at the existing facilities on the planned site since 2005, it is anticipated that the planned site will definitely be affected by future earthquakes in the long and medium terms. In the neighboring

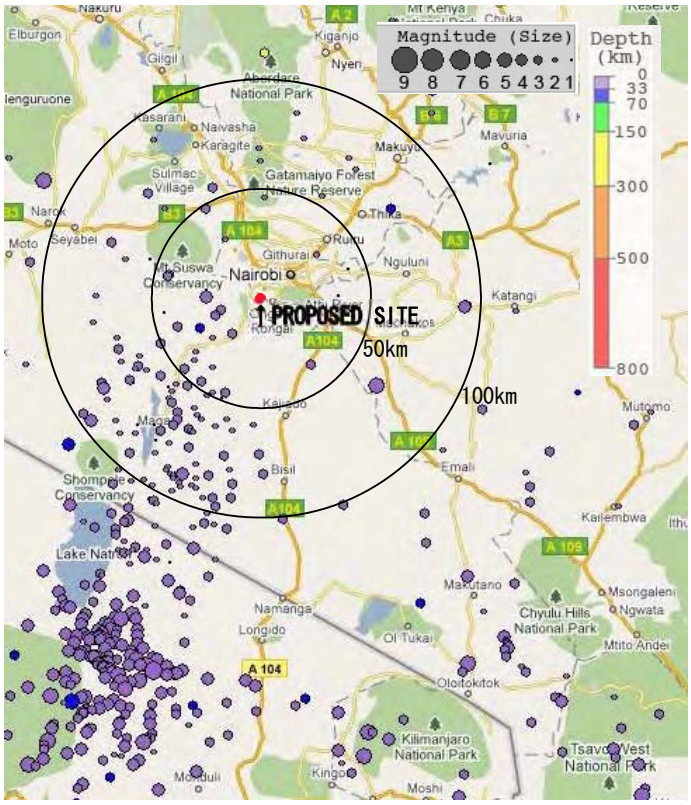


Figure 1-3 Earthquake Data in Kenya

Source: http://www.iris.edu/

country of Tanzania, around Lake Natron in the north, 150km to 200km away from the planned site (on the left bottom of the figure), a number of earthquakes, particularly those at magnitude 4 or over, have occurred.

(6) Other Natural Conditions

In Kenya, during the rainy seasons, rain falls heavily in squalls, often accompanied by gusts of wind and lightning. In addition, since the planned site is located on a slope, the land may be eroded when rain falls heavily. However, there has been no record of such damages at the planned site.

1-3 Environmental and Social Considerations

1-3-1 Environmental Impact Assessment

Since August 2006, the Government of Kenya commenced EIA study on this Project and through the consultations with the neighborhood residents, compiled the EIA report in February 2010. National Environmental Management Authority (hereinafter NEMA) issued the license for this Project based on the EIA report on 23th April, 2010. This license is effective for two years from the date of issuance and the proponent (CEMASTEA) needs to commence a construction work before the effective period expires. In addition, the license incorporates collateral conditions as shown in the table below and the Centre needs to formulate and implement an Environmental Management Plan (hereinafter EMP) to ensure appropriate compliance with the collateral conditions.

Table 1-1 Major Collateral Conditions of EIA License

Provision*	Content	Assumed Organizations in charge of implementation		
		Kenyan side	Japanese side	
			Consultant	Contractor
1.6	To confirm that EMP is implemented effectively and appropriately, an Environmental Audit (EA) report should be submitted to NEMA one year after the commencement of the operation.	○		
1.8, 2.8	The EMP to be formulated throughout the project cycle should be complied.	○		
2.1, 3.2.2	A wastewater treatment plant conforming to the water quality standards of EMCA should be constructed.		○	
2.2	Mature trees within the compound of the facility should be protected and preserved.	○	○	
2.3	Waste materials generated by the excavation or the construction work should be disposed of and removed in accordance with the solid waste standards of Environmental Management & Coordination Act (EMCA).			○
2.4	The noise standards of EMCA should be complied.	○	○	
2.6	Appropriate training, safety gears and temporary toilets should be provided for the construction workers.			○
2.7	Construction work should be carried out between 8:00 and 17:00 only.			○
	Transportation of the equipment and materials should be carried out on weekdays off the peak hours.			○

2.9	The project plan should be developed in accordance with the physical development plan provisions (land utilization, in particular) established by NCC (Nairobi City Council).		○	
3.1	A drainage permit should be obtained for the wastewater treatment plant in compliance with the water quality standards of EMCA.	○		
3.2.2	All wastewater should be treated in compliance with the water quality standards of EMCA.	○		
3.2.3	A grease trap and silt trap should be installed for a drainpipe.		○	
3.4.1	No more than 200 people should use the facility simultaneously and no more than 92 training participants should be accommodated within the compound.	○	○	
3.4.2	Emission control measures should be taken during the construction work.			○
3.5.2	Equipment and devices should be maintained in accordance with the noise and vibration standards of EMCA.	○		○
3.6	Solid waste should be handled in accordance with the solid waste standards of EMCA.	○		○
3.8	A solid waste management plan, energy/water conservation measures, labor/health equipment and firefighting services should be designed, constructed, installed and utilized as facilities and means to prevent environmental pollution.	○	○	○

*As 3.1, 3.2, 3.4 and 3.5 consist of two clauses, each clause has been numbered provisionally, e.g. 3.1.1, 3.1.2, etc.

Based on the collateral conditions of the EIA license, measures to mitigate the anticipated impacts have been developed in this Project, as described in the next chapter. As a result of the scoping of this Project, it is anticipated that the Project will possibly have an impact in the following five areas, namely, “hydrology (excessive pumping of the groundwater),” “conflict of interest in the community,” “life and livelihood (concerns over depletion of the groundwater, etc.),” “conflict of interest in the community” and “impact during the construction period”. Since feasible mitigation measures will be taken in these areas, it is considered that this Project will have a rather small-scale impact on the environment and the society. Considering that the monitoring on the anticipated impacts will be needed, however, this Project can be classified as Category B in the JICA Guidelines for Environmental and Social Considerations.

1-3-1-1 Scope of Environmental and Social Considerations Review

a) To develop mitigation measures for major environmental and social impacts, a monitoring plan and an environmental checklist

b) To confirm the circumstances of the base environment and society (land use, natural environment, economic and social conditions, etc.), the system for environmental and social considerations in Kenya (laws and regulations related to environmental and social considerations) and the outline of the organizations concerned

c) To implement the scoping process

d) To predict and evaluate the impacts of this Project on the environment and the society as well as to make a comparative review with alternative plans (including a zero option). Also, to review

the impact mitigation measures (avoidance, minimization, compensation, etc.)

e) To develop a monitoring plan (system and method of implementing the monitoring, etc.)

f) To modify the plan of scoping summary as needed

g) To hold discussions with stakeholders as needed

1-3-1-2 Results of Environmental and Social Considerations Review

The results of the review of each scope for the environmental and social considerations as specified in the foregoing paragraph in this Project are as follows:

Table 1-2 Results of Environmental and Social Considerations Review

Item (Refer to 1-3-1-1)	Method	Section describing the review result
a)	Through analysis of collected documents, a study of anticipated impacts and mitigation measures was conducted.	Materials 6-1 and 6-2
b)	Through field surveys and interviews with the organizations concerned, the status of the environment and society and the system for environmental and social considerations were confirmed.	1-3-1-4, 1-3-1-5
c)	Scoping was implemented based on “a)”.	1-3-1-7
d)	Through an analysis of information collected in the survey, a study of anticipated impacts, alternative plans and mitigation measures was conducted.	1-3-1-3, 1-3-1-6, 1-3-1-8
e)	By studying the feasibility of the Japanese scope of the EMP formulated by the Kenya, a monitoring plan was developed.	1-3-1-9
f)	Based on the above study, the scoping plan was modified.	1-3-1-7
g)	A stakeholders meeting for explanation of the plan for the neighborhood residents was held.	1-3-1-10

1-3-1-3 Summary of Project Components with Environmental and Social Impacts

The components of this Project that may have environmental and social impacts are classified as shown in the table below:

Table 1-3 Summary of Project Components with Anticipated Environmental and Social Impacts

Component	Content	Anticipated impact	Countermeasures
1. Administration and training buildings	A cluster of facilities composed of four two-story buildings and one one-story lecture hall, to be connected by slopes and covered access corridors (2,947,75 ㎡).	Noise from AV equipment in the lecture hall, increased wastewater and consumption of energy	Sound proof measures will be applied to the design. See Component 5 below on wastewater issue.
2. Dining hall and kitchen buildings	Additional construction of a dining hall and kitchen in the adjacent area of the existing facilities (310,68 ㎡).	Increase in wastewater and consumption of water	See Component 4 and 5 below.
3. Transformer and power distribution system	Transformer and power generator system to meet the increased demand.	Noise from power generators	Power generator will have a soundproof container.
4. Water supply	Additional city water supply	Excessive pumping of	Multiple water resources,

system	provided by the Kenyan side and installation of a reservoir tank to meet the increased demand.	groundwater	usage of treated wastewater for flushing on toilets and watering plants, and usage of rainwater.
5. Wastewater treatment plant	Installation of a wastewater treatment plant in accordance with the water quality regulations, and grease and silt traps in the kitchen.	None	The current wastewater quality will be improved.
6. Equipment	Equipment for mathematics and science education training, kitchen fitments and a commuting bus.	None	The bus service is a measure for transportation of trainees who will be accommodated off the site.

1-3-1-4 Circumstances of the Base Environment and Society

1) Social background of the area surrounding the planned site

The planned site is located on the edge of Karen and Langata District, southwest of Nairobi City. The surrounding area was once the farmland owned by Karen Blixen, an early settler who is well known for her novel entitled ”Out of Africa.” In the adjacent area are the Karen Blixen Museum and Karen Golf and Country Club, a particularly high-status and quiet residential area in the Karen and Langata District. Each plot in the neighboring residential area is 2ha to 5ha in size and some plots even have a total area of 8ha each, which makes the area a low-density residential area. The self-governing organization of Karen and Langata District, KLDA, has long made efforts to prevent overdevelopment in the area, and in 2006, KLDA announced a Local Physical Development Plan (LPDP) and obtained the approval of Nairobi City.

2) Natural environment surrounding the planned site

As mentioned above, the area surrounding the planned site is a significantly low-density residential area and the owners of the plots there are devoted to landscaping and greening. As a result, each plot has rich vegetation with a number of large trees growing in abundance just like forests. Along the road boundaries, hedges of kei apple trees have been developed to maintain the high asset value of the entire area.

In the planned site, the groundwater source is an aquifer located 260m underground, of which the water source is the upstream of the Athi River. Another aquifer once existed at a shallower location of 120m underground, but it has dried up and many of the wells that formerly drew water from there have dried up as well. In Karen and Langata District, a total of 400 to 440 wells exist and the density of wells is the highest in Kenya with 7 wells per $1km^2$. There is a concern, therefore, that the aquifer currently in use could also dry up.

1-3-1-5 Systems and Organizations for Environmental and Social Considerations in Kenya

In Kenya, the Ministry of Environment and Mineral Resources is responsible for formulating and implementing environmental policies. Based on the Environmental Management & Coordination Act (hereinafter EMCA) issued in 1999, NEMA was set up as a governmental organization for

formulating environmental regulations, dissemination and education of environmental conservation activities, and conducting environment-related research. NEMA is an organization with 120 inspectors and 20 prosecutors, and it reviews EIA which is a requirement for development projects and issues licenses (permits for development projects) based on EIA. NEMA has so far reviewed a total of 3,920 EIA programs, registered 1,550 EIA experts and conducted 6,560 Environmental Audits (hereinafter EA) (based on the data from NEMA's annual report for 2008).

Details of EIA are stipulated in the Environmental Impact Assessment and Audit Regulations issued in 2003. The EIA license issued for development projects incorporates collateral conditions, and to ensure that such conditions are satisfied, it is also stipulated that an EMP should be formulated and implemented and that EA should be implemented to confirm the effectiveness and appropriateness of the EMP. In particular, it is stipulated that the first EA should be implemented by an expert registered at NEMA. (EA in the second and subsequent years can be conducted by the owner.)

In addition, EMCA provides bylaws which stipulate the detailed regulations for each environmental item. The regulations related to this Project are indicated in the table below:

Table 1-4 Environmental Regulations related to this Project

Title	Relationship with this Project
EMCA (Water quality regulations), 2006	Stipulates the standards concerning potable water quality and wastewater treatment. Installation of a treatment plant in compliance with these standards is needed in this Project.
EMCA (Noise and vibration regulations), 2009	Stipulates the standards concerning noise generated during the construction work and operation. Notification should be made if the noise during the construction work exceeds the standards.
EMCA (Waste regulations), 2006	Stipulates the treatment method of solid waste generated during the construction work and operation.

If it is found that any of the collateral conditions of the issued EIA license are not complied, NEMA may take remedial actions.* In addition, if the proponent does not comply with this remedial action, a judicial review by the National Environmental Tribunal will be applied.

*Environmental Impact Assessment and Audit Regulations (2003), Article 40

1-3-1-6 Comparative Review of Alternative Plans (including a zero option)

After the basic design was developed for this Project in 2006, during the EIA process the plan was modified by, for example, cancellation of the hostel and addition of a wastewater treatment plant, through discussions with the neighborhood residents. As a result, the previous plan was compared with alternative plans and developed into a plan with less environmental impact.

1-3-1-7 Scoping, Impacts and Mitigation Measures

For this Project, scoping was conducted based on the "JICA Guidelines for Environmental and Social Considerations (April 2010)" and the results were obtained as shown in the table below. It is anticipated that the Project will possibly have an impact in the following five areas, namely, "hydrology (excessive pumping of groundwater)," "conflict of interest in the community," "life and

livelihood (concerns about depletion of groundwater, etc.),” “conflict of interest in the community” and “impact during the construction period.”

Table 1-5 Anticipated Impacts Based on the Results of Scoping and Mitigation Measures

*A=major impact is anticipated; B=impact is anticipated; C=impact is possible (observation is necessary); and D=almost no impact is anticipated

Check item	Impact	Mitigation measures	Evaluation
[Measures against pollution]			
Air Quality	None	None	D
Water Quality	Contamination of the groundwater due to treated wastewater	Advanced wastewater treatment plant will be installed	D
Soil Contamination	A small impact due to a few chemical substances from laboratories	Wastewater from laboratories will be diluted.	D
Solid Waste	Inappropriate waste disposal within the planned site	Waste will be collected by the registered specialized operators.	D
Noise and Vibration	Noise may be discharged from the lecture hall, power generators and wastewater treatment plant.	Sound proof measures will be applied on the design.	D
Land Subsidence	None	None	D
Offensive Odor	No offensive odor discharged from an advanced wastewater treatment plant.	None	D
[Natural environment]			
Natural Reserve	None	None	D
Ecosystem and Biota, etc.	Damages to the vegetation and trees within the planned site due to the construction work	Recovery of the vegetation and plants after completion, and building layout design to avoid cutting of the existing trees as much as possible	D
Topography and Geology	None	None	D
Sediment	None	None	D
Climate Change	None	None	D
Hydrology	Excessive pumping of the groundwater	Multiple water resources and water consumption control	C
[Social environment]			
Demographic shift such as involuntary relocation of residents, etc.	None	None	D
Local economy such as employment and livelihood, etc.	None	None	D
Life and livelihood	Risk of depletion of the groundwater	Same as Hydrology	C
Land use and use of local resources	None	None	D
Social capital and social organizations such as local decision making organizations, etc.	Conflict with local communities	Discussions with stakeholders will be held regularly.	C

Existing social infrastructure and social services	None	None	D
Socially vulnerable groups such as the poor and native population	None	None	D
Division of damages and profits and fairness in the development process	None	None	D
Gender	None	None	D
Cultural heritage	None	None	D
Conflict of interest in the community	Conflict with local communities	Discussions with stakeholders will be held regularly.	C
Infectious diseases such as HIV/AIDS	None	None	D
Minority groups and native population	None	None	D
Work environment	None	None	D
[Others]			
Impacts caused during the construction period	Noise and vibration generated during the construction period, increased traffic of construction vehicles and commuting of workers in the morning and evening	Temporary fences and noise-control sheets surrounding the workplace, adherence of working hours and transportation hours, and provision of transportation for the workers	C
Monitoring	None	Monitoring will be conducted through formulation and implementation of the EMP.	D

1-3-1-8 Mitigation Measures and Cost of Implementing the Measures

Mitigation measures are described in 1-3-1-7 and some of them require careful management during the operation without any additional costs. However, some mitigation measures need additional costs as shown in the table below. As the sound insulation of the lecture hall functions as a soundproof measure against the noise from outside, this cost is not shown on this table.

Table 1-6 Budget for Implementing Mitigation Measures

Item	Initial cost (Japanese side)	Operation cost (Kenyan side)
Advanced wastewater treatment plant	Approx. 4.9 million Ksh (cost of installation)	Approx. 0.3 million Ksh per year (cost of contracting for regular inspection works and replacement of supplies)
Noise control during the construction period	Approx. 4.2 million Ksh (noise control sheets)	
Measures for transporting workers	Approx. 4.2 million Ksh (shuttle bus operation)	
Formulation of EMP and monitoring		Approx. 4.1 million Ksh (formulation of EMP and monitoring during the construction work) Approx. 0.6 million Ksh (after the start of service)

1-3-1-9 Environmental Management Plan and Monitoring Plan

1) Formulation and implementation of environmental management plan (EMP)

According to the EIA license, the Ministry of Education and CEMASTEA will be responsible for formulating the EMP and providing appropriate environmental considerations on a continuing basis through the project cycle. In formulating and implementing the EMP, local environmental consultant will be contracted for the work. The role of the Kenyan side and the Japanese side concerned in formulating and implementing the EMP are shown in the table below:

Table 1-7 Roles of the Organizations Concerned of the Two Countries in Formulating and Implementing the EMP

	Planning and preparatory phase	Construction phase	Operation phase
the Kenyan side	-Formulation of EMP and construction of monitoring system		
	-Implementation and reporting of monitoring		
	-Acquisition of necessary permits and licenses		
	-Inclusion of consideration items in the contract documents for the demolition works		
the Japanese side	-Confirmation of the results of monitoring		
	-Provision of necessary information related to the Project		
	- Inclusion of consideration items in the contract documents for the main construction works	-Provision of necessary technical information concerned in the construction works	

2) Monitoring plan

The summary of the monitoring plan for environmental considerations in this Project is as follows. The entities that will conduct monitoring will be the Ministry of Education and CEMASTEA and the actual monitoring will be conducted by the contracted environmental consultant. The environmental checklist and the monitoring plan are attached in the appendix.

Table 1-8 Summary of Monitoring Plan

Item	Method	Period	Frequency
Various permits	Confirmation of the permit (paper)	From the preparatory phase to the post-completion period	As needed
Implementation status of stakeholders meetings	Confirmation of the minutes of meetings	From the preparatory phase through to the end	When the plan is formulated, Prior to the commencement of the demolition works, Prior to the main construction works, Quarterly during the

			construction period, As needed after completion
Soil pollution (wastewater treatment)	Confirmation of the results of laboratory tests of wastewater quality	After completion	As needed
	Confirmation of the maintenance contract for wastewater treatment	Immediately after completion	
Solid Waste	Confirmation of the content and actual implementation status of the waste management plan Status of waste stored and segregated prior to collection	After completion	As needed
Hydrology (preservation of water sources)	Confirmation of the weekly records of water usage	From the preparatory phase through to the end	Weekly
	Confirmation of the status of rainwater and treated water usage	After completion	As needed
Landscape	Confirmation of the status of landscape development within the planned site	After completion	As needed
Work environment	Confirmation of the content and actual status of the safety management plan, etc.	During the construction period	As needed
Impact during construction period	Whether or not the noise control measures are in place, etc.	During the construction period	As needed

1-3-1-10 Stakeholders Meeting

A stakeholders meeting was held by the Ministry of Education and CEMASTEA in the following manner:

Table 1-9 Summary of Stakeholders Meeting

Date	May 24, 2011, 16:10-17:10	
Place	Meeting room, CEMASTEA	
Agenda	1. Explanation of the content of the plan to the representatives of the neighborhood residents 2. Q&A 3. Explanation of the project schedule	
Participants (honorific titles are omitted from names)	Organization	Name and title
	Karen and Langata District Association (KLDA)	Cilla White
	Field Service Bureau, MOE	Omara (Deputy Director)
	CEMASTEA	Cecilia (Director), Kawa (Deputy Director), Kogolla (in charge of programs), Mwai (administrative official), Kithaka (head of ICT subjects), Nancy (head of mathematics), Gachuhi (head of Chemistry), Chesire (head of Physics), Mary (head of Biology)
	GIBB (environmental consultant)	Alex Mutigo, Joyce Kivi

	Matsuda Consultants International, Co., Ltd. (MC)	Kawazoe, Hyodo

In the Q&A session, discussions were held on the agenda of mitigation measures against groundwater source depletion, stormwater and noise. Following the discussions, KLDA expressed their agreement to the content of the plan in writing (dated June 10, 2011) concerning the following four items which have already been requested in the past.

1. The Project should include “green walls”, kei apple hedges along the road and neighboring plots.
2. The trainees, when off the CEMASTEA property, should conduct themselves in a decent and respectful manner.
3. The Project should comply with the ground-floor-plus-one-story design as is the case with other households in the area.
4. The Project should not adversely affect the existing water supply to the residents.

These conditions have already been incorporated in the plan or are to be handled responsibly by the Kenyan side.

1-3-2 Site Acquisition and Relocation of Residents

In this Project, no plans have been made to acquire new sites or relocate residents.

Chapter 2　Contents of the Project

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

(1) Overall goal and Project purpose

In its long-term development plan (Vision 2030), Kenya has established a national goal to develop an industrialized economy and realize higher living standards, international competitiveness and economic prosperity by 2030. For this purpose, Kenya positions education as an important field to develop human resources equipped with international competitiveness that will contribute to the sustainable development of the country. In the Kenya Education Sector Support Programme (hereinafter "KESSP I") which specifies the implementation strategy for Vision 2030, the importance of improving the quality of teachers on a continuing basis is advocated so that the quality of education will be improved, while priority investment projects which include "in-service training of teachers in primary education" and "in-service training of teachers in secondary mathematics and science education" are established. These priority investment projects are carried over into KESSP II (planned) aimed at enhancing the capabilities of teachers on a continuing basis through high-quality training programs so that the quality of education will be improved.

In order to advance the qualitative improvement of education under these circumstances, since 1998 Kenya has been promoting in-service trainings of teachers through a series of technical cooperation projects by Japan, including "Strengthening of Mathematics and Science in Secondary Education (hereinafter SMASSE)," "SMASSE Phase 2" and "Strengthening of Mathematics and Science Education (hereinafter SMASE)" for greater qualitative improvement of mathematics and science education in both Kenya and other African countries. Under these circumstances, this Project aims to expand the training functions of the Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA), which was established in 2003, so that the training offered at CEMASTEA will be enhanced both in quantity and quality.

(2) Basic concept of the Project

This Project aims to upgrade and refurbish the Centre to enable the facility to implement training programs for up to 200 participants in order to attain the above-mentioned goal and facilitate the implementation of training for teachers in mathematics and science education and persons concerned in the education field in Kenya and other African countries. It is expected that this Project will result in the strengthening of mathematics and science education in Kenya as well as in other African countries, thereby contributing to the development of the national economy of each country.

The Grant Aid Scheme will cover the construction of a lecture room building, a laboratory building, a lecture hall, an administration building and a dining hall/kitchen for the expansion of the Centre, and procurement of the equipment necessary for the implementation of the training programs.

(3) Training plan after implementation of the Project

It is planned that, when this Project is implemented, the training programs will be offered to a larger number of trainees, totaling 5,539 trainees per year, on a total of 33 training courses and the capacity occupation rate will be 83%. The planned annual training programs are shown in the table below:

Table 2-1 Annual Training Programs at CEMASTEA after Implementation of the Project

	Nos. of annual trainees	Duration	No. of Cohorts	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1. Primary INSET															
National w/s for PTTC Principals, Deans and HOD (maths & science)	84	5days	1	84											
National INSET	320	2 weeks	2	160 160	160 160										
2. Diploma INSET															
Diploma teacher training program (ICT)	200	2weeks	1									200 200			
3. Secondary INSET															
National INSET	1,600	2weeks	8		200 200	200 200 200 200 200	200 200	200 200 200 200 200	200 200						
ICT program	600	2weeks	3							200 200 200 200 200	200				
4. Workshop															
DEO W/S (1week)	285	3days	2						140 145						
QASO W/S: Secondary (1week)	285	1week	2									140 145			
QASO W/S: Primary (1week)	285	1week	2										140 145		
National Stakeholders workshop	320	3days	2											120 200	
Principals Workshop for District neighbouring CEMASTEA	1,400	3days	7				200				200 200			200 200	200 200
5. WECSA /TCTP															
WECSA /TCTP (Regular)	80	4weeks	1										80 80 80	80	
WECSA/TCTP (Anglophone Primary)	50	3weeks	1										50 50 50		
WECSA/TCTP (Francophone Priimary)	30	2weeks	1										30 30		
Kenyan educational calendar (39weeks)				Term 1				Term 2				Term 3			
Nos. of weekly users	5,539			84 160 160	160 160 200 200	200 200 200 200 200	200 200 200	200 200 200 200 200	200 200 140 145	200 200 200 200 200	200 200 200	200 200 140 145	140 145 160 160 130	200 200 200 200	200 200
Occupation rate	83.0%			42% 80% 80%	80% 80% 100% 100%	100% 100% 100% 100% 100%	100% 100% 100%	100% 100% 100% 100% 100%	100% 100% 70% 73%	100% 100% 100% 100% 100%	100% 100% 100%	100% 100% 70% 73%	70% 73% 80% 80% 65%	100% 100% 100% 100%	100% 100%

Source: CEMASTEA

Training will be offered based on the following flow: General session → Group session → General session. Each session will be offered based on the following flow: Presentation of the theme → Discussions and practical training in small groups → Collective confirmation as a whole group. Group sessions will be offered in a range of ways; some will be held in lecture rooms and others in laboratories, some can also be held in a form of peer teaching in which the trainees practice teaching methods with each other, following actual examples of teaching.

The figure below indicates the flow of the training schedule, the content of the training activities, session units (number of trainees) and the places of the activities, taking the most common training, INSET, as an example. In the case of INSET, trainees will also visit neighborhood schools to gain experience in the field, dealing with students in reality in a process called actualization.

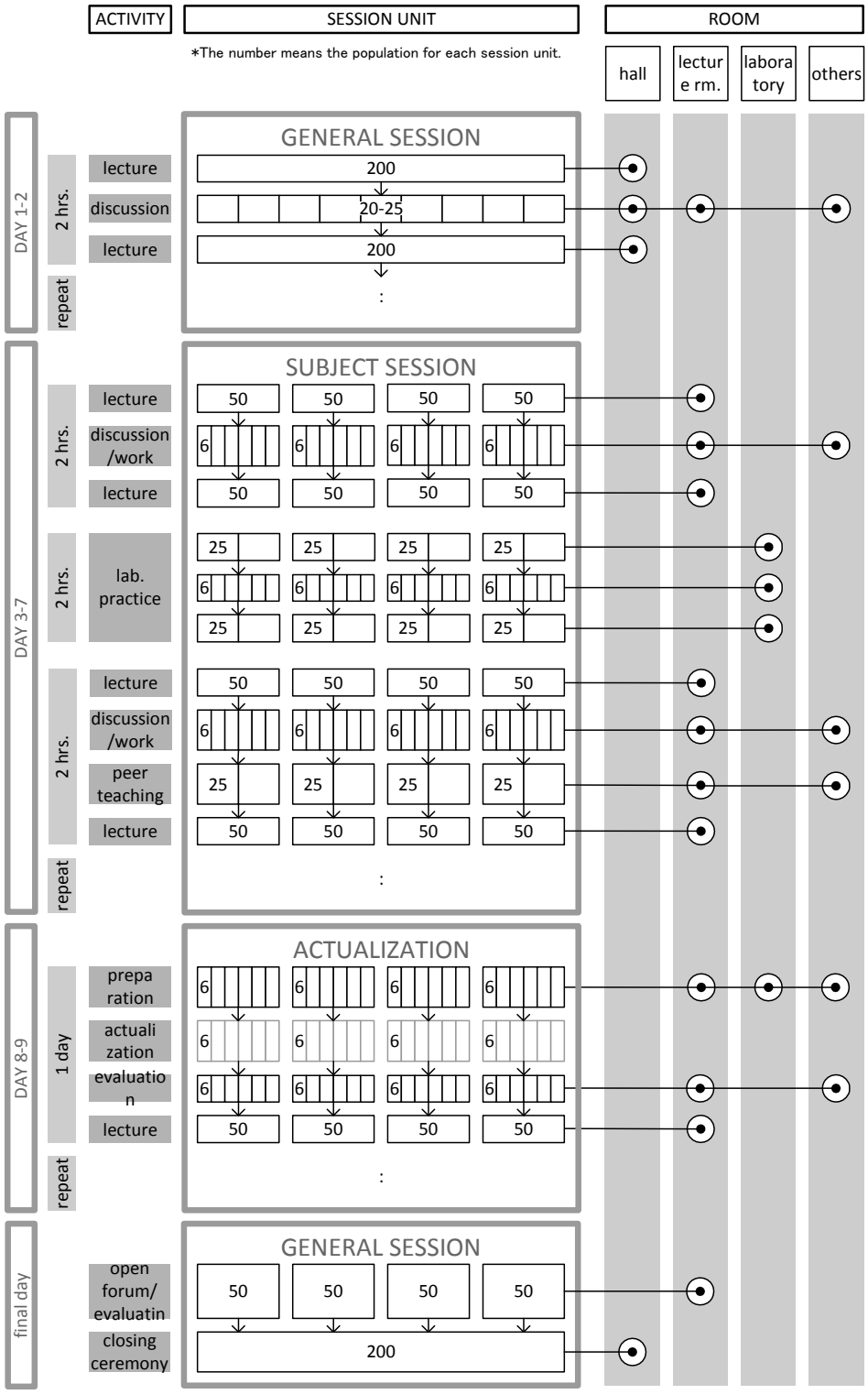


Figure 2-1 Rendering of a Training Schedule for INSET

2-2 Outline Design of the Requested Japanese Assistance

2-2-1 Design Policies

2-2-1-1 Basic Policies

CEMASTEA has two functions: 1) to act as a central training center offering INSET service to INSET trainers and educational officers through a cascaded INSET system for improvement of mathematics and science education in Kenya; and 2) to act as a regional center for the third country training program. In this Project, based on the above understanding of the roles of CEMASTEA, facilities will be constructed and equipment will be procured to expand the capacity of the Centre from the current 92 trainees to 200 trainees, on the assumption that the existing facilities will continue to be used. This Project will be implemented in accordance with the collateral conditions of the EIA license issued by the National Environmental Management Authority (hereinafter NEMA).

The component of the facilities requested under this Project can be grouped into three: 1) training facilities composed of a lecture hall for general sessions, lecture rooms and laboratories for group sessions by subjects, ICT laboratory and library; 2) administration facilities for developing and operating the training programs and curricula; and 3) a dining hall and a kitchen to serve every meal to the trainees staying at the Centre. Each of these components is indispensable to offer the training to 200 trainees and it can be said that the necessity for cooperation is strong enough to implement the Project according to the appropriate scale of the Project.

Therefore, based on the condition that the existing facilities continue to be used, the scope of cooperation under this Project will include the following three groups of components: 1) necessary training facilities to enable the training programs planned by CEMASTEA for 200 trainees; 2) administration facilities to provide the workplace for the planned number of staff at CEMASTEA to develop the training programs and curricula as well as to operate the Centre; and 3) expansion of the existing dining hall and kitchen to prepare and serve meals for up to 200 trainees and the staff.

2-2-1-2 Policies on facility planning

(1) Effective liaison between the existing facilities and the planned facilities

- The planned facilities should be located where they can be easily used in connection with the existing facilities.
- As the activity venue changes with each session or during the session of training, in consideration of training efficiency, the lecture hall, lecture rooms and laboratories for the training should be located close to each other, connected by covered access corridors to provide for rainy weather and located near the existing laboratory and lecture building.
- In consideration of service and work efficiency, the dining hall and kitchen should be expanded close to the existing dining hall as far as the construction allows.

(2) Size of the planned facilities in view of efficiency

- Small group discussions between each training session will also be held in the existing lecture rooms or laboratories. For implementing peer teachings, the existing lecture rooms will also be used.
- Both the existing laboratories with a capacity of 20 people each and new laboratories with a capacity of 30 people each should be used for laboratory sessions.
- Both the existing and the new facilities should be used for ICT training, enabling a total of 200 people to attend the training in two rounds.
- Existing dining hall facilities should be fully utilized and the shortage of seating should be made up for by expansion.
- Existing kitchen facilities should also be fully utilized and only the deficient facilities should be newly constructed.

2-2-1-3 Policies on equipment

(1) Equipment design policy

In accordance with the policy and approach of the training programs at CEMASTEA "to teach scientific principles effectively using materials readily available in the daily environment," an equipment plan was developed, keeping it to the minimum necessary to meet the requirement of the training programs based on the final request list of equipment submitted by the Kenyan side. In this regard, the following priorities established through the discussion with the Kenyan side will be taken into account:

- A: Equipment that is indispensable for the implementation of training or appropriate administration of the Centre
- B: Equipment that is deemed necessary but not as indispensable as "priority A" equipment
- C: Equipment that overlaps with the existing equipment, can be substituted by other equipment or can be easily procured by the Kenyan side

"Priority C" equipment will not be included in the scope of this Project. The necessity and relevance of "priority A" and "B" equipment are verified according to the following selection criteria when developing the equipment plan:

- The equipment is necessary for the implementation of the training curricula.
- The user has an adequate level of skill.
- Maintenance is relatively easy (does not require special skills or expensive consumables that are difficult to be procured).

- The cost-benefit performance is appropriate.
- The equipment is indispensable for the operation and maintenance of the Centre.
- Enough space is secured for the installation of the equipment in each room of the facility.
- The equipment is an appropriate target of the Japanese Grant Aid Scheme.

Items that do not meet any of the above-mentioned criteria will not be covered by the Project.

(2) Setting the amount of equipment

The quantity of equipment to be procured will be kept to the minimum necessary in accordance with the amount of the existing usable equipment and training methods (demonstration, group practice, personal practice) as confirmed in the field survey. The quantity of equipment is determined as follows:

- Equipment used in presentations by lecturers: One or two pieces
- Equipment used in group workshops: To be determined and calculated according to the content of the experiment
- Equipment used in individual workshops: 50 pieces

In this Project, the existing kitchen and dining hall will continue to be used in the future, while expanding these facilities to complement the shortage in capacity. During the training, the trainees will have three meals and tea break at the kitchen and dining hall. Therefore, enough kitchen equipment will be procured so that meals can be prepared and served for up to approximately 200 trainees per day. As in the case of other equipment, based on the condition and quantity of the existing equipment as confirmed in the field survey, kitchen equipment will also be renewed if it is out of order or too damaged for use. In addition, it was decided that, in order to respond to the increase of the capacity of the Centre from 92 to 200 trainees, the existing equipment will be complemented with new equipment, while a new function (gas baking oven) will be procured to satisfy the estimated demand to bake twenty-five pieces of 800g bread dough needed for one of the three meals in a day.

2-2-1-4 Policies on Natural Environmental Conditions

(1) Measures to deal with atmospheric temperature and solar radiation

In the area around the planned site, the temperature is comfortable almost throughout the year with a monthly average highest temperature of between 21°C and 26°C and a monthly average lowest temperature of 11°C to 15°C. Seasonal winds blow all year from diverse directions. Because of the moderate temperature and seasonal winds, general buildings are not equipped with air-conditioning and it feels cold even around July. Therefore, following the general practice in this area, when designing the buildings in this Project, the ceiling height should be secured and openings such as

windows should be made large enough to facilitate the natural ventilation.

Also, to deal with strong solar radiation, sloping roofs and concrete eaves should be used to allow in only the light, while blocking the strong direct rays of the sun.

(2) Measures to deal with rainfall

The rainy season comes twice a year, the major rainy season in March to May and the minor rainy season in October to December. Rainfall varies from year to year and according to the records for rainfall in the past 6 years, in one of those years, annual rainfall amounted to as much as 2,500mm. The monthly average rainfall is often highest in April, when squall-like rain falls heavily in a short period of time.

With respect to the topography of the site, there is a difference in elevation of about 19m from northeast to southwest and the entire ground slopes at a gradient of approximately 1/19. In the event of a squall, because the soil is barely pervious, a large amount of rainwater may flow towards the south of the site as runoff without penetrating the ground. As the floor of the planned facilities will be almost at the same level as the ground upstream of the water flow, a rainwater drainage ditch should be built on the upstream side to immediately divert the runoff and the rainwater on the roof away from the buildings and drain it towards the south of the site. The planned rainwater drainage ditch should have seepage pits allowing the rainwater to penetrate the ground in order to deal with rainwater drainage in the event of a squall.

(3) Policies on existing trees

Under the collateral conditions of the EIA license, it is required that mature trees on the planned site should be protected and preserved. Therefore, when laying out buildings or constructing temporary structures, plans should be developed so as to cause as little negative impact to the existing mature trees as possible. Also, since the roots of the existing trees may extend horizontally under the ground and destroy the foundations of the buildings, root-proof sheets made of plastic should be laid two meters below the ground surface around the existing trees adjacent to the planned facilities.

(4) Approach to ground and anti-earthquake measures

The boring tests carried out in this survey revealed that the ground at the planned construction area is of favorable quality and has a clay/silt layer extending up to 2.2 to 2.5 meters from the surface with an N value of no less than 20. The allowable bearing capacity of this layer is expected to be 150kN/m^2, which is sufficient to support the two-storied buildings assumed in this Project. Therefore, a spread foundation using this layer as the bearing layer should be adopted in this Project.

The planned site is located beside the Great Rift Valley running north to south in East Africa. The site belongs to the earthquake zone of level 8 in the Modified Mercali scale. Accordingly, the structural design should be done in consideration of the earthquake force according to the seismic-resistant design standard of Kenya.

(5) Measures for Groundwater Resources

In Karen and Langata District where the planned site is located, water from an aquifer located at 200 to 300 meters underground is shared. The amount of spring water from the aquifer, however, is not abundant and some local residents are concerned about the possible depletion of the aquifer. In this Project, therefore, it is planned to use three different water sources, namely, the groundwater, the public water supply and the water tank trucks to reduce dependence on the groundwater, and use of rainwater and reuse of treated wastewater are planned as well (both for greening and cleaning work).

(6) Others

According to the Kenyan Standard KS02-26 (1977), the standard wind velocity in Nairobi is 27m/s. As none of the aforementioned data from the Dagoretti Observatory in the last three years exceeds this velocity, it should be adopted as the design standard wind velocity.

Lightning arrester service is not applicable to this Project. Although thunderstorms are sometimes observed, according to the regulations lightning arrester equipment only needs to be installed for buildings that are more than 15m high. However, a protective circuit against lightning surges should be built into the distribution boards.

2-2-1-5 Policies on Social Conditions

(1) Policies on environmental considerations

The Karen and Langata District in which the planned site is located is a historical district where settlement began in the early 20th century. It still maintains a quiet residential environment with large premises. All the neighborhood residents utilize the land at a low density. Kei apple tree hedges are planted along the border for an aesthetic appearance. As this Project involves a relatively high density of land utilization, maximum consideration should be given to determining the details of the plan and the construction method so as not to destroy the pleasant environment when implementing this Project. Also, to protect the quiet residential environment, it is necessary to install soundproofing measures in the lecture hall where audio equipment will be used.

(2) Policies on consideration for the disabled

In Kenya, it is necessary to give consideration to the disabled when designing public facilities. In view of the nature of the Centre that it accepts training participants from diverse backgrounds from in and out of the country, it is considered necessary to take appropriate measures for the disabled. Therefore, a barrier-free design should be adopted for the training facilities in this Project.

(3) Others

In view of gender consideration, the amount of sanitary equipment in the men’s and women’s toilet facilities should be the same. Also, to meet the demands of training participants from Kenya and

abroad with diverse cultural backgrounds and customs, a shower should be installed for some of the water closets.

The security situation in Kenya has deteriorated in the last few years. The Centre has a guard station with a security guard permanently on duty, but it is hardly sufficient to ensure safety. Therefore, this Project should include the installation of security grills and outdoor security lights.

2-2-1-6 Policies on Construction and Procurement Circumstances

(1) Building regulations and related legislation

In this Project, building designs will be prepared in accordance with the relevant construction regulations and laws as indicated in the following paragraphs1) to 4):

1) Building standards

The building standards in Kenya are provided in the Building Code, 1968. Kenyan Standards (KS) and British Standards (BS) are referred to for material and structural standards.

2) Physical development plan

The planned site is designated as a low density residential area where the building-to-land ratio should be no more than 25% and the buildings should be no higher than two stories in the Karen and Langata Local Physical Development Plan (LPDP).

3) Guidance by Ministry of Public Works

Since the building permit for this Project is granted by the Ministry of Public Works (MoPW), it is necessary to have the Project plan examined by MoPW-registered architects and engineers and receive guidance with respect to the building plan and fire prevention measures. The following matters have already been pointed out regarding this Project:

- The width of the corridors should be 1.8m.
- The ceiling height should be 3.0m.
- Each room should have two entrances as standard and the doors should open outward to enable easy evacuation.
- The width of the entrance should be 0.9m in principle, while that of the entrance to the lecture rooms and laboratories should be 1.2m and to the hall should be 1.8m.
- If the evacuation distance from the first floor to the evacuation facility (a staircase or a ramp) exceeds 30m, two evacuation facilities should be provided.
- An accessible toilet should be installed in each building.

4) Fire prevention regulations

There are no statutory regulations concerning firefighting service, but the above-mentioned

Building Code stipulates that firefighting service should be installed in accordance with MoPW guidance (Appendix II Article13). The services in this Project have been designed in accordance with MoPW guidance.

(2) Environmental regulations

Refer to 1-3.

(3) Utilization of locally available materials

Most of the construction materials are either produced in Kenya or constantly available on the local market. In this Project, materials that are sturdy and have no problems concerning maintenance should be selected from the locally available materials.

(4) Utilization of local construction methods and labor

In this Project, the local common methods and specifications of the construction work were adopted. The planned building consists of the main structure of reinforced concrete, Nairobi stone's wall, and sloping roofs of metal roof sheet on steel roof structure. For this reason, local labor can be utilized for this Project.

2-2-1-7 Policies on Utilization of Construction Companies and Consultant

Since contractors in Kenya have developed adequate technical capabilities in the domestic market, this Project should adopt the local common construction methods to enable the utilization of local contractors.

2-2-1-8 Policies on Operation and Maintenance

(1) Reduction of running cost and maintenance cost

For the purpose of facilitating the long-term securement of operation and maintenance costs and conservation of resources and energy, the following measures should be incorporated into the Project.

- The lighting equipment should be mainly comprised of fluorescent lamps. The amount of equipment should be minimized by setting the illumination at a low level and a system that enables zone-wise lighting should be adopted.
- Natural ventilation should be utilized, in principle, to reduce the ventilation load.

(2) Using easy-to-operate equipment and systems

The equipment and systems in the planned facilities should be the same as those in the existing facilities or should be the equipment and systems whose general operation is easy to carry out in Nairobi. When the facilities are handed over upon the completion of the construction work, the

Contractor should explain the maintenance method to the responsible person and the staff in charge at CEMASTEA to ensure that they will be maintained appropriately.

(3) Facilities and equipment specifications to allow on-site inspection, repair and replacement of supplies

CEMASTEA has no plans to allocate staff with specialized expertise in maintenance and management of the facilities and equipment, and inspection and repair of facilities and equipment and replacement of supplies will be outsourced to independent suppliers in Nairobi as needed. Therefore, facilities and equipment with specifications that can be taken care of in Nairobi and handled by local engineers with average skills should be adopted.

2-2-1-9 Policies on Setting the Grade of Facilities and Equipment

The objective of the activities carried out in the planned facilities is to provide training services to mathematics and science teachers and the persons concerned in the education field. The users will be educational officers of local governments, trainers at training schools of teachers and officers from third countries. Accordingly, the grade of the planned facilities should be determined to ensure that these people, who have a relatively high social status, will be able to concentrate on the training, free from stress, during the short training period.

The grade and specifications of the planned equipment should be set in consideration of the skill level of the users, frequency of use, durability and maintenance cost as well as to make sure that they are duly competitive in the tender.

2-2-1-10 Construction/Procurement Method and Construction Period

It has been determined that the construction of the planned facilities and the procurement of the equipment can be completed in about 13 months, if the Project is implemented under the Japanese Grant Aid Scheme, using local common materials and methods of construction.

2-2-2 Basic plan (Facility Plan/Equipment Plan)

The requested items consist of facilities, such as an administration facility for the operation and administration of training at the Centre, training facilities for the training through lectures and experiments, and a dining facility for the training participants, and equipment, such as training equipment, kitchen equipment and a bus for the training participants. However, since it was found that 1) the request was made without assuming the use of the existing facilities and equipment, 2) the size of the facilities is too large in view of the personnel assignment plan and 3) the requested items included equipment not used for the activities of the Centre, it was decided that the Project should cover only the minimal expansion of the facilities that are necessary for the implementation of the training programs and whose operation and maintenance are feasible, on the assumption that the existing facilities will continue to be used. Also, the scope of the equipment covered by the Project was minimized on the assumption that the existing equipment will continue to be used as long as

possible. The outline of the plan is as follows:

Table 2-2 Outline of the Requested Japanese Assistance

Room	Original request		Consultation result		Consultation result
	No. of rooms	Capacity	No. of rooms	Capacity	
A. Administration building					
Office	5	20	5	15	・The capacity of the offices was reduced in consideration of the actual organizational setup.
Principal's room	1	1	1	1	
Boardroom	1	25	1	30	・To be used as a meeting room as well.
Registry room	1	1	1	1	・To be used for the storage of documents.
Deputy principal's room	1	2	1	1	・Officers' private offices. The accountant's room, HRM and administration officer's room, procurement officer's room and internal audit officer's room were added to the request following consultation. It is considered necessary to provide these persons with private offices, as they handle confidential matters, such as matters relating to personnel management, money, or meetings with external contractors.
Finance officer's room	1	1	1	1	
Accountant's room	Not applicable		1	1	
HRM and administration officer's room			1	1	
Procurement officer's room			1	1	
Internal audit officer's room			1	1	
Counseling room	1	10	Not applicable		・These items were deleted following the additional request for the above-mentioned private offices.
Secretary room	1	6			
Meeting room	1	30			・The boardroom should also be used as a meeting room.
Pantry	2		2		・To be incorporated into the toilet facilities and shared by the officers and staff.
Printing room	1	5	1	5	
B. Labs & lecture building					
Lecture hall	1	200	1	200	
Lecture room	4	50	4	50	
Physics lab.	1	50	1	30	・To reduce the size of these labs from the original request on the assumption that the existing laboratories will continue to be used and the sessions will be conducted in two groups for each course.
Chemistry lab.	1	50	1	30	
Biology lab.	1	50	1	30	
General workshop room	1	50	Not applicable		・These were removed from the scope as it was considered possible to use other rooms as substitutes.
Pedagogy study room	2	25			
ICT laboratory	1	50	1	50	・As the INSET for ICT teachers requires two ICT laboratories with a capacity of 50 people each, even if the existing laboratory is repaired for use, another laboratory will be needed. Therefore, it was decided to include this in the Project.
Library	1	100	1	30	・To be reduced to 30 people from the original request, considering the possibility that the self-study space in

					the existing hostels and the ICT laboratory may be used.
Toilet facilities	2		2		
C. Dining building					
Dining hall	1	120	1	120	・On the assumption that the existing dining hall will continue to be used, it was decided to connect the new dining hall with the existing hall by a covered access corridor so that the two halls can be integrated into a single space. ・The number of seats in the expanded area should be determined in such a way that a total of 260 training participants and lecturers can be accommodated after the expansion.
Kitchen	1		1		・On the assumption that the existing kitchen will continue to be used, additional space should be built to fill the deficiency.
Common space for the above					
Measures for the disabled					・Ramps should be installed to make all the training-related rooms accessible to the training participants. ・Appropriate measures should be taken for disabled staff in terms of the operation of the facility, e.g. by allowing them to work in the office on the ground floor. ・An accessible toilet should be installed in the administration building, laboratory buildings, lecture buildings and lecture hall.
Pavement and storm drainage					・In principle, the scope of the Project should be limited to the necessary component for the planned facility to fulfill its functions. However, a wastewater treatment plant that is mandatory for the EIA and power supply utility for the facility expansion, need to be covered by the Project.
Power supply and backup					
Wastewater treatment plant					
Water supply system					
Car park	20				・In view of the nature of the Japanese Grant Aid Scheme, this should be included in the Kenyan scope.

2-2-2-1 Facility Design

The site has an area of about 13.51 acres (54,674m^2) and slopes from north to south with an elevation difference of about 19m. Four existing laboratory and lecture buildings, a dining hall and two hostels as well as 12 staff dwellings are scattered over a large area. Trees grow in abundance on the site. The bricks of the exterior walls of the existing facilities harmonize well with the green trees, creating a calm atmosphere. The conditions of the planned site are as follows:

- The site faces a road on the northern and eastern sides. The main entrance is on the eastern side.
- The planned site is located on a slope slanting from northeast to southwest and descending 19m with a diagonal length of 360m, corresponding to an inclination of 1/19.

- The existing facilities are divided into four zones, namely, administration zone, training zone, hostel zone and dining zone for the training participants, and staff dwellings.
- The former administration building is dilapidated and unused and should be demolished, while the rest of the existing facilities should continue to be used.
- As tall trees grow in abundance on the site, some of the trees need to be cut down in order to secure the land for the construction.

2-2-2-1-1 Site and facility location plan

- Based on the 2006 draft plan, which was approved in the EIA, the location of the planned buildings should be adjusted to minimize the cutting down of trees. The administration building and the laboratory and lecture building, which constitute a major part of the Project, should be constructed in the zone where the former administration building is located.
- To reduce the foundation and earthworks, the planned facilities should be located on the northwest to southeast axis and aligned with the slope of the ground and the axis of the existing facilities.
- To minimize the cutting down of trees, the buildings should be divided according to function. The administration functions should be concentrated in two buildings, one consisting of shared offices and a meeting room and the other consisting of private offices for supervisory officers, and these buildings should be located between the trees.
- Since the training program involves moving between the lecture hall, lecture rooms and laboratories between each session or during the session, to enable the participants and lecturers to move without getting wet on rainy days, the buildings should be located close to each other and connected by a covered access corridor.
- To facilitate the reception of guests, the administration building should be located at the entrance to the zone containing the administration building and laboratory and lecture building, facing the central car park and driveway of the Centre.
- The new dining hall, which will supplement the shortage of seats in the existing dining hall, should be located close to the existing dining hall so that users can be easily served in the existing dining hall. The additional kitchen should be located in the backyard of the existing kitchen to enable the staff of the two kitchens to collaborate with each other.
- The new wastewater treatment plant should be located on the vacant land at the south of the site where the existing septic tanks are also located.

2-2-2-1-2 Building design

(1) Floor plan

- The administration building, lecture building, and laboratory building should be two-storied for efficient land utilization. The lecture hall, which has a large span, and the dining hall, kitchen and electricity room, which perform a single function and are small in size, should be single-storied.

- The administration building, lecture building and laboratory building should be balcony access type and staircases and ramps, which are necessary for evacuation from the first floor, should be installed in accordance with Kenyan standards.

- The width of the corridor in the lecture and laboratory buildings should be 1.8m (from the center line of the wall to the slab edge) and that of the administration building should be 1.5m (same as above). With respect to the lecture and laboratory buildings, as a large number of people may go out into the corridor at the same time between the training sessions, in accordance with the guidance from the MoPW, the width of the corridor is set at 1.8m. On the other hand, since the corridors in the administration building may not be used all at the same time and the number of users is less than that of the lecture and laboratory buildings, the minimum width was adopted.

- Since the lecture hall will be a large span structure, the plane face should be elliptic to make the upper structure, including the roof works, simple and economical. As an elliptic floor plan enables the efficient arrangement of chairs in contrast to a rectangular plane face, it will also help reduce the use of floors, roofs and walls, realizing an economical design.

- Taking advantage of the fact that the site is sloped, ramps should be installed and the entrance area of the administration building and training facilities should be paved flat to enable wheelchair users to reach the rooms used for training on their own after getting off the shuttle bus. With respect to the disabled staff (including managers), an appropriate response should be made in terms of operation. They should be allowed to have desks in the office on the ground floor of the administration building, which is accessible to them.

- The dining hall should be provided with a large, wide opening that faces the central car park and driveway of the Centre so that the administration building and the laboratory and lecture buildings, which are the main facilities of the Centre, can be seen from the dining hall, cultivating a sense of unity.

- A toilet facility should be installed in all the buildings except for the lecture building. The lecture building offers easy access to the toilet facilities in the administration building or the laboratory building by way of the covered access corridor. An accessible toilet should be installed in three locations, namely, in the administration building, laboratory building and lecture hall for the convenience of disabled persons.

・ Based on the above considerations, the floor plan of each room should be as follows:

1) Administration function

a. Office for each department

The offices are allocated to five departments, namely, biology, chemistry, physics, mathematics, and ICT and R&D studies. They provide space for the staff of each department to develop their training curricula and materials and prepare for the implementation of training. According to the personnel plan of the Centre to be approved by TSC, each department should have about 12 members of staff, but it is assumed that each department will have 15 persons, including a margin of three persons to provide for the possibility of hosting external experts and trainees from universities. The furniture should be transferred from the existing facility and the shortfall will be made up by the Kenyan side.

Table 2-3 Area of Office of Each Department according to the Plan and Comparison with Existing/Similar Facility

	Floor area	Capacity	Unit area
This Project	72.0 m^2	15 persons	4.8 m^2/person
Existing facility (temporary) *1	76.1 m^2	9-13 persons	5.8-8.5 m^2/person
Similar facility (AICAD)*2	64.0 m^2	7 persons	9.1 m^2/person

*1 As the former administration building has deteriorated and is in a dangerous state, the existing rooms used for administration are scattered in different buildings and have been temporarily provided by refurbishing the staff quarters. The comparison has been made on the basis of the effective area, excluding the toilet, shower, kitchen and the terrace at the entrance.
*2 The data for the similar facility referenced in this table as well as in other parts of this section are based on the "Report on the Basic Design Survey for the Project for the Upgrading and Refurbishment of the Centre for Mathematics, Science and Technology Education in Africa (May 2006)".

b. Principal's room

The principal's room is an office used exclusively by the principal, who is responsible for the operation and management of the Centre. Since it is used for meetings and receiving distinguished guests, it is also designed to be larger than the other officers' rooms in the similar facility. The furniture will be transferred from the existing facility.

Table 2-4 Area of Principal's Room according to the Plan and Comparison with Existing/Similar Facility

	Floor area	Capacity	Unit area
This Project	33.2 m^2	1person	33.2 m^2/person
Existing facility (temporary) *	76.1 m^2	4 persons	19.0 m^2/person
Similar facility (AICAD)	48.0 m^2	1person	48.0 m^2/person

*The existing facility has been temporarily created by refurbishing the staff quarters and it is used by the principal, internal audit officer and two secretaries.

c. Supervisory officers' rooms

It is necessary for the deputy principal, finance officer, accountant, HRM and administration officer, procurement officer and internal audit officer to work in private offices because their respective work involves handling of confidential matters and money and meetings with external parties. Therefore, they should each be provided with a private office as the minimum necessity in this Project. The officers' titles correspond to those in the organization chart of the Centre. The furniture will be transferred from the existing facility.

Table 2-5 Area of Supervisory Officers' Room according to the Plan and Comparison with Existing Facility

	Floor area	Capacity	Unit area
This Project	16.0-21.4 m^2	1person each	16.0-21.4 m^2/person
Existing facility (temporary) *	76.1 m^2	4 persons	19.0 m^2/person

*The data for the existing facility are the same as those in the previous section and are for reference only.

d. Boardroom/meeting room

Meetings held at the Centre include the operating directors' meetings (once or twice a month, attended by 7-15 persons), planning meetings (every Monday, attended by 15-20 persons), irregular meetings of academic staff (two or three times a week, attended by 10-50 persons) and meetings with guests from foreign countries (three or four times a year, attended by up to 20 persons). Considering the frequency of use, it was decided that the capacity should be around 30 persons. The furniture (to be provided as equipment) should consist of tables for 20 persons, as the room will be mostly used by no more than 20 persons, and chairs for 30 persons. The furniture should be used in a flexible manner, depending on the usage of the room.

Table 2-6 Area of Boardroom/Meeting Room according to the Plan and Comparison with Existing Facility

	Floor area	Capacity	Unit area
This Project	96.0 m^2	30 persons	3.2 m^2/person
Existing facility (temporary) *	40.2 m^2	15 persons	2.7 m^2/person

*The existing facility is a temporary building created by refurbishing the staff quarters. The comparison was made in terms of the area of the meeting room and the toilet facility.

e. Printing room

The printing rooms in the former administration building are now scattered in each office building. The size of the printing room in this Project should be equivalent to that in the former administration building; large enough to accommodate two existing copy machines, one bookbinder, workbenches and shelves, as well as the existing desks and chairs for three members of staff.

Table 2-7 Area of Printing Room according
to the Plan and Comparison with Former Facility

	Floor area	Capacity	Unit area
This Project	33.2 m^2	3 persons	11.1 m^2/person
Former administration building*	31.0 m^2	1 person	31.0 m^2/person

* The data for the former administration building are based on the "Report on the Basic Design Survey for the Project for the Upgrading and Refurbishment of the Centre for Mathematics, Science and Technology Education in Africa (May 2006)".

2) Training function

f. Lecture hall

The lecture hall is used for the opening and closing ceremonies of each training program as well as for overall trainings and workshops. The capacity should be 200 persons and tablet arm chairs should be included in the plan for the use of 200 training participants. A stage and a screen should be installed at the front of the hall to enable lectures and presentations. A small room for the operation of AV equipment and a storage room should be provided on both sides of the stage and a toilet facility including an accessible toilet should be planned at the rear of the hall.

Table 2-8 Area of Lecture Hall (Excluding Stage) according
to the Plan and Comparison with Similar Facilities

	Floor area	Capacity	Unit area
This Project	263.0 m^2	200 persons	1.3 m^2/person
Similar facility (AICAD)	224.0 m^2	220 persons	1.0 m^2/person

g. Lecture room

Four lecture rooms with a capacity of 50 persons each (50 persons x 4 rooms=200 persons) should be planned for the subject-oriented sessions. Besides listening to lectures while facing the blackboard, the training participants also participate in group sessions, including discussions, preparation of teaching materials and development of class plans. Accordingly, it was decided that the furniture should consist of a combination of tables and chairs, which can be used for both lectures and group sessions. In addition to a blackboard and a notice board, a screen should be installed on the front wall to enable the lectures using a projector.

Table 2-9 Area of Lecture Room according
to the Plan and Comparison with Similar Facilities

	Floor area	Capacity	Unit area
This Project	97.9 m^2	50 persons	2.0 m^2/person
Existing facility	54.0 m^2	23 persons	2.3 m^2/person

*The area of the similar facility is based on the inside dimensions

h. Laboratory

The physics, chemistry and biology laboratories are used for practical training in experiments in the subject-oriented sessions. In the case of secondary education, the number of training participants in each subject is 50, but in consideration of efficient training, the optimum number of participants to be taught by one lecturer would be between 20 and 30. Therefore, it was decided that the capacity of the new laboratory should be 30, while that of the existing laboratory is 20. The area of the laboratory and the layout of the laboratory tables should be decided in reference to those of the existing laboratory. A 4200×900 central laboratory table for participants' use and a 3000×900 laboratory table for the lecturer's use should be installed. In addition, side tables should be installed facing the window and the rear wall of the lecture room, while securing an adequate passage width. A cabinet should be provided under each table and in front of the rear wall for the storage of equipment and tools and the display of teaching materials prepared by the participants. The services necessary for a laboratory in each subject (water supply and drainage, power supply, gas supply and draft chamber) as well as a blackout curtain for the physics laboratory should be incorporated in the plan.

Each laboratory should also be equipped with a preparation room and a storage room for the lecturer to prepare experiments and engage in desk work and for the storage of consumables.

Table 2-10 Area of Laboratory according
to the Plan and Comparison with Similar Facilities

	Floor area	Capacity	Unit area
This Project	96.0 m^2	30 persons	3.2 m^2/person
Existing facility	81.0 m^2	23 persons	3.5 m^2/person

i. ICT laboratory

The ICT laboratory is used for the training of ICT teachers and by the participants in other training courses to prepare reports and collect information. In the ICT training, 200 participants are divided into four groups of 50 persons. According to the plan, the Kenyan side will provide an ICT laboratory with a capacity of 50 persons by refurbishing the existing ICT laboratory (conversion of the storage room) and the Japanese side will construct a new ICT laboratory with a capacity of 50 persons in order to enable alternate practical training in the ICT laboratory and lecture-style training in the lecture room in two rounds. With respect to the furniture, 25 tables for two persons and 50 chairs as well as a table and a chair for the lecturer should be provided and the installation of PCs and hubs and wiring for LAN should be included in the scope of Japanese. The Japanese side will only carry out the wiring and the Kenyan side will construct the network system.

Table 2-11 Area of ICT Laboratory according
to the Plan and Comparison with Similar Facilities

	Floor area	Capacity	Unit area
This Project	96.0 m^2	50 persons	1.9 m^2/person

Existing facility	108.0 m^2	32 persons	3.4 m^2/person
Similar facility (AICAD)	112.0 m^2	30 persons	3.7 m^2/person

j. Library

The library is used for the storage of reference books and by the training participants to read and study by themselves after the training program. The library plan should assume the storage of approximately 2,000 books currently held by the Centre and 1,000 books that will be added in future and enable a librarian to be permanently stationed there. The number of seats should be 30, that is, sufficient for one-third of the 90 persons who may be staying at the facility and are most likely to use the library. The Project should therefore provide five reading tables and 30 chairs, open-access shelves and a desk for the librarian.

Table 2-12 Area of Library according
to the Plan and Comparison with Existing/Similar Facility

	Floor area	Capacity	Unit area
This Project	72.0 m^2	30 persons + 3,000 books	NA
Existing facility	47.0 m^2	1,000 books	NA
Similar facility (AICAD)	104.0 m^2	24 persons + 10,000 books	NA

3) Dining function

k. Dining hall

The training program at the Centre includes a one-hour break for each meal and a 30-minute tea break between sessions. For the participants in the training programs at the Centre, namely, INSET trainers from various parts of the country and educational officers from local Governments, exchange of information during and after meals and during the tea break is an important activity. In particular, in the WECSA/TCTP, meals and tea breaks provide a valuable opportunity for the participants to discuss the circumstances and problems surrounding education in each country, and as such, the significance of the time spent in the dining hall should not be ignored. Given these circumstances, it is not desirable to determine the number of seats on the assumption that the dining hall will be used in two rounds within the one-hour meal break, in consideration of the role of the Centre. Therefore, in this Project, the number of seats is planned to be 260 in total, consisting of 200 training participants and 60 lecturers. The existing dining hall has 80 seats, but it is possible to convert another room in the same building which is used for board meetings, trainings and meetings into a dining hall with 48 seats. In this Project, a roof will be built over the inner court area connecting the new dining hall with 112 seats and the existing dining hall to create a semi-outdoor space (connecting hall), where 20 tables and chairs will be installed, thereby securing a total of 260 seats.

Meals will be served in the existing dining hall, but the new dining hall should also be equipped with a simple counter, where drinks and fruit can be served. A hand-washing basin and a toilet facility should also be installed. The new dining hall and the connecting hall should have tables

and chairs for six or four persons. The tables and chairs in the existing dining hall should be prepared by the Kenyan side by either converting the existing ones or procuring new items.

Table 2-13 Area of Dining Hall according
to the Plan and Comparison with Existing Facility (Dining Area Only)

	Floor area	Capacity	Unit area
This Project	197.9 m^2	112 persons	1.8 m^2/person
Existing dining hall	152.0 m^2	80 persons	1.9 m^2/person

l. Kitchen

The existing kitchen is in good condition and is capable of serving 260 persons if the malfunctioning cooking stove and other equipment are replaced. However, there is a problem in that no space is available for the installation of a baking oven or for doing work such as management of food storage and development of menus and for the cooking staff to take a break. Also, the existing cold room has deteriorated and needs to be replaced. Consequently, it was decided to construct a new kitchen adjacent to the existing kitchen in the backyard of the existing kitchen to add cooking space for the installation of a baking oven, a food ingredient storage room with a cold room and a freezer and a staff room.

Table 2-14 Area of Kitchen according
to the Plan and Comparison with Existing Facility

	Floor area	Capacity	Unit area
Existing kitchen	134.0 m^2	141 meals *	1.0 m^2/person
Existing + new kitchen	184.4 m^2	260 meals	0.7 m^2/person

*The existing kitchen provides meals for 92 training participants and 49 members of the academic staff.

Table 2-15 Scale of Planned Facilities

Rooms	Capacity	Area	Nos. of rooms	Planned area
A. Administration building 1				299.12 m^2
Principal's room	1 person			33.20 m^2
Deputy principal's room, etc.	1 person	16-21.4 m^2	6	108.00 m^2
Printing room	3 persons			33.20 m^2
Toilet, hall, staircase, etc.				124.72 m^2
B. Administration room 2				762.17 m^2
Office	15 persons	72.00 m^2	5	360.00 m^2
Meeting room/boardroom	30 persons			95.03 m^2
Toilet, hall, storage room, corridor, staircase, etc.				307.15 m^2
C. Lecture hall				397.48 m^2
Hall	260 persons			259.71 m^2
Toilet, foyer, storage, etc.				137.77 m^2
D. Lecture building				562.91 m^2
Lecture room	50 persons	97.92 m^2	4	391.68 m^2

Corridor, staircase, etc.				171.23 m^2
E. Laboratory building				763.87 m^2
Laboratory	30 persons	96.00 m^2	3	288.00 m^2
Preparation room, storage room		24.00 m^2	3	72.00 m^2
Library	30 persons			72.00 m^2
ICT laboratory	50 persons			96.00 m^2
Toilet, corridor, staircase, storage, etc.				235.87 m^2
F. Dining hall				226.68 m^2
Dining hall (including terrace)	112 persons			197.88 m^2
Toilet, serving space, etc.				28.80 m^2
G. Connecting hall	20 persons			33.60 m^2
H. Kitchen				50.40 m^2
I. Transformer building				36.54 m^2
J. Generator building				55.44 m^2
X. Covered access corridor				161.20 m^2
Total area				3,349.41 m^2

(2) Section design

- As a solid and homogeneous layer spreads from the ground surface to a depth of -2.5 to -3.5m, the foundation bed should be 50cm from the current foundations and the depth of the foundations should be set along the slope. With respect to the lecture hall, which will be built in the area where the former administration building currently stands, the level of the foundation bed should be set in accordance with the excavation depth for the removal of the foundations of the administration building.

- To prevent the building foundations from being affected and protect the ground from erosion by rainwaterter and for the partial utilization of rainwater, eave gutters will be provided and connected to the storm drainage to be built around the buildings or to the rainwater reservoir tanks.

- The floor level of the ground floor of the buildings should be set to be the same as or slightly higher than the highest ground level in the surrounding area of the buildings so that the amount of filled soil under floor slab will not be excessive. The plan presupposes that the storm drainage will prevent floor inundation in the event of heavy rainfall. The floor level of the dining hall should be designed to be almost the same as that of the existing facility, as it will be used in combination with the existing facility.

- The ceiling height should be 3.0m as instructed by the Kenyan MoPW, which is generally the same as that of other educational facilities in Africa. However, the ceiling height of the rooms below the toilet facilities, which in most cases are also toilet facilities, should be 2.6m in order to secure ceiling space for the piping.

- With respect to the administration and laboratory and lecture buildings, the ceiling space for the ground floor should be 30cm, which is the minimum dimension for installation of the piping, and the ceiling of the first floor should directly installed on the bottom chord of the

steel frame truss. This will make the design economical by securing the ceiling height while maintaining a minimum storey height. An economical design should also be adopted for the lecture hall, dining hall and kitchen, securing the ceiling height and maintaining a reasonable storey height by directly installing the ceiling on the sloping steel frame beam.

- The roof eaves should be deep enough to prevent the wall surface from being exposed to intense squalls and the rooms from direct sunlight during the daytime. Concrete eaves should be provided over the windows on the ground floor located on the opposite side of the corridor of the two-storied buildings. The roof eaves at the end of the buildings should also be an appropriate depth to the extent allowable by the structure.
- In consideration of the surrounding environment, the walls, roof and opening of the lecture hall, where audio equipment is used, should be designed to be soundproof. More specifically, the walls should be double-leaf walls and glass wool should be laid under the roof to enhance the sound absorption effect.

(3) Structural design

1) Design policy

Structural design should be carried out following the loading guidelines and the structural design standards in the Kenyan Standards and British Standards. The specifications of the Architectural Institute of Japan should be used to complement these standards.

2) Ground condition and foundation design

According to the results of boring surveys carried out at five locations around the site, the ground at the construction site comprises a red clay/silt layer extending from the ground surface to a depth of -2.2 to -2.5m. It is solid ground with an N value of no less than 20. The allowable bearing capacity at a depth of -1.5m estimated from the results of laboratory tests is 175 to 200kN/m^2, which is sufficient to support two-storied buildings. Therefore, it was decided to use this layer as the bearing layer so as not to cause differential settlement of the buildings.

- Type of foundation: Pad footing
- Bearing layer: Ground level -0.5m or deeper
- Bearing capacity: 150kN/m^2

3) Frame plan

The main frame should be a frame structure commonly adopted in Kenya. The structure should be of the following type:

- Main structure: Reinforced concrete
- Roof structure: Steel frame
- Interior and exterior walls: The exterior walls should be built with natural stone blocks fair-face masonry and the interior partition walls should be built with concrete blocks.

4) Design load

The design load should be decided in consideration of the dead load, live load, wind load and earthquake load.

a. Live load

In compliance with Kenyan Standard KS 02-755: 1988 and British Standard BS 6399-1: 1996, the live load should be set according to the usage of the room. The live load of the main rooms should be as follows:

- Office: 2,500 N/m^2
- Lecture room: 3,000N/m^2
- Laboratory: 3,000N/m^2

b. Wind load

The wind load should be calculated based on the standards, using the standard wind velocity of 27m/s (Nairobi City) in accordance with KS02-26 (1977).

c. Earthquake load

According to the Kenyan regulation, the earthquake load should be set as follows in accordance with the usage and structural type of the planned facility, the ground conditions and the earthquake zone. It should be noted that the vertical distribution of the shear coefficient (Ai distribution) complies with Japanese standards.

■Setting the earthquake load

Earthquake load F＝C×W

W: Building weight

C: From the conditions below, the standard shear coefficient is C＝1.0×Cb.

Usage	: Class A for school and accommodation facilities
Structural type	: RC frame structure (flexible)
Ground conditions	: Medium, based on the results of the geological survey
Earthquake zone	: Zone VIII-IX

Cb＝0.05／3√T、T＝0.09H／√D (T: Natural period, D: Building width, H: Building height)

The calculation results revealed that the earthquake load was around 0.10 (0.2 in Japan), although there was a slight variation depending on the plane face and height of the building.

5) Materials

The following materials that can be procured locally should be given preference in use:

- Concrete: Regular concrete, design standard strength C25 (BS5328)
- Reinforcement: Deformed bar T6-T20 (grade 460 (<T20), grade 425 (T20): BS4449)
- Steel frame: H-shaped steel, equal angle steel, rectangular steel tube, steel tube, round steel (S275: BS5950)

(4) Electrical service design

1) Transformer and Power distribution system

Electricity is supplied to the existing facility by means of a low voltage distribution line, but high voltage distribution of 11kV will be needed after the expansion and refurbishment of the facility as the power receiving capacity will exceed the limit of low voltage distribution. In response to this, an electricity room should be built near the gate on the eastern side of the site. A power transformer should be installed in this room to reduce the voltage to 415kV. The power lead-in to the transformer is within the scope of Japan by Kenya Power & Lighting Company (KPLC) and the lead-in from the transformer should be covered by this Project. A circuit breaker and main distribution board should be installed in the electricity room to distribute electricity to each building in the facility and the main distribution board in the existing electricity room. The system beyond the existing electricity room should be left as it is.

Although the voltage variation is within the range of approximately 0-10% according to the measurements obtained at the plug outlets in the existing facilities, the measurement records show that it sometimes drops below 0 and even to –15%. Therefore, automatic voltage regulators (AVRs) will be installed on pumps that are vulnerable to voltage variation.

2) Emergency power supply

The power supply is unstable and power outages often occur. Outages occur 2 to 3 times weekly during the rainy seasons and 1 to 2 times weekly during the dry season. Particularly when strong winds blow during the rainy season, power outages often occur. From the operation records for the power generators which automatically start up when a power outage occurs, it is known that a total 1.5-hour power outage occurs each week. In the existing facilities, a 250kVA power generator has been installed for the training and hostels and a 22kVA generator for the staff dwellings to generate power to ensure the full capacity during power outages.

This Project should include a 150kVA generator for the planned facilities based on the assumption that the demand factor is 80% for lighting, 30% for sockets, 20% for the kitchen and 100%* for others. A generator that is compatible with the existing generator should be selected to ensure that consumables can be easily replaced during maintenance work.

*The capacity has been calculated according to the “Standards for Building Service Design” compiled under the supervision of the Government of Japan.

3) Lightning protection

Lightning arrestor system is not applicable to this Project. Although thunderstorms occur in this area, according to the regulations, installation of lightning arrestor equipment is mandatory only for buildings whose height exceeds 15m. However, each distribution board, except for the main distribution board, should incorporate a protective circuit as a countermeasure against lightning surges to prevent the low-energy power system from being damaged by stray currents if the facility is struck by lightning.

4) Lighting services

Referring to the illumination settings in similar projects in Africa, the illumination of the rooms should be set at 300 lux, in general. Only the library and the kitchen, which need to be bright considering their functions, are set at 500 lux. With respect to the entrance hall, dining hall and corridor, where visual recognition of characters is irrelevant, lighting equipment should be installed on every column without setting an illumination standard.

In consideration of economic efficiency, fluorescent lamps should basically be used for the lighting equipment. Fluorescent lamps that are readily available on the market should be used.

Table 2-16 Illumination Settings

Usage	General administrative work, Meeting room, Lecture room, ICT, Lecture hall	Laboratory, Library, Kitchen	Reception, Dining hall, Corridor
Design (lux)	300	500	N/A

5) Socket services

Sockets should be type BF; an appropriate number should be installed considering the layout of the furniture. Many items of electrical equipment are used and it is necessary to flexibly respond to revision of the furniture and electrical equipment layout. With respect to the ICT laboratory and office, wiring trunking should be installed on the walls to provide power sockets and communication outlets.

6) Communication services (telephone and internet communication services)

Wired communication is not available in the existing facility due to repeated power theft from the communication cables laid outside the premises. A system integrating internet communication and an IP telephone system is to be implemented in this Project by installing a transmitter/receiver antenna on the existing pylons.

From the transmitter/receiver antenna, communication cables will be laid to the existing ICT laboratory, data will be converted for optical communication, and underground piping and wiring will be installed as far as the new server room. Then, from the server room, piping and wiring will be laid to each room where communication services will be installed via a low-energy distribution board in each building.

For wired internet communication, each telephone terminal will be connected to a PC with a LAN cable. The plan should also include the installation of wireless LAN access points and power supply sockets to enable the facility to flexibly adapt to future changes in the style of internet usage.

The telephones to be installed should allow the expansion and limitation of the call function to be changed by a private branch exchange (PBX) according to the usage condition.

(5) Mechanical service design

1) Water supply service

The existing elevated water tank is made of steel panels and has a capacity of 40m^3. It is in very good condition with internal waterproofing and external coating carried out a few years ago. It is estimated that 43m^3 of water needs to be supplied every day when the Centre is running fully (see the table below). Since the capacity of the existing elevated water tank is almost equivalent to the daily water usage, use of the tank should be continued.

Table 2-17 Calculation of Required Water Supply

Category	Unit	Unit requirement (L/day)*	Daily requirement (m^3/day)
Training participants (residents)	90 persons	200	18.0
Training participants (non residents)	110 persons	50	5.5
Staff (living at the Centre)	20 households	750	15.0
Staff (commuting to the Centre)	124 persons	50	4.9
Total			43.4

*This value was obtained by modifying the unit requirement (minimum value) in Japan based on Vol. 3, Ver. 11 of the Air-Conditioning and Sanitary Engineering Handbook to suit the local conditions.

The water source for the existing facility is a borehole. Completed in 2004, the borehole is 315m deep and a pump is installed at a depth of 240m. Since the pump discharge amount fluctuates greatly according to the season, a sufficient amount of water cannot be secured during the dry season and water from a water truck makes up the shortage. In addition, of the two public water supply distribution systems, only one of them is connected to the existing facilities (a local small-scale network) and through this system, water is supplied only once a week. Since the water pressure is not strong enough to pump the water to be stored in an elevated water tank, the public water supply is currently not in use at the site.

In this Project, another water distribution system (a wide-area network) will be connected to the planned water reservoir tank (50m^3, 10m^3 for firefighting) to enable the use of both distribution systems. The water will be pumped to the existing elevated water tank by the planned pump. In the elevated water tank, the public water will be mixed with the groundwater. In the event of a shortage of water, water will also be supplied from the water tank trucks as it is now. In this Project, the groundwater will be the main water source, while the water from the public water supply and the water tank trucks, respectively, will also be the sources. Even when the two

public water supply systems are connected, water will be supplied once a week. While the Nairobi City Water and Sewerage Company is making efforts to improve the water supply conditions in Karen and Langata District, what is planned for the area around the planned site is unknown. However, it is expected that the water supply will be improved in the future.

A main supply pipe will be newly installed at the planned site to establish a new on-site supply system. To supply water to the kitchen which will be expanded from the current size, it is planned to supply water through a $3m^3$ auxiliary tank so that the facilities can be operated without problem even if the water supply is disrupted due to power outages.

2) Sanitary service

With respect to sanitary equipment, following the Building Code and guidance from the MoPW, an appropriate number of toilet bowls, urinals and hand-washing basins should be included in the plan. In addition, in consideration of diverse cultural backgrounds and customs, a shower will be installed for some of the water closets.

Mirrors and soap dispensers should be installed on the hand-washing basins. Also, a hand-drier should be installed near the hand-washing basins in the new dining hall for sanitary considerations.

3) Wastewater treatment service

a. Sewage water/miscellaneous wastewater

To comply with Kenya's wastewater quality standards (EMCA water quality standards), as required by the collateral conditions of the EIA license, by bringing down the BOD of the wastewater to 30ppm or less, an advanced treatment plant incorporating an aeration process should be planned. This Project will use a combined treatment system by which sewage water from the toilet facilities and miscellaneous wastewater from the hand-washing basins and kitchen as well as wastewater from the existing facility are treated together. The products of a Nairobi-based manufacturer with a well-established maintenance system will be adopted.

Wastewater from the planned and existing facilities will go first to a septic tank, which is to be newly constructed. After anaerobic processing, it will be pumped to the treatment plant and purified until the BOD reaches the prescribed level by aeration, filtration and ozonation. To reduce demand for water, the treated water should be reused for flushing the new toilet facilities and gardening. Surplus water should be left to overflow and penetrate the ground.

b. Laboratory wastewater

Wastewater from the laboratories contains chemicals, but since their usage is minimal, the wastewater should be adequately diluted with water and combined with general sewage water and wastewater. However, metal ions, such as Cu2+ and Pb2+, should be precipitated by adding alkali to the wastewater, and after discharging the supernatant, the residue should be stored in a separate container and disposed of outside the premises. A proposal should be made to the

Kenyan side to teach metal ion treatment methods as part of the training, as it will help improve the situation in secondary schools around the country, which currently discharge wastewater containing untreated metal ions.

4) Air-conditioning and ventilation services

The plan presupposes that each room will be naturally ventilated, but mechanical exhaust ventilation system should be applied to the laboratories and preparation rooms where chemicals and gas apparatuses are handled, the lecture hall where a large number of people will gather for meetings, the kitchen where gas equipment is handled, the toilet stalls adjacent to general rooms where leakage of odor must be controlled, and the server room that radiates a large amount of heat. The specifications of the exhaust ventilation equipment should be selected taking into consideration the required ventilation frequency. Similarly, in accordance with the required volume of suction air, the doors for each room should be undercut or provided with a grille.

Also, since the existing cold room is old and dilapidated, a cold room (external dimensions 2m×2m×3m) should be installed in the new kitchen.

5) Gas service

The kitchen, biology laboratory, chemistry laboratory and physics laboratory have LPG equipment. A gas storage tank with a capacity of 1.5m^3 has been installed for the kitchen and the gas is replenished once every 30 to 45 days. Although gas consumption is expected to increase after implementation of the Project, a reserve gas cylinder (50kg) is also available and it is deemed that the current service will be able to meet the demand.

An LPG cylinder storage is planned to be built for the new laboratory building. A steel grille door will be installed on the storage facility for crime and gas leakage prevention, while ensuring adequate ventilation. As is the case with the existing laboratories, opening and closing of the cylinders should be carried out in the storage facility and gas should be supplied to the laboratories with steel piping. For easy maintenance, horizontal pipes should be installed in the ceiling space and the floor trenches on the ground floor, while vertical pipes should be exposed. A gas cock should be installed on the end of the pipes.

6) Firefighting service

In accordance with the guidance from the MoPW, firefighting service required for initial firefighting activity is planned as follows:

Table 2-18 Outline of Firefighting Services

Service	Location and details
Control panel	Should be installed near the entrance for an easy recognition by firefighters in case of fire.
Hose reel	A hose reel for a protected zone with a 30m radius should be installed near the staircases so that the whole facility is within the protected zone. Fire extinguishers (water extinguisher and CO2 extinguisher), alarm switch,

	beacon (for the hearing-impaired), automatic alarm bell and manual alarm bell should be provided near the hose reel.
Alarm bell (automatic) /alarm switch	Should be installed at intervals within a walking distance of 30m.
Fire extinguishers (powder/CO2)	Should be installed in each laboratory, the kitchen annex, the gas cylinder storage facility and the electricity room.
Fire extinguishers (water/ CO2)	Should be installed in the corridors of each building.
Smoke detector	Should be installed in all the rooms except for the laboratories, preparation rooms and kitchen.
Heat detector	Should be installed in the laboratories, preparation rooms and kitchen.
Fire extinguishing device, fireproof blanket	Not installed as oil fires are unlikely to occur in the new kitchen.
Emergency lighting equipment	Planned to be installed in the corridors and on the staircases, except for the corridors on the ground floor from which direct evacuation to outside of the building is possible. Also planned to be installed in the lecture hall and dining hall which accommodate a large number of people to avoid confusion in the event of emergency evacuation.
Exit lighting (sign) for evacuation	Should be installed in the corridors and on the staircases, except for the corridors on the ground floor from which direct evacuation to outside of the building is possible, to immediately guide facility users to the evacuation exit in case of emergency. A guiding light with a sign should be installed at the evacuation exit to guide people to an evacuation area at an adequate distance from the new and existing buildings.
Firefighting water tank	A firefighting water tank with the necessary capacity and a pressure feedwater pump with the necessary water pressure (to feed water to the fire hydrants) should be installed. The pump should be so designed that it is automatically switched on when the fire hydrants are open. The necessary capacity is calculated as follows: (The sum of the number of fire hydrants in the planned facility (9) and the number of fire hydrants expected to be installed in future(2)x 0.5 (simultaneous use ratio) x 0.38 L/sec. x 30 minutes (in which water may be sprayed continuously) = Approximately 4t<10t

7) Solid waste

Solid waste from the Centre is supposed to be disposed of outside the premises by a specialized contractor commissioned by the Centre. However, it was observed in the survey that waste paper from the offices and used syringes from the laboratories were scattered around the vacant lot south of the premises. This situation goes against the collateral conditions of the EIA license and requires improvement in order to maintain a positive relationship with the residents in the surrounding area. This Project should include a solid waste station to ensure sorted collection of solid waste and to improve the status of solid waste management.

(6) Building material planning

The basic policy when selecting the building materials is to adopt materials and finishing methods that are suited to the local climate and environment and are widely used, thereby constructing a facility that can be easily maintained. Also, materials that can be locally procured should be used

wherever possible to facilitate repair and maintenance at the site.

Table 2-19 Building Material Plan

		Local construction method	Adopted construction method	Reason for adoption
Exterior	Sloped roof	Light-gauge steel or wooded substrate + metal roof sheet or cement tiles	Light-gauge steel substrate + galvanized and aluminum coated metal roof sheet	Commonly adopted in this area and has good workability. Combination of sheathing roof board and asphalt waterproofing ensure highly soundproof and waterproof finish.
	Flat roof	Mortar substrate + asphalt waterproofing	Mortar substrate + liquid-applied membrane waterproofing	Commonly adopted in this area and has good workability.
	Exterior walls	Natural stones fair-face masonry with mortar paint finish	Natural stones fair-face masonry	Commonly adopted in this area, inexpensive and does not require repainting.
	Doors and windows	Steel, aluminum or wooden doors and windows	Steel windows and doors, wooden doors	Commonly adopted in this area, and easy to procure, process and maintain.
Interior	Ceiling	Chipboard + paint, sound absorption board, wooden strip	Sound absorption board (general), wooden strip (lecture hall, dining hall)	Commonly adopted in this area and has excellent sound insulation and maintainability as well as an aesthetic appearance.
	Walls	Mortar paint, tiles, wooden strip	Mortar paint (general), tiles (water usage areas such as laboratories, toilets and kitchen), wooden strip (boardroom, lecture hall)	Commonly adopted in this area and has excellent workability and maintainability.
	Floors	Porcelain tiles, PVC tiles, terrazzo applied at the site, wooden parquet, etc.	Porcelain tiles (general), wooden parquet (lecture hall), terrazzo tiles (corridors), exposed-aggregate finish (ramp)	Commonly adopted in this area and has excellent durability and maintainability. As ramps are slippery, anti-slip exposed-aggregate finish should be applied for safety.

2-2-2-2 Equipment Plan

According to an analysis of the usage situation of the existing equipment, the content of the training programs (curricula), details of the future training programs, budgetary steps for maintenance and management costs, suitability of the equipment for maintenance, and method of procuring consumables and replacement parts, based on the selection criteria and quantity calculation method shown in 2-2-1-3, the equipment to be procured under this Project will be selected and the necessary quantity will be calculated. The requested equipment can be grouped into: 1) equipment for mathematics and science education; 2) lecture support equipment; 3) ICT equipment; 4) equipment

for the lecture hall; 5) education furniture; and 6) equipment for the hostels, kitchen and dining hall. As a result, the following equipment plan was developed:

1) Equipment for mathematics and science education (physics, chemistry, biology and mathematics)

In accordance with the policy and approach of the training programs at CEMASTEA "to teach scientific principles effectively using materials readily available in the daily environment," it was decided to exclude from the scope of the Project the equipment of which the sufficient quantity already exists, advanced equipment that cannot be used in the actual field of education, equipment with an extremely low frequency of use and equipment that is widely available in Kenya, inexpensive and can be procured within the budget of CEMASTEA. The quantity was decided in accordance with the purpose of use.

The specification for each of the equipment was planned based on the previous Project in 2006. However, considering the possibility that equipment of different specifications may be required due to revision of the curricula, the specifications should be planned in accordance with the class level in Kenya and neighboring countries, while avoiding excessively high-end specifications.

2) Lecture support equipment

The specifications of the projector and screen should be decided in accordance with the size of the lecture room, ICT laboratory or boardroom/meeting room where they will be installed. The AV equipment should be of standard specifications since it will be mainly used for the projection of teaching materials and reference materials.

With respect to the bus, since the collateral conditions of the EIA license require the provision of an adequate means of transportation for the training participants, the bus should be of a size that will ensure efficient daily transport for 110 training participants staying outside the premises. Consideration should also be given to the growing scale of the training. When deciding the size of the bus, it should also be taken into consideration that two existing microbuses with a capacity of 33 people, under the management of a technical cooperation project, are scheduled to be transferred to the Centre after the completion of the Project.

3) ICT equipment

The quantity should be determined to meet the demands of the training programs. It should also be noted that the training plans of CEMASTEA after the upgrading and refurbishment include ICT training courses. With respect to the specifications of the PCs, it was decided to adopt general purpose models as they will be used for education. Switching hubs necessary for networking should also be included in the plan.

4) Equipment for lecture hall

The configuration of the audio system and the size of the projector and screen were determined

in accordance with the size of the lecture hall. As the specifications of audio systems vary greatly, when deciding the specifications, care should be taken to ensure that the equipment can be used without problem by referring to the level of equipment used in educational institutions in Japan.

5) Education furniture (lecture room, laboratory, library and boardroom)

The details of the furniture should be decided in accordance with the usage. Plans for the experimental tables and draft chambers, in particular, should be developed after comprehensively studying the size of the existing laboratories, the layout of standard laboratories in Kenya and the scale of training at CEMASTEA.

6) Equipment for hostels, kitchen and dining hall

The plan should enable appropriate arrangement of the equipment on the premise that the existing facility will continue to be used and the dining hall and kitchen will be expanded. Of the malfunctioning equipment, repairable equipment should be repaired to enable continued use, with the costs borne by the Kenyan side, to minimize replacement of the equipment. The equipment plan should also enable the dining hall to serve breakfast, lunch and dinner to a maximum of 200 training participants after the upgrading and refurbishment of the Centre.

Table 2-21 is a list of the planned equipment that was developed as a result of the studies and analyses described above. The list consists of 86 equipment items.

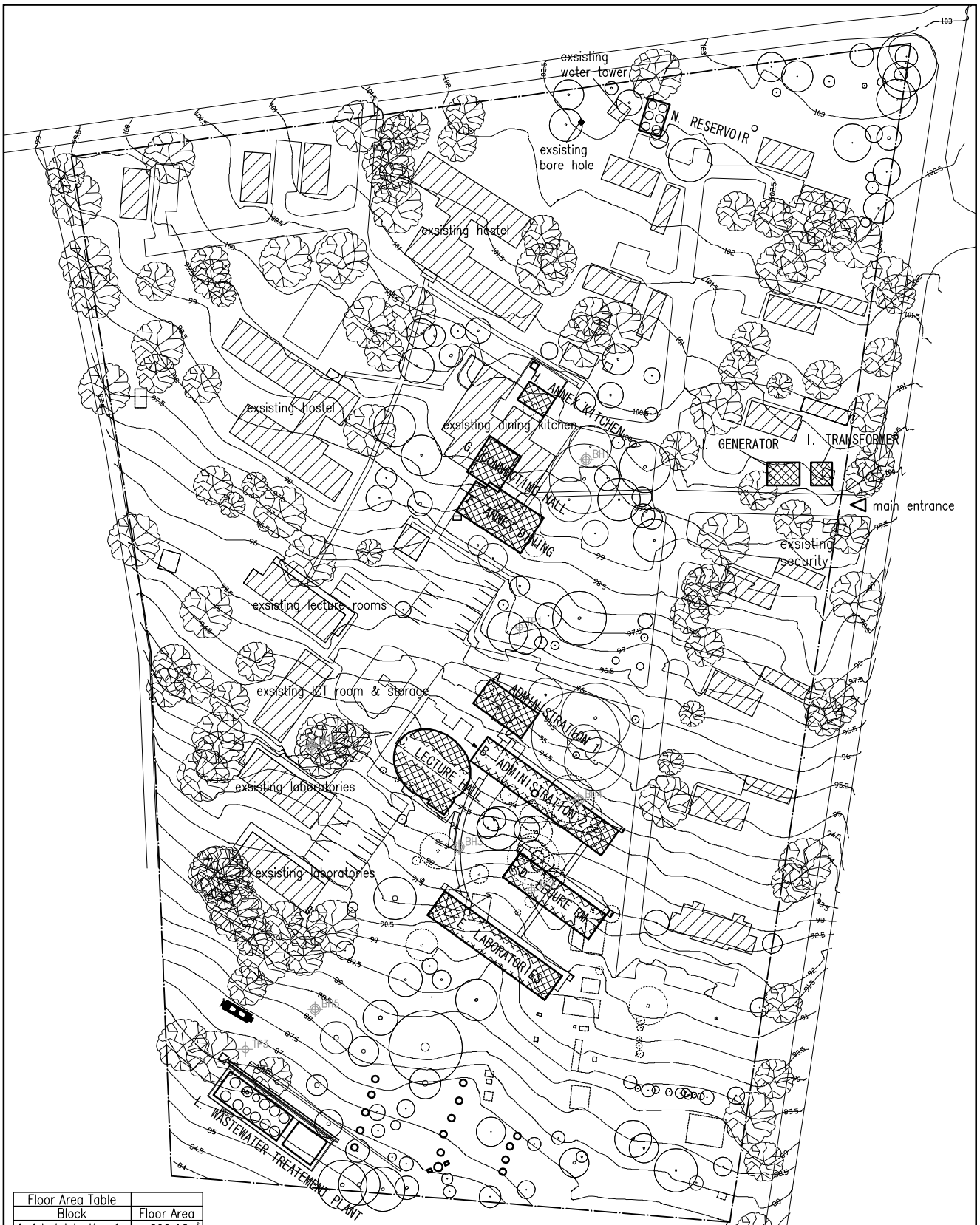
2-2-3 Outline Design Drawings

2-2-3-1 Design Drawings of the Facilities

- Layout plan
- A. Administration building 1 / floor plan, elevation view and cross-section view
- B. Administration building 2 / floor plan, elevation view and cross-section view
- C. Lecture hall / floor plan, elevation view and cross-section view
- D. Lecture building / floor plan, elevation view and cross-section view
- E. Laboratory building / floor plan, elevation view and cross-section view
- F. Dining hall, G. Connecting hall, H. Kitchen / floor plan, elevation view and cross-section view
- I. Transformer building, J. Generator building / floor plan, elevation view and cross-section view

Table 2-20 List of Floor Space, Furniture and Equipment by Building

Building name	Floor space	Furniture	Equipment excluding the one listed in 2-3-2
A. Administration building 1		None	Sink for hot water (2)
B. Administration building 2	762.17 m^2	None	Reception desk, sink for hot water (2)
C. Lecture hall	397.48 m^2	Tablet arm chairs (200), folding chairs (60), conference tables (4), podium	
D. Lecture building	562.91 m^2	Lecture room tables (20), folding chairs (200)	Blackboard (4)
E. Laboratory building	763.87 m^2	Stools (93), desks and chairs for preparation room (3 each), tables for the ICT laboratory (25), reading desks (5), folding chairs (80)	Laboratory side tables, cabinets
F. Dining hall	226.68 m^2	Dining tables and chairs (for 112 people)	Hot water counter
G. Connecting hall	33.60 m^2	Dining tables and chairs (for 20 people)	
H. Kitchen	50.40 m^2	Tables (2)	
I. Transformer building	36.54 m^2	None	
J. Generator building	55.44 m^2	None	
Covered access corridor	161.20 m^2	None	
Total floor space	3,349.41 m^2	None	



Floor Area Table	
Block	Floor Area
A. Administration 1	299.12㎡
B. Administration 2	762.17㎡
C. Lecture Hall	397.48㎡
D. Lecture Rooms	562.91㎡
E. Laboratories	763.87㎡
F. Annex Dinning	226.68㎡
G. Connecting Hall	33.60㎡
H. Annex Kitchen	50.40㎡
I. Transformer	36.54㎡
J. Generator	55.44㎡
Slope Bridges	161.20㎡
Total	3349.41㎡

LEGEND
- exsisting building
- proposed building
- trees

0 5 10 20 30 40 50

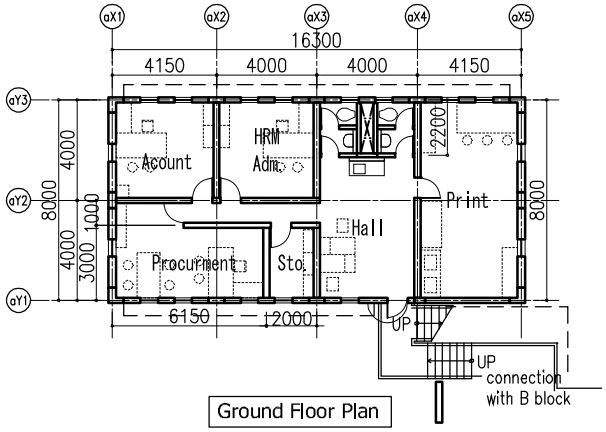
NORTH

Site layout Plan S=1/1500

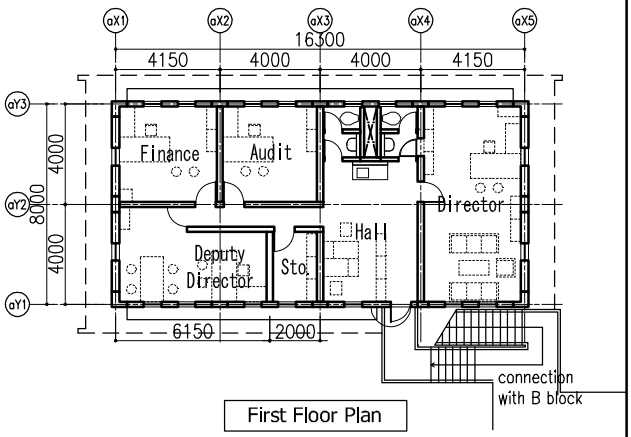
The Project for the Upgrading and Refurbishment of the Centre for Mathematics, Science and Technology Education in Africa

A-01

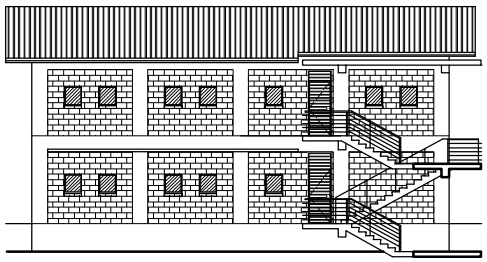
A. Administration 1



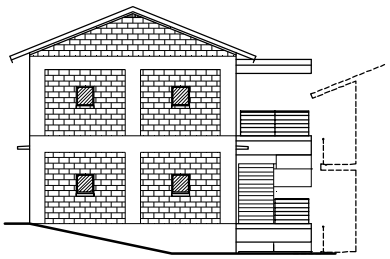
Ground Floor Plan



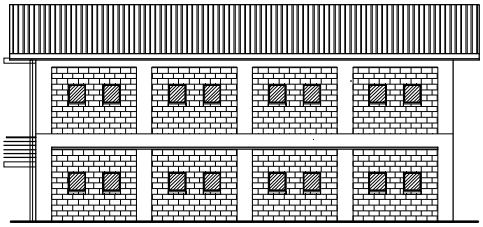
First Floor Plan



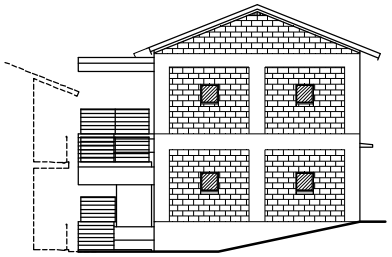
South Elevation



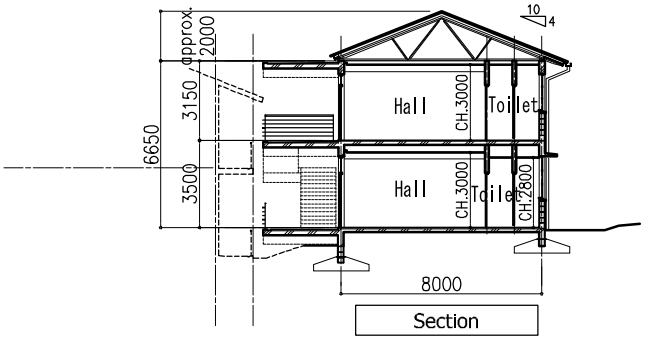
West Elevation



North Elevation

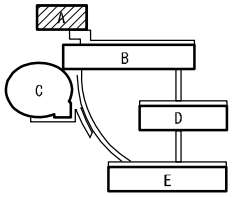


East Elevation



Section

A-E Key Plan

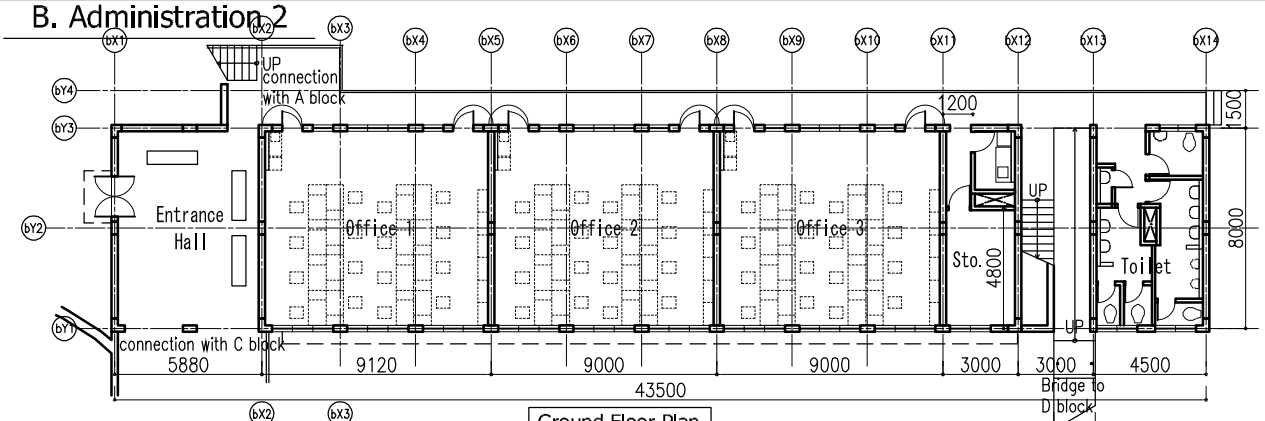


A. Administration 1	Plan, Elevation, Section	S=1/300

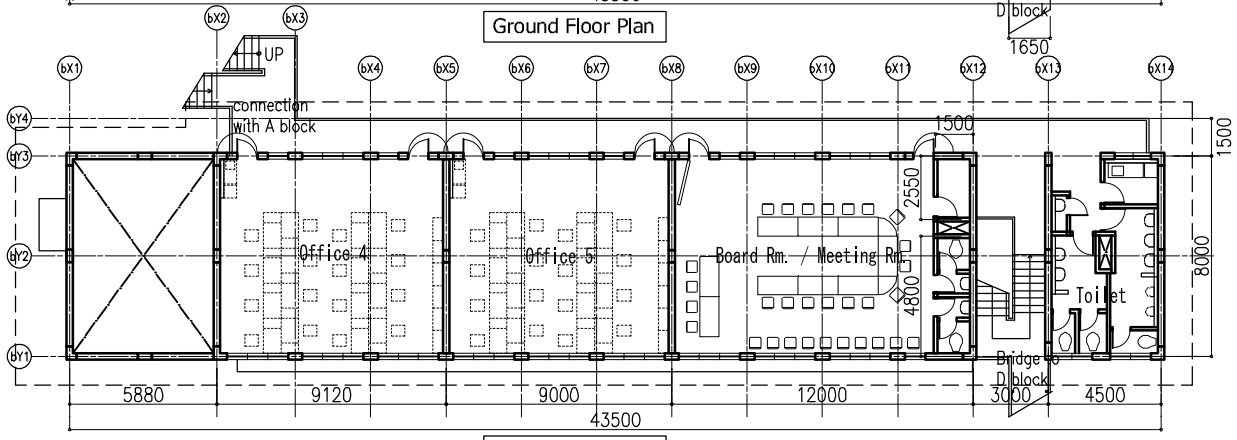
The Project for the Upgrading and Refurbishment of the Centre for Mathematics, Science and Technology Education in Africa

A-02

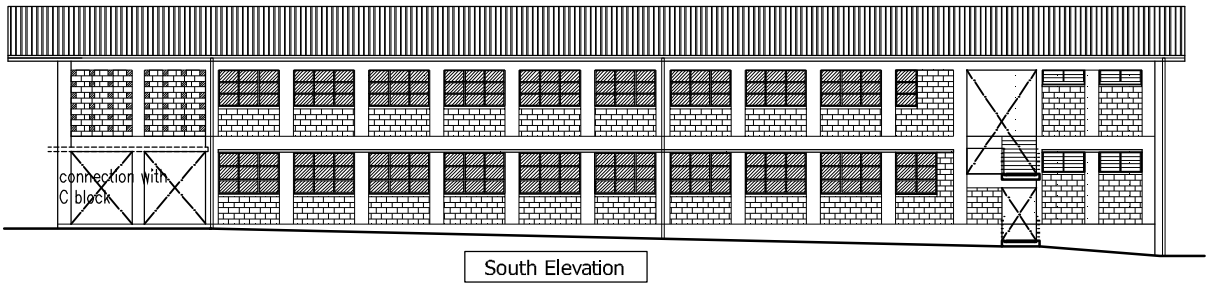
B. Administration 2



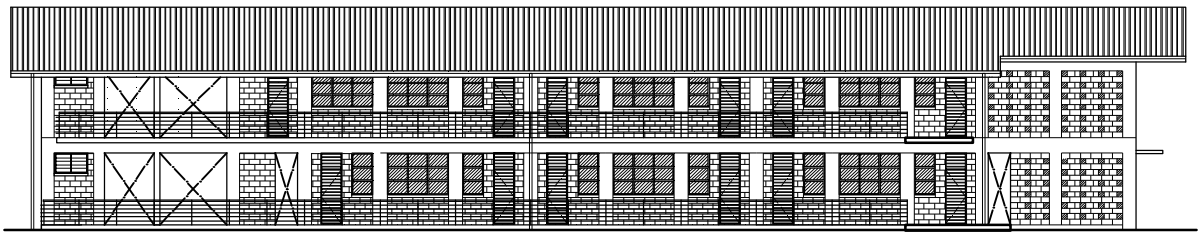
Ground Floor Plan



First Floor Plan

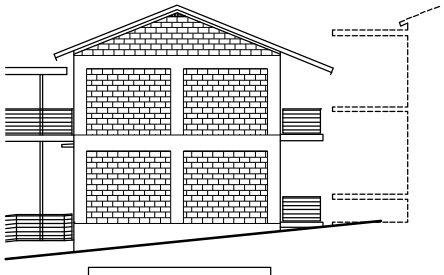


South Elevation

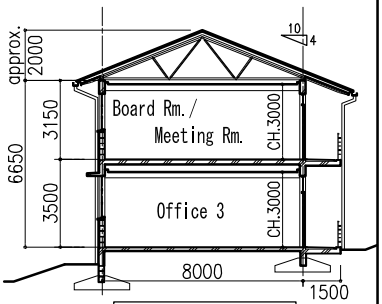


North Elevation

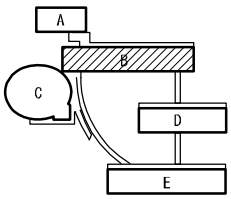
West Elevation



East Elevation



Section



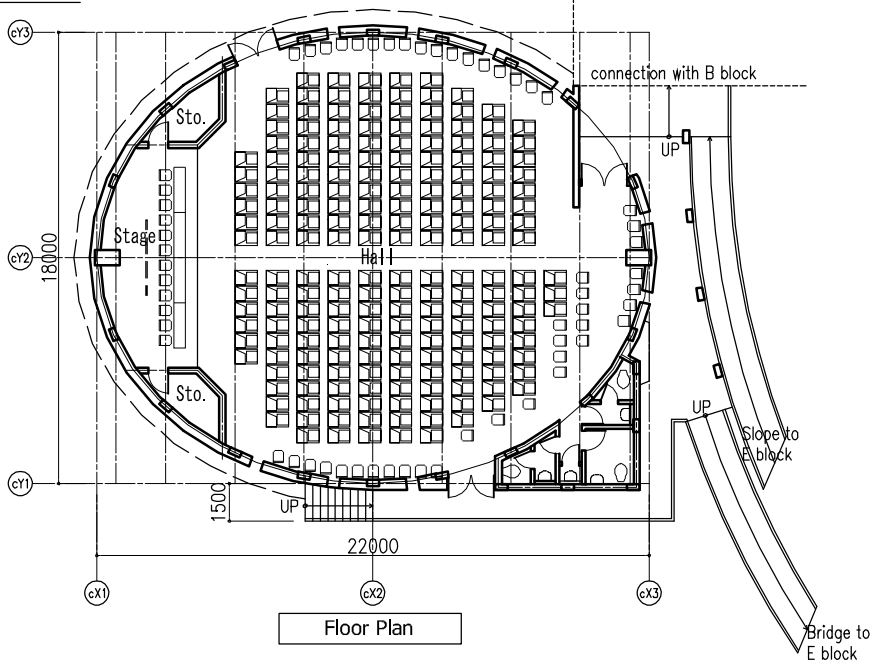
A-E Key Plan

B. Administration 2	Plan, Elevation, Section	S=1/300

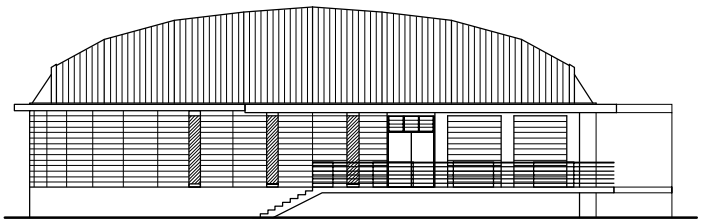
The Project for the Upgrading and Refurbishment of the Centre for Mathematics, Science and Technology Education in Africa

A-03

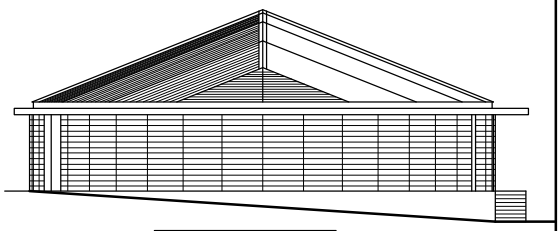
C. Lecture Hall



Floor Plan



South Elevation



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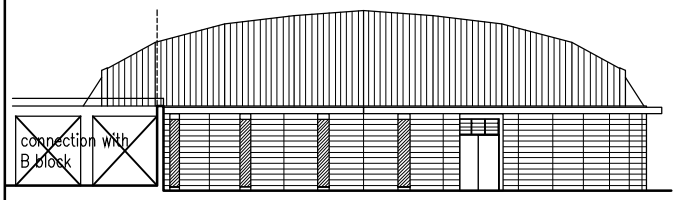
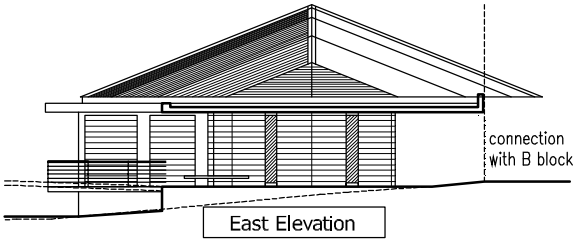
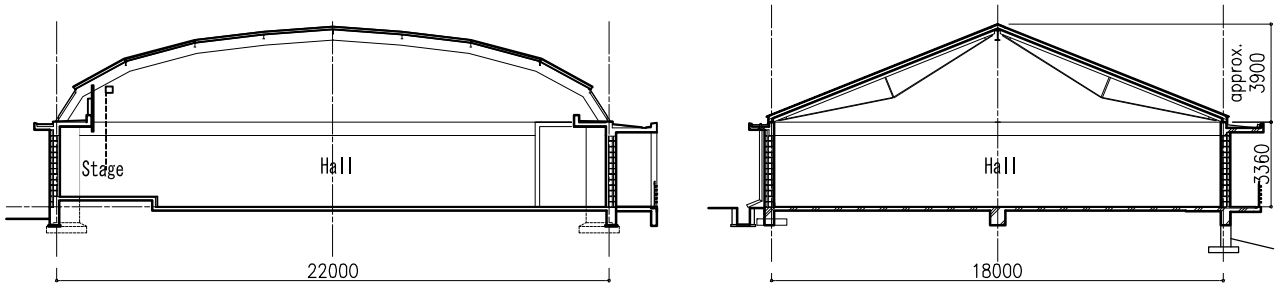


North Elevation

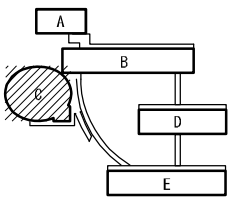


East Elevation



Section

A-E Key Plan

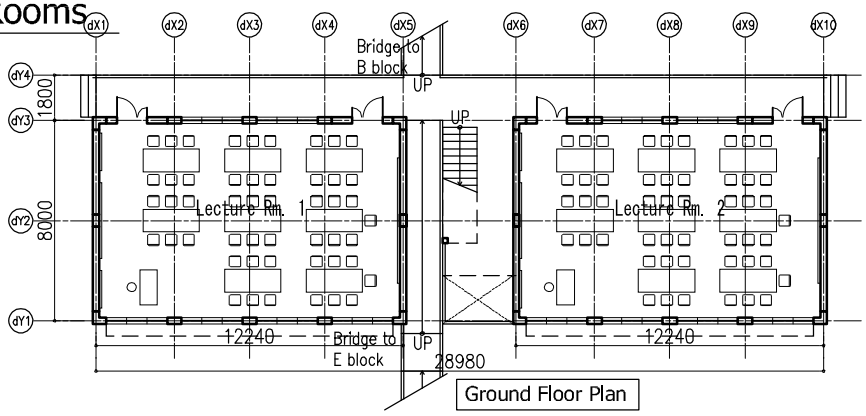


C. Lecture Hall | Plan, Elevation, Section | S=1/300

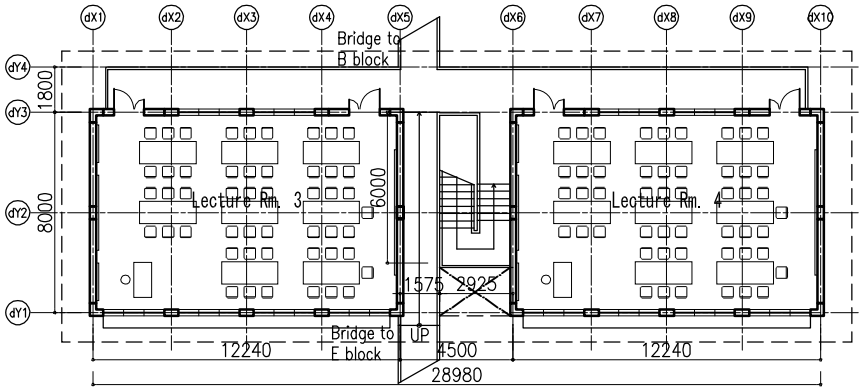
The Project for the Upgrading and Refurbishment of the Centre for Mathematics, Science and Technology Education in Africa

A-04

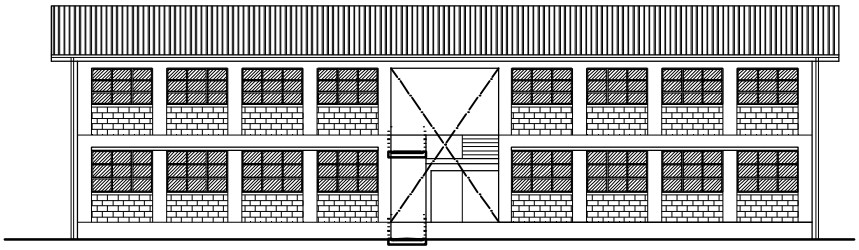
D. Lecture Rooms



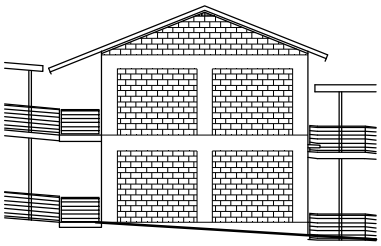
Ground Floor Plan



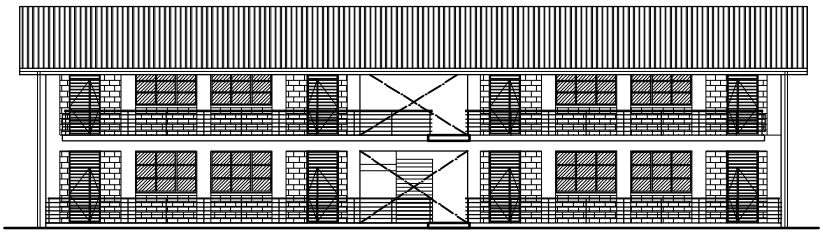
First Floor Plan



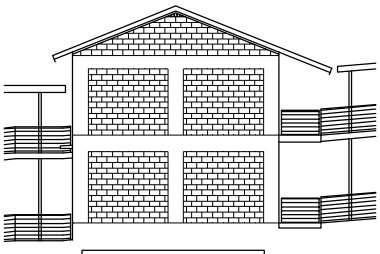
South Elevation



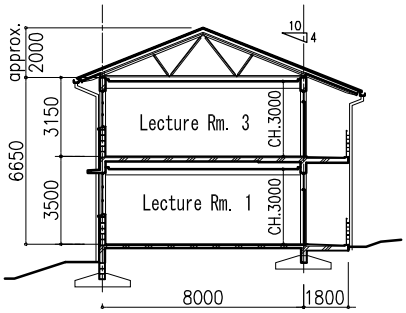
West Elevation



North Elevation

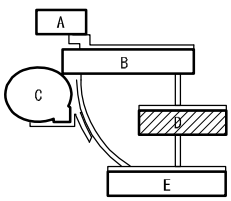


East Elevation



Section

A-E Key Plan

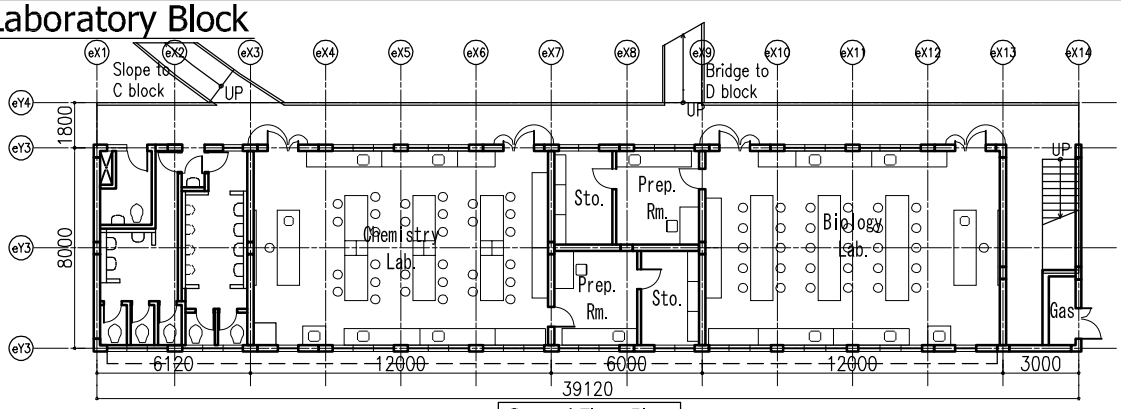


D. Lecture Rooms | Plan, Elevation, Section | S=1/300

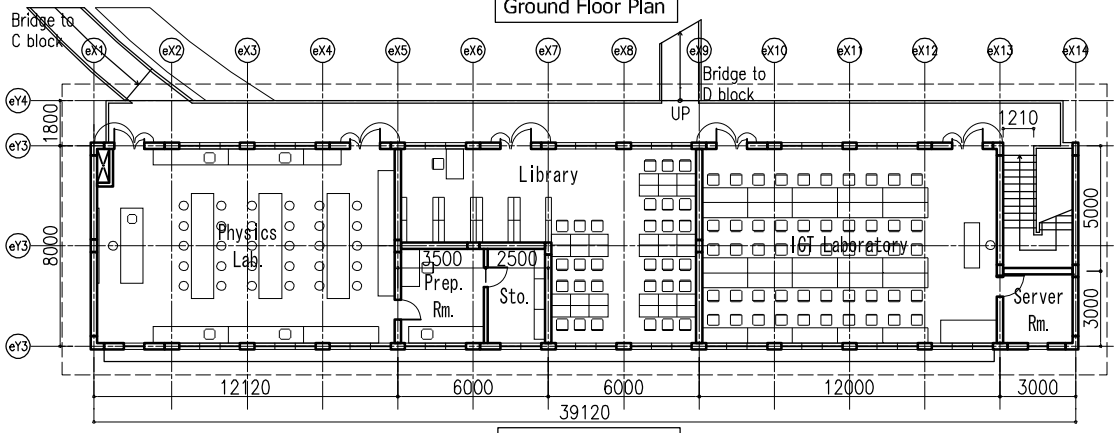
The Project for the Upgrading and Refurbishment of the Centre for Mathematics, Science and Technology Education in Africa

A-05

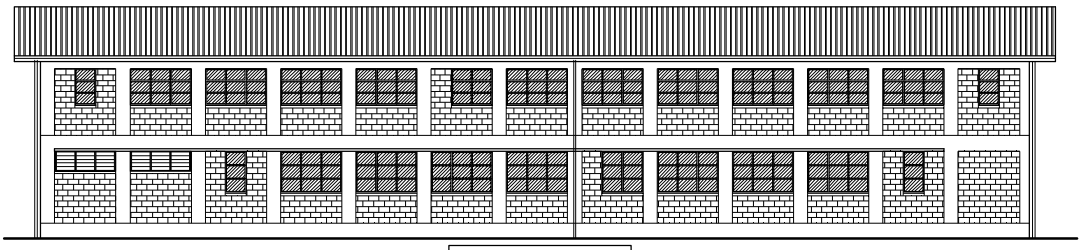
E. Laboratory Block



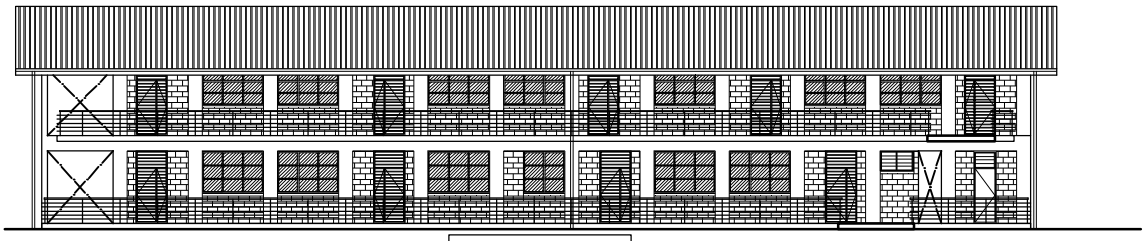
Ground Floor Plan



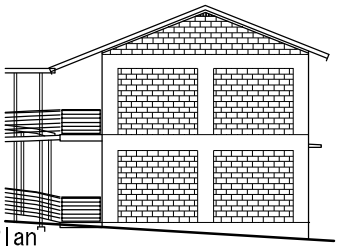
First Floor Plan



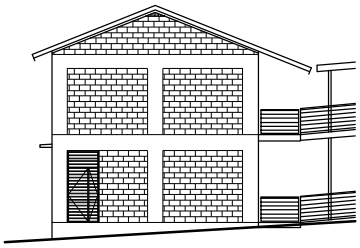
South Elevation



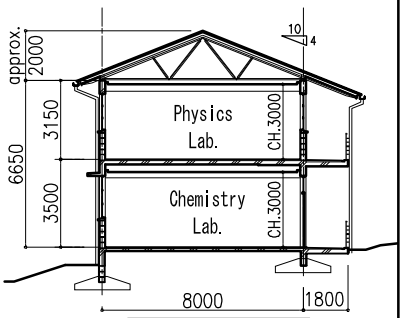
North Elevation



West Elevation

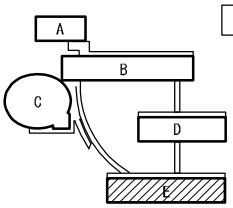


East Elevation



Section

A-E Key Plan

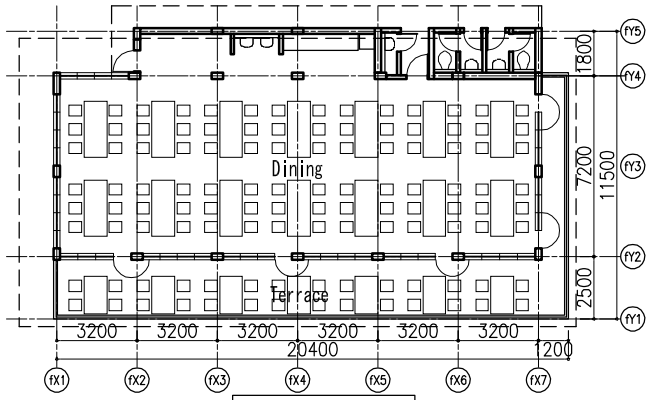


E. Laboratories | Plan, Elevation, Section S=1/300

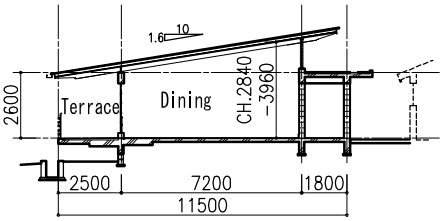
The Project for the Upgrading and Refurbishment of the Centre for Mathematics, Science and Technology Education in Africa

A-06

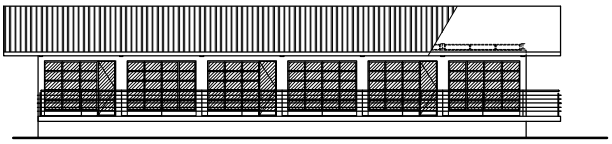
F. Annex Dining



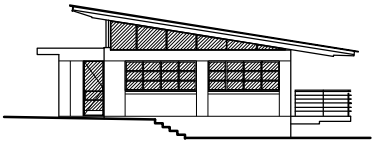
Floor Plan



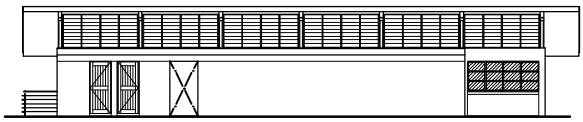
Section



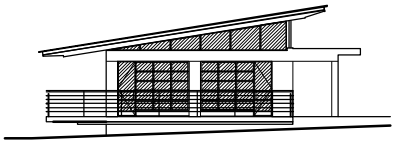
South Elevation



West Elevation

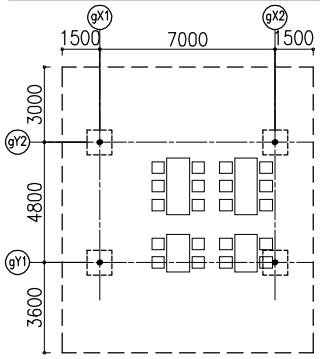


North Elevation

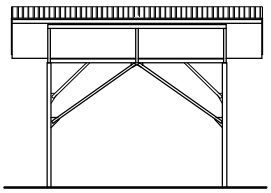


East Elevation

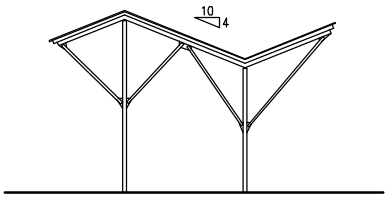
G. Connecting Hall



Floor Plan

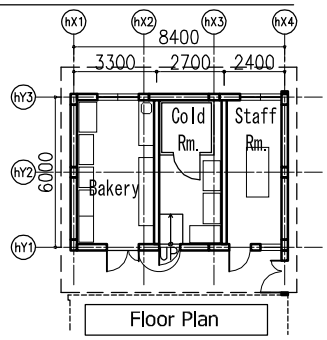


South Elevation

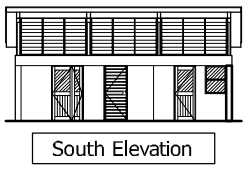


West Elevation

H. Annex Kitchen



Floor Plan



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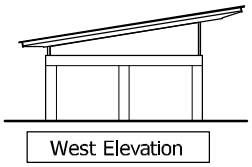

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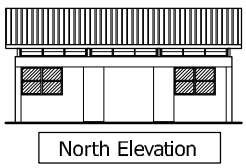
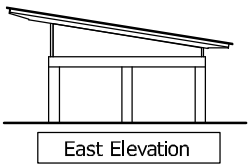


North Elevation



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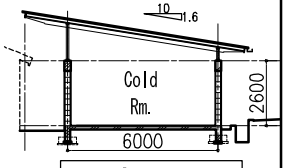
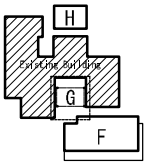


Section



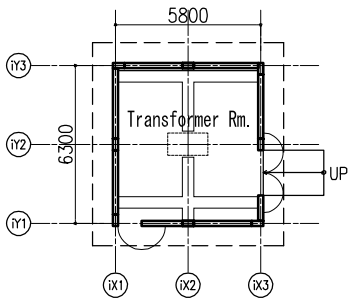
F-H Key Plan

F. Annex Dining, G. Connecting Hall, H. Annex Kitchen | Plan, Elevation, Section | S=1/300

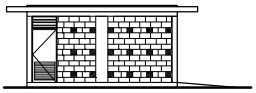
The Project for the Upgrading and Refurbishment of the Centre for Mathematics, Science and Technology Education in Africa

A-07

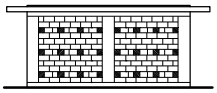
I. Transformer Room



Floor Plan



South Elevation



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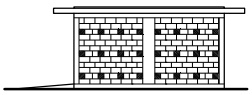
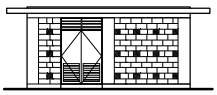
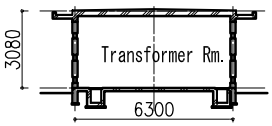


North Elevation

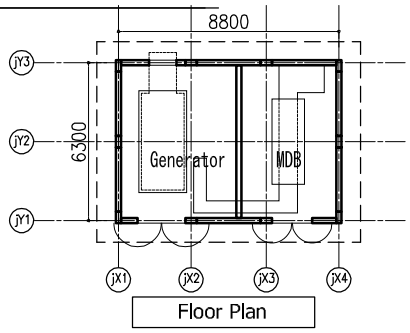


East Elevation

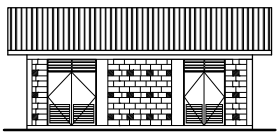


Section

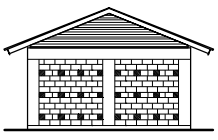
J. Generator Room



Floor Plan



South Elevation



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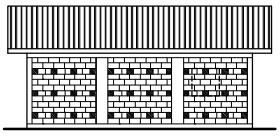
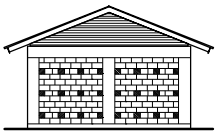
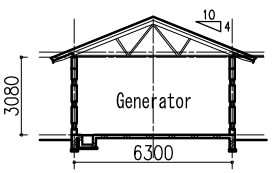


North Elevation



East Elevation



Section

I. Transformer Room, J. Generator Room | Plan, Elevation, Section | S=1/300

The Project for the Upgrading and Refurbishment of the Centre for Mathematics, Science and Technology Education in Africa

A-08

2-2-3-2 Planned Equipment List

Table 2-21 Planned Equipment List

Class		No.	Code No.	Equipment name	Quantity	Unit
Mathematics and Science Education	Physics	1	PH-1	Electronic precision balance	1	piece
		2	PH-18	Demonstration galvanometer	2	piece
		3	PH-23	Resistance box	2	piece
		4	PH-26	Oscilloscope	2	piece
		5	PH-43	Experimental vacuum drop tube	1	set
		6	PH-45	Electric rotation platform	1	piece
		7	PH-53	Magdeburg hemispheres	1	piece
		8	PH-56	Rotary vacuum pump	1	piece
		9	PH-70	Optical water tank	1	piece
		10	PH-93	Magnet set	1	set
		11	PH-96	Magnetising coil	1	piece
		12	PH-103	Electrostatic generator	1	piece
		13	PH-119	Magnetic field experiment equipment	2	piece
	Chemistry	14	CH-15	Vacuum pump	1	piece
		15	CH-26	Electronic table balance	10	piece
		16	CH-27	Molecular structure model inorganic	1	set
		17	CH-28	Molecular structure model organic	1	set
		18	CH-31	Bunsen burner	10	piece
		19	CH-41	DC milliammeter	5	piece
		20	CH-45	Desiccator	3	piece
		21	CH-51	Water distillation apparatus	2	piece
		22	CH-53	Hoffman’s apparatus	1	piece
		23	CH-54	Kipps apparatus	1	piece
		24	CH-55	Sample of ores	1	set
	Biology	25	BI-22	Microtome	5	set
		26	BI-24	Prepared slide set	3	set
		27	BI-29	Digital microscope	1	piece
		28	BI-34	Model set	10	set
		29	BI-39	Human skeleton	1	piece
		30	BI-47	Deep freezer	1	piece
	Mathematics	31	MA-8	Geometric model set	2	set
		32	MA-11	Blackboard instrument	5	piece
		33	MA-18	Geoboard with plastic pegs	10	piece
Lecture support		34	LS-3	Projector	6	piece
		35	LS-4	Visual presenter	4	piece
		36	LS-6	Video camera	2	piece
		37	LS-7	DVD/VCD player	4	piece
		38	LS-10	Bus	1	piece
		39	LS-11	Screen	6	piece
ICT		40	PC-1	Computer	51	piece
		41	PC-2	Printer	1	piece
		42	PC-9	Switching hub	5	piece
Lecture hall		43	LH-1	Sound equipment	1	piece
		44	LH-2	Projector	1	piece

		45	LH-3	Screen	1	piece
Education furniture	Lecture room	46	LR-4	White board portable	4	piece
	Laboratory	47	LF-1-1	Laboratory central experimental table for Physics	3	piece
		48	LF-1-2	Laboratory central experimental table for Chemistry	3	piece
		49	LF-1-3	Laboratory central experimental table for Biology	3	piece
		50	LF-2	Laboratory table for lecturer	3	piece
		51	LF-9	Draft chamber	2	piece
	Library	52	OB-1	Shelf for library	8	set
	Boardroom	54	BR-1	Table set	1	set
		55	BR-2	Chair	30	piece
Hostels, kitchen & dining hall equipment	Hostels	56	HB-3	Ironing roller	1	piece
		57	HB-8	Trolley for dry linen	1	piece
		58	HB-9	Trolley for wet linen	1	piece
		59	KD-9	Stock pot stove	1	piece
	Kitchen & dining hall	60	KD-11	Potato peeler	1	piece
		61	KD-14	Potato chipper	2	piece
		62	KD-15	Table for potato chipper	2	piece
		63	KD-16	Mixing machine	1	piece
		64	KD-17	Refrigerator	1	piece
		65	KD-19	S.B.S.D. sink unit	1	piece
		66	KD-20	Cutlery rack	1	set
		67	KD-21	SS work top	1	piece
		68	KD-22	Meat slicing machine	1	piece
		69	KD-25	Meat chopping block	1	piece
		70	KD-26	Chicken grill	1	piece
		71	KD-31	Chest type freezer cabinet	1	piece
		72	KD-32	Platform weight scale	1	piece
		73	KD-34	Stainless container with valve for pouring	2	piece
		74	KD-35	Warmer (large)	1	piece
		75	KD-36	Warmer (small)	1	piece
		76	KD-37	Coffee making machine	1	piece
		77	KD-38	Bench scale	2	piece
		78	KD-41	High pressure cooker	1	piece
		79	KD-42	Gas baking oven	1	piece
		80	KD-44	Worktop with partition	1	piece
		81	KD-45	Automatic dishwasher	1	piece
		82	KD-46	Beverage refrigerator	3	piece
		83	KD-48	Meat mincer	1	piece
		84	KD-49	Blender	2	piece
		85	KD-50	Tilting bratt pan	1	piece
		86	KD-51	Dough proofer	1	piece

2-2-4 Implementation / Procurement Plan

2-2-4-1 Implementation / Procurement Policies

(1) Basis for Project Implementation

This Project will be implemented on the basis of the framework of the Government of Japan for its Grant Aid Scheme, after exchanging of Notes (E/N) regarding the implementation of the Project between the Government of Japan and the Government of Kenya and conclusion of the Grant Agreement (hereinafter G/A) between JICA and the Government of Kenya, following the approval of the Japanese Cabinet. Subsequently, the Government of Kenya and a Japanese consultant companies will thereafter enter into a contract, and detailed designs of the facilities and equipment will be prepared. Following the completion of the detailed design documents and the tender documents, a competitive tender among Japanese companies that satisfy the specified requirements will be carried out. Construction of the facilities and procurement of the necessary equipment will be executed based on the contract concluded between the selected companies and the Government of Kenya. In this Project, equipment procurement accounts for only a small percentage, and the process of delivery and installation is closely related with construction of the facilities. Therefore, it is favorable to package the construction work and equipment procurement together when inviting bids for the Project.

(2) Project Implementation System

1) Implementing Organization on Kenyan Side

The Ministry of Education is responsible for implementing this Project in Kenya, and CEMASTEA, which will be the operating body after the Project is handed over, is in charge of coordination and promotion of the whole project as the implementing organization. The Kenyan Ministry of Education is in charge of the conclusion of the design and supervision contracts and construction works and equipment procurement contracts with Japanese companies, procedures related to opening bank accounts and making payments, budgetary measures necessary to cover the undertakings to be taken by the Kenyan side, and the obtainment of approvals and authorizations necessary for the Project. As for the implementation of the construction works to be covered by the Kenyan side, the preparation of the site and other issues that are to be taken care of at the site, they are the responsibility of CEMESTEA.

Since the Ministry of Education has no technical staff with specialized expertise in construction, the technical components of the obligations of the Kenyan side (preparation of the tender documents for the demolition work, acquisition of the building permit, etc.) will be implemented with the cooperation of the Ministry of Public Works. For the E/N to be concluded between the two governments implementing this Project, the Ministry of Finance of Kenya will be in charge on behalf of the Government of Kenya.

2) Japan International Cooperation Agency

The Japan International Cooperation Agency (JICA) concludes the G/A with the Ministry of Finance of Kenya and is in charge of supervising the implementation of the Project so that the Project will be carried out in accordance with the Japanese Grant Aid Scheme.

3) Consultant

The Consultant are, in line with the design and supervision contracts concluded with the Kenyan implementing organization, in charge of working out the detailed designs of the facilities and equipment as well as supervising the construction and procurement works based on the content of this report.

Moreover, the Consultant also develop the tender documents, and support the selection of the Contractor and the conclusion of the construction work and equipment procurement contracts with them. To conduct the above-mentioned operations efficiently, the Consultant will work cooperatively with CEMASTEA, the implementing organization, and dispatch a resident engineer required at the site during the construction and procurement period.

4) Contractor

The Japanese Contractor selected through a competitive tender will complete the construction and equipment procurement works within the implementation period, in accordance with the contract documents, based on the construction and equipment procurement contracts concluded with the Kenyan implementing organization. In the actual construction and equipment procurement works, they will establish an effective system for construction and procurement in accordance with the scope and the content of this Project.

5) Utilization of Local Contractors and Dispatch of Supervisor (s)

The local construction market in Kenya is large, and local contractors and suppliers with quality control capability are available around the country. The Japanese Contractor are therefore able to utilize these local contractors in various types of work. For this Project, locally manufactured roofing and waterproofing materials will be used to finish the pitched roof. As the roofing work largely determine the quality and function of the building, a Japanese supervisor specialized in roofing work will be detached. The dispatched supervisor will also be in charge of providing technical guidance on structural steel work, which similarly has a big impact on the building quality and the construction period.

*In many of the previous Japanese Grant Aid Scheme projects, the double-skin construction method was used to install roofing on a groundwork of concrete slabs or steel. In this Project, however, it is planned to use single-skin roofing to reduce costs, and roofing board or other materials will be installed directly on the steel beam groundwork.

6) Project Implementing System

The figure below shows the relationship between the different organizations and the system for promoting the Project at the implementing stage:

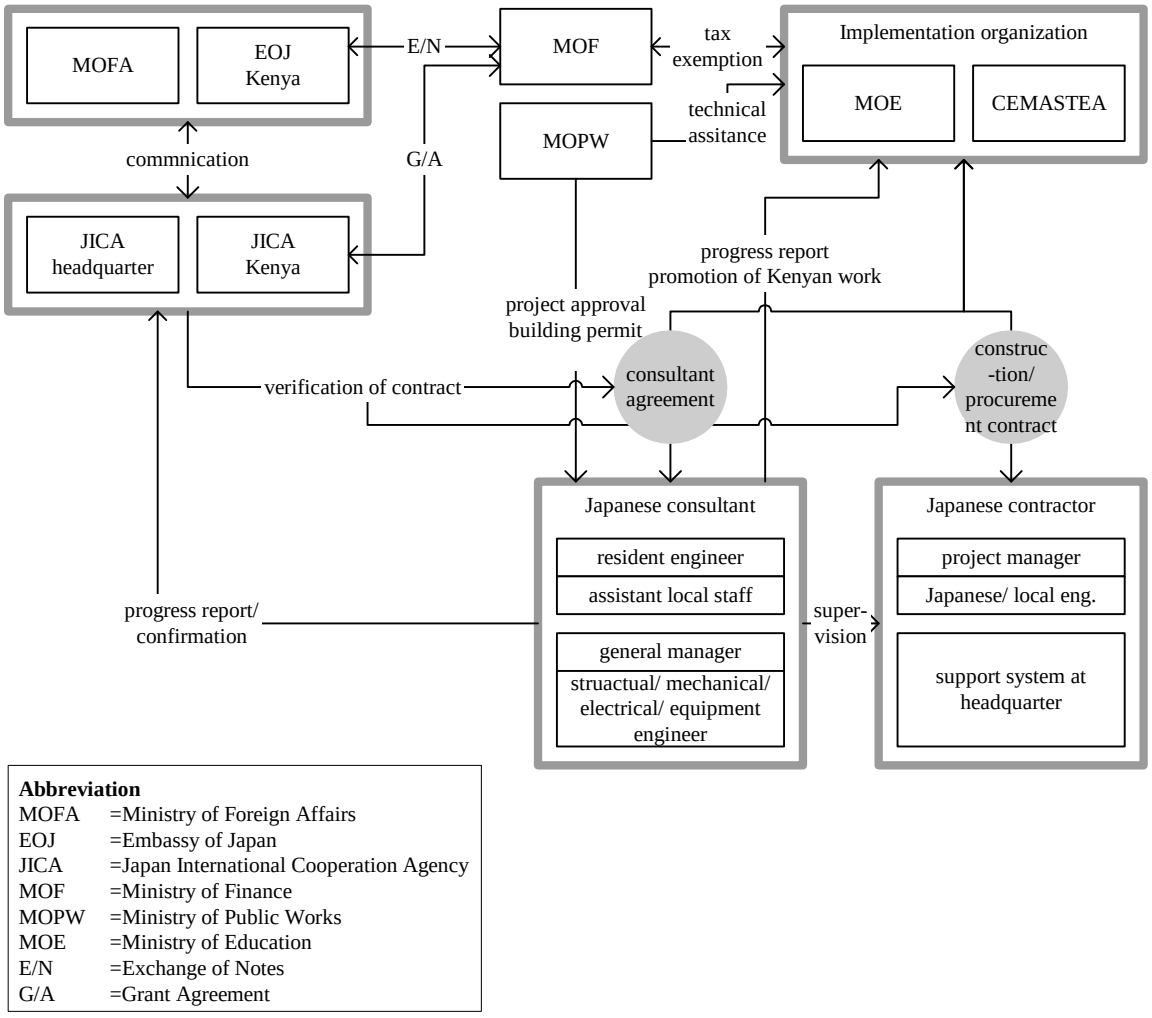


Figure 2-2 Project Implementation System

2-2-4-2 Important Issues concerning Construction/Procurement Work

(1) Laborers' Skill Levels

The view of the local laborers' skill levels is as follows:

- Considering the average labor efficiency of skilled workers in Kenya such as carpenters, plasterers, reinforcing bar placers and finishers, the labor power of about 2.5 to 4 times as much as that of Japanese skilled workers will be needed in Kenya.
- Highly skilled workers are being trained in various areas.

(2) Issues concerning Natural Conditions

In Nairobi there are two rainy seasons from March to May and from November to December, during which it is preferable to avoid earthwork and foundation work. Furthermore, the typical pattern of rainfall in Nairobi is squalls characterized by a sharp increase in wind speed with heavy rain, and the

soil at the planned site is regarded as clayey to silty with low permeability. In addition, considering that the site is on sloping land, the construction work in the rainy season is likely to be difficult. However, interviews with local engineers have revealed that it is possible to conduct normal construction work by taking adequate measures against stormwater. On the assumption that a rainwater drainage plan will be set up carefully and appropriately, the work schedule should be prepared, taking into consideration that the construction work may commence during the rainy season.

(3) Issues concerning Safety Management

The construction site is on the premises of the existing training facilities where various training courses will be conducted during the construction work. Therefore, it is necessary to take safety measures for the training participants and the staff of the facilities. Along with the installation of a temporary fence around the construction area to avoid interference with the course, dedicated approach paths for the construction workers and construction vehicles are to be prepared so that the safety of the training participants and the staff can be secured. CEMASTEA, the Consultant and the Contractor need to discuss the safety control and rules prior to the commencement of the work.

(4) Issues concerning Environmental Considerations

Of the collateral conditions of the EIA license, the following conditions are imposed on construction work:

- In principle, working hours will be from 8:00am to 5:00pm and conformity to the occupational safety and health standards will be ensured.
- In principle, construction materials will be transported to the site off peak time on weekdays.
- To take measures against noise and vibration, in particular, the construction site is to be surrounded by soundproof sheeting to obtain excessive noise permit prior to the work generating noise and vibration.
- To take care to preserve the trees --- not to leave heavy equipment constantly around roots on the site
- To have regular meetings with the neighborhood residents and explain the schedule and the actual content of the work
- To adhere to the rules on construction waste disposal
- To separate the construction wastewater by use and treat it in compliance with the rules on the wastewater disposal (organic solvents are to be processed separately)
- Water used for the work is to be brought in by the water truck, as the groundwater is a scarce and precious resource shared in the community

CEMASTEA and any parties concerned in this Project need to be aware that the above-mentioned

conditions are important to comply with these collateral conditions of EIA license for the smooth implementation of the Project and to take necessary measures in organizing the work plan.

(5) Issues concerning Equipment Procurement

Since it is particularly necessary to adjust the installation of the following equipment for the planned facilities, the Consultant need to keep in close communication with the Contractor to control the work schedule.

- Central experimental tables
- Draft chamber
- Audio visual equipment, and so on

2-2-4-3 Scope of Work

(1) Work to be borne by the Japanese side

1) Construction of the Facilities

- Construction of two administration buildings, a lecture hall, a lecture room building, a laboratory building, and covered access corridors connecting the above-mentioned buildings, dining hall, a hall connecting the newly built section and the existing dining room, kitchen and transformer and generator building
- Installation of rainwater drainage ditches, water supply and drainage, sanitation, mechanical and electrical services attached to the facilities on the premises of the buildings mentioned above

2) Equipment Procurement

- Provision and installation of equipment are shown in the Table 2-21 Planned Equipment List

(2) Scope of Work for Both Countries

Although the work to be borne by the Kenyan side is reported in Chapter 3, the following table shows the work to be borne by each Government:

Table 2-22 Work to be Borne by Each Government

Items	To be borne by the Japanese side	To be borne by the Kenyan side
Public water supply	Installation of a water reservoir tank and a pump system to pump water to the existing elevated tank	Connection of the public water to the planned water reservoir tank
Electric power supply	Construction of the transformer building	Extension of high voltage line to a transformer in the transformer building

Integrated communication system	Wiring and piping work after the receiver in the existing ICT laboratory to the planned buildings	Installation of an antennae, extension of buried wires to the receiver in the existing ICT laboratory
		Relocation of the existing network equipment (including necessary installation of additional equipment)
Gas supply	Setting up of the gas storage room, piping to the laboratories, installation of bulb to the gas storage room	Installation of gas containers and connection with the containers and the bulbs
Kitchen equipment installed in existing kitchen	Procurement and installation of the kitchen equipment	Securing of necessary electricity, gas and water supply and drainage at the installation points

2-2-4-4 Supervision Plan

(1) Supervision Policies

The Consultant will aim at a consistent implementation of the Project throughout the work that includes detailed design, tender, supervision of the construction and procurement, and handover based on the framework of the government of Japan for its Grant Aid and on the outline design. When supervising the construction and procurement, the Consultant will maintain close communication between the Governments of Kenya and Japan and provide the persons concerned in the construction and procurement with necessary advice in a timely manner, so that the facilities and the equipment procurement will be completed without delay in accordance with the contract documents. The following points require particular attention:

- In this Project, the construction work will be implemented while training courses are being conducted in the existing facilities. In particular, the following problems arise: the main road on the premises and the temporary road between the construction sites will intersect with each other and the access to the existing dining hall will be restricted when the dining hall and kitchen are under construction. Therefore, the Consultant need to hold meetings with the CEMASTEA staff to discuss how to make it possible for both the construction team and the staff members to go ahead with their work without any interruption by reviewing the work schedule together.
- Adherence to the collateral conditions of the EIA, such as noise and vibration control, treatment of wastewater and solid waste, and disciplined behavior of the construction workers, is strongly required by the neighborhood residents. The Consultant should therefore maintain close communication with the focal person at the Centre to implement the construction work in harmony with the neighborhood residents.

(2) Supervision Plan

To appropriately supervise the construction work, the Consultant will dispatch an architect as a

resident engineer to the site, to be based in Kenya throughout the construction and procurement period. The role of the resident engineer covers the items below:

- To examine the plans and schedules such as the implementation plan, work schedule, procurement plan for construction materials, furniture and equipment, quality control plan and safety measures, and to instruct and advise the Contractor or to make adjustments with them when necessary
- To confirm the shop drawings, production drawings and sample products submitted by the Contractor and to give approval to them
- To grasp the progress status of the work on the construction and procurement, and to instruct the Contractor when necessary as well as to submit work progress reports to the organizations concerned of both countries
- To confirm the safety management plans formulated by the Contractor on how to secure safety at the site, to check the actual safety measures on the site, and to give advice when necessary
- To conduct inspections on the quality and the workmanship of each work and to advise the Contractor when necessary
- To make technical adjustments and to confirm the progress status of the work to be borne by the Kenyan side
- To support the issuance of certificates regarding payment and the implementation of various procedures upon completion of the work
- To conduct the inspections on the specifications, description and quantity of the planned equipment
- To conduct the inspections on completion of the work, to witness the handover of the facilities and equipment to the recipient country and to confirm the guidance by the Contractor concerning the operation and maintenance

To supervise the construction and procurement work in this Project, the resident engineer will be required to have a wide range of abilities to carry out various different tasks, including on-site coordination relating to equipment procurement, and close communication with the Kenyan organizations concerned in addition to the supervision of the general construction of the facilities. Therefore, it is necessary to select the resident engineer from among the engineers who have not only the technical expertise in construction but also a thorough knowledge of the facilities, equipment and the Japanese Grant Aid.

Furthermore, the project manager in Japan should assign engineers in various fields including architectural design, structural design, electrical and machinery design and equipment so that a system will be established to take care of the overall supervision of the Project, communication and coordination with the organizations concerned in Japan, and support for the resident engineer by

sharing the supervisory task of inspecting the materials and equipment procured in Japan. In addition, as the Project progresses, different professional engineers are to be dispatched for a short period of time to witness the inspection at the planned site or to give guidance on the construction work.

2-2-4-5 Quality Control Plan

The planned facilities have rigid structure of reinforced concrete and steel roof structure, natural stone masonry wall. The buildings are either one storey or two stories. The quality control will be focused on the procedures that will have a major impact on fundamental performance, such as the durability of the buildings. The quality control will be focused on the structure work (re-bar work, concrete work and steel structure work), roofing work, wall masonry work, and building service work, as described below. As regards the standards of the materials and tests, this Project will basically follow BS or KS, and refer to other standards if necessary, including SABS, European Norm (EN), JIS and so on.

- Prior to the commencement of each work, the Contractor should develop the work method document which include the process, specifications, materials, methods, procedures, test methods, and quality requirements, and submit to the Consultant for approval.
- Bearing subsoil: After the excavation, the subgrade reaction of the soil will be visually checked to see if there is any discrepancy with the test results from the ground investigation conducted during the preparatory survey.
- Reinforcing bars: A material quality check will be conducted based on the product test results issued by the manufacturer each time the reinforcing bars are delivered.
- Concrete: It is planned to utilize a ready-mixed concrete plant in the suburbs of Nairobi. The nominal concrete strength is C25 (25N/mm^3) and the compressive strength of concrete will be controlled at 28N/mm^3, up 3N/mm^3 from 25N/mm^3. The specified mix proportion will be decided based on the trial mix, and the slump, temperature, amount of the air and chloride content of fresh concre on sitewill be checked and recorded. In addition, compressive strength test will conducted on three specimens at 7 days and 28 days of age concrete by every 50m^3 and by every structural element.
- As it is relatively cool at the planned site, there is no necessity for special measures against concrete work in hot weather, but some necessary measures will be taken, such as sprinkling water over the aggregate, water temperature management and surface protection by sheets after the concrete is casted.
- The amount of chloride contained in the fresh concrete should not be allowed to exceed 0.3kg/m^3 in view of anti-corrosion.
- The steel fabricator will be carefully selected in view of quality control, and a consistent quality control will be conducted throughout the procedures, from the shop drawings, production, and anti-corrosion treatment to the product inspection.

- As for the masonry work, the quality will be controlled by specifying the unit weight or compressive strength, in view of the fact that the porous stone is tend to absorb water. Moreover, basically, stone blocks cut by machine are to be used, and the allowable deviation based on the local standards will also be specified. In addition, stone blocks will be laid horizontally using leveling lines.
- As regards the roofing work, based on specifications and standardized roofing techniques of the manufacturer, the actual roofing procedures will be thoroughly confirmed using the specified procedure documents and execution drawings. At the construction site, the actual roofing work will be carefully checked by clarifying the required accuracy and important parts such as the joints and the supporting metals.

2-2-4-6 Procurement Plan

(1) Construction Materials

Most of the construction materials can be acquired locally, and the basic principle of this Project as regards the construction materials is local procurement. The Project makes active use of materials that can be purchased locally as they will be preferable for the operation and maintenance once the facilities are completed. As for the materials and equipment that are difficult to procure locally or for which a certain quality must be ensured, purchases will be made in Japan. The table below is a list of suppliers of the main materials and equipment:

Table 2-23 Suppliers of Main Construction Materials and Equipment

Material name		Procured in Kenya		Procured in Japan	Remarks
		Domestic product	Imported product		
Construction Material	Sand	○			River sand are available from the suburbs of Nairobi
	Aggregate	○			ditto
	Cement	○			Multiple manufacturers exist, and Portland Pozzolonic Cement (CEM-IV 32.5) is widely available. Regular Portland Cement (CEM-II 42.5) is also available.
	Fresh concrete	○			Concrete plants are available within ninety minutes from the planned site. Further study will be needed to ensure the quality.
	Stone	○			Nairobi stone is widely available as exterior finish material. As the strength and specific gravity vary depending on the production site and type, specifications of this material must be properly designated.
	Wood	○			Raw timber procured in Kenya, Tanzania, or Congo is dried and sawed into timber in Kenya. Tree species include cypress, mahogany, etc.

	Plywood	○			Domestic products are available. Lumber core board and MDF are also available.
	Reinforcing bars	○	○		Twisted square bars are widely available, but the deformed bars (compliant with BS) are also manufactured domestically.
	Structural steel	○	○		Since the type of domestic product is limited, import products from UK, South Africa, etc. are widely available. Careful selection of fabricators is required in view of quality control.
	Roofing materials (steel plate/ steel sheet)	○	○		Both domestic and imported materials are widely available. Quality of the domestic products vary depending on the manufacturer.
	Metal door and window frame	○			Domestic products, both steel and aluminum are widely available. Types and accessories of products are limited.
	Porcelain tiles	○	○		Domestic and imported products are widely available, but many of them are print type which are vulnerable to friction. Products imported from Italy or Spain are homogeneous type which are durable and friction resistant.
	Terrazzo tiles	○			Domestic products are available and marble chippings are imported.
	Paints	○			Multiple manufacturers exist in Kenya.
	Hardware		○	○	Products from UK, India and China are widely available. Inspection hatches and expansion joint cover, etc. will be procured from Japan.
	Boards	○	○		Plaster boards and acoustic boards are available.
	Scaffolding materials	○			Formwork materials and supports are available both in wood and steel. Separators and inserts, etc. for the exposed concrete work will be procured in Japan.
Service equipment	Pipes	○	○		Domestic and Indian products are available.
	Sanitary ware ceramics & faucets		○	○	Products from UK, India and China are available. Grab bars, emergency showers, mirrors, paper holders will be procured in Japan.
	Wires and cables	○			Domestic products are widely available.
	Lighting apparatus, sockets, switches		○		Products from UK, India and China are available.

(2) Equipment

In principle, equipment for this Project will be procured in Japan or Kenya.

Concerning the equipment for mathematics and science education and education furniture, since the Japanese products have a certain level of quality and competitiveness in tender between multiple manufacturers is ensured, all the equipment other than the refrigerator are planned to be procured in Japan. Since the refrigerator for raw meat used in the training curricula is widely available in Kenya, it is planned to be procured in Kenya with certain specifications to secure the quality.

Concerning the lecture support equipment requiring installation such as audio equipment, projectors and screens, since a certain level of skill is required to install such equipment, these equipment are planned to be procured in Japan, and a supervisor for the installation work will be dispatched from Japan. Equipment other than the ones mentioned above including PCs, are planned to be procured in Kenya with certain specifications to secure the quality since many agencies and distributors exist in Kenya.

Concerning the equipment for the hostels, kitchen and dining hall, Kenya has a number of manufacturers of stainless steel products, which are often the agents of cooking appliances of Europe and other countries. These Kenyan companies have already delivered their products to CEMASTEA in the past, and there have been no problems with their products. Therefore, under the procurement plan in this Project, cooking appliances can also be procured from the third-country manufacturers with specific conditions to secure a certain quality level. As for stainless steel products, however, domestically manufactured Kenyan products are to be acquired.

(3) Transport Plan

In principle, the materials and equipment will be transported from Japan by sea. Construction materials will be packed in crates or put into containers, as the volume of the construction materials to be transported is small. Equipment is to be put into containers for transportation. They have frequent consolidated shipping services from Japan to the Mombasa Port, which is the biggest trade port of Kenya. Freight from Japan undergoes customs inspection at the bonded warehouse in the port. After the inspection, the Contractor will transport the freight to the planned site by trailer. The road condition between the port of Mombasa and the planned site in Nairobi is good enough to allow the transportation of the freight easily and securely. It is expected to take about six weeks for the shipment of the materials and equipment from Japan to reach the site, including the time required for customs clearance. The freight from third countries, if applicable, will be put into containers and landed at the Mombasa Port.

2-2-4-7 Instruction of Operation and Training

It is planned to provide an instruction of operation following the delivery, installation and adjustment test of the equipment. The Contractor will provide an instruction, under the supervision of the Consultant to make sure that this instruction is properly conducted. When the equipment is handed over, the Consultant will confirm if the director and persons in charge of CEMASTEA are able to operate the equipment by themselves.

This Project has no plan of offering trainings of the operation.

2-2-4-8 Soft Component Plan (Technical Assistance)

The Ministry of Education and CEMASTEA will contract with an environmental consultant to establish and implement a monitoring system regarding the environmental considerations during the construction and the operation phase, since the Ministry of Education has no environmental specialist. The Japanese side will provide technical information to assist this environmental consultant, but will not offer soft-component cooperation (technical assistance) from the perspective of capacity building of the implementing organization.

2-2-4-9 Implementation Schedule

Under the Japanese Grant Aid, the Project would be implemented through the following phases after the Exchange of Notes (E/N) and Grant Agreement (G/A) are concluded:

(1) Detailed Design (approx. 3.5 months)

The Consultant will conclude a consultancy agreement with the implementing organization of Kenya and develop the detailed design drawings and tender documents. The Consultant will come to Kenya for meetings with the implementing organization when they commence their work and explain the drawings and tender document for the final approval which will complete the work. The period from the conclusion of agreement to the completion of this phase is estimated to be about 3.5 months.

(2) Tender (approx. 3.0 months)

After the approval of tender documents, the Consultant act on behalf of the implementing organization and advertise an invitation to prequalification (P/Q) on a paper and conduct the P/Q to confirm the capability and resource of potential tenderers to perform the particular work. The tender documents will be delivered to the passed tenderers and the prepared tenders will be opened in the presence of the representatives from the implementing organization.

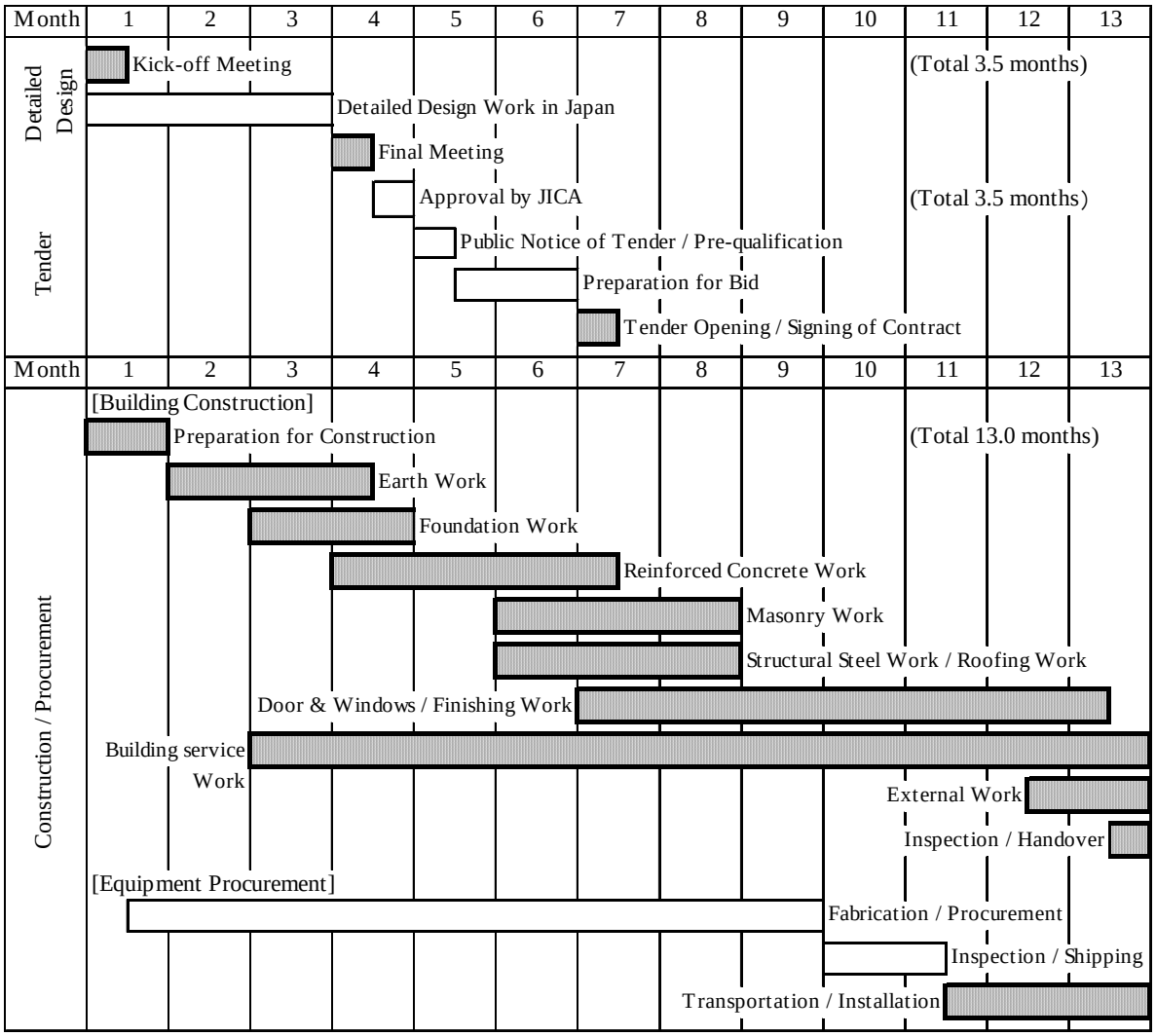
The tenderer who proposes the lowest price will win, if the content of the bid is evaluated as appropriate, and concludes a contract on the construction work and equipment procurement with the implementing organization. The period of time required between the public announcement of the P/Q and conclusion of the contract is estimated to be about 3.0 months.

(3) Construction/Procurement (approx. 13.0 months)

After signing the contract, the Contractor will commence the construction work and the procurement of equipment. In consideration of the scale and the specific conditions of the construction work and the local labor efficiency, it will take about 13.0 months to carry out the construction, procurement and installation work. This estimation is based on the assumption that the material and equipment procurement will proceed smoothly, and that the necessary procedures will be conducted without delay by the organizations concerned on the Kenyan side, and that the work undertaken by the Kenyan side will proceed smoothly.

The following table lists the implementation schedule explained above:

Table 2-24 Implementation Schedule



2-3 Obligations of the Recipient Country

In implementing this Project with the Japanese Grant Aid Scheme, the obligations of the Government of Kenya will include the following. Through the discussions of the field survey, the Ministry of Education and CEMASTEA agreed to implement these obligations and nominate the director and the program coordinator of CEMASTEA and the deputy director of the Field Service Division, MOE for responsible persons. Since the responsibility of CEMASTEA under this Project will be extensive, CEMASTEA needs to implement each of its obligations one by one through close communication with the Japanese side.

Furthermore, although it is estimated that the initial investment cost will be 23.8 million Ksh to cover items (1) to (4) as calculated in 2-5-1 (2), a budget request for 43.7 million Ksh has been made for fiscal 2011/12, so it is deemed that there will be enough budget to cover the cost of the undertakings.

(1) Preparatory Phase of the Construction

No.	Item	Timing/Deadline	Responsible organization
1)	Development of EMP according to the Clause 1.8 of EIA License dated on 23rd April, 2010 and report to JICA	By the end of August, 2011	CEMASTEA
2)-1	Holding of a stakeholders meeting involving the neighborhood residents to explain the outline design of the Project	By the end of May, 2011	CEMASTEA, MOE FS Dept.
2)-2	Holding of a stakeholders meeting involving the neighborhood residents to explain the EMP (The Consultant drafting the EMP should attend as well.)	By the end of August, 2011	CEMASTEA, MOE FS Dept.
2)-3	Holding of a stakeholders meeting involving the neighborhood residents to explain the demolition work program (The Contractor of the demolition work should attend the meeting as well.)	By the end of November, 2011	CEMASTEA, MOE FS Dept.
2)-4	Holding of a stakeholders meeting involving the neighborhood residents to explain the construction program (The Contractor of the construction work should attend the meeting as well.)	Within half a month after signing of the contract	CEMASTEA, MOE FS Dept.
3)-1	Acquisition of demolition permit (from NEMA) according to the Article 14, Second Schedule of EMCA (Environmental Management & Coordination Act) (Noise and Excessive Vibration)	By the end of November, 2011	MOE FS Dept.
3)-2	Registration of workplace (with NCC) according to the Article 44 of OSHA (Occupational Safety and Health Act), 2007, and acquisition of certificate for plans for workplace premises (from NCC) according to the Article 125 of OSHA	Before the commencement of demolition work	MOE FS Dept.
3)-3	Notification of the commencement of the demolition work (to NCC) according to the Article 9 (1)(b) of Building Code	Before the demolition work	MOE FS Dept.
3)-4	Demolition of the former administration building	By the end of December, 2011	CEMASTEA
4)-1	Acquisition of removal permit for indigenous tress (from NEMA or the Ministry of Natural Resources)	By the end of November, 2011	MOE FS Dept., CEMASTEA

4)-2	Removal of existing trees in relation to the construction of the training and administration complex	By the end of December, 2011	CEMASTEA
4)-3	Preservation of saplings (young trees) to be transplanted after construction (or preparation of the plan to plant indigenous trees after the completion of the work)	By the end of November, 2011	CEMASTEA
5)	Removal of existing fences, sheds, rainwater drainage ditches and concrete structures in relation to the construction of the training and administration complex	By the end of December, 2011	CEMASTEA
6)	Relocation of aerial wiring and poles, buried power cables, rainwater drainage ditches, and pits in relation to the construction of the dining hall	By the end of December, 2011	CEMASTEA
7)	Acquisition of building permit (from NCC) according to the article 9 of Building Code	By the end of January, 2012	MOE FS Dept., MOPW
8)-1	Registration of workplace (with NCC) according to the article 44 of OSHA (Occupational Safety and Health Act), 2007, and Acquisition of certificate of plans of workplace premises (from NCC) according to the Article 125 of OSHA	Before the commencement of the work	MOE FS Dept.
8)-2	Notification of the commencement of work (to NCC) according to the Article 9 (1)(b) of Building Code	Before the commencement of the work	MOE FS Dept.
9)	Employment of a clerk of work (who will be a future member of maintenance staff)	Before the commencement of the work	CEMASTEA

(2) Construction Phase

1)	Implementation of EMP and report to JICA	At the necessary point	CEMASTEA
2)	Holding of a regular meeting involving the neighborhood residents to explain the progress of the work	At the necessary point	CEMASTEA
3)	Acquisition of permit for excessive noise generated by the construction work (from NEMA) according to the Article 18 of EMCA (Noise and Excessive Vibration)	At the necessary point	CEMASTEA
4)	Planting of kei apple hedges along the property boundary	By the end of the completion of construction work	CEMASTEA
5)	Extension and connection of high voltage power line and additional city water to the planned service equipment	Three months prior to the completion of construction work	CEMASTEA
6)	Reconnection of city water to the planned tank (including change in the pipe diameter)	Three months prior to the completion of construction work	CEMASTEA
7)	Installation of communication aerial and establishment of an account with an internet service provider (for internet connection and IP phone)	Three months prior to the completion of construction work	CEMASTEA
8)	Relocation of the existing LAN (local area network system within the facilities)	Within one month after the completion	CEMASTEA
9)	Refurnishing of the existing ICT laboratory including increase in PCs, refurnishing of the water and power supply to the existing kitchen for the installation of the equipment in the Project	By the end of the completion of construction work	CEMASTEA

10)	Subscription to CATV (or extension of existing cables) and preparation of necessary equipment (if necessary)	(At appropriate time)	CEMASTEA

(3) General Tasks Before and During Construction

1)	Establishment of Banking Arrangement (B/A) and payment of commissions to the bank (in Japan)	Promptly after E/N	MOE FS Dept., MOF
2)	Issuance of Authorization to Pay (A/P) and payment of commissions to the bank (in Japan)	At the necessary point	MOE FS Dept., MOF
3)	Exemption of taxes including VAT, local taxes and various duties imposed by GOK on purchases of products and services under the verified contract, for Japanese nationals and third-country workers	At the necessary point	MOE FS Dept., MOF
4)	Ensuring of prompt unloading and customs clearance of the materials and equipment imported from Japan and other countries at the port of disembarkation, and assistance for internal transportation of the materials and equipment	At the necessary point	MOE FS Dept., MOF
5)	To accord Japanese nationals and persons from any third country, whose services may be required in connection with the supply of the products and the services, such facilities as may be necessary for their entry into Kenya and stay therein for the performance of their work	At the necessary point	MOE FS Dept.

(4) Preparations for Operation Phase

1)	Acquisition of an effluent discharge license (from NEMA) according to the Article 16 of EMCA (Water), and signing of maintenance contract for wastewater treatment plant (with wastewater treatment service company)	Within one month of completion of work	CEMASTEA
2)	Procurement and relocation of the general furniture and office stationery that are not covered by the Project	Within one month of completion of work	CEMASTEA
3)	Transplanting of saplings and other planting work	Within one month of completion of work	CEMASTEA
4)	Provision of gas containers used in laboratories and connection of gas regulator to the main pipes of the building	Within one month of completion of work	CEMASTEA

(5) Operation Phase

1)	Implementation of EMP according to the Clause 1.8 of EIA License dated on 23rd April, 2010 and report to JICA		CEMASTEA
2)	Purchase of consumables and replacement parts necessary for maintenance of the facilities and equipment	At the necessary point	CEMASTEA
3)	Proper and effective utilization and maintenance of the facilities and equipment	At the necessary point	MOE FS Dept., CEMASTEA
4)	Implementation of environment audit according to the Clause 1.7 of EIA License dated on 23rd April, 2010 and report to NEMA and JICA	Within one year of completion of construction work	CEMASTEA

2-4 Project Operation and Maintenance Plan

2-4-1 Operation Plan

(1) Operational Structure and Organization

Although the organizational structure after the implementation of this Project will be the same as that of present, the numbers of staff by rank and service were shown in the table below. This personnel plan after the expansion has been already approved by the Teachers Service Commission (TSC). The number of academic staff will be increased by 11 from 49 to 60, while the number of non-academic staff will be increased from the current 23 to 34 (all to be employed by CEMASTEA). As a result, currently vacant positions, for example, librarian and receptionist, will be filled. In addition, during the construction period under this Project, a clerk of work with technical expertise will be deployed as the representative of CEMASTEA and such person will be employed regularly as the maintenance and management staff at the Centre after the handover of the completed facilities.

*The clerk of work will be an engineer without an academic degree but with vocational training.

Table 2-25 Planned Staff Composition of CEMASTEA

Department / Rank & Service	Current No. of staff	Planned No. of staff
Total	72	117
Academic staff	49	60
Administrative staff	3	2
Director	1	1
Deputy director	1	1
Program coordinator	1	
Biology	9	58
Dean	1	*
Head of Department	1	
Lecturer	7	
Chemistry	13	
Dean	1	
Head of Department	1	
Lecturer	11	
Mathematics	12	
Dean	1	
Head of Department	1	
Lecturer	10	
Physics	11	
Dean	1	
Head of Department	1	
Lecturer	9	
ICT/Research and Development	1	
Coordinator	1	
Non-academic staff	23	57

Finance department	5	5
Finance & Accounting	3	3
Procurement	2	2
HRM & Administration	11	17
HR management	1	2
Administration	6	8
Receptionist		1
Record keeper		1
Technician in lab/ ICT	4	4
Librarian		1
Catering & Housekeeping	4	23
Cook	2	10
Table setter (catering, waiter/waitress)	2	5
Laundry	1	4
Cleaning		3
Nurse		1
Security/Vehicle Repair Work	1	11
Security		3
Warehouse keeper		2
Driver		5
Mechanic	1	1
Internal Audit	1	1
Audit Officer	1	1

(2) Training plan

Refer to 2-1 (3).

2-4-2 Maintenance Plan

(1) Maintenance System

Operation of the Centre, including running of the training courses, is conducted under an organizational system led by the Board of Governors. So far as the maintenance of the facilities and equipment is concerned, the administrative staff in charge takes care of the daily inspections and management and, in case any problems requiring repair are found, the Centre places an order to the external contractor. For maintenance and management of the facilities and equipment after the implementation of this Project, the administrative staff in charge or the clerk of work described in 2-4-1 will be responsible for daily inspection and management. In addition, as needed, repair, maintenance and replacement of supplies will be outsourced to external contractors. Under this Project, basically, easy-to-use machinery, electrical equipment and systems available locally will be introduced as they now are in the existing facilities.

Table 2-26 Items to be Outsourced and Number of External Contractors

(Technology and Utility Services Only)

Item	Number of suppliers
Water supply and drainage installation, electrical work, and related work	6
Supply and delivery of gas and charcoal	3
Water supply and delivery	4
Insurance services (travel, building, employee compensation)	5
PC-related maintenance and repair (PC, software, network maintenance)	3
Supply and maintenance of generator	5
Travel/rental car services	7
Maintenance and installation of OA equipment such as copy machine, printer, shredder, etc.	2
Supply and maintenance of communication equipment such as PBX, telephone, FAX, etc.	5
Cleaning services	4
Internet provider	6
Installation and maintenance of laundry machine, water boiler, refrigerator and other cooking appliances	3
Security and safety services	5
Supply, delivery and maintenance of furniture	3
Supply and delivery of fuel for diesel appliances	1
Supply of bed linen and curtains	3
Training and human resources development	8
Program development for PC	1
Environmental consulting and monitoring services	1
Maintenance of wastewater treatment plant	1

Source: “2010/11 Public Notice for Examination of Qualifications of Suppliers of Goods and Service”

In the same manner, the planned equipment that would require the professional services can be supported by the capable local agencies.

(2) Maintenance Method

By excluding advanced systems and complicated specifications, the design of the planned facilities has achieved an easy maintenance, but in order to keep the buildings in a good condition for a long time, the Centre needs to ensure daily cleaning and inspections to avoid problems caused by wear, tear and ageing at an early stage.

- Regular cleaning: Daily, weekly and quarterly cleaning schedules will need to be developed in order to achieve regular cleaning by the cleaning staff
- Regular repair of the facilities: To repair the worn, torn or aged parts of the facilities, regular inspections and repairs will be needed, including annual inspections of the doors and windows, touching up of the painted areas every three years and repainting every ten to fifteen years, and so on.

- Maintenance of the building services: Daily “preventive maintenance” will be important before any damages or waste of consumables occur. The life of building services can certainly be extended by proper operation, daily maintenance, lubrication, adjustment, cleaning, fixing and so on.
- In the Project, the building services which are widely used in Kenya were adopted and complicated systems were excluded. The Centre needs to establish a system to conduct minor repairs, replacement of parts and so on by themselves, based on the maintenance manuals to be provided upon completion, and outsource regular inspections of pumps and power generators to external contractors.
- Maintenance of outdoor utilities: The drainage pits will require an inspection and cleaning about twice a year, and the septic tanks will require annual cleaning and sludge removal. For the wastewater treatment plant which has many aeration and other pumps, the Centre needs to conduct regular inspections on a quarterly basis and annual replacement of ozone cells.
- Maintenance of the equipment: Inspection, maintenance and replacement of consumables and spare parts will be carried out in accordance with the users’ manuals provided by the suppliers. Each department which keeps the equipment will be required to develop the inventory and the maintenance record for the well-maintenance of the equipment.

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

(1) Costs to be borne by the Japanese Side

Not to be disclosed until the Contractor are approved.

(2) Costs to be borne by the Kenyan Side

Table 2-27 Costs to be borne by the Kenyan Side

Estimated project cost: approx. 24.7 million JPY

Item	Estimated cost (million Ksh)	(million JPY)
Demolition of the existing facilities, indigenous trees and infrastructure	4.64	4.82
Hedge along the property boundary	2.94	3.06
Extension of high voltage power line to the facilities	1.80	1.87
Communication-related contract and extension of communication line to the facilities	2.85	2.96
Curtains, furniture, office stationery	3.71	3.85
Supply of furniture and PCs to the existing ICT laboratory, and	2.47	3.41

power enhancement and water supply for the kitchen		
Service charges for the building permit and the excessive noise permit	0.25	0.26
Commissions paid to the bank, such as bank arrangement and payment commission	1.00	1.04
Establishment of EMP and implementation of the monitoring program and stakeholders meetings	4.10	4.26
Total	23.75	24.70

(3) Conditions for Estimate of Accumulation

- Estimated as of ：February 2011
- Exchange Rate ：1 Ksh (local currency) = 1.04JPY, 1USD = 84.46JPY
- The period required for detailed design, construction and procurement is as shown in the implementation schedule.
- Others: Estimate of Accumulation is to be conducted on the basis of the Japanese Grant Aid Scheme

2-5-2 Operation and Maintenance Costs

The following is a preliminary calculation of the costs expected to be required for operation and maintenance of this Project.

(1) Personnel Emoluments

Although the number of academic staff will increase from 49 to 60 as a result of the implementation of this Project, the increase of academic staff will have no impact on the budget of the Centre as the Ministry of Education directly pays their salaries. However, the Centre will cover all the increased personnel costs for the 34 non-academic staff members, up from 23 to 57 members. The average basic salary of the non-academic staff is 201,000 Ksh (the median of the minimum salary of each rank in the organization). Therefore, assuming that the average annual personnel cost per person will be about 402,000 Ksh, twice as much as the above-mentioned salary including allowances, it is estimated that the total increase will be 13,668,000 Ksh, which is equal to 402,000 multiplied by 34.

(2) Training Expenses

Based on the planned training programs to be implemented after the expansion of the facilities is completed, the training expenses calculated independently by CEMASTEA will be 350,252,000 Ksh. Since the budgeted training expenses are 200,000,000 Ksh, this corresponds to an increase of 150,252,000 Ksh.

(3) Utility Charge

Water and power charges are calculated as follows:

1) Water Charge

Water will be provided from three sources, namely, the groundwater, public water and water tank trucks. The estimated supply and demand for water is shown below. The required amount of water will be doubled from 6,000 m^3 in 2010, as shown in the table below, to 12,000 m^3, as a result of which the estimated water costs will be 1,237,000 Ksh.

- Public water: 5,000m^3 × 53.8 Ksh = 269,000 Ksh
- Water tank trucks: 387 units × 2,500 Ksh = 968,000 Ksh

Table 2-28 Estimated Supply and Demand for Water

■ Demand side	Full operation	Weekend during training course	Period without training courses
[A] Number of days	208	40	117
[B] Required water amount per day (m^3/day)	44	33	15
[A] × [B]	9,079	1,336	1,755
Required amount of water per year (m^3)			12,170

■ Supply side	Water supply per year (m^3)	Remarks
Well water	3,300	Estimated water supply for 2010
Public water	5,000	4 m^3 (approx. half that of Japan) × 12 hours × 2 days × 52 weeks
Water trucks	3,870	10 m^3/unit × 387 trucks

2) Electricity Costs

- Assuming that the existing facilities (hostel, dining hall, laboratories and lecture room) use electricity in the present manner, only the power used by the newly constructed facilities is calculated as an increase.
- Assuming that the utilization ratio is estimated at 80%, i.e. on weekdays only (five days a week), the facilities are estimated to be used 208 days a year.
- Electricity use per day, hours of use and the utilization ratio are as follows:

Table 2-29 Hours of Use and Utilization Ratio of Electrical Services

	Disaster prevention equipment	Lighting (daytime)	Lighting (nighttime)	Power socket load	Lab equipment	Kitchen equipment	Pump-related
Time	24hr	7hr	3hr	12hr	4hr	8hr	24hr
Demand factor	100%	20%	80%	20%	60%	60%	60%

It has been calculated that the electric power used by the facilities after the implementation of

the Project is estimated to be 159,990 kWh, and the estimated cost is as follows:

- [Base charge 2,500 Ksh × 12 months] + [Power rate 4.73 Ksh × 159,990 kWh] = 787,000 Ksh

(4) Communication Charge

This Project intends to use IP phones as part of the Internet system for the facilities, and it is difficult to calculate the cost at this point as it depends on the communication speed and charging system of the Internet service provider. In this report, it is estimated to be double the 1,849,000 Ksh for 2010, and therefore, an increase of 1,849,000 Ksh is estimated.

(5) Operation and Maintenance Costs

1) Facilities Operation and Maintenance Costs

The cost of the operation and maintenance of the planned facilities is calculated as follows:

- The cost of general repair work is calculated by referring to the operation and maintenance costs in Japan, including the following: partial touchup and repainting of interior and exterior steel areas, partial repair of roofs and ceilings, replacement of damaged hardware and light bulbs, replacement of faulty equipment such as pumps and panels, repair of damaged furniture and doors/windows, and so on. The recurring operation and maintenance costs of the planned facilities based on the content and specifications are estimated as shown below.
  - Operation and maintenance cost of the buildings: direct construction cost of buildings × 0.6%　(general figure used in Japan)
  - Operation and maintenance cost of the utilities: direct construction cost of the utilities × 1.67% (25% of which is assumed to be for pumps, panels and other equipment to be renewed after 15 years)
  - Operation and maintenance cost of the furniture: direct cost of the furniture × 5.0% (assumed to be renewed after 20 years)
- The items below are the costs unique to this Project.
  - Regular inspection services at the wastewater treatment plant and replacement of ozone cells: 266,000 Ksh
  - Sludge removal from water purifier tank and cleaning of water catch pit: 150,000 Ksh (once a year).

As a result of the above-mentioned calculation, the operation and maintenance costs are estimated to increase by 3,517,000 Ksh due to the implementation of this Project.

Table 2-30 Facilities Operation and Maintenance Cost Estimation (per annum, thousand Ksh)

General Operation and Maintenance Cost			Project-Specific Cost	Total
Construction O&M	Service O&M	Furniture O&M		
1,292	1,542	267	416	3,517

2) Equipment Operation and Maintenance Costs

Most of the planned equipment in this Project does not require any special costs for the operation and maintenance. The table below shows the necessary costs estimated for consumables and replacement of the parts required for some of the equipment. As a result, there will be an increase of 532,000 Ksh per year for the general equipment, excluding a bus, and an increase of 639,000 Ksh for buses.

Table 2-31 Equipment Operation and Maintenance Cost Estimation

Code No.	Equipment name	Quantity	Consumables	Amount used per year	Unit price thousand Ksh	Total price thousand Ksh
LS-3	Projector	6	Lamp	6	60	360
PC-2	Printer	1	Toner	5	20	100
LH-2	Projector	1	Lamp	1	50	50
LR-4	Whiteboard	4	Marker pens (4 colors)	10	4	4
KD-37	Coffee urn	1	Filter	6,000	0.003	18
Total						532

Table 2-32 Annual Bus-Related Costs (unit: thousand Ksh)

Item	Quantity	Unit price	Annual cost	Remarks
Driver's monthly salary	12	35	420	1 person
Fuel (diesel)	1470	0.108	159	Amount = annual mileage 8,380 km / the amount of fuel consumption Calculated using 108 Ksh/L (past records) and fuel consumption of 5.70 km/L
Inspection	1	30	30	
Insurance	1	30	30	
Total			639	

(6) Others

600,000 Ksh is expected to be required for the expenses for outsourcing the EMP monitoring work during the operation phase.

(7) Summary of Operation and Maintenance Costs

Summarizing the above-mentioned calculation, the total annual cost of the operation and

maintenance by implementing the Project will be 516,572,000 Ksh or 537 million JPY, an increase of 173,081,000 Ksh or 180 million JPY from fiscal year 2010/11, which accounts for 50% of the actual expenditure for those years, which was 343,491,000 Ksh or 357 million JPY. The largest part of the rise is accounted for by the training expense, which account for approximately 87% of the total increase, or 150,252,000 Ksh or 156million JPY. In addition, taking into account the inflation rate* for approximately two years from now until the commencement of the operation, the training costs will be 574,944,000 Ksh (¥598 million).

* The inflation rate for 2012 is expected to be 5.5% (IMF), so the inflation rate to be applied to compensation will be: 1.055 x 1.055 = 1.113.

It has been confirmed that the draft KESSP II also keeps the policies to provide in-service training courses for teachers of primary and secondary education, and includes a budget plan of training courses. Therefore, it is considered that the increased costs due to the implementation of this Project can be borne without difficulties.

Table 2-33 Estimation of Annual Operation and Maintenance/Management Costs

(unit: Thousand Ksh)

Expense item	Details and basis	Increase in annual costs	2010/11 Budget	Budget after project implementation	After inflation compensation
		[A]	[B]	[C]=[A]+[B]	[C]×1.113
Personnel emoluments	Increase of non-academic staff to 34	13,668	7,912	21,580	24,019
Water supply	Calculated based on the estimation of the demand and distribution of water supply by the groundwater, public water and water trucks based on the planned training programs for 2014	1,237	6,500	8,524	9,487
Power consumption	Usage rate is established for each of the newly introduced facilities, on the assumption that there will be no change in the existing facilities.	787			
Communication	On the assumption that it will be twice the current figure	1,849	1,849	3,698	4,116
Travel and allowances			6,863	6,863	7,639
Printing and advertisings			4,400	4,400	4,897
Training expense-current exp.			34,558	34,558	38,463
Hospitality supplies			2,950	2,950	3,283
Insurance			5,800	5,800	6,455

Specialized materials	Expected as outsourcing costs for the EMP monitoring	600	19,750	20350	22,650
Other operational expenses	Accounted for as costs for environmental monitoring work during the operation phase		11,239	11,239	12,509
Office supplies			1,400	1,400	1,558
Facilities maintenance and management	Established based on the assumption of proper renewal frequency based on the total construction work costs of this Project	3,517	4,956	9,644	10,734
Equipment maintenance and management	Stock of supplies for the planned five pieces of equipment and regular replacement of parts	532			
	Estimation of bus maintenance and management costs based on the bus operation plan in this Project	639			
Office furniture			1,400	1,400	1,558
Research and study			3,614	3,614	4,022
Total current expenditure		22,829	113,191	136,020	151,390
Training expense-development	Estimated based on the planned training programs for 2014	150,252	200,000	350,252	389,830
Human resource development (TCTP, JICA)			20,000	20,000	22,260
Human resource development			5,300	5,300	5,899
Minor alteration and PC purchase			5,000	5,000	5,565
Total Development Costs		150,252	230,300	380,552	423,554
Total Operation Costs		173,081	343,491	516,572	574,944

*Source: Proposed Budget 2010/11, CEMASTEA

Chapter3 Project Evaluation

Chapter 3 Project Evaluation

3-1 Preconditions for Project Implementation

As preconditions for implementing this Project, matters for which the Kenyan side should be responsible are described in 2-3 and, in relation to those matters, particular attention should be paid to the following:

(1) A committee in charge of environmental issues should be established so that the Environmental Management Plan (EMP) will be implemented timely.

The implementation of the Project should be conducted in compliance with the collateral conditions set by the EIA license. If the Kenyan side fails to comply with the conditions, NEMA might take remedial actions which would obstruct the work progress. In implementing this Project, the most important precondition will be the timely implementation of EMP and the establishment of good relations with neighborhood residents. To this end, the Ministry of Education and CEMASTEA have already agreed to ensure that a committee in charge of environmental issues will be established and that the matters for which the Kenyan side is responsible will be implemented without fail, including the implementation of EMP (refer to appendix 4-2, Attachment 3-4).

(2) Timely Implementation of Demolition Works

In this Project, as it is planned to conduct construction works at the existing site, CEMASTEA needs to complete demolition of a number of existing facilities, structures and other buried underground structures in the area where the construction works are planned. In addition, the construction works need to commence within the effective period of the EIA license. Since the entire construction works will be deemed to have commenced when the demolition works start, it is also necessary to make sure that the demolition works will be implemented timely without fail. The scope of the demolition works is broad and includes demolition of the former administration building and its underground structure, underground cables and pipes, rainwater ditches around the existing dining hall building, electric poles, a number of warehouses and structures located in the southern part of the site and cutting down of the trees and digging away of the tree roots. In implementing the demolition works, the Centre needs to confirm with the Japanese side which facilities and structures should be demolished so as not to obstruct the commencement of the main work. To implement the demolition work, the committee in charge of environmental issues, described in the former section, needs to develop an implementation schedule and execute the following tasks with a technical support from the Ministry of Public Works without fail:

- Preparation of tender documents for the selection of contractors for the demolition works
- Tender announcement, evaluation of bidders' documents, selection and contracting
- Various necessary notifications to the regulatory authority prior to the commencement of the demolition works

- Explanation of the program of the demolition work to the neighborhood residents
- Supervision of the demolition works

The committee should be careful to prepare the tender document in compliance with the provisions of the EMP.

(3) Application and Acquisition of Various Permits Necessary for Facilities Construction

Prior to the commencement of the main construction works, the Ministry of Education and CEMASTEA need to obtain the building permit. The Ministry of Education and CEMASTEA will apply the permit, and the Ministry of Public Works will check the technical drawings and carry out the procedures of the permit. To apply for the building permit, the following documents will be required. The blueprint drawings will be provided by the Japanese side and other documents will be prepared by the Ministry of Education.

- Blueprint drawings (architecture, structure and facilities): 4 sets
- Architect licenses (architects from the Ministry of Public Works will substitute)
- Land ownership document (a letter of allotment, requesting issue of the document to the Ministry of Land will substitute)
- Survey map
- Charges

The proponent needs to commence the work within one year from the issuance date of the building permit and complete the work within two years from the commencement date of the work.

(4) Timely Implementation of Tax Exemption Procedures

There are two methods for tax exemption from value-added tax (VAT 16%): (i) To pay the tax and be refunded later; or (ii) To obtain a tax-exemption certificate instead of paying the tax. In principle, (ii) is applied and the tax-exemption procedures will be as follows:

- Following the conclusion of the construction contract, the contractor will promptly prepare a master list indicating details and prices of goods to be purchased for tax benefits and submit the list to the Ministry of Education. Then, the Ministry of Education will submit the application document to the Ministry of Finance to obtain an approval of the Finance Minister.
- After obtaining the approval of the Finance Minister, the Ministry of Education will apply for a tax-exemption certificate to the Kenya Revenue Authority. The Kenya Revenue Authority will collate the master list approved by the Ministry of Finance with the details of the application and issue the tax-exemption certificate.

In order to carry out the tax-exemption procedures timely without fail, the Ministry of Education needs to understand the process and establish a strong cooperation framework through due advance coordination with other organizations concerned including the Ministry of Finance and the Kenya Revenue Authority.

3-2 Necessary Inputs (Obligations) by Recipient Country to Implement the Overall Plan of the Project

As a precondition for delivering and maintaining of the effectiveness of the Project, it is considered that the Kenyan side should work on the following issues:

(1) Issues to be Undertaken by the Recipient Country

1) Continued provision of training programs through maximum utilization of the facilities

The effectiveness of this Project will be delivered by increasing the capacity of the Centre to receive trainees from the current number of 92 to 200 at a time and by offering training programs to 5,539 trainees per year on a total of 33 courses. The expansion of the facilities is the input for that purpose and, if training is offered as planned, the capacity operating rate of the facilities will be 83%. The most important precondition of this Project is that CEMASTEA should make the best use of the planned facilities as well as the existing facilities to run the training programs on a continuing basis for a total of 200 trainees at a time. Through discussions held during this study, the Ministry of Education recognized the low capacity operating rate in the past and agreed to monitor the rate on an ongoing basis so that the planned facilities can be effectively utilized.

In addition, if the Project progresses as planned, it is expected that the facilities will be completed and be in service by the latter half of 2013, while the Japanese technical cooperation project is scheduled to be completed in December 2013. Therefore, during the technical cooperation project period, preparations will be made to expand the training programs from 2013 onwards and support will be offered so that CEMASTEA can continue to run training programs in later years. In order to offer training programs on a continuing basis, the Ministry of Education needs to allocate sufficient budget to CEMASTEA by giving priority to the continuous implementation of the in-service training of teachers. CEMASTEA also needs to implement the training programs while continuously monitoring their effectiveness and offering advice and guidance.

The ongoing WECSA/TCTP (Third Country Training Program) should also be run even after the Japanese technical cooperation project is completed, which is another important issue for this Project to deliver its effectiveness.

2) Acquisition of budget necessary for the operation of the Centre and appropriate deployment of staff as approved

As for the operating costs of CEMASTEA, 343 million Ksh (approx. 356 million yen) for

FY2010/2011 have been allocated and this is expected to increase 1.67 times to 575 million Ksh (approx. 598 million yen) when this Project is completed. In order to ensure that the training programs described in the previous section will be offered on a continuing basis, the operating budget must be acquired in a stable manner. Furtheremore, in order to acquire the budget, the Centre needs to voluntarily explain the effectiveness of the training programs to the Ministry of Education as well as to taxpayers.

In addition, although CEMASTEA currently has the approval of TSC to deploy 60 academic staff and 57 nonacademic staff, 49 academic staff and 23 nonacademic staff are actually deployed. In order to offer training programs to a total of 200 trainees at a time after the completion of this Project, these staff should be deployed appropriately as approved.

3) Research and development of training programs

In order to deliver the full effectiveness of the training programs, CEMASTEA needs to sufficiently figure out the demands of the trainees and the status and issues of mathematics and science education and, thereby, to provide quality training programs. It is also important to develop an evaluation and monitoring system to confirm the effectiveness of the training programs and provide feedback for the future programs. Although the ICT/R&D (Research and Development) division of CEMASTEA currently has only one staff member, it is likely that the number of the personnel will increase in the future. It is necessary to promote research and development of efficient training programs under the leadership of the ICT/R&D division.

Also, to improve the efficiency of WECSA/TCTP (Third Country Training Program), it is important to understand the status of mathematics and science education and in-service training programs for teachers in Africa and to provide quality training programs to meet their demands.

4) Continuous operation of environmental management plan (EMP)

To continue the training activities of the Centre, an important issue will be the continuous implementation of EMP, which has three main issues, namely, appropriate management of water use, maintenance of the wastewater treatment plant, and appropriate management of the solid waste.

a. Appropriate management of water use

In the neighborhood of the planned site, since the groundwater resource is relatively scarce and the public water supply is limited, an important issue will be the control of water consumption. At the planned site, too, the groundwater is a major water source and, as stipulated in the EIA license, wasting of water and excessive pumping of water are not allowed. In this Project, the facilities will be designed to reduce the groundwater consumption through the use of public water and water trucks, the reuse of treated wastewater and use of rainwater. It is important, however, that the water usage will be managed comprehensively to reduce the consumption as much as possible.

The principle of water management should be carried out through recording of the water

consumption and sensitizing of the users on a water-saving issue. To this end, as it is stipulated in the EMP, the Centre needs to record water supply weekly by reading the borehole meter and also the meter for the public water supply, the number of water trucks, the number of trainees who stay within the site, to calculate the unit of consumption per person from these information for comparison with a target value. The form to be filled for the record is attached in the appendix.

b. Maintenance of wastewater treatment facilities

Since the wastewater treatment plant is a highly critical component for the operation of the facilities, the Centre needs to conclude a maintenance contract for the plant promptly after the handover of the facilities. In addition, for the septic tank, whose function is one step before that of the treatment plant, the Centre needs to remove sludge regularly, approximately once a year (included in the EMP items).

c. Appropriate management of solid waste

In view of sanitation and harmony with local communities, an appropriate management of solid waste will be an important management issue. CEMASTEA has concluded a contract for the solid waste disposal with a registered company in Nairobi and uses the periodic collection service of solid waste. This Project includes an installation of waste collection stations where waste is separated and stored until the collection. CEMASTEA will be required to maintain the system for the waste disposal and train its staff and trainees on a continuing basis.

5) Implementation of maintenance and management of planned facilities and equipment

In order to ensure that the facilities and equipment to be developed under this Project will be appropriately maintained and effectively used over the long term, they need to be maintained and managed sustainably. The Centre needs to develop a maintenance program which includes a routine inspection and a maintenance schedule by equipment and utilities, and facilities. The maintenance staff will conduct inspections and maintenance based on this program, and contract with the service company by item when he finds any trouble.

In addition, as the equipment such as pumps and motors require a regular inspection by an engineering company, the Centre needs to contract with companies for the regular inspections to avoid serious damages which would require regular exchanges of parts.

(2) Matters to be Complemented and Enhanced by Other Schemes

As mentioned above, the Centre will receive technical support from SMASE on progress, for the preparation and implementation of the training programs after completion of the Project. The Centre needs, however, to obtain support for the training programs which are not covered by SMASE, such as diploma teacher training and ICT training, from other organizations including foreign aid organizations and organizations other than CEMASTEA such as universities and various research institutes.

3-3 Important Assumptions

The important assumptions to allow this Project to deliver and maintain its effectiveness and, thereby, to enable the overall goal of the Project (i.e. improvement of the quality of education) to be achieved are as follows:

(1) National policies for in-service training of teachers should be continued.

The Sessional Paper No.1 of 2005 expresses the necessity of improving the capacities of teachers through continuous trainings. Based on this, KESSP I established priority investment projects which include “in-service training of teachers in primary education” and “in-service training of teachers in mathematics and science education.” In addition, these priority investment projects are carried over into draft KESSP II on work, which specifies that the capability of teachers should be improved sustainably through quality training programs so that the quality of education will be improved.

In order to deliver sustainably the outcome of this Project, the direction of these education policies needs to be maintained without any major changes. Particularly, as the education reform is being promoted, one of the important assumptions among others is that mathematics and science education will be advanced and the policy to sustainably provide in-service trainings to teachers will be kept. In addition, it is also important to develop a comprehensive policy on the education of teachers for an integrated program aimed at the improvement of quality of teachers, covering pre-service training (PRESET) as well as in-service education and training (INSET) of teachers, thereby harmonizing various programs of in-service education and training.

(2) Stable national finances should be maintained so that a proper budget will be allocated to education.

Currently, about 80% of the operational costs of CEMASTEA are allocated by the Ministry of Education and the budget of the ministry has been growing steadily for the past three years, remaining at a stable rate of around 16% of the total government budget. To maintain sustainably the outcome of this Project, the Government needs to allocate a steady budget for the training programs to CEMASTEA as well as to the local districts. To this end, the Government will be required to make efforts to stabilize the national finances for an appropriate allocation of a proper budget to the education field for a long period.

(3) A cascaded training system should function and the concept of ASEI/PDSI should permeate the education frontline.

This Project is considered to deliver its effectiveness when teachers at the frontline apply and utilize the concept of ASEI/PDSI that CEMASTEA advocates as necessary for daily teaching. To this end, it is necessary for the trainers and school managers trained at CEMASTEA to offer trainings in a cascaded manner in districts and divisions so that the trainings will be reached reliably to the teachers at the frontline. In addition, it is necessary that school principals and educational officers trained at CEMASTEA will provide trainings in districts so that school principals and QAS officers

at the frontline can receive the trainings and support the dissemination of the concept of ASEI/PDSI around the country. In this regard, CEMASTEA and the Ministry of Education need not only to provide the training programs but also to provide support to practice ASEI/PDSI at the educational frontline as much as possible.

3-4 Project Evaluation

3-4-1 Relevance of the Project

The relevance of this Project is recognized as follows:

(1) Beneficiaries of the Project

In this Project, the direct beneficiaries will be the training participants at CEMASTEA numbering 5,539 per year, consisting of the persons concerned in the education field, including INSET trainers, school principals and educational officers, as well as 117 staff members of the Centre. In addition, when INSET trainers who participated in the training at CEMASTEA implement in-service trainings of teachers in local districts, about 80,000 teachers of primary and secondary mathematics and science education and about 26,000 school principals across the country will indirectly benefit and ultimately, about 9.3 million students of primary and secondary school across the country will also benefit from this Project every year. At the same time, teachers and students of other African countries will also benefit from this Project, as capabilities of the INSET trainers in those countries will be enhanced through WECSA/TCTP (Third Country Training Program). In this way, this Project will benefit people of both Kenya and other African countries.

(2) Objective and Urgency of Implementing the Project

This Project, through upgrading and refurbishment of the training facilities of CEMASTEA, the only center in Kenya which offers in-service trainings of teachers specialized in mathematics and science education, aims at enhancing the quantity and quality of the training programs intended to enhance capabilities of the persons concerned in mathematics and science education in both Kenya and other African countries and, thereby, at contributing to the qualitative improvement of mathematics and science education in Kenya and other African countries. In order to improve qualitatively the mathematics and science education which remains stagnant, it is an urgent issue to enhance capabilities of the persons concerned in the education field through a continuous expansion of accessibility to training for such people including teachers of mathematics and science education and educational officers. However, since CEMASTEA is currently unable to offer sufficient trainings due to a lack and deterioration of the existing training facilities, it is urgently necessary to upgrade and refurbish the facilities.

(3) Contribution to the Achievement of Goal of Mid/Long-Term Development Plan

In its long-term development plan “Vision 2030”, Kenya strives to develop an industrialized

economy, improve living standards and international competitiveness and achieve economic prosperity by 2030. This Project will contribute to one of the strategies of Vision 2030, which is to ensure “Kenya will provide globally competitive quality education, training and research to her citizens for the development and enhanced individual well-being” through development of the core facilities to improve the quality of teachers on a continuing basis, thus contributing to the achievement of the national development goal.

Also, regarding this long-term development plan, KESSP I and KESSP II (planned) advocate the importance of sustainable improvement of the quality of teachers and establish priority investment projects which include “in-service training of teachers in primary education” and “in-service training of teachers in mathematics and science education.” Through the development of the core facilities which offer trainings to improve the capabilities of teachers on a continuing basis, it can be said that this Project will greatly contribute to the qualitative improvement of education which is the goal of Vision 2030 and KESSP Ⅰ.

(4) Conformance with Japanese Aid Policy

The basic policies of Japan’s ODA to Kenya include “encouraging self-help efforts of the Government of Kenya and supporting their efforts for poverty reduction and sustainable growth” and “considering regional approaches that will also benefit neighboring countries” (Ministry of Foreign Affairs, “Country Data Book”) and with respect to the human resource development, which is one of the five priority areas, “improvement of the quality and teaching methods of teachers of secondary mathematics and science education” is the policy for primary and secondary education. Also, in the TICAD IV Yokohama Action Plan, Japan committed to support “expansion of training for teachers of mathematics and science education” in the African region. This Project aims to develop the Centre for the training of teachers for the qualitative improvement of mathematics and science education in Kenya and Africa, and as such, it contributes to realize the objectives of the policy for the Japanese Grant Aid to Kenya and the African region.

3-4-2 Effectiveness

(1) Quantitative Effect

Through the implementation of this Project, the following quantitative effect will be expected:

- When this Project is implemented and the facilities of CEMASTEA such as training rooms and laboratories, ICT laboratory and lecture hall are newly constructed, it will be possible to develop more efficient training programs through effective use of entire facilities including the existing facilities. As a result, the number of training courses offered annually will increase from 18 (2010) to 33 (2016), which will lead to an expansion of training opportunities.
- When this Project is implemented, the capacity of the training facilities will be expanded and the number of people who can be trained simultaneously at CEMASTEA will increase

Table 3-1 Expected Quantitative Effect

Indicator	Reference (2010)	Target (2016)
Number of trainees per year	964	5,539
Number of training courses per year	18	33

(2) Qualitative Effect

It is expected that the implementation of this Project will bring about the following qualitative effect:

- Through the construction of the training rooms/laboratories and integration of the administrative functions, the training environment will be improved, thereby improving the quality of the training.
- CEMASTEA will be developed and enhanced as a center for training mathematics and science teachers not only in Kenya but also in Africa which will contribute to the improvement of mathematics and science education in Africa.

While this Project can be expected to bring about the above-mentioned effectiveness, it can also develop the important core facilities to implement in-service trainings of teachers across the country on a regular basis which are indispensable for the improvement of the capabilities of teachers of mathematics and science education, and support the qualitative improvement of education through enhancement of the capabilities of teachers on a continuing basis at which the Government of Kenya targets. Thus, this Project can contribute to the achievement of a sustainable development which is the overall goal of Vision 2030 through development of globally competitive human resources. In the same manner, it will also contribute to the development of Africa as a whole through the training of INSET trainers in mathematics and science education field in other African regions. Based on the above perspective, it is highly relevant to implement this Project with the Japanese Grant Aid Scheme, while this Project can also be deemed to have sufficient effectiveness.