

APPENDIX 4 MINUTES OF DISCUSSIONS

MINUTES OF DISCUSSIONS

BASIC DESIGN STUDY ON THE PROJECT FOR
THE REINFORCEMENT OF ELECTRIC POWER DISTRIBUTION NETWORK
IN KAMPALA SUBURBAN AREA
IN
THE REPUBLIC OF UGANDA

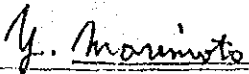
In response to a request from the Government of the Republic of Uganda, the Government of Japan decided to conduct a Basic Design Study on the Project for the Reinforcement of Electric Power Distribution Network in Kampala Suburban Area (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (JICA).

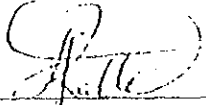
JICA sent to Uganda a study team, which is headed by Mr. Yasuhiro Morimoto, Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs, and is scheduled to stay in the country from June 8 to July 11, 1993.

The team held discussions with the officials concerned of the Government of Uganda and conducted a field survey at the study area.

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

Kampala, June 14, 1993


Mr. Yasuhiro Morimoto
Leader
Basic Design Study Team
Japan International Cooperation Agency


Mr. A.R. Rutta
Managing Director
Uganda Electricity Board

ATTACHMENT

1. Title of the Project

The official title of the Project is changed to "The Project for the Reinforcement of Electric Power Distribution Network in Kampala Suburban Area".

2. Objective

The objective of the Project is to rehabilitate the Kampala Electricity Distribution System in order to supply adequate and reliable power at all times to several important areas, thus contributing to revitalization of all various industrial, commercial and social activities and to improvement of living standard of inhabitant in Kampala suburban area.

3. Project Site

The Project sites are located in Kampala and Jinja as shown in Annex-I.

4. Execution Agency

Uganda Electricity Board(UEB) is responsible for the administration and execution of the Project.

5. Items Requested by the Government of Uganda

After discussions with the Basic Design Study Team, the following items were finally requested by the Ugandan side.

(1) Construction or Rehabilitation of:

- 1) Kawanda Substation (Rehabilitation)
- 2) Kisubi Substation (Rehabilitation)
- 3) Kawala Substation (New Construction)
- 4) Kisugu Substation (New Construction)
- 5) Ntinda Substation (New Construction)
- 6) Kampala South Substation (New Construction)

- 7) Njeru Substation (Rehabilitation)
- (2) Provision of Equipment and Materials
 - 1) Equipment and Materials for MV and LV Network for the Project
 - 2) Maintenance Vehicles for the Project

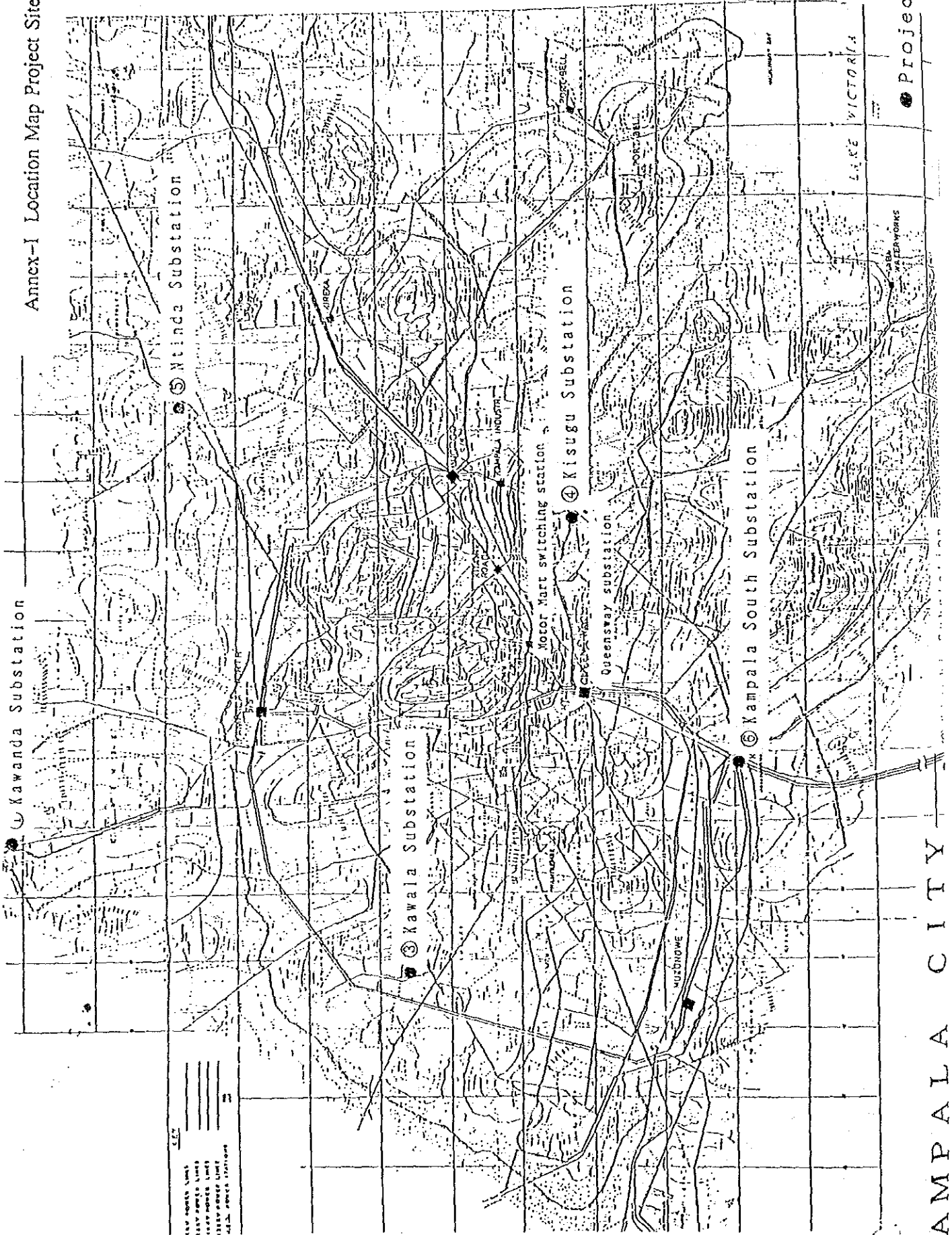
However, the final components of the Project will be decided after further studies.

5. Japan's Grant Aid System

- (1) The Government of Uganda has understood the system of Japan's Grant Aid explained by the team.
- (2) The Government of Uganda will take the necessary measures described in Annex II for smooth implementation of the Project, on condition that the Grant Aid assistance by the Government of Japan is extended to the Project.

6. Schedule of the Study

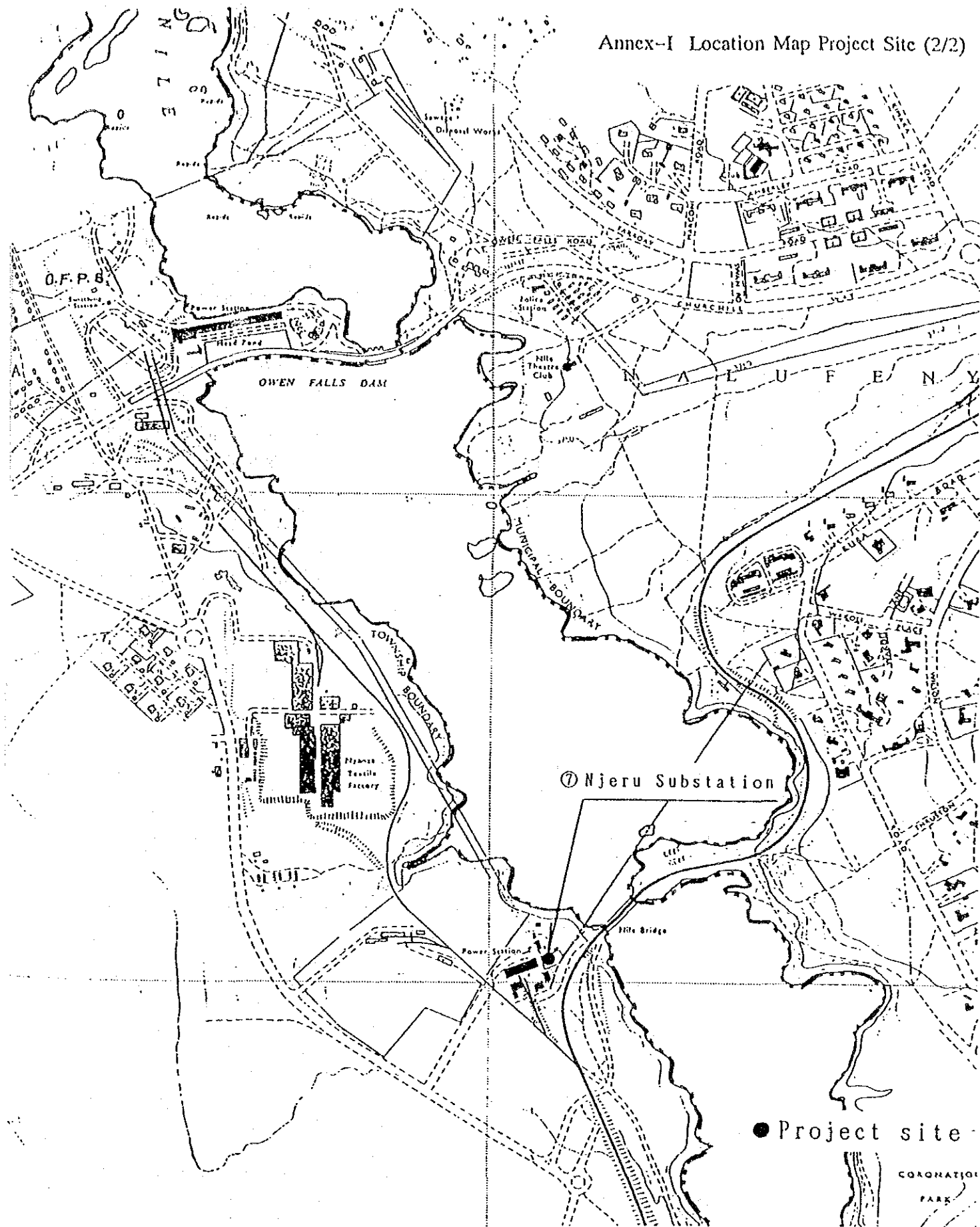
- (1) The consultants will proceed to further studies in Uganda until July 11, 1993.
- (2) Based on the Minutes of Discussions and technical examination of the study results, JICA will prepare a final draft report in English and dispatch a mission to Uganda in order to explain its contents by the middle of September, 1993.
- (3) In case that the contents of the report are accepted in principle by the Government of Uganda, JICA will complete a final report and send it to Uganda by the end of December, 1993.



Project site

KAMPALA CITY

M. m



JINJA CITY

g. m

ANNEX-II

UNDERTAKINGS BY THE GOVERNMENT
OF THE REPUBLIC OF UGANDA

- a) To secure and provide cleared, embanked and leveled land as well as access road for the Project prior to the commencement of the construction of the Japanese side.
- b) To provide the land for temporary site offices, warehouses and stock yards in the sites during the implementation period.
- c) To ensure speedy unloading, tax exemption, custom clearance of the goods for the Project at the port and/or airport of disembarkation.
- d) To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contracts such facilities as may be necessary for their entry into the Republic of Uganda and stay therein for the performance of their work.
- e) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the Republic of Uganda with respect to the supply of the products and services under the verified contracts.
- f) To bear commissions to a Japanese foreign exchange bank for the banking services based upon the Banking Arrangement.
- g) To bear all the expenses, other than those to be borne by the Grant Aid necessary for the execution of the Project.
- h) To provide proper arrangements for the construction, such as water supply, electricity, drainage, etc., if necessary.
- i) To assign exclusive-counterpart engineers and technicians to the Project in order to transfer the operation and maintenance technique for the Project and to witness and confirm construction when inspection are carried out.
- j) To take necessary measures and responsibility for the stoppage of electricity during a construction period, when it is necessary.
- k) To construct and connect the cables for incoming and outgoing feeders for substations which will be constructed under the Project.

- l) To dismantle and remove the existing equipment and facilities not to be used for the Project in the existing Substations.
- m) To provide a bench mark at the sites.
- n) To provide site drainage system and other facilities including outdoor lighting system, fire fighting system, telecommunication system, etc., at the sites, if necessary.
- o) To provide necessary data and information for the detailed design of the Project.
- p) To take necessary measures to expedite the approval for executions of the Project by the Government of Uganda.
- q) To control traffic during the inland transportation of the facilities of the Project, if necessary.
- r) To provide the disposal places of the surplus soil during the construction period.
- s) To secure the approval for access to public and private land for the Project.
- t) To secure the approval for protection works for the existing facilities, if necessary.
- u) To provide relay tap setting work regarding the transmission and distribution lines and study of the transmission and distribution network including relay protection coordination, short circuit calculation, etc.

MINUTES OF DISCUSSIONS

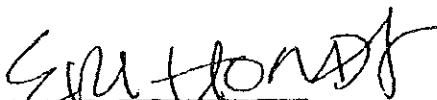
BASIC DESIGN STUDY ON THE PROJECT FOR
THE REINFORCEMENT OF ELECTRIC POWER DISTRIBUTION NETWORK
IN KAMPALA SUBURBAN AREA
IN
THE REPUBLIC OF UGANDA
(CONSULTATION ON DRAFT REPORT)

In June 1993, the Japan International Cooperation Agency (JICA) dispatched a Basic Design Study Team on the Project for the Reinforcement of Electric Power Distribution Network in Kampala Suburban Area (hereinafter referred to as "the Project") to the Republic of Uganda, and through discussions, field survey, and technical examination of the results in Japan, has prepared the draft report of the study.

In order to explain and to consult the Ugandan side on the components of the draft report, JICA sent to Uganda a study team, which is headed by Ms. Eri Honda, Planning Division, Planning Department, JICA, and is scheduled to stay in the country from September 4 to 9, 1993.

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

Kampala, September 9, 1993



Ms. Eri Honda
Leader
Draft Report Explanation Team
JICA



Mr. A.R. Rutta
Managing Director
Uganda Electricity Board

ATTACHMENT

1. Components of Draft Report

The Government of Uganda has agreed and accepted in principle the components of the draft report proposed by the team.

2. Japan's Grant Aid system

- (1) The Government of Uganda has understood the system of Japan's Grant Aid explained by the team.
- (2) The Government of Uganda will take the necessary measures, described in Annex, for smooth implementation of the Project on condition that the Grant Aid assistance by the Government of Japan is extended to the Project.

3. Further schedule of the study

The team will make the final report in accordance with the confirmed items, and send it to the Government of Uganda by the end of December, 1993.

4. Operation and maintenance for the facilities

The Government of Uganda stressed that it will allocate necessary budget for the works including operation and maintenance of the facilities to be constructed under the Project.

The Government of Uganda also confirmed that the MV and LV distribution materials to be procured under the Project will be utilized properly.

ANNEX: Necessary measures to be taken by the Government of Uganda in case Japan's Grant Aid is extended.

- a) To secure and provide cleared, embanked and leveled land as well as access road for the Project prior to the commencement of the construction of the Japanese side.
- b) To provide the land for temporary site offices, warehouses and stock yards in the sites during the implementation period.
- c) To ensure speedy unloading, internal transportation, tax exemption and custom clearance of the goods for the Project at the port and/or airport of disembarkation, and internal transportation in the Republic of Uganda.
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S.H. J

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E.H. *J*

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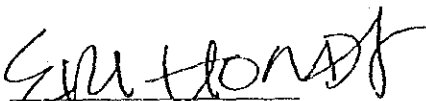
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S.H. *d*

APPENDIX 5 FIELD REPORT

THE BASIC DESIGN STUDY
ON
THE PROJECT FOR
THE REINFORCEMENT OF ELECTRIC POWER DISTRIBUTION NETWORK
IN
KAMPALA SUBURBAN AREA
IN
THE REPUBLIC OF UGANDA

FIELD REPORT

July 5, 1993

Yachiyo Engineering Co., Ltd.

Basic Design Study Team

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ATTACHMENT

- Attachment-1 Load Demand Forecast and Load Assignment Forecast to the Substation' 11kV Bus Bar in Kampala prepared by UEB
- Attachment-2 Load Demand Forecast and Load Assignment Forecast to the Substation' 11kV Bus Bar in Jinja prepared by UEB
- Attachment-3 33kV Network Plan prepared by UEB
- Attachment-4 Location of Project Sites
- Attachment-5 List of Distribution Materials and Vehicles requested by UEB

ANNEX

(Preliminary Basic Design Drawings)

	<u>Drawing No.</u>
1. KAWANDA SUBSTATION	
1) Oneline Diagram	BD-KWD-01
2) Outline of Outdoor Type 33kV Receiving Cubicle	BD-KWD-02
3) Outline of Outdoor Type 11kV Distribution Cubicle	BD-KWD-03
4) Layout Plan of Substation	BD-KWD-04
5) Description of Kawanda Substation	SPC-KWD-01
2. KISUBI SUBSTATION	
1) Oneline Diagram	BD-KSB-01
2) Outline of Outdoor Type 33kV Receiving Cubicle	BD-KSB-02
3) Outline of Outdoor Type 11kV Distribution Cubicle	BD-KSB-03
4) Layout Plan of Substation	BD-KSB-04
5) Description of Kawanda Substation	SPC-KSB-01
3. KAWALA SUBSTATION	
1) Oneline Diagram	BD-KWL-01
2) Outline of Outdoor Type 33kV Receiving Cubicle	BD-KWL-02
3) Outline of Outdoor Type 11kV Distribution Cubicle	BD-KWL-03
4) Layout Plan of Substation	BD-KWL-04
5) Description of Kawanda Substation	SPC-KWL-01
4. KISUGU SUBSTATION	
1) Oneline Diagram	BD-KSG-01
2) Outline of Outdoor Type 33kV Receiving Cubicle	BD-KSG-02

	<u>Drawing No.</u>
3) Outline of Outdoor Type 11kV Distribution Cubicle	BD-KSG-03
4) Layout Plan of Substation	BD-KSG-04
5) Description of Kawanda Substation	SPC-KSG-01
5. NTINDA SUBSTATION	
1) Oneline Diagram	BD-NTD-01
2) Outline of Outdoor Type 33kV Receiving Cubicle	BD-NTD-02
3) Outline of Outdoor Type 11kV Distribution Cubicle	BD-NTD-03
4) Layout Plan of Substation	BD-NTD-04
5) Description of Kawanda Substation	SPC-NTD-01
6. KAMPALA SOUTH SUBSTATION	
1) Oneline Diagram	BD-KPS-01
2) Outline of Outdoor Type 33kV Receiving Cubicle	BD-KPS-02
3) Outline of Outdoor Type 11kV Distribution Cubicle	BD-KPS-03
4) Layout Plan of Substation	BD-KPS-04
5) Description of Kawanda Substation	SPC-KPS-01
7. NJERU SUBSTATION	
1) Oneline Diagram	BD-NJR-01
2) Outline of Outdoor Type 33kV Receiving Cubicle	BD-NJR-02
3) Outline of Outdoor Type 11kV Distribution Cubicle	BD-NJR-03
4) Layout Plan of Substation	BD-NJR-04
6) Description of Kawanda Substation	SPC-NJR-015

1. Introduction

This field report has been prepared by the basic design study team (hereinafter referred to as "the team") on the Project for Reinforcement of Electric Power Distribution Network in Kampala Suburban Area in the Republic of Uganda (hereinafter referred to as "the Project"), based on the field survey and discussions with the authorities concerned of the Government of Uganda, in accordance with the Inception Report prepared by the team, in order to build mutual understanding of the Project.

This report describes the information obtained during the field survey, as well as the basic concept of the Project components consisting of the following seven (7) substations, MV and LV distribution materials and maintenance vehicles which were requested by Ugandan Government.

- 1) Kawanda Substation (Rehabilitation)
- 2) Kisubi Substation (Rehabilitation)
- 3) Kawala Substation (New Construction)
- 4) Kisugu Substation (New Construction)
- 5) Ntinda Substation (New Construction)
- 6) Kampala South Substation (New Construction)
- 7) Njeru Substation (Rehabilitation)

However, all the items in the basic concept are subject to the approval of the Japanese Government.

In addition to the above, this report describes some undertakings to be carried out by the Government of Uganda if Grant Aid is extended.

As described in the Inception Report, the team will continue the study in Japan in accordance with this Field Report, data and information collected during the field survey, as well as the discussions with authorities concerned of Japanese Government.

A final draft report of the Project will be prepared in consultation with the Japanese authorities concerned, and will be submitted by the middle of September, 1993 as mentioned in the Minutes of Discussions (M/D) concluded on June 14, 1993.

2. Background of the Project

2.1 Load Demand Forecast in Kampala and Jinja

UEB has studied the load demand forecast in Kampala and Jinja in consideration of the actual load demand recorded in 1991. The study results have been presented to the team by UEB for the purpose of conducting the basic design study.

Attachment-1 and -2 show the load demand forecast and load assignment forecast to the substation' 11kV busbar in Kampala and Jinja prepared by UEB.

2.2 Related Projects under Planning and/or On-going

2.2.1 General

Based on the strategy of national development and rehabilitation plans, UEB formulated various projects under cooperation and financing by several agencies.

In 1985, the Power-2 Project financed by the World Bank, CDC, ODA and other donors was planned and have been implementing in order to relieve immediate electrical energy constraints and to allow economic recovery on the medium term, including rehabilitation of the transmission and distribution network system, etc.

In 1992, the Power-3 Project financed by the World Bank and other donors was planned and have been commenced their implementation, following to the Power-2 project. The Power-3 project focused on exploitation of hydroelectric power potential and on strengthening and extending the country's transmission and distribution facilities, in order to meet medium and long term demand necessary for economic growth, and to provide a framework for export growth.

Positioning of Japan's Grant Aid Projects

This Grant Aid Project and the previous Phase-I and II projects are positioned in a part of the Power-2 and Power-3 projects and will support the plan of rehabilitation of Kampala suburban transmission and distribution network which is urgently required for economy recovery in the medium term.

Ugandan side has confirmed that there is no overlapping of the contents of the Project requested by Ugandan side and the Power-2 and Power-3 projects as well as other projects assisted by other donors and agencies.

2.2.2 Related Project

33kV transmission line

As described in the aforesaid section 2.2.1, the Project is a part of the plan for rehabilitation of the transmission and distribution network. Based on the philosophy of Power-2 and Power-3 projects, UEB has made further study on the 33kV network composition in order to make it more reliable system.

The 33kV transmission network plan prepared by UEB is given in Attachment-3.

SCADA system

To solve serious problem on the existing metering and control system on the transmission and distribution network, UEB has been introducing a SCADA system financed by Scandinavian countries. This SCADA system will cover all the substations including the new 7 substations of the Project.

3. Land Acquisition of the Project Sites

Conditions of the land acquisition for the Project are as follows.
Attachment-4 shows the location of the Project sites.

<u>No.</u>	<u>Site Name</u>	<u>Land Acquisition Conditions</u>
(1)	Kawanda Substation (Rehabilitation)	UEB's own land [In the existing substation]
(2)	Kisubi Substation (Rehabilitation)	UEB's own land [In the existing substation]
(3)	Kawala Substation (New Construction)	Government land [Under negotiation with the Government]
(4)	Kisugu Substation (New Construction)	UEB's own land [Recently purchased private land]
(5)	Ntinda Substation (New Construction)	UEB's own land [Recently purchased private land]
(6)	Kampala South Substation (New Construction)	UEB's own land [In the existing switching station]
(7)	Njeru Substation (Rehabilitation)	UEB's own land [In the existing substation]

Note: For Kawala site, UEB must obtain the permission of the land use from the Ugandan Government and shall inform Japanese side of the permission with area and location, by the end of August, 1993.

4. Conceptual Plan for the Project

4.1 General

This section describes the basic concept for the design and installation of the new 7 substations requested by Ugandan side, as well as the procurement of distribution material and maintenance vehicles for the Project.

However, this basic concept is subject to the approval of the Japanese Government.

4.2 Construction or Rehabilitation of Substations

4.2.1 Design Concept

As a result of the field survey on the present site conditions such as site location, arrangement of the existing facilities, etc., the following items shall principally be considered for the design:

- (1) Load demand forecast and load assignment to the substation's 11kV busbar in Kampala and Jinja prepared by UEB shown in the aforesaid section 2.1 shall be applied to the Project.
- (2) Outdoor cubicle type switchgear will be adopted so that the construction period can be minimized as shorter as possible.
- (3) Easy maintenance will be considered.
- (4) Vacuum circuit breaker will be installed in consideration of easy maintenance.
- (5) IEC, ISO and Japanese code and standards shall be applied.

4.2.2 Design Conditions

(1) Climatic and site conditions

- 1) Altitude: approximately 1300m from sea level
- 2) Ambient temperature: maximum 40°C
minimum 15°C
average 23°C
- 3) Relative humidity: maximum 100%
- 4) Mean annual rainfall: 1,300mm
- 5) Seismic acceleration: 0.1g (horizontal)
- 6) Hail: To be taken into consideration
- 7) Dust: To be taken into consideration
- 8) Soil bearing capacity: 5tons/m² (continuous)

(2) Power supply conditions

- 1) Nominal system voltage between phases:
Transmission line: 33kV, 3-phase
Distribution line: 11kV, 3-phase
- 2) Highest system voltage between phases:
Transmission line: 36kV, 3-phase
Distribution line: 12.1kV, 3-phase
- 3) Frequency: 50Hz
- 4) System fault level: 33kV system 16kA (symmetrical)
11kV system 20kA (symmetrical)
- 5) Rated current of bus bar: 33kV system 2000A
11kV system 2000A
- 6) System earthing: 33kV system Solid
11kV system Solid
- 7) Maximum line current: 33kV transmission line 400A
11kV distribution line 300A
(Note: In Kisubi S/S, max. 11kV line current is 200A.)

4.2.3 Outline of Major Equipment

Each substation will consist of the following major equipment:

- (1) 33kV outdoor type metal-clad switchgear consisting of:
 - 33kV busbar
 - 33kV coupling section
 - (Where applicable) 33kV transformer feeder(s)
 - 33kV line feeders

- (2) 11kV outdoor type metal clad switchgear consisting of:
 - 11kV busbar
 - 11kV coupling section (only for Kampala South and Njeru substations)
 - 11kV transformer feeder(s)
 - 11kV line feeders
 - 11kV/433-250V station transformer cubicle
 - DC110V battery system
 - SCADA interface marshalling cubicle

- (3) Power transformer(s)
 - 33/11.55kV, 50Hz, ONAN/ Yyn0
 - with voltage regulating device

4.2.4 Outline of System Composition

Online diagram, outline of 33kV and 11kV cubicles, layout plan and descriptions of equipment for each substation are given in Annex of this Report, respectively.

The work demarcation for the line connection, between Japanese side and Ugandan side, shall basically be as follows:

(1) 33kV transmission lines

Japanese side: 33kV cables, 50 meter length per line, with cable head, jointing materials and 30kV arrestors will be supplied by Japanese side.

Ugandan side: Construction work including cable connection between the 33kV cables and the existing/new 33kV transmission lines shall be done by Ugandan side.

Ugandan side shall locate the dead end structure for 33kV transmission lines which will be connected with the 33kV cables to be provided by Japanese side within the above 33kV cable length, i.e., 50m from the 33kV cubicle to transmission line.

Design, material supply and construction work for the 33kV transmission lines up to the dead end structure above shall be done by Ugandan side.

(2) 11kV distribution lines

Japanese side: 11kV cables with cable head, jointing materials and 12kV arrestors will be supplied by Japanese side. However, cabling materials and arrestors for spare feeders will not be provided.

The cable length to be supplied by Japanese side shall be in accordance with the specified length in Attachment-5.

Ugandan side: Construction work including connection work between the 11kV cables and the existing/new 11kV distribution lines shall be done by Ugandan side.

Ugandan side shall locate the dead end structure for 11kV distribution lines which will be connected with the 11kV cables to be provided by Japanese side within the specified length above.

Design, material supply and construction work for the 11kV distribution lines up to the dead end structure above shall be done by Ugandan side.

4.2.5 Existing Facility and Equipment to be used

The following existing facilities in the substations will be used for the Project:

(1) Kawanda Substation (Rehabilitation)

- Existing 33kV transmission line (from Kampala North to Bombo substations) with wooden pole structures

(2) Kawala Substation (New Construction)

- Not applicable

(3) Kisugu Substation (New Construction)

- Existing 33kV transmission line (from Lugogo to Queensway substations) with steel structure

(4) Ntinda Substation (New Construction)

- Not applicable

(5) Kisubi Substation (Rehabilitation)

- Existing 33kV transmission line (from Mutundwe to Entebbe substations) with wooden pole structure

(6) Kampala South Substation (New Construction)

- Existing 33kV transmission lines (from Mutundwe substation to Kampala South switching station: 1 line, Kampala South switching station to Queensway substation: 2 lines) with wooden pole structures

(7) Njeru Substation (Rehabilitation)

- Existing 33kV transmission line (from Owenfalls power station to Njeru substation: 2 lines) with steel structure

4.3 MV and LV Distribution Materials and Maintenance Vehicles

UEB's requested items and specifications for MV and LV distribution materials and maintenance vehicles which are given in Attachment-5 will be studied in Japan.

5. Priority of the Project Components

For the priority of the Project component, UEB has made on the following priority taking into consideration of urgency, importance, etc.

Priority

- 1 Rehabilitation of construction of the substations
 - 1-1 Kampala South substation
 - 1-2 Ntinda substation
 - 1-3 Kisugu substation
 - 1-4 Kawanda substation
 - 1-5 Njeru substation
 - 1-6 Kisubi substation
 - 1-7 Kawala substation
- 2 MV and LV distribution materials
- 3 Maintenance vehicles

6. Undertakings by the Government of Uganda

The undertakings by the Government of Uganda are described in the Minutes of Discussions (M/D) concluded on June 14, 1993.

In additions to the above, necessary measures for the following additional notes and/or items shall also be taken by the Government of Uganda if the Grant Aid is extended.

Items marked with "*" show the additional items to M/D.

- a) To secure and provide cleared, embanked and leveled land as well as access road for the Project prior to the commencement of the construction of the Japanese side.

* All the works shall be done and completed in accordance with site layout plans and an implementation plan which will be indicated in the final report.

- b) To provide the land for temporary site offices, warehouses and stock yards in the sites during the implementation period.
- * In addition to the installation space for the permanent equipment, temporary construction space of about 250m² in each substation will be required during the construction period.
- c) To ensure speedy unloading, tax exemption, custom clearance of the goods for the Project at the port and/or airport of disembarkation.
- d) To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contracts such facilities as may be necessary for their entry into the Republic of Uganda and stay therein for the performance of their work.
- e) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the Republic of Uganda with respect to the supply of the products and services under the verified contracts.
- f) To bear commissions to a Japanese foreign exchange bank for the banking services based upon the Banking Arrangement.
- g) To bear all the expenses, other than those to be borne by the Grant Aid necessary for the execution of the Project.
- h) To provide proper arrangements for the construction, such as water supply, electricity, drainage, etc., if necessary.
- i) To assign exclusive-counterpart engineers and technicians to the Project in order to transfer the operation and maintenance technique for the Project and to witness and confirm construction when inspection are carried out.
- j) To take necessary measures and responsibility for the stoppage of electricity during a construction period, when it is necessary.
- k) To construct and connect the cables for incoming and outgoing feeders for substations which will be constructed under the Project.
- * The connection works to be done by Ugandan side shall be completed before the commencement of the site test by Japanese side.
- l) To dismantle and remove the existing equipment and facilities not to be used for the Project in the existing Substations.

* This work shall include the following items and be completed before the commencement of the construction works of Japanese side.

Kawanda site

- Dismantle and remove the existing foundation and transformer in the site.
- Installation of stay wires with insulators for the existing 33kV transmission lines in the site.

Njeru site

- Dismantle and remove the existing water tank, foundation, LV lines and the fence in the site.

Kisubi site

- Remove the existing 11kV lines in the site.
- Dismantle and remove the existing transformers and their foundations in the site.

- m) To provide a bench mark at the sites.
- n) To provide site drainage system and other facilities including outdoor lighting system, fire fighting system, telecommunication system, etc., at the sites, if necessary.
 - * This work shall include the provision and construction of the boundary fence at each substation. The construction of the fence shall be completed immediately after completions of the construction work by Japanese side.
- o) To provide necessary data and information for the detailed design of the Project.
- p) To take necessary measures to expedite the approval for executions of the Project by the Government of Uganda.
- q) To control traffic during the inland transportation of the facilities of the Project, if necessary.
- r) To provide the disposal places of the surplus soil during the construction period.
- s) To secure the approval for access to public and private land for the Project.
- t) To secure the approval for protection works for the existing facilities, if necessary.
- u) To provide relay tap setting work regarding the transmission and distribution lines and study of the transmission and distribution network including relay protection coordination, short circuit calculation, etc.

Attachment-1 Load Demand Forecast and Load Assignment Forecast to the Substation' 11kV Bus Bar in Kampala prepared by UEB

1-1 Load Demand Forecast in Kampala Area including Entebbe

Forecasts for consumptions in Gwh

	1991	1992	1993	1995	2000	2005	2010
Domestic	301.5	318.69	336.85	376.35	496.55	655.14	864.39
Commercial	15.3	16.45	17.68	20.43	26.96	35.57	46.97
Industrial	23.6	27.35	31.70	42.58	56.19	74.13	97.81
General	33.7	38.08	43.03	54.95	72.50	95.65	126.20
St. Lighting	3.1	3.13	3.16	3.23	4.26	5.62	7.41
Total	377.2	403.70	432.43	497.54	656.45	866.11	1,142.74

Forecasts for numbers of consumers

	1991	1992	1993	1995	2000	2005	2010
Domestic	63,482	67,100	70,975	79,741	104,550	137,943	182,007
Commercial	6,901	7,419	7,975	9,216	12,160	16,043	21,168
Industrial	35	41	47	63	83	110	145
General	250	283	319	408	538	710	936
St. Lighting	136	137	139	142	187	246	325
Total	70,804.0	74,979	79,405	89,069	117,518	155,053	204,576

Forecasts for maximum loads in MW

	1991	1992	1993	1995	2000	2005	2010
Domestic	75.4	79.67	84.21	94.09	124.14	163.79	216.10
Commercial	3.8	4.11	4.42	5.11	6.74	8.89	11.73
Industrial	5.9	6.84	7.93	10.65	14.05	18.53	24.45
General	8.4	9.52	10.76	13.74	18.12	23.91	31.55
St. Lighting	0.8	0.78	0.79	0.81	1.06	1.40	1.85
Totals	94.3	100.92	108.11	124.38	164.11	216.53	285.69

1-2 Load Assignment Forecast to the Substations' 11kV Bus Bars in Kampala including Entebbe

	LOAD FORECAST MW MVA					
	1992	1993	1995	2000	2005	2010
ENTEBBE	4.5	6.4	5.5	7.7	10.8	15.2
KISUBI	0.0	0.0	1.8	2.6	3.6	5.1
KAJANST	0.7	0.8	0.9	1.3	1.8	2.5
QUEENSWAY	27.6	29.5	24.9	34.9	49.0	68.8
LUWERO	24.7	26.4	17.9	25.1	35.2	49.5
GABA	0.0	0.0	10.4	11.2	12.9	15.3
KISIGU	0.0	0.0	2.6	3.7	5.2	7.3
PORTRELI	5.2	5.6	6.4	9.0	12.6	17.8
KIREKA	0.0	0.0	2.3	3.2	4.5	6.3
NTINDA	0.0	0.0	3.4	4.8	6.8	9.5
KAMPALA N	30.2	32.3	30.0	42.1	59.9	83.1
KAWANDA	0.0	0.0	2.6	3.7	5.2	7.3
MUTUNDWF	0.0	0.0	3.4	4.8	6.8	9.5
KAMPALA S	0.0	0.0	5.5	7.7	10.8	15.2
KAWALA	0.0	0.0	2.6	3.7	5.2	7.3
TOTAL	92.9	101.0	120.4	165.6	229.7	319.7

Attachment-2 Load Demand Forecast and Load Assignment Forecast to the Substation' 11kV Bus Bar in Jinja prepared by UEB

2-1 Load Demand Forecast in Jinja

Forecasts for consumptions in Gwh

	1991	1992	1993	1995	2000	2005	2010
Domestic	23.7	25.52	27.48	31.86	46.13	66.77	88.10
Commercial	2.2	2.37	2.55	2.96	4.28	6.20	9.13
Industrial	1.0	1.08	1.16	1.34	1.95	2.92	3.72
General	3.1	3.7	4.4	10.9	15.8	22.8	30.1
St. Lighting	0.6	0.6	0.7	0.8	1.2	1.7	2.2
Total	35.6	38.3	41.3	47.9	69.3	100.3	132.3
Large Industry	29.3	29.5	29.5	30.7	33.9	37.4	41.3
NEW TOTAL	65.1	67.8	70.8	78.6	103.2	137.7	173.6

Forecasts for numbers of consumers

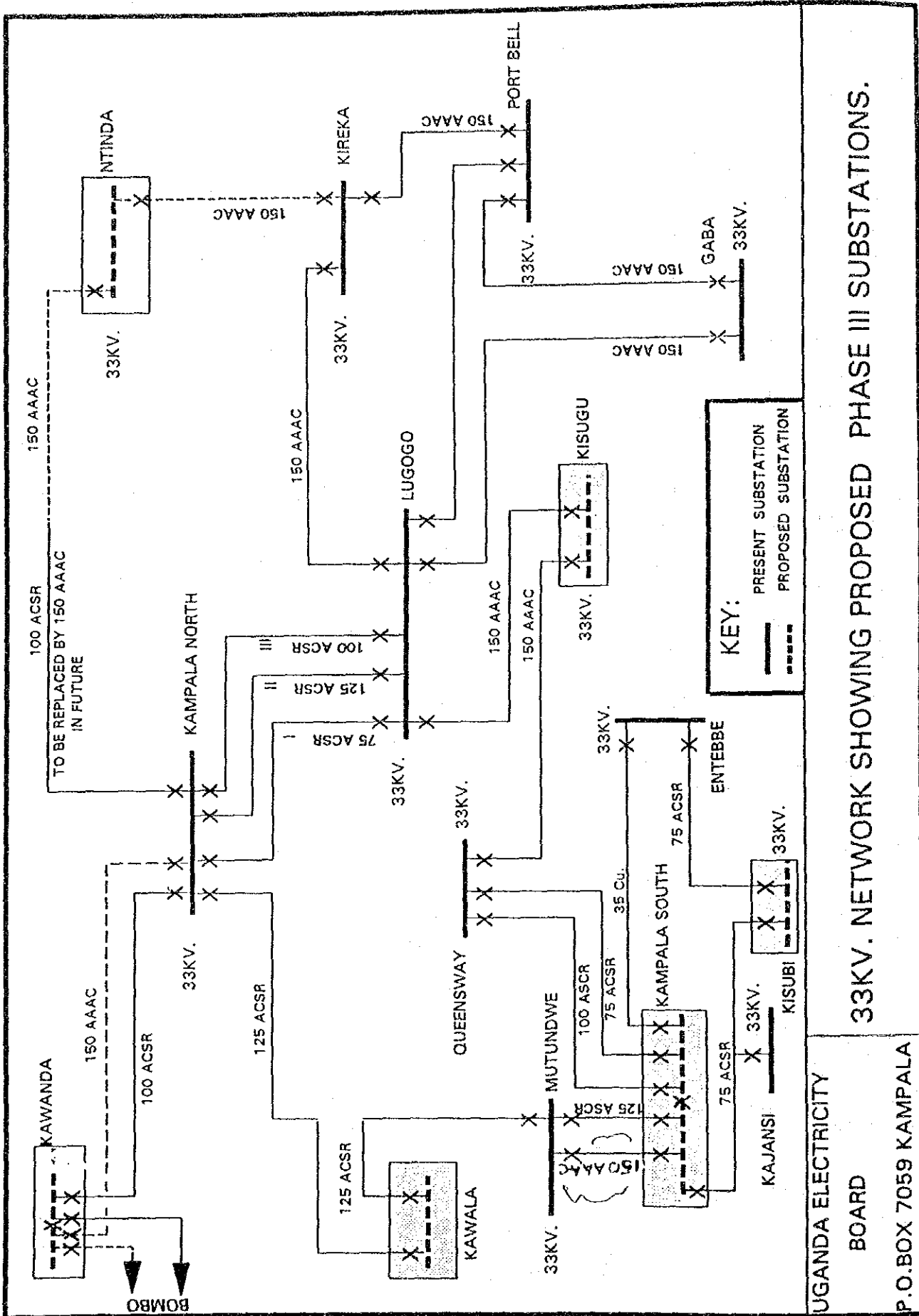
	1991	1992	1993	1995	2000	2005	2010
Domestic	9,910	9594	10331	11979	17341	25104	33122
Commercial	1,007	1084	1163	1354	1960	2837	3743
Industrial	9	9	9	11	16	23	30
General	79	95	92	106	154	223	294
St. Lighting	58	62	67	78	113	163	216
Total	10,062	10,835	11,667	13,527	19,583	28,350	37,404
Large Industry	11	11	11	12	13	15	16
NEW TOTAL	10073	10846	11678	13539	19596	28364	37420

Forecasts for maximum loads in MW

	1991	1992	1993	1995	2000	2005	2010
Domestic	5.9	6.38	6.87	7.97	11.53	16.69	22.03
Commercial	0.6	0.59	0.64	0.74	1.07	1.55	2.04
Industrial	0.3	0.27	0.29	0.34	0.49	0.70	0.93
General	2.0	2.18	2.35	2.72	3.94	5.71	7.53
St. Lighting	0.2	0.16	0.17	0.20	0.29	0.42	0.56
Totals	8.9	9.6	10.3	12.0	17.3	25.1	33.1
MVA	9.9	10.6	11.5	13.3	19.2	27.9	36.8
L/Industry (MVA)	32.8	33.4	34.1	35.5	39.2	43.2	43.0
GRAND TOTAL	42.7	44.1	45.6	48.8	58.4	71.1	79.7

2-2 Load Assignment Forecast to the Substations' 11kV Bus Bar in Jinja

	LOAD GROWTH IN MVA						
	1991	1992	1993	1995	2000	2005	2010
JINJA IND	4.2	4.6	4.9	5.7	8.2	11.9	17.2
NJERU	5.9	6.3	6.8	7.9	11.1	16.5	23.9



33KV. NETWORK SHOWING PROPOSED PHASE III SUBSTATIONS.

UGANDA ELECTRICITY BOARD
 P.O. BOX 7059 KAMPALA

① Kawanda Substation

⑤ Ntinda Substation

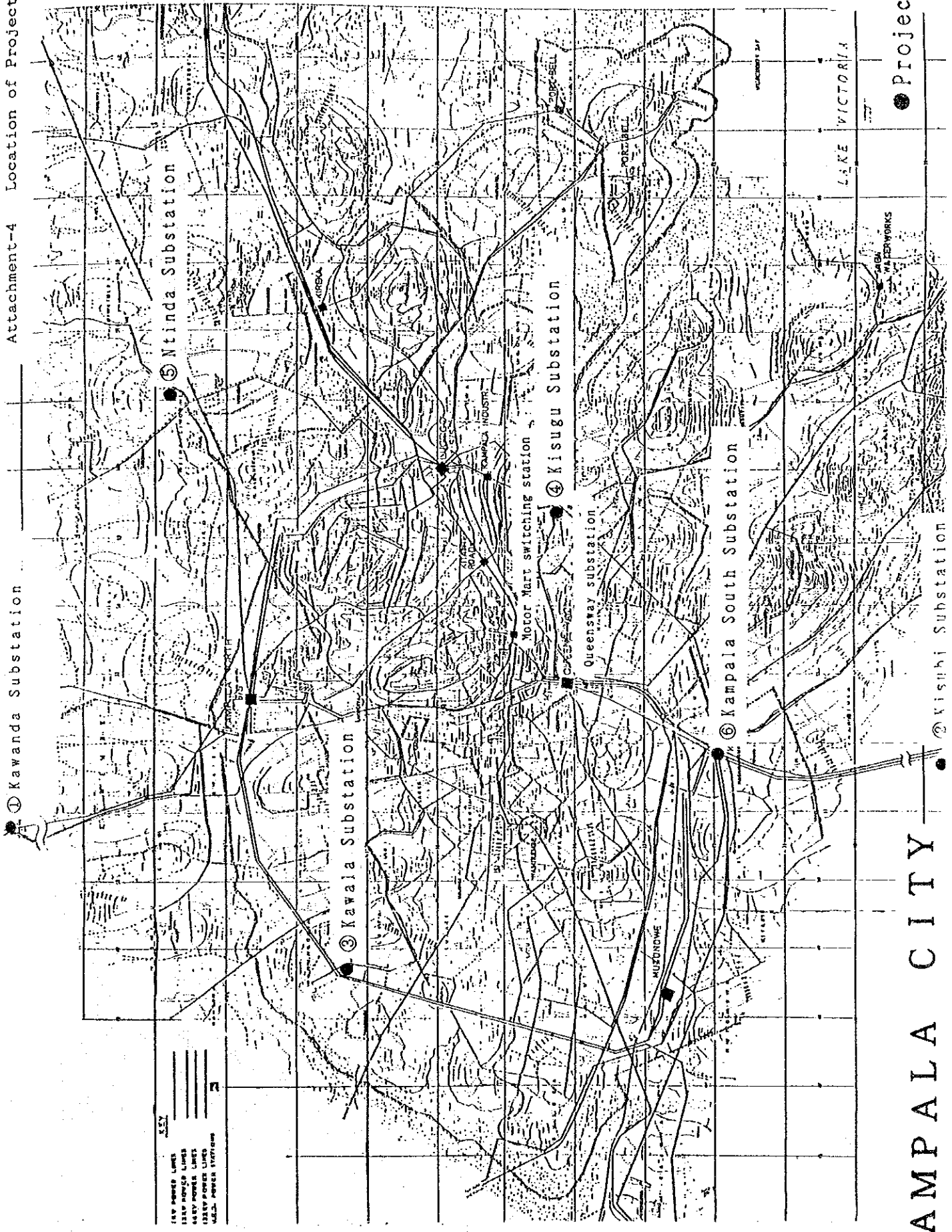
③ Kawala Substation

④ Kisugu Substation

⑥ Kampala South Substation

② Kisubi Substation

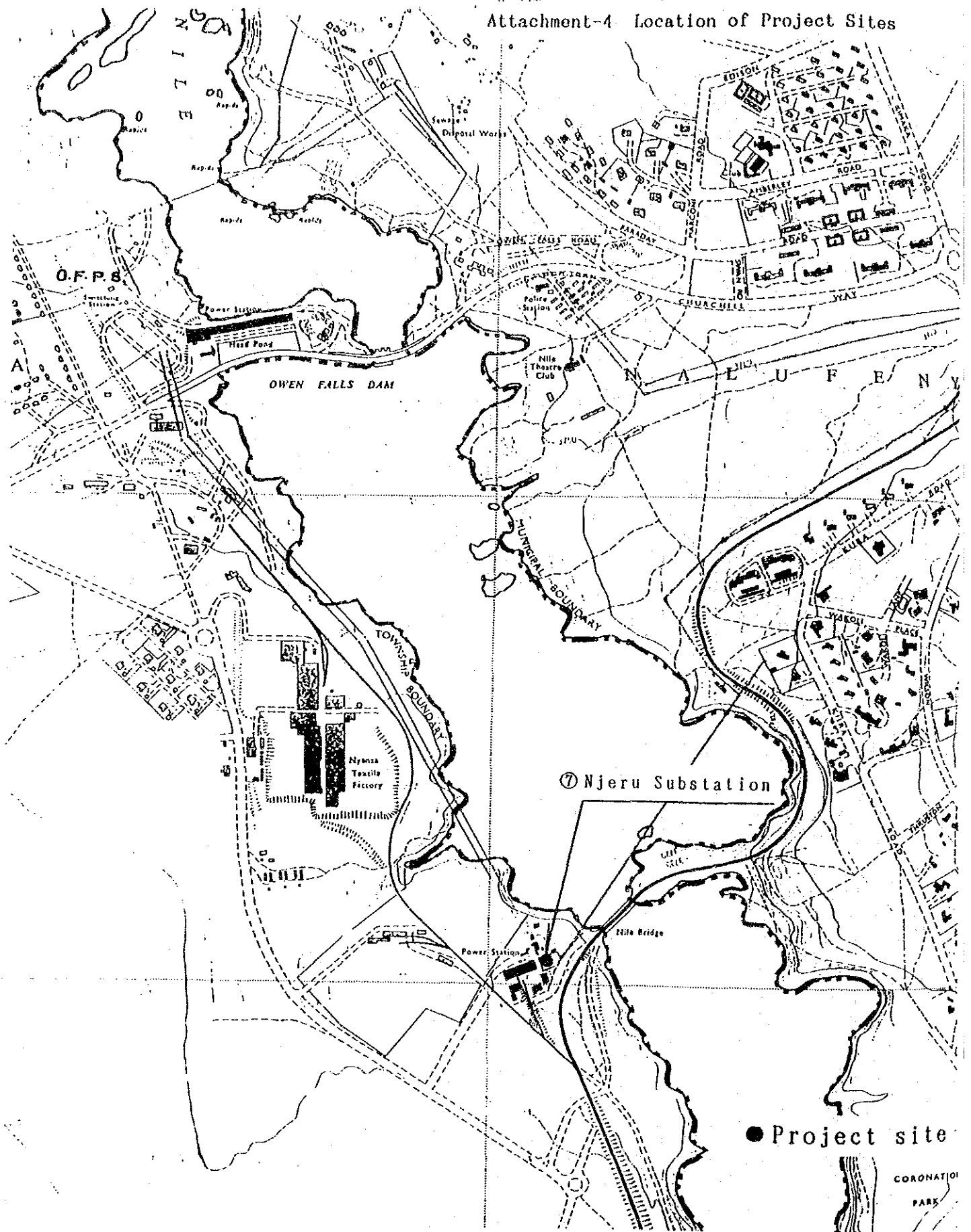
● Project site



132KV POWER LINES
 11KV POWER LINES
 33KV POWER LINES
 22KV POWER SYSTEMS

KAMPALA CITY

Attachment-4 Location of Project Sites



JINJA CITY

DISTRIBUTION MATERIALS AND VEHICLE REQUIREMENTS.

1. KISUBI
2. KAWANDA
3. NJERU
4. NTINDA
5. KAWALA
6. KISUGU
7. KAMPALA SOUTH
8. VEHICLES
9. SPECIFICATIONS
10. SUMMARY

KISUBI

1. 150 sq. mm AAAC conductor 100 mts.
2. 100 sq. mm Cu, XLPE, 3C cable (11 KV) - 250 mts.
3. 185 sq. mm Cu, XLPE, 1C cable (33 KV) - 100 mts.
4. Indoor terminations 100 sq. mm - 2 sets
5. Indoor terminations 185 sq. mm - 6
6. Pole-Mounted terminations 100 sq. mm 2 sets
7. Outdoor terminations 185 sq. mm - 6
8. 11/.433KV 3- phase Pole- Mounted Transformers.

100 KVA	-	6
200 KVA	-	4
315 KVA	-	4

TOTAL = 14

9. Surge Arrestors (11 KV) - Transformers - 42
- Surge Arrestors (11 KV) - Feeders - 6

10. Surge arrestors (33 KV) - 6

KAWANDA

1. 150 sq.mm AAAC conductor - 100 mts.
2. 100 sq. mm Cu, XLPE, 3C cable (11 KV) - 400 mts.
3. 185 sq. mm Cu, XLPE, 1C cable (33 KV) - 100 mts.
4. Indoor terminations 100 sq. mm - 3 sets.
5. Indoor terminations 185 sq. mm - 6

6. Pole mounted terminations 100 sq. mm - 3 sets
7. Outdoor terminations 185 sq.mm - 6
8. 11/.433KV, 3 - phase pole mounted transformers.

100 KVA	-	8
200 KVA	-	2
315 KVA	-	6

TOTAL		16

9. Surge Arrestors (11KV) Transformers - 68
 Surge Arrestors (11KV) Feeders - 9
10. 33 KV Surge arrestors - 6
11. 11/.433KV, 1- phase pole mounted Transformers 25KVA - 10

NJERU

1. 100 sq. mm Cu, XPPE, 3C cable (11 KV) - 600 mts.
2. 185 sq.mm Cu, XLPE, 1C cable (33 KV) - 300 mts.
3. Indoor terminations 100 sq.mm - 4 sets
4. Indoor terminations 185 sq.mm - 6
5. Pole mounted terminations 100 sq mm - 4 sets
6. Outdoor terminations 185 sq. mm - 6
7. 11/.433KV, 3- phase pole mounted Transformers.

100 KVA	-	4
200 KVA	-	8
315 KVA	-	2
500 KVA	-	2
TOTAL	=	16

8. 11/.433KV, 3- phase groundmounted Transformers
 500 KVA - 6
9. Surge Arrestors (11 KV) Transformers - 66
 Surge Arrestors (11 KV) Feeders - 12
10. Surge Arrestors (33 KV) - 6

NTINDA

1. 150 sq. mm AAAC conductor - 12 km.
(Required for Bukoto to Ntinda 33 KV line)
2. 150 sq.mm AAAC conductor - 30 km
(Required for Ntinda to Kireka 33 KV line)
3. 100 sq.mm Cu XLPE, 3C cable (11KV) - 250 mts.
4. 185sq mm Cu XLPE, 1C cable (33KV) - 100 mts.
5. Indoor terminations 100 sq mm - 3. sets
6. Indoor terminations 185sq mm -6.
7. Pole mounted terminations 100 sq mm - 3.sets
8. Outdoor terminations 185sq mm - 6.
9. 11/.433KV, 3 phase pole mounted transformers 315KVA - 15.
10. 11KV surge Arrestors for transformers - 45
11KV surge Arrestors for feeders - 9
11. Disc insulators - 800.
12. Pin insulators R110 - 400.
13. 33KV surge arrestors - 6.

KAWALA

1. 150sq mm AAAC conductor - 1 KM
 2. 100sq mm cu, XLPE 3C cable (11KV) - 100 mts.
 3. 185sq mm cu, XLPE 1C cable (33KV) - 100 mts.
 4. 11/.433KV, 3 phase pole mounted transformers
100KVA - 5
200KVA - 2
315KVA - 9
- TOTAL: = 16

5. 11KV Surge Arrestors - Transformers - 48
- 11KV Surge Arrestors - Feeders - 9
6. Indoor terminations 100 sq mm - 3 sets
7. Indoor terminations 185 sq mm - 6
8. Pole mounted terminations 100 sq mm - 3 sets
9. Outdoor terminations 185sq mm - 6
10. 33KV surge arrestors - 6

KISUGU

1. 150sq mm AAAC Conductor - 300 mts.
2. 100 sq mm Cu, XLPE 3C cable (11KV) - 150 mts.
3. 185sq mm Cu XLPE 1C cable (33KV) - 100 mts.
4. Indoor terminations 100 sq mm - 3 sets
5. Indoor terminations 185sq mm - 6
6. Pole mounted terminations 100 sq mm - 3 sets
7. Outdoor terminations 185sq mm - 6
8. 11/.433KV, 3 phase pole mounted transformers 315KVA - 5
9. 11/.433KV, 3 phase ground mounted transformers 500KVA, - 5
10. 11KV Surge Arrestors Transformers - 30
- 11KV Surge Arrestors Feeders - 9
11. 33KV Surge Arrestors - 6

KAMPALA SOUTH

1. 150sq mm AAAC conductor **300 mts.**
2. 100 sq mm cu, XLPE 3 core cable - 700 mts.

- 3. 100KVA - (3)
- 200KVA - (3)
- 315KVA - (6)

TOTAL: = 12.

- 4. 11KV Surge Arrestors Transformers - 36
- 11KV Surge Arrestors Feeders - 12
- 5. 185sq mm Cu, XLPE 1C cable - 150 mts.
- 6. Indoor terminations 100 sq mm - 4 sets
- 7. Indoor terminations 185sq mm - 18
- 8. Pole mounted terminations 100 sq mm - 4 sets
- 9. Outdoor terminations 185sq mm - 18
- 10. 33KV surge arrestors - 18

PRESENT SITUATION OF VEHICLES

A) ENTEBBE:

i) District Manager has (1) 4W/Drive Pajero with mileage of 150,000km.

N.B. The above vehicle is also used by other Sections.

ii) Faultsman has (1) Land Rover which is very old with mileage recorder which is faulty.

N.B. This vehicle is always breaking down and the faultsman has to use the Manager's vehicle from time to time.

iii) Mains gang has 1 lorry with mileage of 100,000km.

N.B. Another lorry is required for swift maintenance of the network which is growing at a very fast rate.

iv) The Accounts Section has one motor-cycle for Meter reading and Revenue collection.

B) JINJA:

- i) District Manager has (1) 4W/Drive Pajero with mileage of 155,000km.
- ii) District Engineer has (1) Land Rover which is very old and therefore needs replacement for efficient execution of his duties.
- iii) District Technician shares with the District Engineer.
- iv) The faults section has one old Land Rover.
- v) The Accounts Section has two old Land Rovers and (5) motor-cycles for Meter reading.
- vi) There are three lorries for the Mains gangs with mileage:-
 - i) 200,000 km. - Fiat.
 - ii) 210,000 km. - Fiat.
 - iii) Very old Bedford with faulty mileage recorder.

VEHICLE REQUESTED

ENTEBBE:

- i) 1 - 4 W/Drive for Faultsman.
- ii) 1 - lorry for Gang.

JINJA:-

- i) 1 - 4 W/Drive for District Engineer
- ii) 1 - lorry for Gang.

KAMPALA:-

- iii) 3 - 4 W/Drive for Assistant Section Engineers.

SPARES:- Spare parts for the vehicles as recommended by the manufacturers i.e. same as in phase 1 and phase 11.

N.B.

The above vehicles are urgently required for the:-

- i) transportation of staff, equipment and materials for groups responsible for the construction and maintenance work of the distribution network.

ii) patrols by the maintenance supervisors and faultsmen responsible for distribution network switchings and inspections in order to minimise delays in the restoration of supply.

SPECIFICATIONS

Specifications for the following items are the same as those in Phase 1 and Phase 11.

- 1) 11/.433KV, 3 - phase pole mounted transformers (50,100,315,500KVA).
- ii) 11/.433KV, 3 - phase ground mounted transformers (500KVA).
- iii) 100 mm sq cu, XLPE, 3C cables.
- iv) 185sq mm cu, XLPE, 1C cables.
- v) 11KV Surge Arrestors.
- vi) 33KV Surge Arrestors.
- vii) Indoor terminations 100 sq mm (11KV).
- viii) Indoor terminations 185sq mm (33KV).
- ix) Pole mounted terminations 100 sq mm (11KV).
- x) Outdoor terminations 185 sq mm (33KV).

SPECIFICATIONS

- i) Specifications for lorries should be the same as those in phase 1 and phase 11.
- ii) 4 W/Drive general purpose vehicle e.g. Land Cruiser suitable to be driven in rugged terrain for electricity line patrols. (see attached Specifications).
- iii) Spare parts for both types of vehicles as recommended by manufacturers i.e. same as in phase 1 and phase 11.

4 WHEEL DRIVE STATION WAGON:

Requirements for Chassis:

1. Overall dimensions (Approx.):	Length	4,185mm
	Width	1,635mm
	Height	1,480mm
	Ground clearance	180mm

2. Number of crews: 9 persons.
3. Engine - type: 4 cycle, 4 cylinder, water cooled Diesel OHC.
- Minimum output: 65 KW at 5,300 rpm
- Maximum torque (DIN net) 139 Nm (14.5kg.m) at 3500rpm
4. Transmission: 5 Forward and 1 reverse manual operation.
5. Maximum speed: 160 km/h.
6. Maximum climbing ability (tan θ): 0.74
7. Accessories - Maintenance tool set with body: 1
8. Number of doors 5
9. Air condition Yes
10. Radio Yes
11. Painting:
- a) Top of vehicle White
- b) Body Royal Red
- c) Two (2) doors of each vehicle shall have the Client's mark.
- d) The painting colour for the Client's mark shall be yellow.

150 AAAC CONDUCTOR: ALL ALUMINIUM ALLOY CONDUCTOR

SCHEDULE E 1 LINE CONDUCTORS 33 KV SYSTEM

The phase conductors for the 33KV overhead lines shall be as follows:

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>Data Minimum</u>
	Name	AAAC	150
1	Standard	DIN	48201
2	Total cross section	sq mm	147.11
3.	Stranding and alum. alloy wire dia.		37/2.25

4.	Conductor overall diameter	mm	15.75
5.	Weight	kg/km	405
6.	Electrical DC resistance at 20 deg.C	ohm/km	0.227
7.	Modulus of elasticity	N/mm sq	57,000
8.	Nominal breaking load	N	41,090
9.	Current rating (VDE)	Amp	425
10.	Thermal transmission capacity	MVA	24.2

TABLE 4: INSULATOR ELECTRICAL MECHANICAL CHARACTERISTICS

INSULATOR TYPE

(Minimum Requirements)

	PIN TYPE		DISC TYPE
	33 KV	11 KV	
ANSI Standard Class	55-4	55-4	IEC 305
min. Leakage Distance, mm	792	264	280
Tension Strength, kM	-	-	70.0
Cantilever Strength, kM	12.5	12.5	-
Transverse Strength, kM	-	-	-
Power Frequency Dry Flashover, kV	130	65	70
Power Frequency Wet withstand, kV	70	38	40
Impulse Withstand, + kV and - kV	200	95	100
Low Frequency Puncture Voltage, kV	110	80	130
Maximum RIV 1000kHz, V	200	50	50

SUMMARY

- 150 sq mm AAAC conductor - 43.8 km
- 100 sq mm Cu, XLPE, 3C (11KV) cable - 2.45 km
- 185 sq mm Cu, XLPE, IC (33KV) cable 0.95 km
- Indoor terminations 100 sq mm - 22 sets

5. Indoor terminations 185 sq mm - 54
6. Outdoor terminations 185 sq mm - 54
7. 11/.433KV, 3 phase pole mounted transformers
 - 100KVA - 26
 - 200KVA - 19
 - 315KVA - 50
 - 500KVA - 2
8. 11/.433KV, 3 phase, ground mounted transformers - 500KVA - 11
9. Surge Arrestors (11KV) - 40
10. Surge Arrestors (33KV) - 54
11. Disc insulators - 800
12. Pin insulators - 400
13. 4W/Drive vehicles - 5
14. Lorries - 2
15. Pole-mounted terminations 100 sq mm - 22 sets

APPENDIX 6

**LETTER OF APPROVAL BY THE
GOVERNMENT OF UGANDA FOR THE FIELD REPORT**

UGANDA ELECTRICITY BOARD

TELEPHONE NO: KAMPALA 254071/7
TELEX: 61028 FAX NO: 235119
TELEGRAPHS: AMBER, KAMPALA



AMBER HOUSE
P.O. BOX 7059
KAMPALA
UGANDA

3rd July, 1993

JAPAN INTERNATIONAL COOPERATION AGENCY
THE BASIC DESIGN STUDY TEAM ON THE PROJECT
FOR THE REINFORCEMENT OF ELECTRIC POWER
DISTRIBUTION NETWORK IN KAMPALA (PHASE III)

RE: THE PROJECT FOR THE REINFORCEMENT OF ELECTRIC POWER
DISTRIBUTION NETWORK IN KAMPALA SUBURBAN AREA

SUB: APPROVAL OF THE FIELD REPORT

Dear Sirs,

This is to inform you that we have received your Field Report and have reviewed it. The Report is satisfactory and meets the points discussed throughout your visit.

The purpose of this letter is to inform you that the Report is approved.

Yours faithfully,

S.G.D'UANGA
DEPUTY MANAGING DIRECTOR (T)

APPENDIX 7 COUNTRY DATA

Country Data

1. Basic Facts on the Republic of Uganda

1) Capital : Kampala

2) Land Area / Population

Land Area.....	197,096 km ²
Population	16,671,700 (1991 census)
Population Density.....	85 persons/km ² (1991 census)
Population Growth Rate	2.5% / year (1991 census)

3) Currency

1 US dollar = 1,193 Ush (Average from January to June 1993)

4) Climate

There are two rainy seasons, i.e., the main rainy season from March to May and the minor rainy season from September to November, both with frequent electrical storms.

5) Geography

Uganda is an inland country located at the equator some 800 km from the nearest ocean (the Indian Ocean). It is bordered by five countries: Sudan to the north, Zaire to the west, Rwanda and Tanzania to the south, and Kenya to the east. Lake Victoria, the third largest lake in the world, is located in Uganda. Eighty-four percent of the national land, excluding Lake Victoria, is highland, with elevation ranging from 900 m to 1,500 m. From the highlands, the land slopes gently toward the central area where Lake Kyoga is formed. Located on the eastern side of the Western Rift Valley is land of less than 900 m elevation, which accounts for some 9% of the national land.

6) Geographical Location

Between 2°S Lat. and 4°N Lat. and between 28°E Long. and 35°E Long.

2. Socioeconomic Indices

1) GDP

Approximately 2,015,462 million Ush (1991)

(Source: Background to the Budget 1993-1994).

2) Industries

Agriculture is the main industry, producing coffee, cotton and tea. A small amount of copper is mined.

GDP Share by Industry (Converted from 1991/92 factored cost indices)

(Unit : Millions of Ush)

Item	1990/91		1991/92		1992/93	
	Value	%	Value	%	Value	%
Agriculture	1,083,177	2.6%	1,067,248	▲1.5%	1,165,155	9.2%
Mining & Quarrying	5,908	83.3%	6,635	12.3%	7,388	11.3%
Manufacturing	82,549	4.9%	98,580	19.4%	98,827	0.3%
Electricity/Water	12,602	15.4%	14,034	11.4%	14,769	5.2%
Construction	119,561	8.4%	121,685	1.7%	129,023	6.0%
Retail/Wholesale Trade	259,134	4.2%	273,954	5.7%	288,276	5.2%
Transportation & Communication	85,878	4.4%	87,443	1.8%	92,572	5.9%
Community Services	268,944	5.6%	281,676	4.7%	295,112	4.8%
Others	62,455	2.7%	64,171	2.7%	65,933	2.7%
GDP	1,980,208		2,015,462		2,157,055	
Growth Rate of GDP		3.9%		1.8%		7.0%

Source: Background to the Budget (1993-1994)

3. Other Information

1) National Holidays (1993)

New Years' Day	January 1
Liberation Day	January 26
International Women's Day	March 8
Good Friday	March 29
Easter Sunday.....	March 31
Easter Monday.....	April 1
Labour Day.....	May 1
Hero's Day.....	June 9
Independence Day.....	October 9
Boxing Day	December 26
Idd El Fitri.....	(Not Fixed)
Idd Adhuha.....	(Not Fixed)

2) Office Hours

08:30 ~ 16:45

Lunch break: 12:45 ~ 14:00

Closed on Saturdays and Sundays

APPENDIX 8

**ESTIMATED COST FOR WORK TO BE UNDERTAKEN
BY UGANDAN SIDE**

Estimated Cost for Work To Be Done by the Ugandan Side

The Government of Uganda shall bear the following construction costs.

PHASE I

1. Kampala South Substation	4,561.47 US\$
2. Ntinda Substation	35,431.55 US\$
3. Kisugu Substation	6,606.37 US\$
4. Kawanda Substation	7,160.28 US\$
Total	53,759.67 US\$

PHASE II

1. Njeru Substation	5,911.15 US\$
2. Kisubi Substation	5,290.30 US\$
3. Kawala Substation	11,182.70 US\$
Total	22,384.15 US\$
Grand Total	76,143.82 US\$

Breakdown of Estimated Costs of Work To Be Done by Ugandan Side (PHASE I)

1. Kampala South Substation

1-1 Relocation of Existing Facilities (Wooden Poles 8 x 2pcs, with Aluminum Conductor 3 core 100mm²)

(1) Technician (Electrician)	3 persons x 1 day x 12US\$/day	=	36US\$
(2) Workers	3 persons x 1 day x 12US\$/day	=	36US\$
Total		=	72US\$

1-2 Access Road (10W x 22L = 220m²)

(1) Compaction Work	220m ² x 0.5m x 0.25US\$/m ³	=	27.5US\$
(2) Gravel	220m ² x 0.3m x 25US\$/m ³	=	1,650 US\$
Total		=	1,677.5US\$

1-3 Site Preparation Work (786m²) (including site drainage work)

(1) Land Clearance and Preparation	786m ² x 0.1m x 0.25US\$/m ³	=	19.65US\$
Total		=	19.65US\$

1-4 Graveling Work at Site (786m²)

(1) Graveling work	786m ² x 0.05m x 0.25US\$/m ³	=	9.82US\$
(2) Gravel	786m ² x 0.05m x 25US\$/m ³	=	982.5 US\$
Total		=	992.32US\$

1-5 Installation Work of 33kV Transmission Line (150mm² AAAC x 100m)

(1) Technician (Electrician)	100m x 0.13 person/man-day x 12US\$/day	=	156US\$
Total		=	156US\$

1-6 Installation Work of 11kV Distribution Line (11kV CV 3c 100mm² x 700m)

(1) Technician (Electrician)	700m x 0.19 person/man-day x 12US\$/day	=	1,596US\$
Total		=	1,596US\$

1-7 Outdoor Lighting System (10m pole, 2pcs)

(1) Pole Mounding Work			
(Technician)	2 person x 1 day x 12US\$/day	=	24US\$
(Worker)	2 person x 1 day x 12US\$/day	=	24US\$
Total		=	48US\$

Total (Kampala South) 4,561.47US\$

2. Ntinda Substation

2-1 Relocation of Existing Facilities (Existing houses, 12 houses)

(1) Technical (Electrician)	5 persons x 6 days x 12US\$/day	=	360US\$
(2) Workers	5 persons x 6 days x 12US\$/day	=	360US\$
(3) Heavy Machinery for Removal (Back Hoe)	1 unit x 4 days x 484US\$/day	=	1,520US\$
(4) Dump Truck	1 unit x 4 days x 380US\$/day	=	1,520US\$
	Total	=	4,176US\$

2-2 Access Road (6W x 85L = 510m²)

(1) Compaction work	510m ² x 0.5m x 0.25US\$/m ³	=	63.75US\$
(2) Gravel	510m ² x 0.3m x 25US\$/m ³	=	3,825 US\$
	Total	=	3,888.75US\$

2-3 Site Preparation Work (1,024m²) (including site drainage work)

(1) Land Clearance and Preparation	1,024m ² x 0.1m x 0.25US\$/m ³	=	25.6US\$
	Total	=	25.6US\$

2-4 Graveling Work at Site (1,024m³)

(1) Graveling work	1,024m ² x 0.05m x 0.25US\$/m ³	=	12.8US\$
(2) Gravel	1024m ² x 0.05m x 25US\$/m ³	=	1,280 US\$
	Total	=	1,292.8US\$

2-5 Instatallation Work of 33kV Transmission Line (150mm², AAAC x 14km)

(1) Technician (Electrician)	14,000m x 0.13 person/man-day x 12US\$/day	=	21,840US\$
	Total	=	21,840US\$

2-6 Installation Work of 11kV Distribution Line (11kV CV 3c 100mm² x 250m)

(1) Technician (Electrician)	250m x 0.19 person/man-day x 12US\$/day	=	570US\$
	Total	=	570US\$

2-7 Outdoor Lighting System (10m pole, 2pcs)

(1) Pole Mounding Work Technicians (Electrician)	2 persons x 1 day x 12US\$/day	=	24US\$
Workers	2 persons x 1 day x 12US\$/day	=	24US\$
	Total	=	48US\$

2-8 Boundary Fence (t = 150, Brick wall 1.5H x 128L = 192m²)

(1) Fence Work	192m ² x 18.7US\$/m ²	=	3,590.4US\$
		Total	= 3,590.4US\$
	Total (Ntinda)		=35,431.55US\$

3. Kisugu Substation

3-1 Relocation of Existing Facilities (relocation of low voltage distribution lines)

(1) Technician (Electrician)	3 persons x 1 day x 12US\$/day	=	36US\$
(2) Workers	3 persons x 1 day x 12US\$/day	=	36US\$
		Total	= 72US\$

3-2 Site Preparation Work (1,882m²) (including site drainage work)

(1) Land Clearance and Preparation	1,882m ² x 0.1m x 0.25US\$/m ³	=	47.05US\$
		Total	= 47.05US\$

3-3 Graveling Work at Site (1,882m³)

(1) Graveling work	1,882m ² x 0.05m x 0.25US\$/m ³	=	23.52US\$
(2) Gravel	1,882m ² x 0.05m x 25US\$/m ³	=	2,352.5 US\$
		Total	= 2,376.02US\$

3-4 Installation Work of 11kV Distribution Line (11kV CV 3c 100mm² x 150m)

(1) Technician (Electrician)	150m x 0.19 person/man day x 12US\$/day	=	342US\$
		Total	= 342US\$

3-5 Outdoor Lighting System (10m pole, 2pcs)

(1) Pole Mounding Work Technicians (Electricians)	2 persons x 1 day x 12US\$/day	=	24US\$
Workers	2 persons x 1 day x 12US\$/day	=	24US\$
		Total	= 48US\$

3-6 Boundary Fence (t = 150, Brick wall 1.5H x 133L = 199m²)

(1) Fence work	199m ² x 18.7US\$/m ²	=	3,721.3US\$
		Total	= 3,721.3US\$

Total (Kisugu) =6,606.37US\$

4. Kawanda Substation

4-1 Relocation of Existing Facilities (removal of transformer foundation and main unit)

(1) Technician (Electrician)	3 persons x 3 days x 12US\$/day	=	108US\$
(2) Workers	4 persons x 3 days x 12US\$/day	=	144US\$
(3) Heavy Machinery for Removal (Back Hoe)	1 unit x 3 days x 484US\$/day	=	1,452US\$
(4) Dump Truck	1 unit x 3 days x 380US\$/day	=	1,140US\$
		Total	= 2,844US\$

4-2 Site Preparation Work (817m²) (including site drainage work)

(1) Land Clearance and Preparation	817m ² x 0.1m x 0.25US\$/m ³	=	20.42US\$
		Total	= 20.42US\$

4-3 Graveling Work at Site (817m³)

(1) Graveling Work	817m ² x 0.05m x 0.25US\$/m ³	=	10.21US\$
(2) Gravel	817m ² x 0.05m x 25US\$/m ³	=	1,021.25US\$
		Total	= 1,031.46US\$

4-4 Outdoor Lighting System (10m pole, 2pcs)

(1) Pole Mounding Work Technicians (Electricians)	2 persons x 1 day x 12US\$/day	=	24US\$
Workers	2 persons x 1 day x 12US\$/day	=	24US\$
		Total	= 48US\$

4-5 Boundary Fence (t = 150, Brick wall 1.5H x 115L = 172m²)

(1) Fence work	172m ² x 18.7US\$/m ²	=	3,216.4US\$
		Total	= 3,216.4US\$

Total (Kawanda) =7,160.28US\$

Breakdown of Estimated Costs of Work To Be Done by Ugandan Side (PHASE II)

1. Njeru Substation

1-1 Relocation of Existing Facilities (removal of cement floor and tank)

(1) Technical (Electrician)	3 persons x 3 days x 12US\$/day	=	108US\$
(2) Workers	4 persons x 3 days x 12US\$/day	=	144US\$
(3) Heavy Machinery for Removal (Back Hoe)	1 unit x 3 days x 484US\$/day	=	1,452US\$
(4) Dump Truck	1 unit x 3 days x 380US\$/day	=	1,140US\$
	Total	=	2,844US\$

1-2 Site Preparation Work (380m²) (including site drainage work)

(1) Land Clearance and Preparation	380m ² x 0.1m x 0.25US\$/m ³	=	9.5US\$
	Total	=	9.5US\$

1-3 Graveling Work at Site (380m³)

(1) Graveling Work	380m ² x 0.05m x 0.25US\$/m ³	=	4.75US\$
(2) Gravel	380m ² x 0.05m x 25US\$/m ³	=	475 US\$
	Total	=	479.75US\$

1-4 Installation Work of 11kV Distribution Line (11kV CV 3c 100mm² x 600m)

(1) Technician (Electrician)	600m x 0.19 person/man-day x 12US\$/day	=	342US\$
	Total	=	342US\$

1-5 Outdoor Lighting System (10m pole, 2pcs)

(1) Pole Mounding Work Technicians	2 persons x 1 day x 12US\$/day	=	24US\$
Workers	2 persons x 1 day x 12US\$/day	=	24US\$
	Total	=	48US\$

1-6 Boundary Fence (t = 150, Brick wall 1.5H x 78L = 117m²)

(1) Fence Work	117m ² x 18.7US\$/m ²	=	2,187.9US\$
	Total	=	2,187.9US\$

Total (Njeru) 5,911.15US\$

2. Kisubi Substation

2-1 Relocation of Existing Facilities (Existing Transformers (2 Sets) and 11 kV Poles)

(1) Technician (Electrician)	1 person x 1 day x 12US\$/day	=	12US\$
(2) Workers	2 persons x 1 day x 12US\$/day	=	24US\$
	Total	=	36US\$

2-2 Access Road (3.4W x 60L = 204m²)

(1) Compaction Work	204m ² x 0.5m x 0.25US\$/m ³	=	25.5US\$
(2) Gravel	204m ² x 0.3m x 25US\$/m ³	=	1,530 US\$
	Total	=	1,555.5US\$

2-3 Site Preparation Work (567m²) (including site drainage work)

(1) Land Clearance and Preparation	567m ² x 0.1m x 0.25US\$/m ³	=	14.17US\$
	Total	=	14.17US\$

2-4 Graveling Work at Site (567m²)

(1) Graveling work	567m ² x 0.05m x 0.25US\$/m ³	=	7.08US\$
(2) Gravel	567m ² x 0.05m x 25US\$/m ³	=	708.75US\$
	Total	=	716.83US\$

2-5 Installation Work of 11kV Distribution Line (11kV CV 3c 100mm² x 100m)

(1) Technician (Electrician)	100m x 0.19 person/man-days x 1US\$/day	=	228US\$
	Total	=	228US\$

2-6 Outdoor Lighting System (10m pole, 2pcs)

(1) Pole Mounding Work Technicians (Electricians)	2 persons x 1 day x 12US\$/day	=	24US\$
Workers	2 persons x 1 day x 12US\$/day	=	24US\$
	Total	=	48US\$

2-7 Boundary Fence (t = 150, Brick wall 1.5H x 96L = 144m²)

(1) Fence Work	142m ² x 18.7US\$/m ²	=	2,692.8US\$
	Total	=	2,692.8US\$

Total (Kisubi) = 5,290.3US\$

3. Kawala Substation

3-1 Site Preparation Work (3,215m²) (including site drainage work)

(1) Land Clearance and Preparation	3,215m ² x 0.1m x 0.25US\$/m ³	=	80.37US\$
		Total	= 80.37US\$

3-2 Graveling Work at Site (3,215m²)

(1) Graveling work	3,215m ² x 0.05m x 0.25US\$/m ³	=	40.18US\$
(2) Gravel	3,215m ² x 0.05m x 25US\$/m ³	=	4,018.75US\$
		Total	= 4,058.93US\$

3-3 Instatallation Work of 33kV Transmission Line (150mm² AAAC x 200m)

(1) Instatallation Work of Transmission Line Technician (Electrician)	200m x 0.13 person/m, day x 12US\$/day	=	312US\$
(2) Pole Mounding Work Technician (Electrician)	2 persons x 1 day x 12US\$/day	=	24US\$
	Worker 2 persons x 1 day x 12US\$/day	=	24US\$
		Total	= 372US\$

3-4 Installation Work of 11kV Distribution Line (11kV CV 3c 100mm² x 100m)

(1) Technician (Electrician)	100m x 0.19 person/man-day x 12US\$/day	=	228US\$
		Total	= 228US\$

3-5 Outdoor Lighting System (10m pole, 2pcs)

(1) Pole Mounding Work Technician (Electrician)	2 persons x 1 day x 12US\$/day	=	24US\$
Worker	2 persons x 1 day x 12US\$/day	=	24US\$
		Total	= 48US\$

3-6 Boundary Fence (t = 150, Brick wall 1.5H x 228L = 342m²)

(1) Fence Work	342m ² x 18.7US\$/m ²	=	6,395.4US\$
		Total	= 6,395.4US\$

Total (Kawala) =11,182.7US\$

