

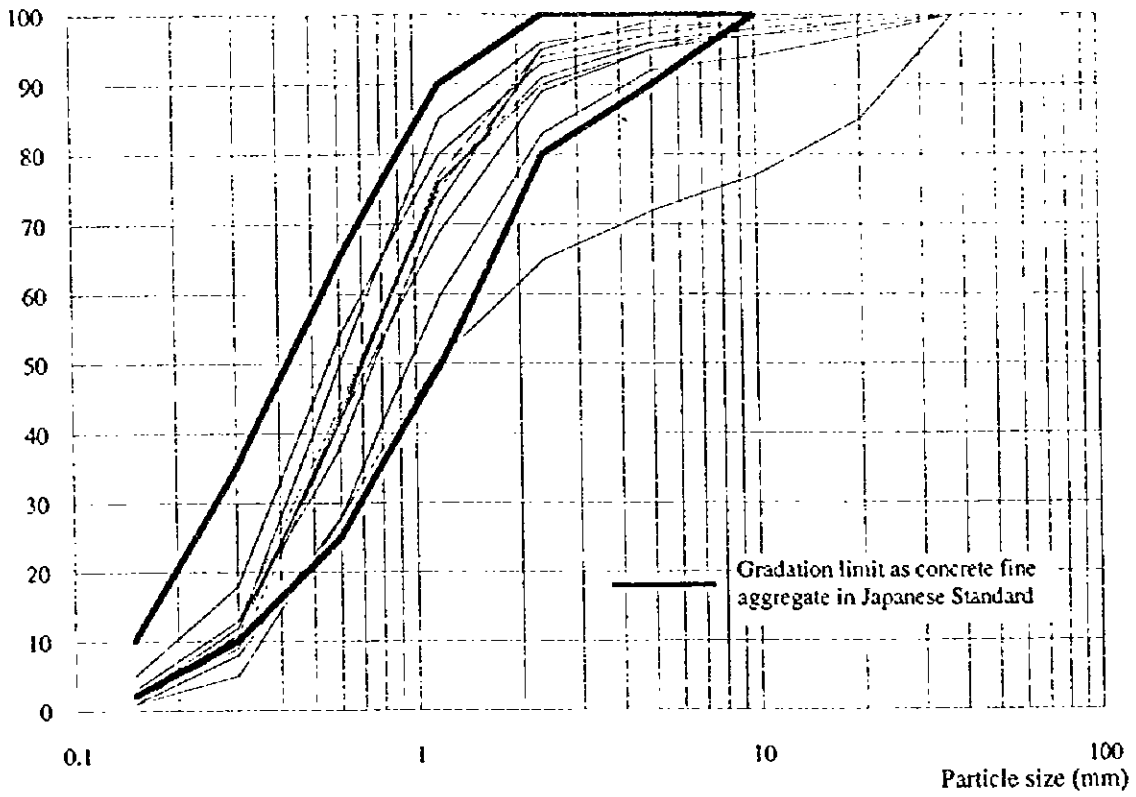
JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

Grand Falls Dam Site

Fig. No.
 3.4.2

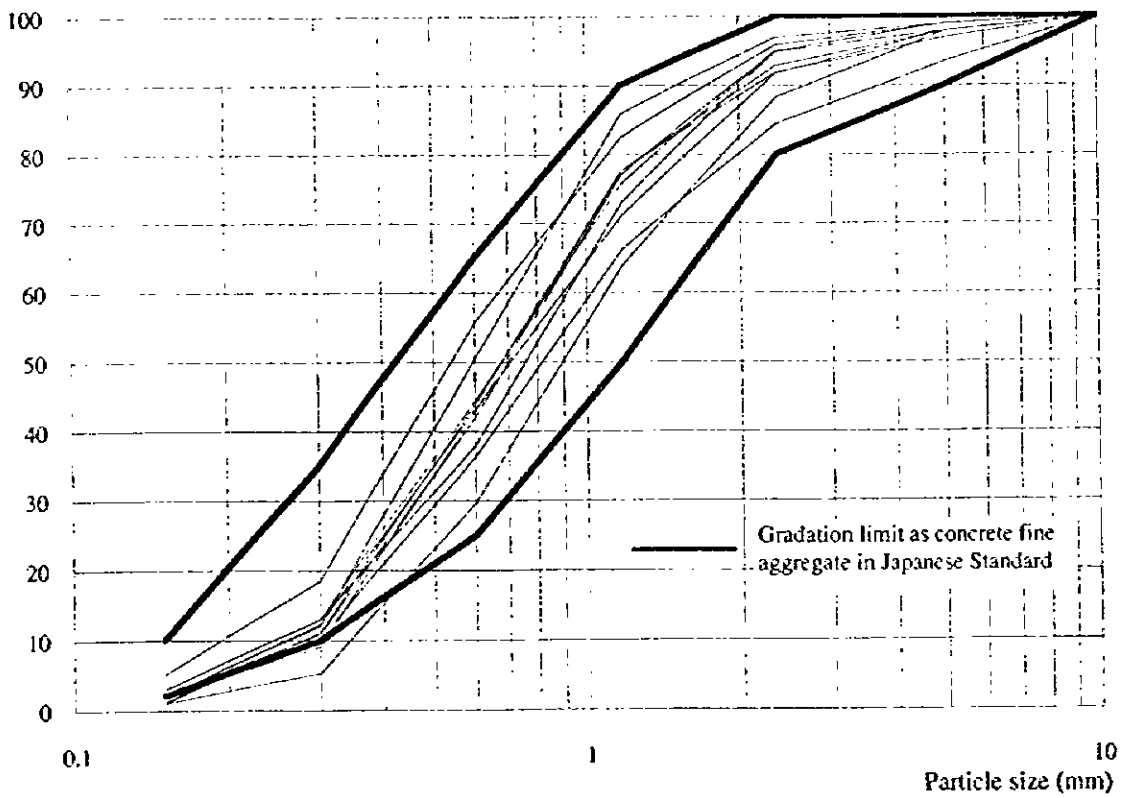
Passing (%)

Sampled Material



Passing (%)

After Cutting Particles over 10 mm



JAPAN INTERNATIONAL COOPERATION AGENCY

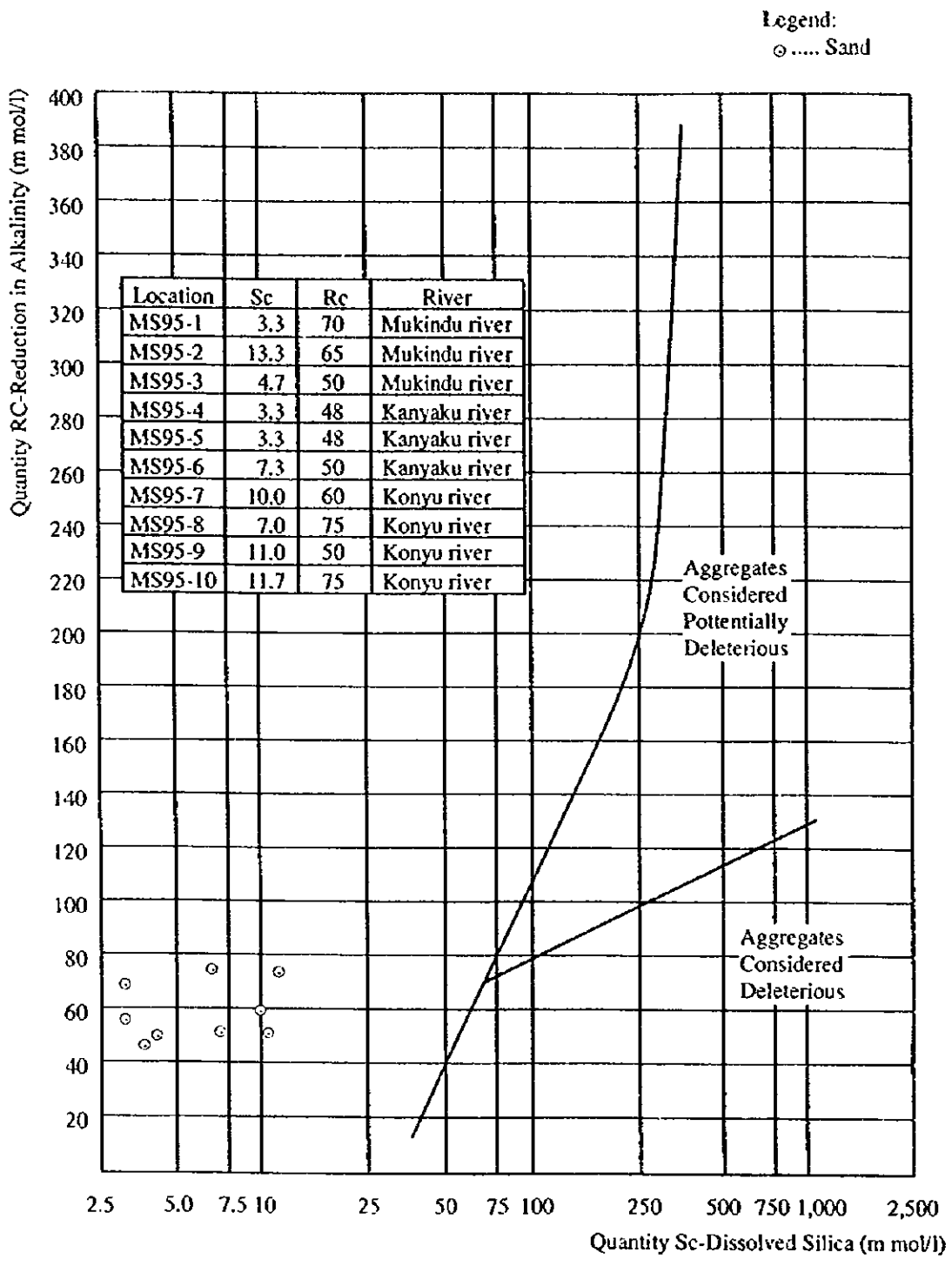
REPUBLIC OF KENYA

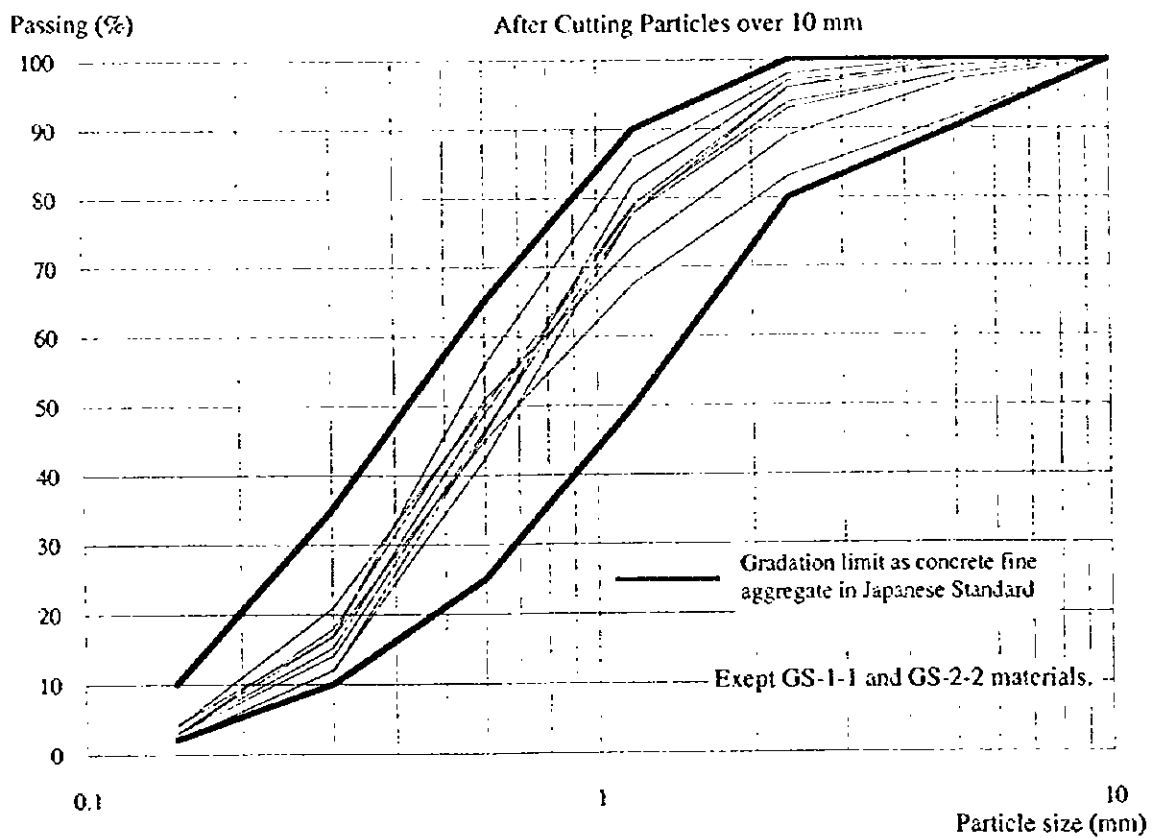
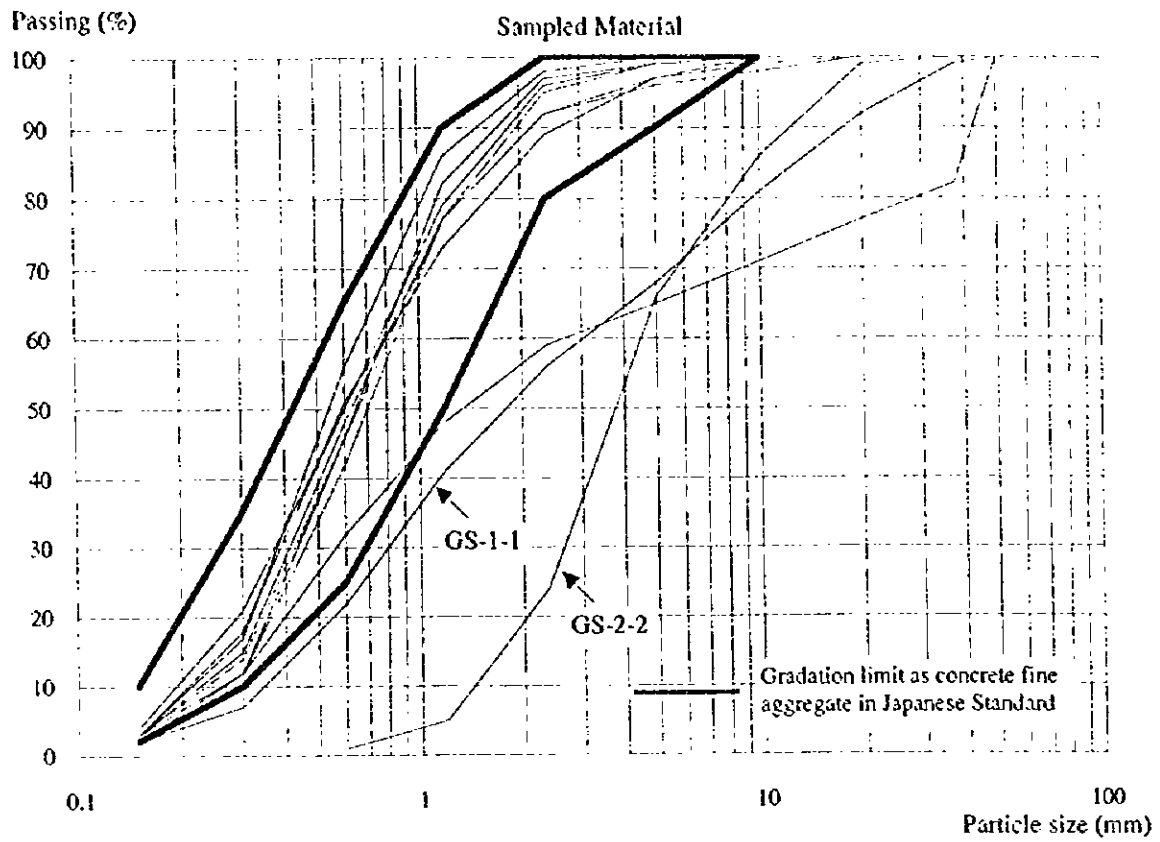
MUTONGA/GRAND FALLS HYDROPOWER PROJECT

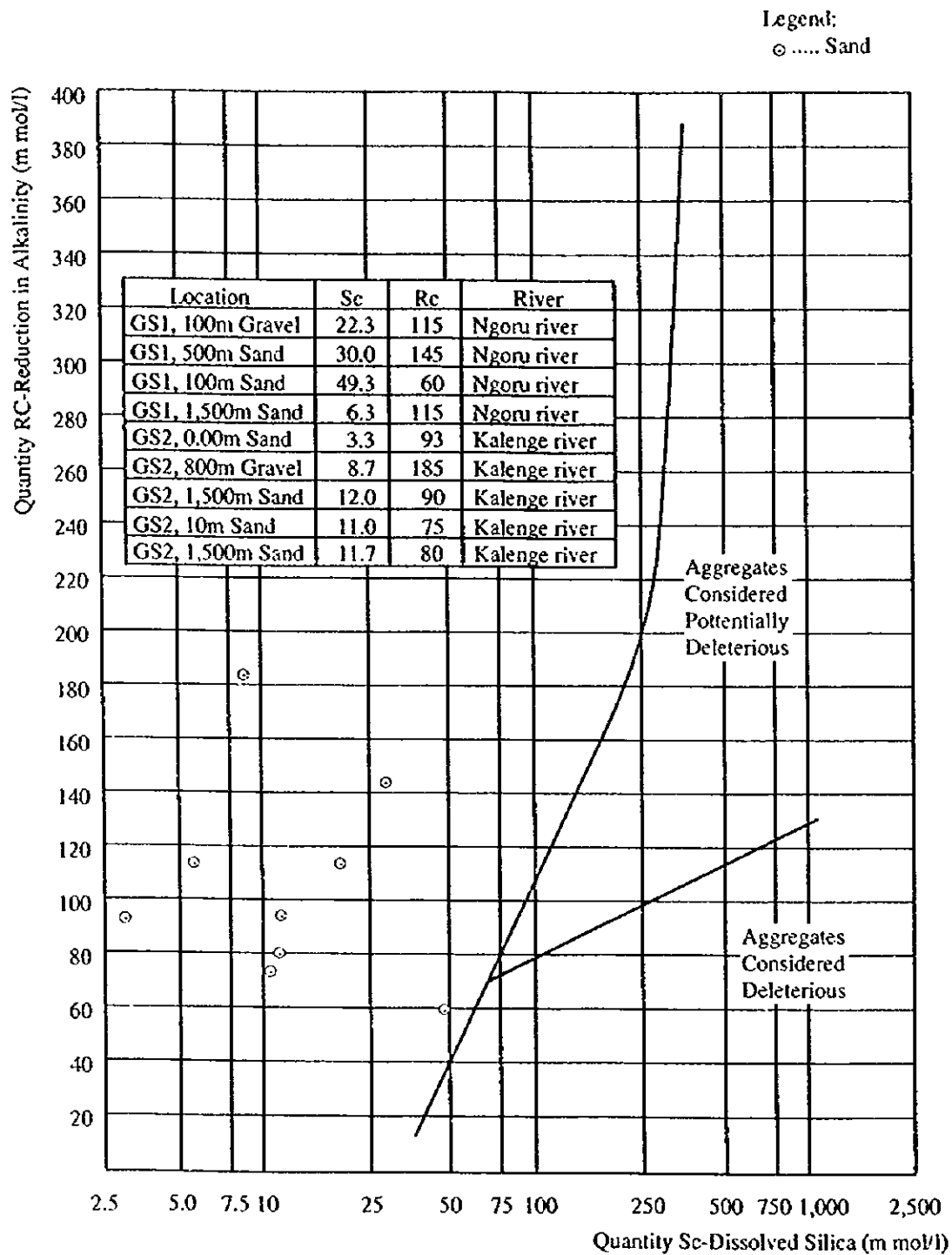
Sand Gradation Curve (Mutonga)

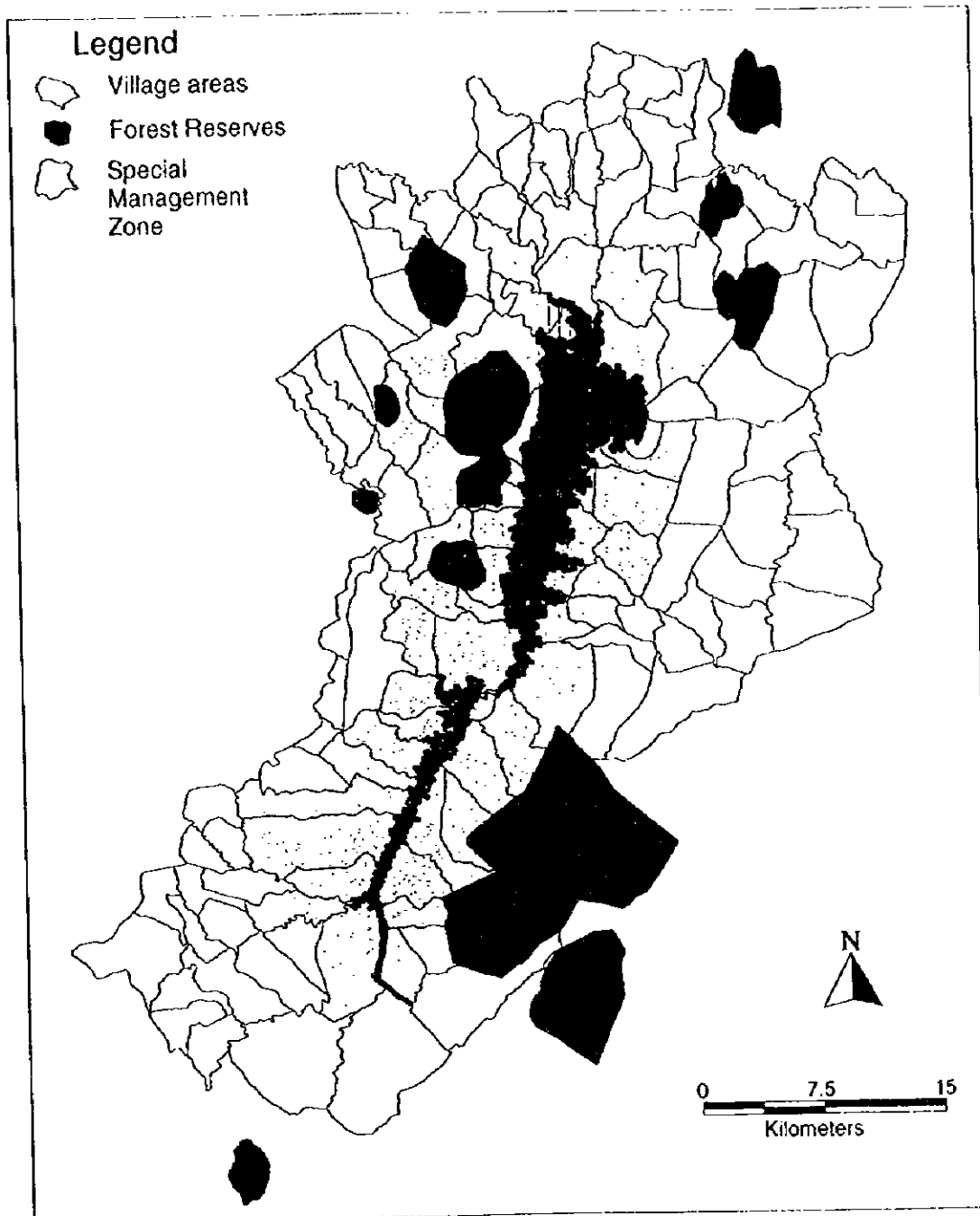
Fig. No.

3.4.3



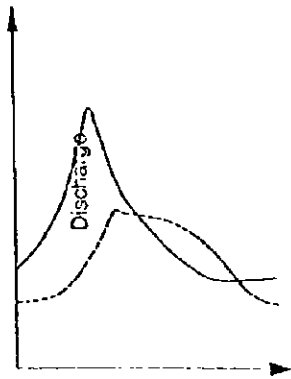






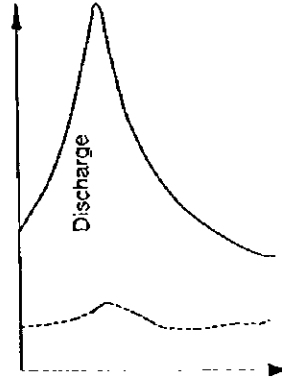
JAPAN INTERNATIONAL COOPERATION AGENCY	Proposed Special Management Zone for Mutonga and Grand Falls Reservoirs . Combined	Fig. No.
REPUBLIC OF KENYA MUTONGA/GRAND FALLS HYDROPOWER PROJECT		4.2.1

Type A



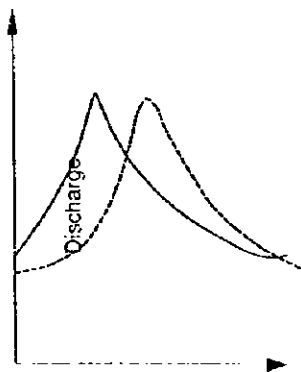
Time

Type B



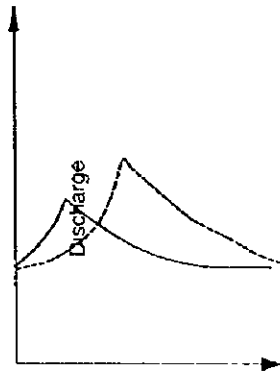
Time

Type C

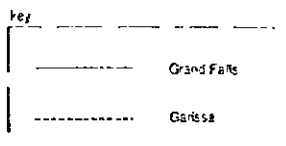


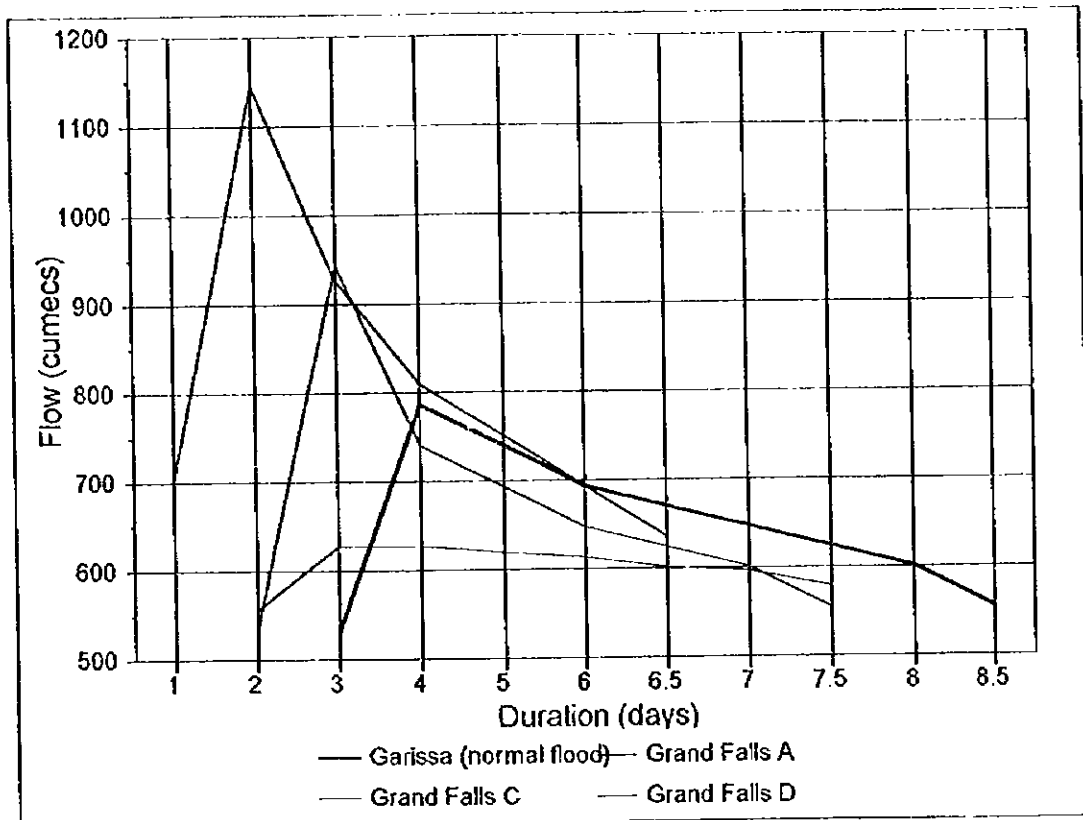
Time

Type D



Time





Flood Type	Peak (m^3s^{-1})	Duration (days)	Volume (MCM)
A	1145.8	6.5	490.3
C	943.4	6.5	406.8
D	627.7	6.5	364.0

JAPAN INTERNATIONAL COOPERATION AGENCY

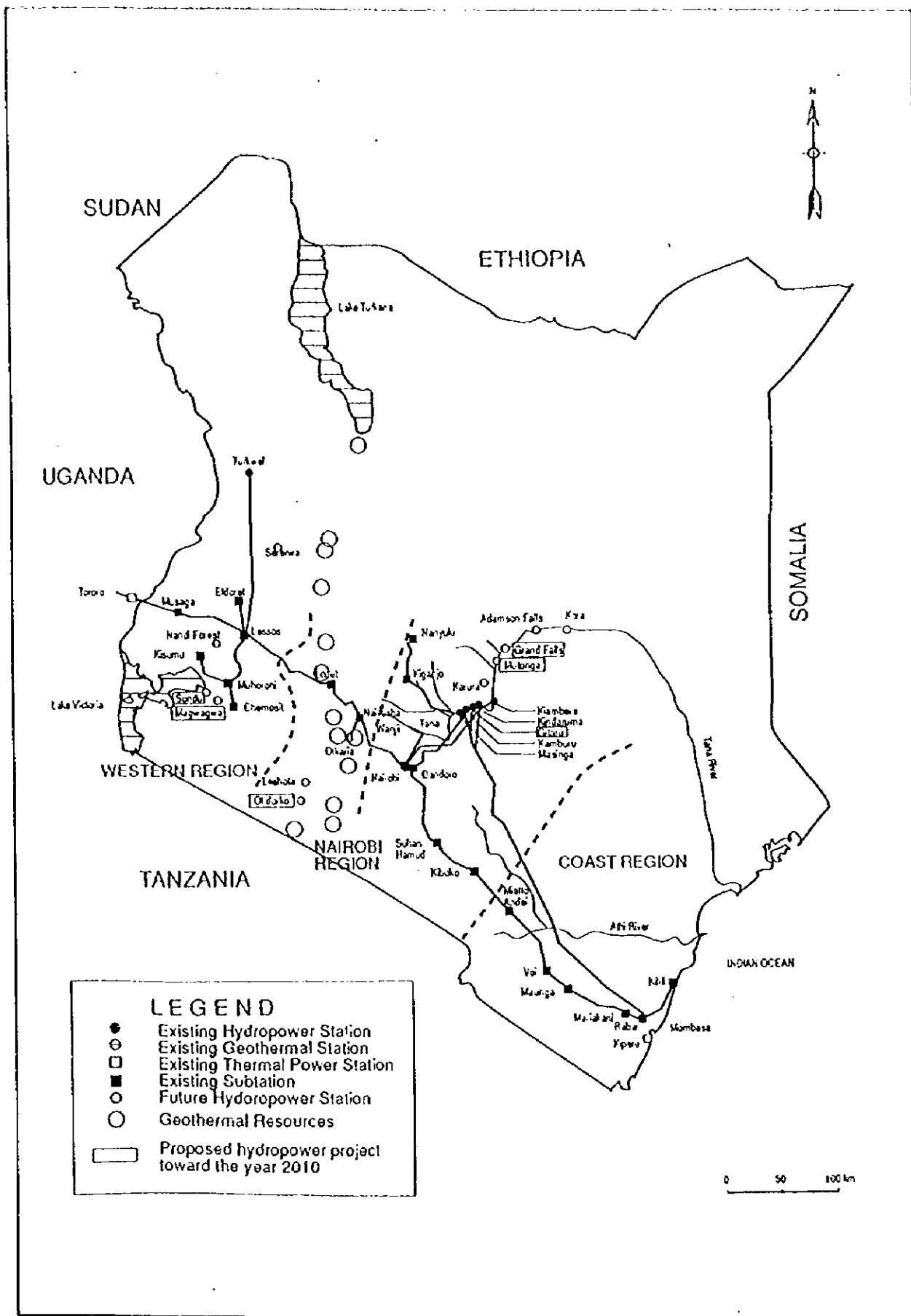
REPUBLIC OF KENYA

MUTONGA/GRAND FALLS HYDROPOWER PROJECT

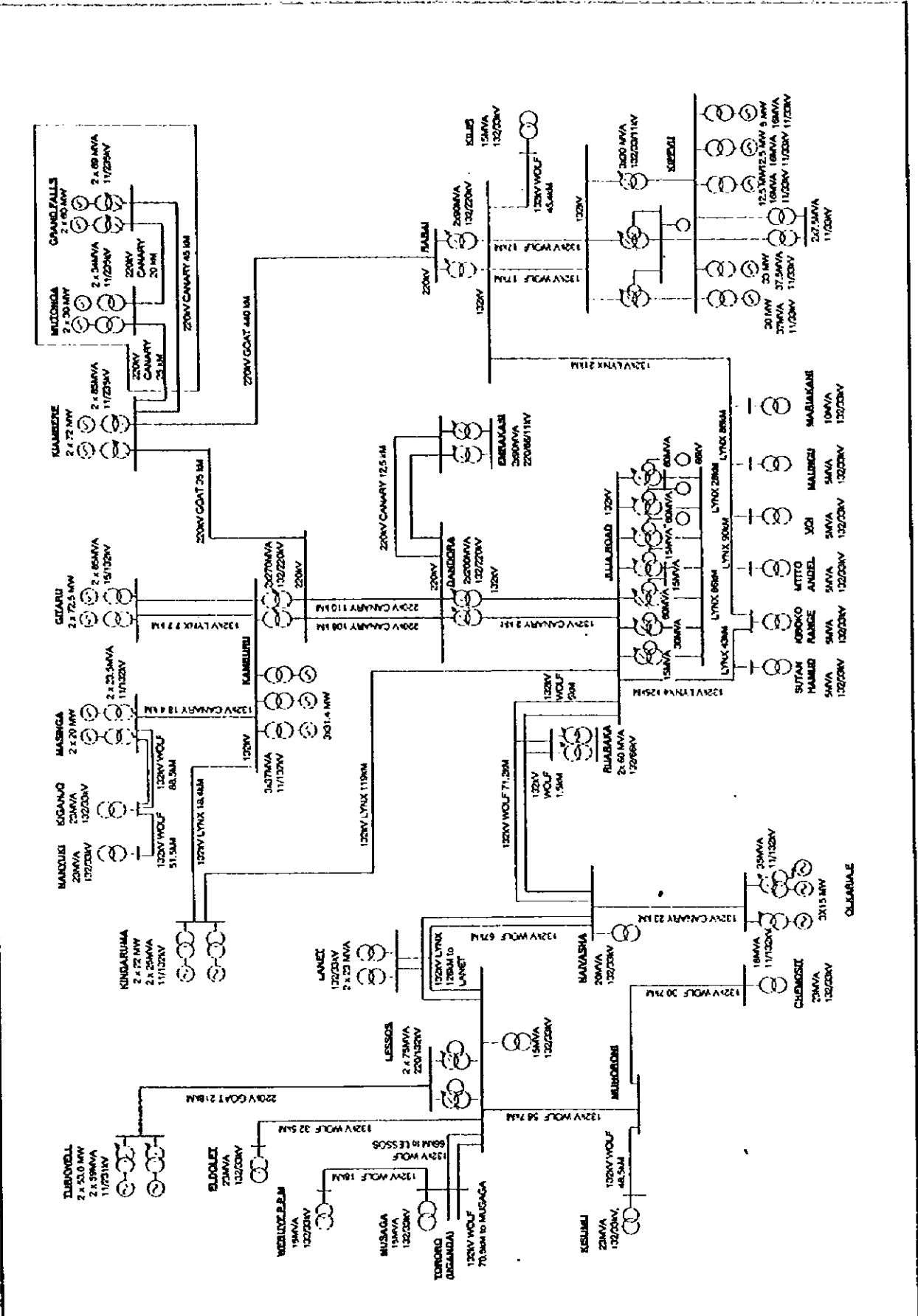
Flood Hydrographs at Grand Falls
relating to "Normal" Floods at Garissa

Fig. No.

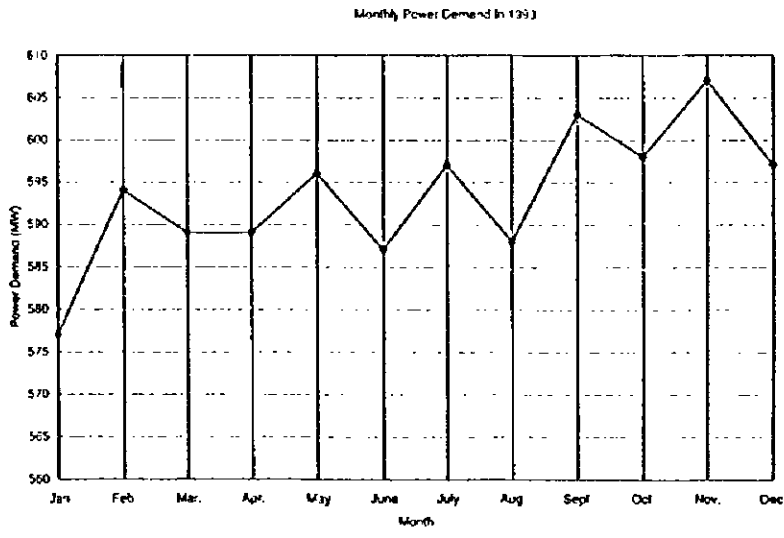
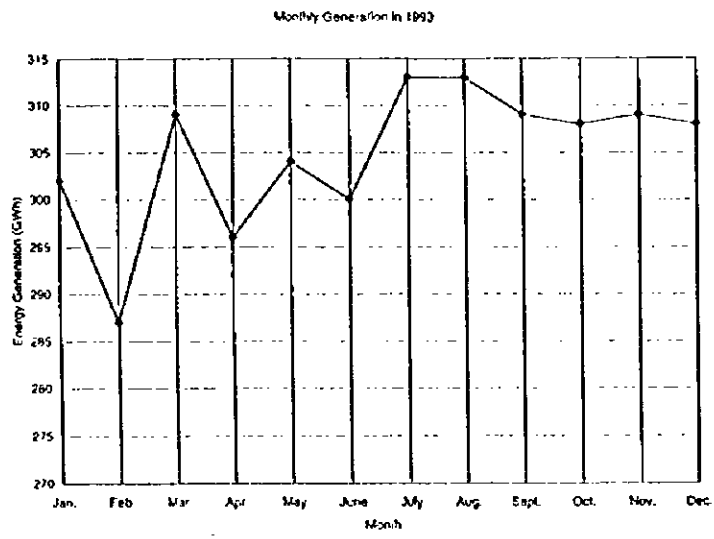
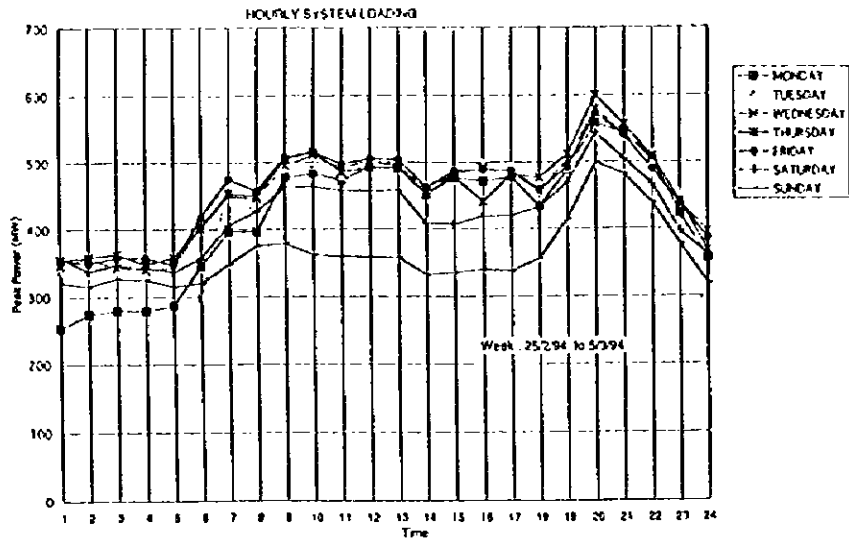
4.5.2

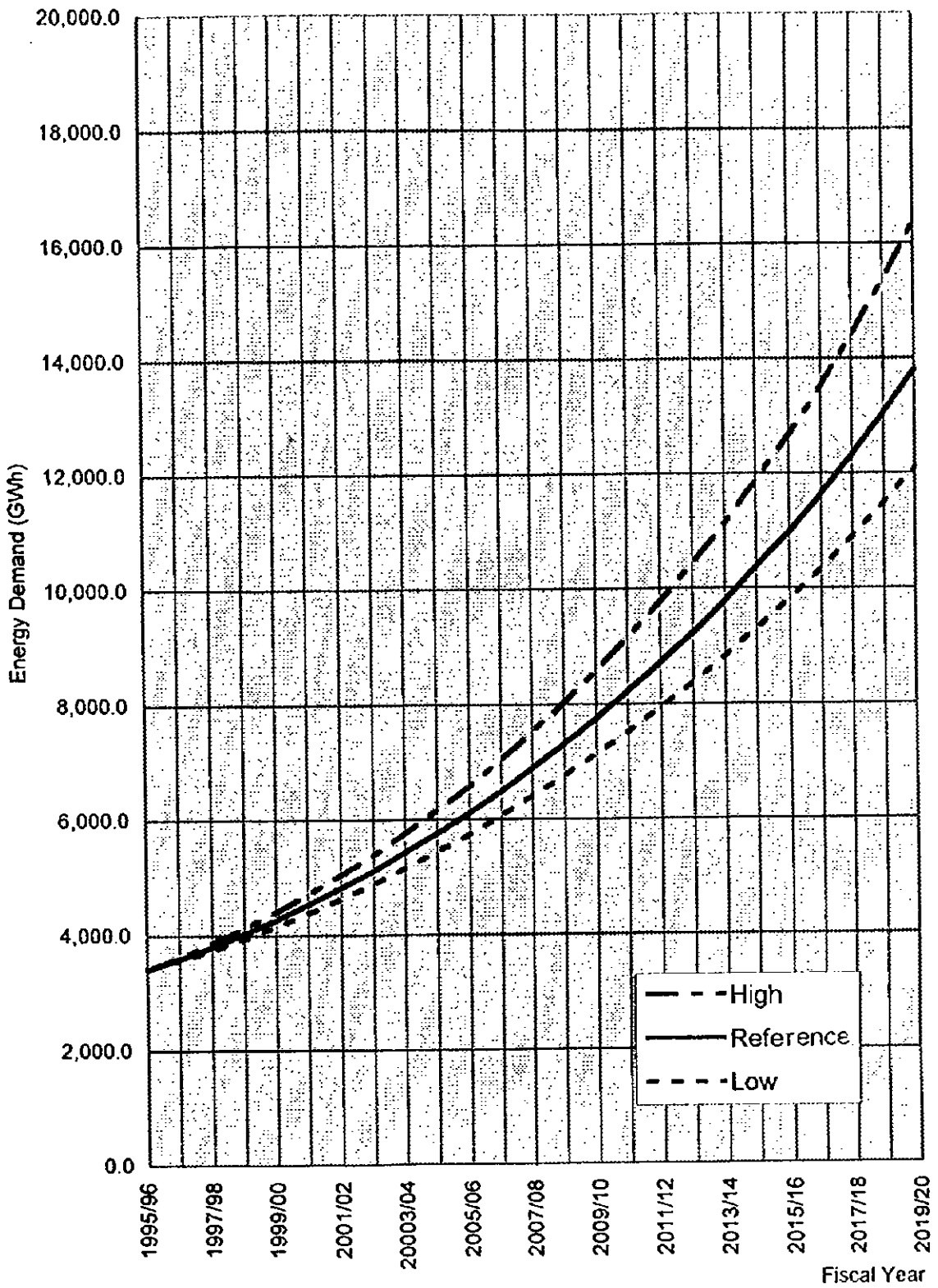


JAPAN INTERNATIONAL COOPERATION AGENCY REPUBLIC OF KENYA MUTONGA/GRAND FALLS HYDROPOWER PROJECT	Location of Existing Power Plant	Fig. No.
		5.2.1



JAPAN INTERNATIONAL COOPERATION AGENCY REPUBLIC OF KENYA MUTONGA/GRAND FALLS HYDROPOWER PROJECT	Existing National Power System	Fig. No. 5.2.2
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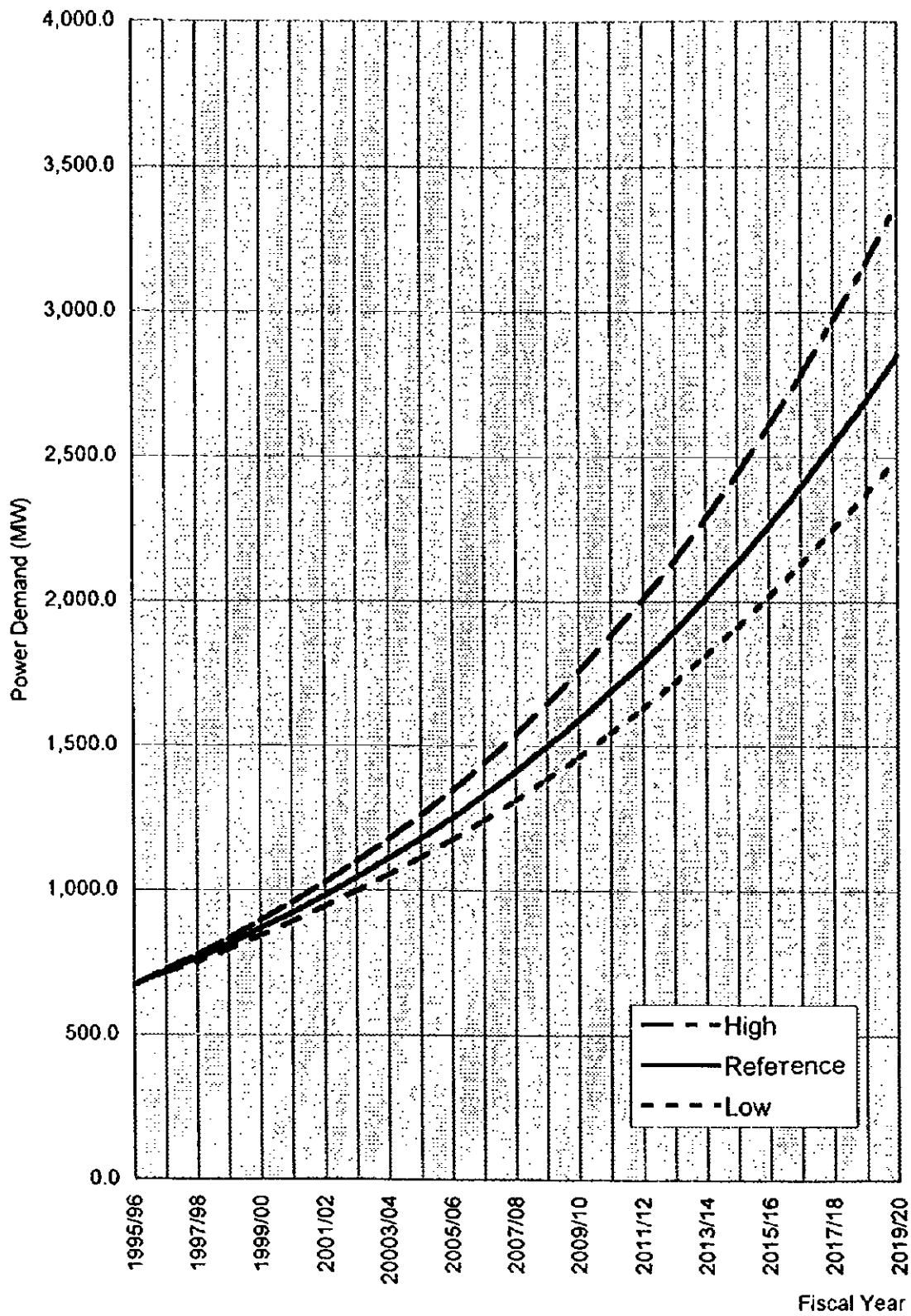




JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

Energy Demand Forecast

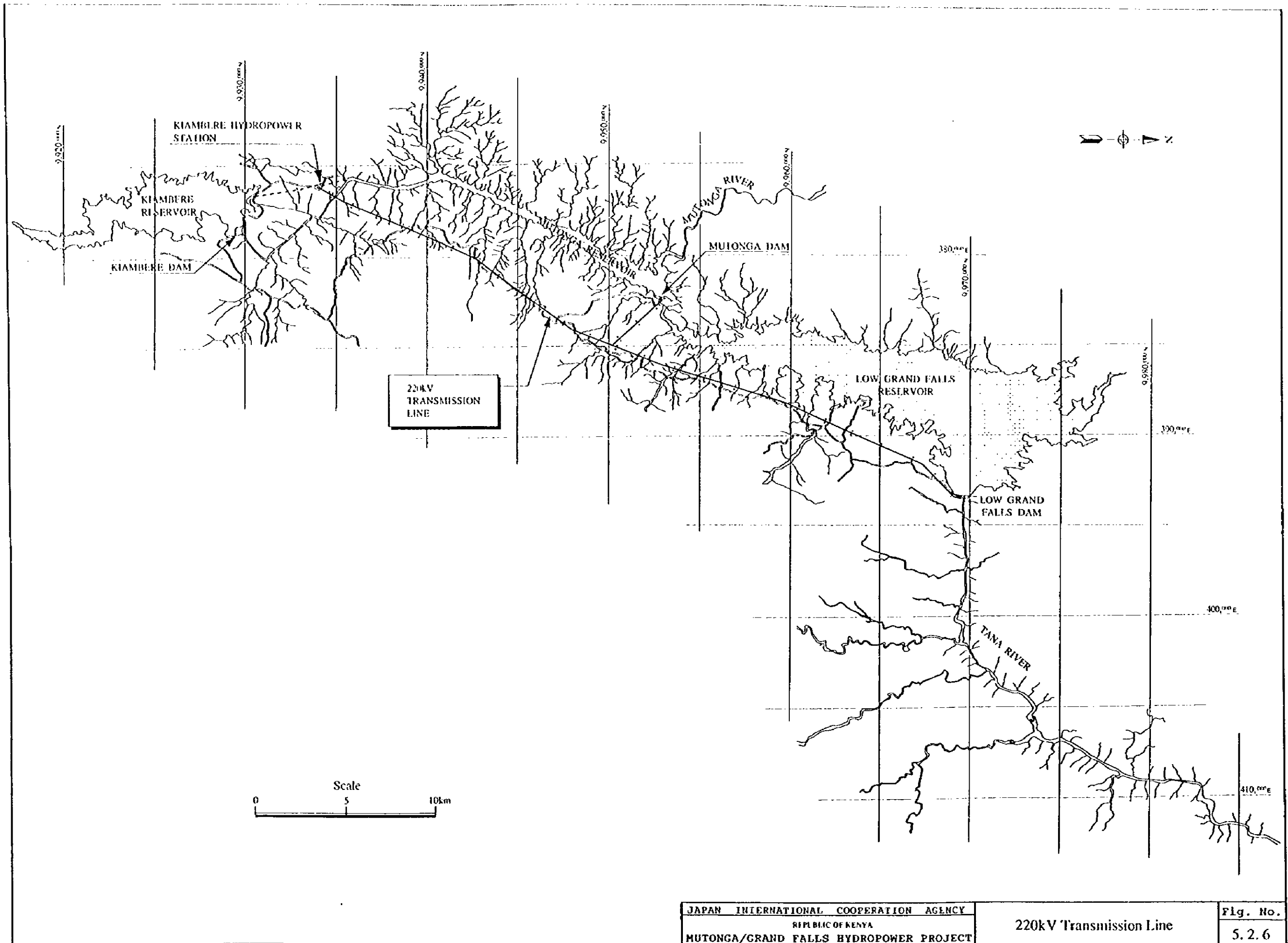
Fig. No.
 5.2.4



JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

Power Demand Forecast

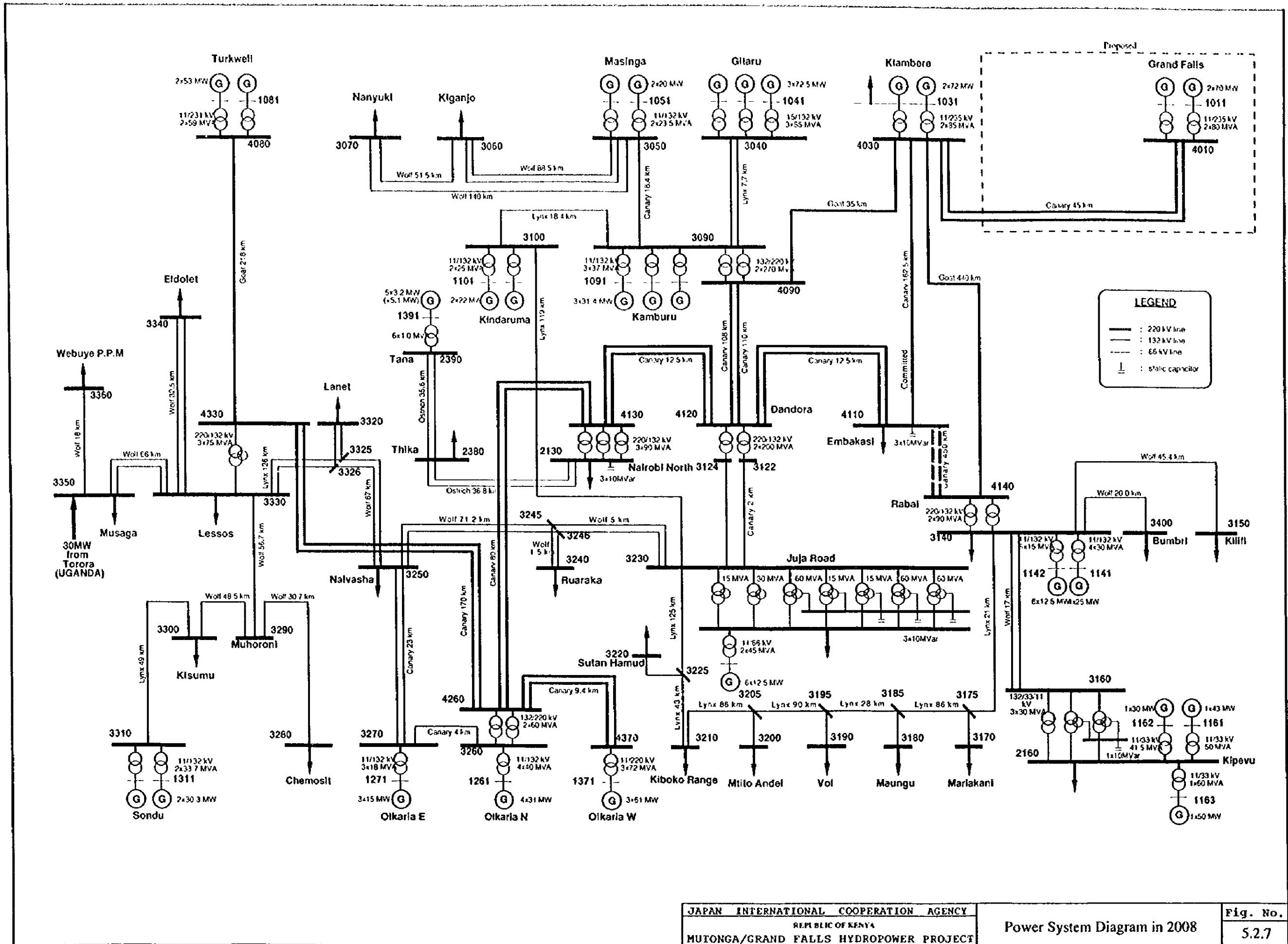
Fig. No.
 5.2.5

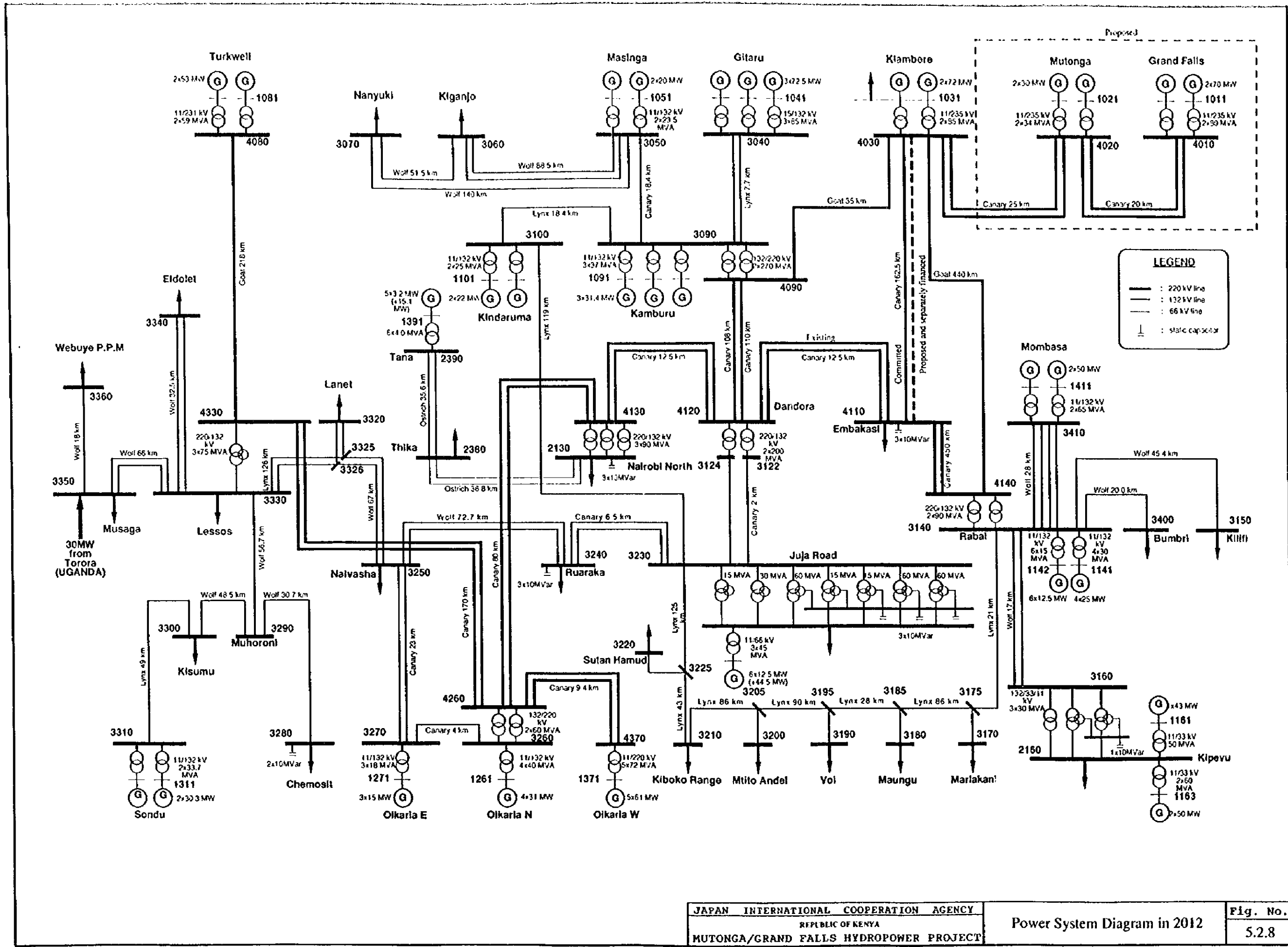


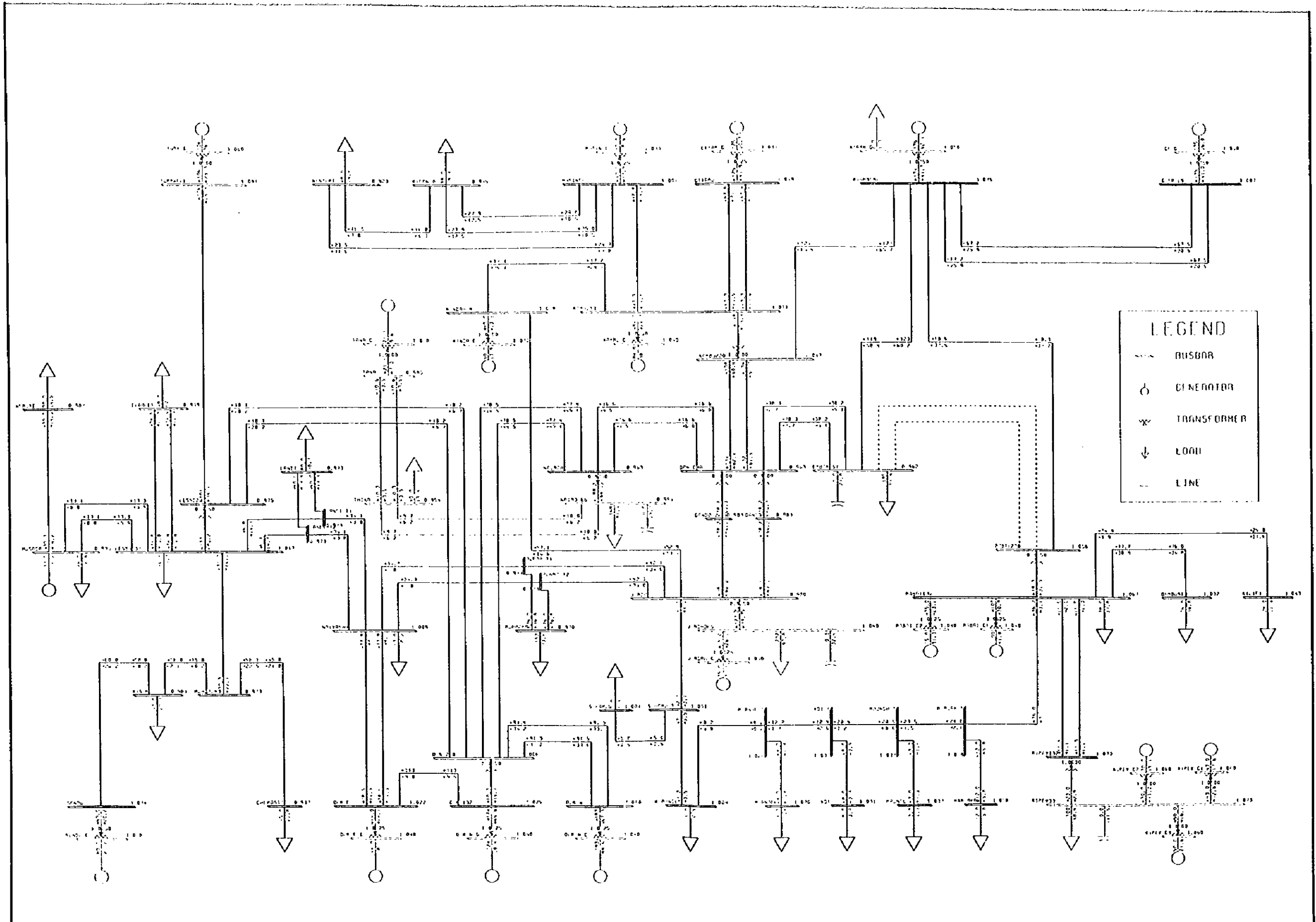
JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

220kV Transmission Line

Fig. No.
 5.2.6







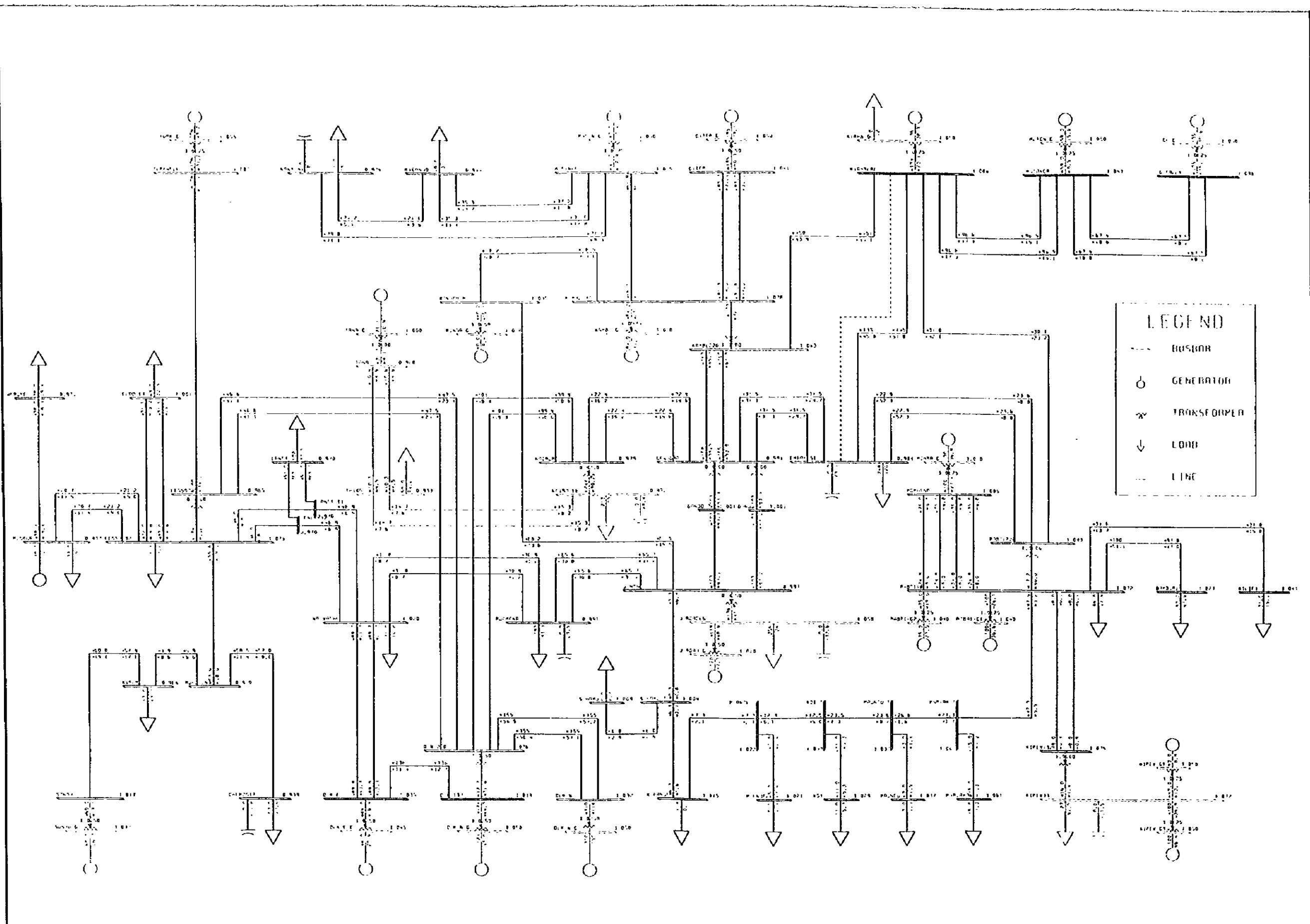
LEGEND

- BUSBAR
- GENERATOR
- ⊗ TRANSFORMER
- ↓ LOAD
- LINE

JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF YEMEN
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

Power Flow Analysis in 2008

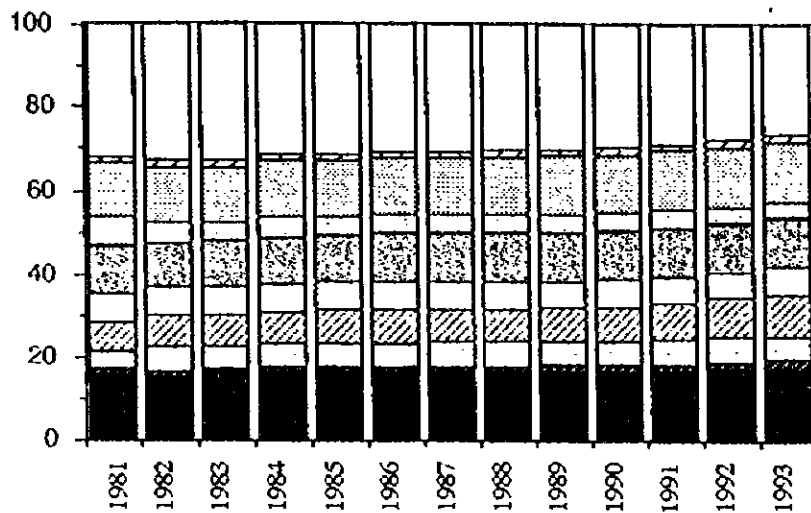
Fig. No.
 5.2.9



JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

Power Flow Analysis in 2012

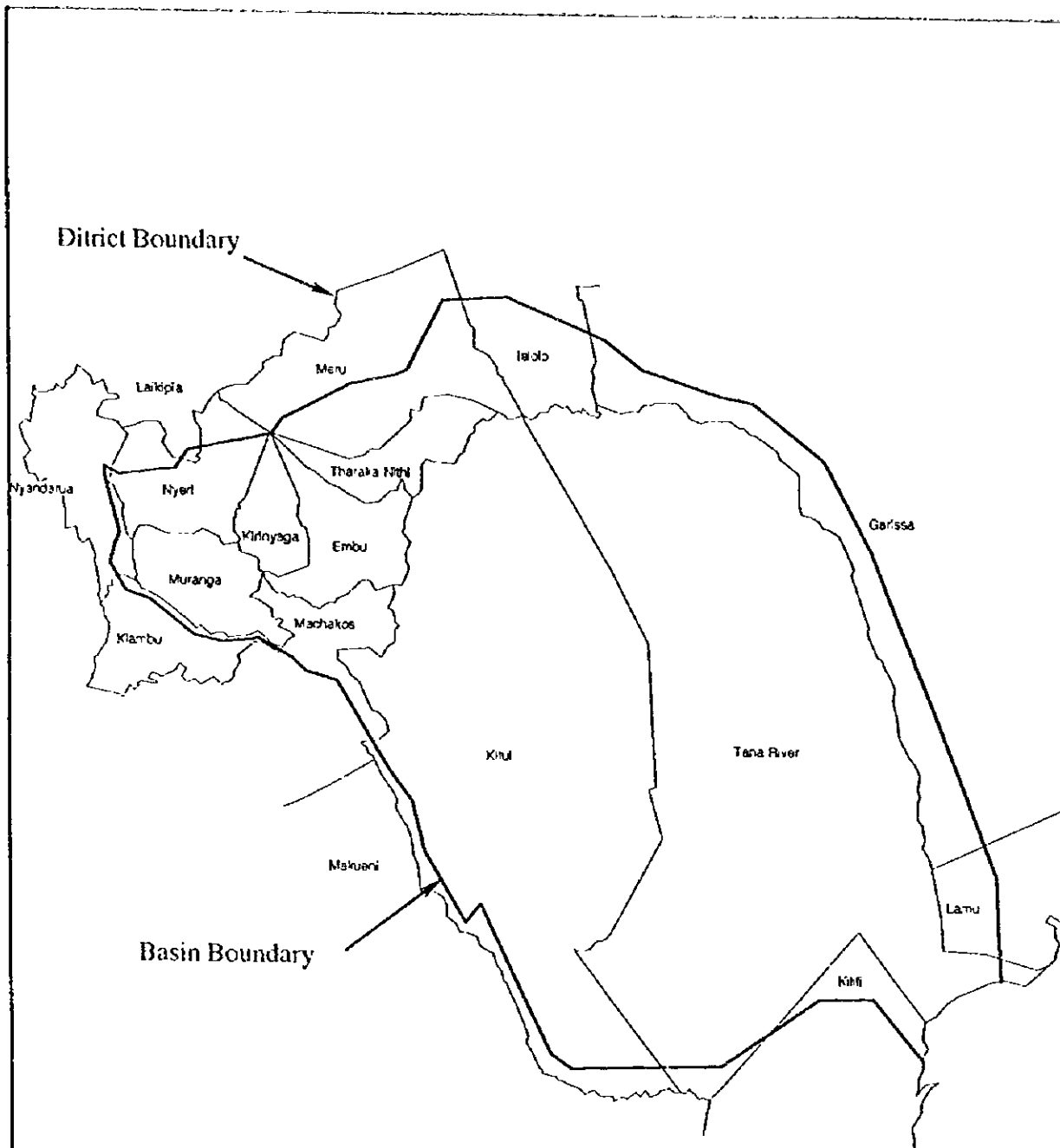
Fig. No.
 5.2.10



- Agriculture
- ▨ Forestry, Fishery, Mining/quarrying
- ▤ Manufacturing
- ▧ Building/construction, Electricity/water
- ▩ Trade/restaurant/hotel
- Transport/storage/communication
- ▨ Finance/insurance/real estate/business services
- ▤ Other services
- ▧ Domestic Services
- ▩ Procedures of Government Services

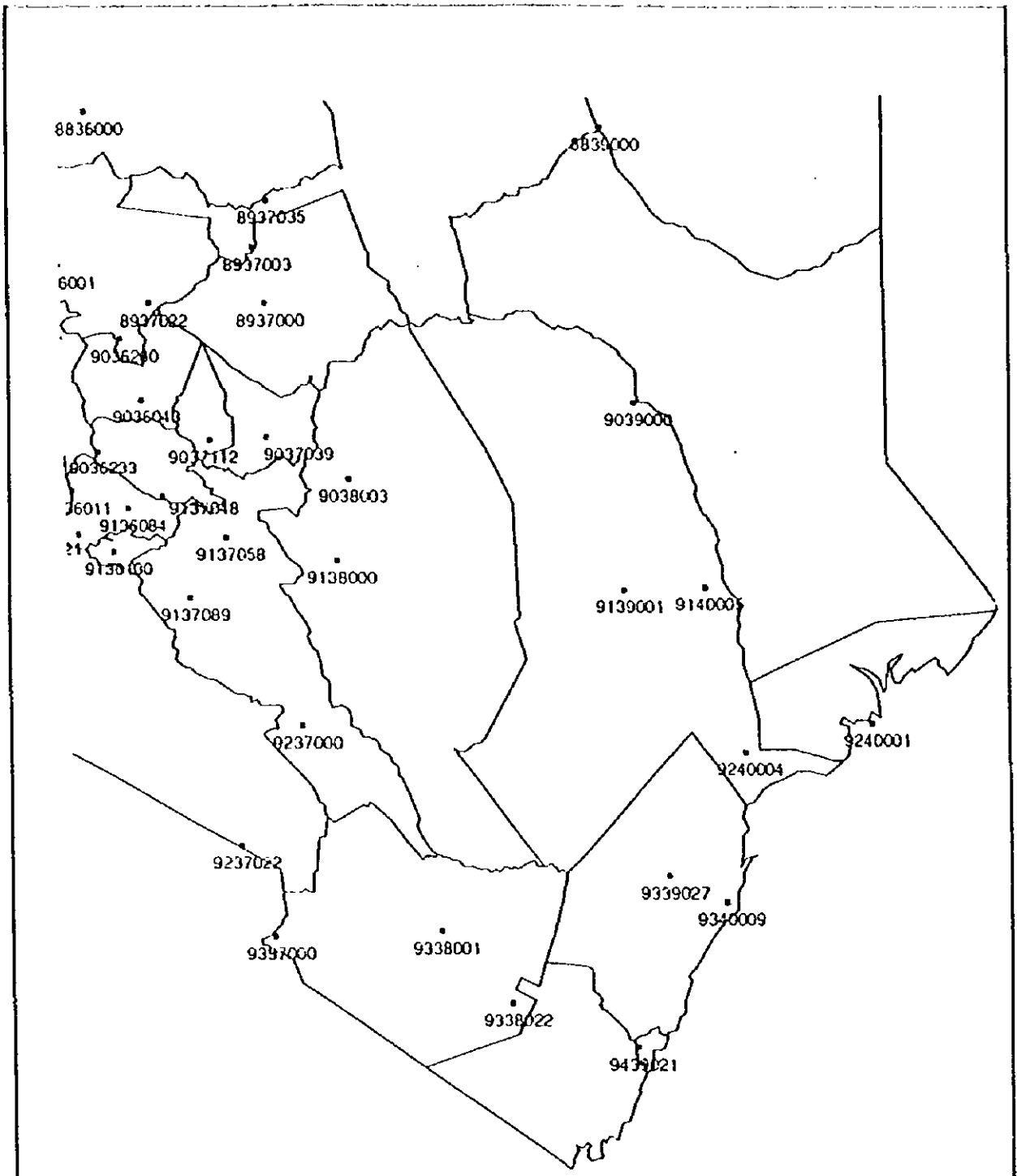
Source : Statistical Abstract 1991

JAPAN INTERNATIONAL COOPERATION AGENCY	Sector's Share of Gross Regional Domestic Products in the Nation	Fig. No.
REPUBLIC OF KENYA MUTONGA/GRAND FALLS HYDROPOWER PROJECT		5.3.1



Source : TARDA

<p>JAPAN INTERNATIONAL COOPERATION AGENCY REPUBLIC OF KENYA MUTONGA/GRAND FALLS HYDROPOWER PROJECT</p>	<p>Districts in the Tana River Basin</p>	<p>Fig. No. 5.3.2</p>
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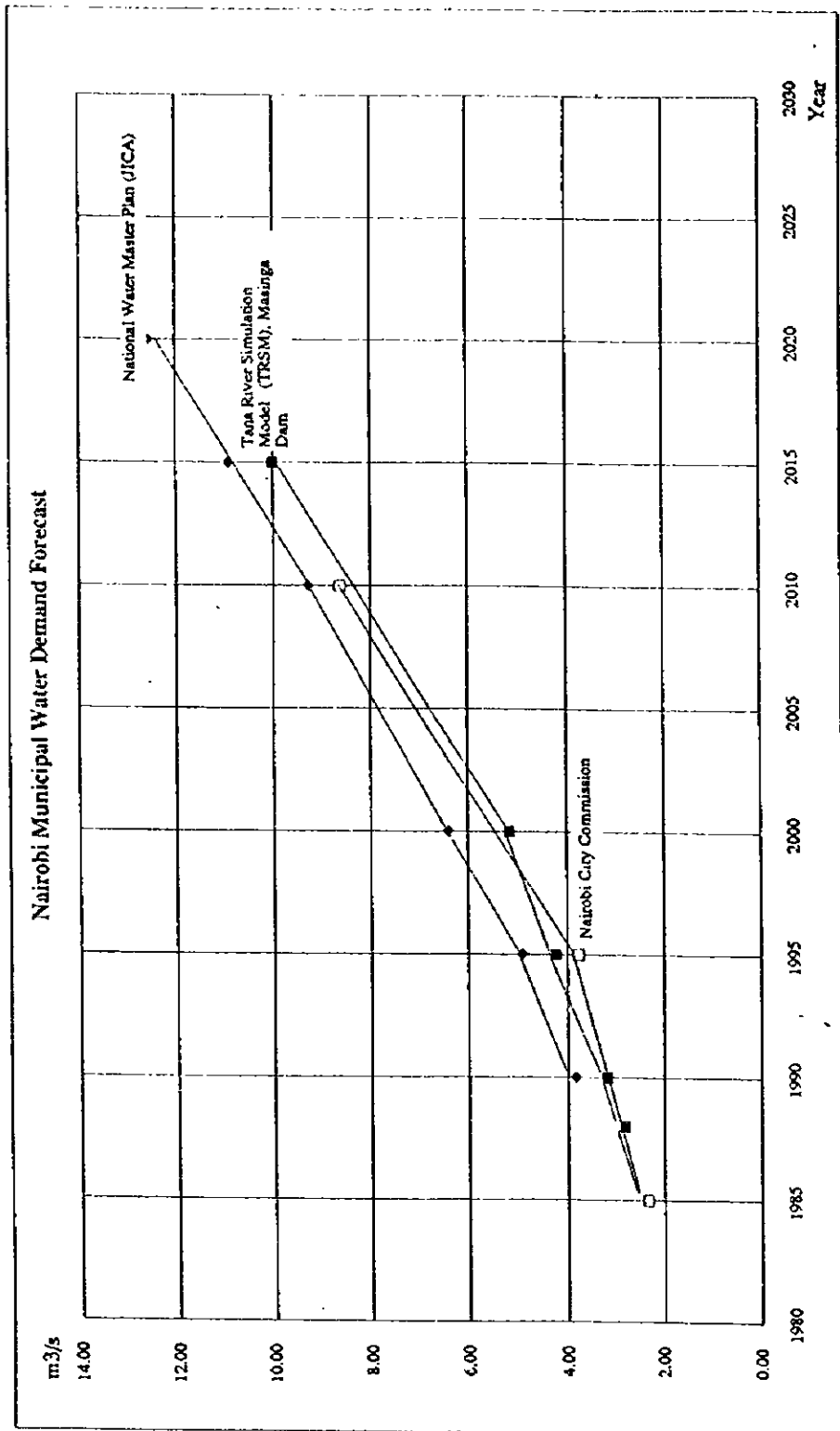


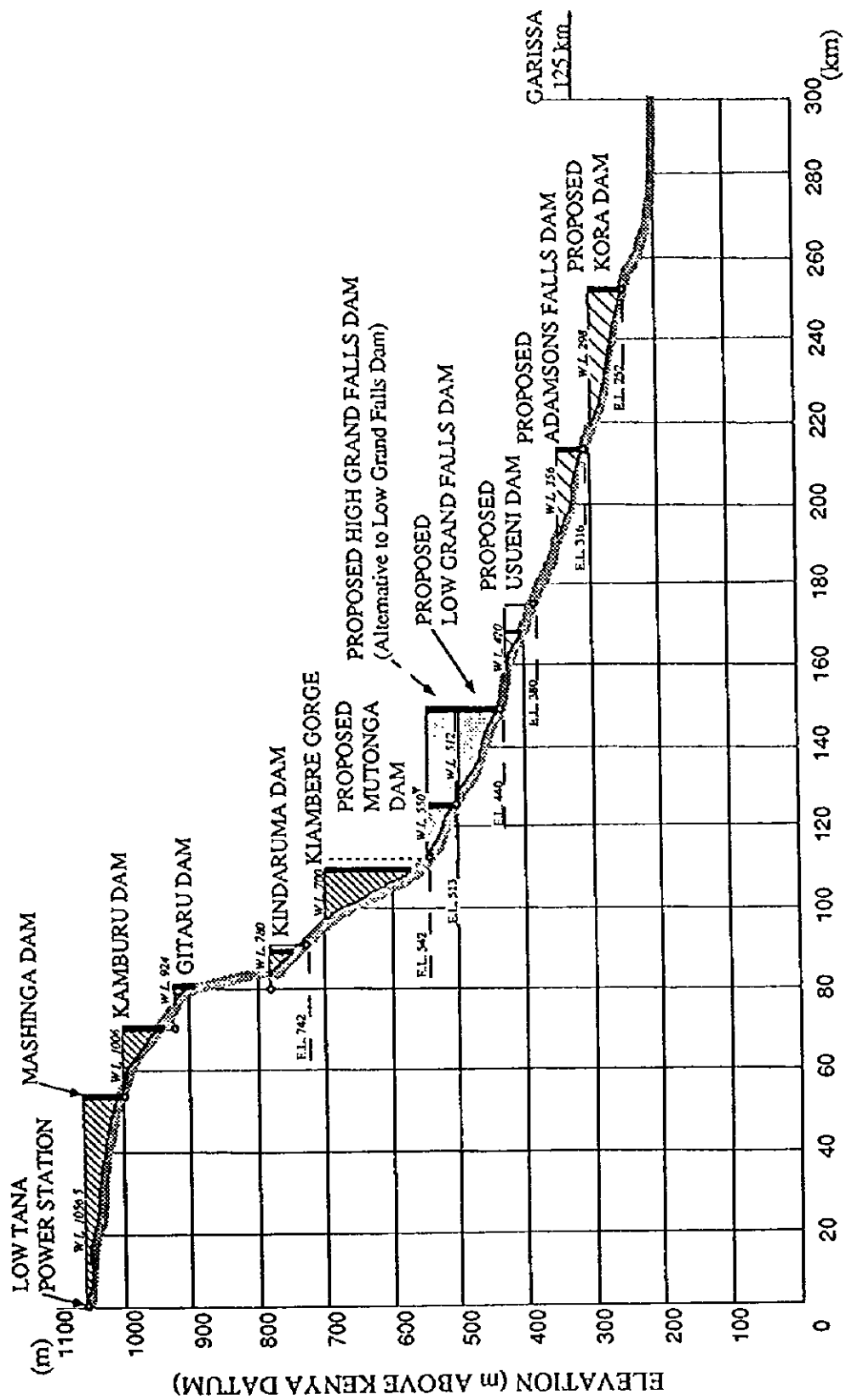
LEGEND

9136167 Station Number

Source : National Water Master Plan 1992, JICA

<p>JAPAN INTERNATIONAL COOPERATION AGENCY REPUBLIC OF KENYA MUTONGA/GRAND FALLS HYDROPOWER PROJECT</p>	<p>Location of Meteorological Station</p>	<p>Fig. No. 5.3.3</p>
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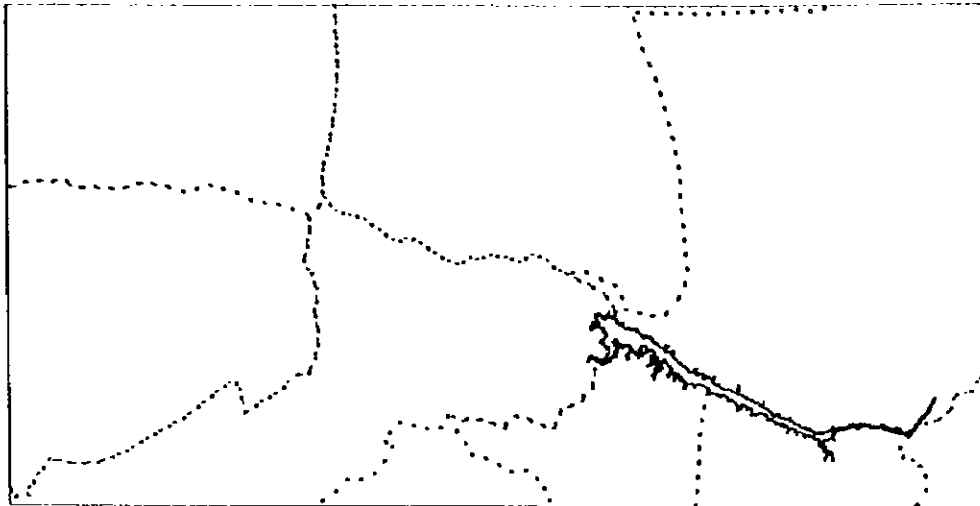




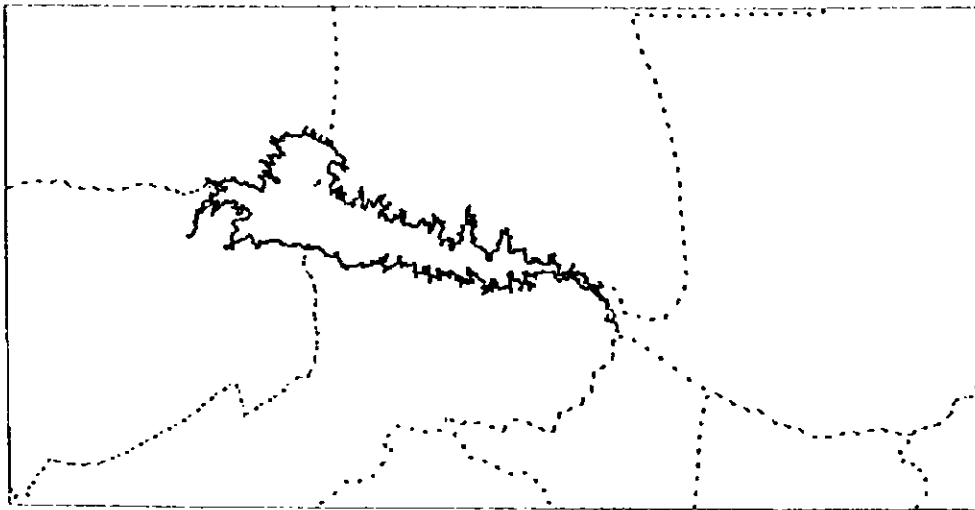
JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

Tana River Cascade Hydropower

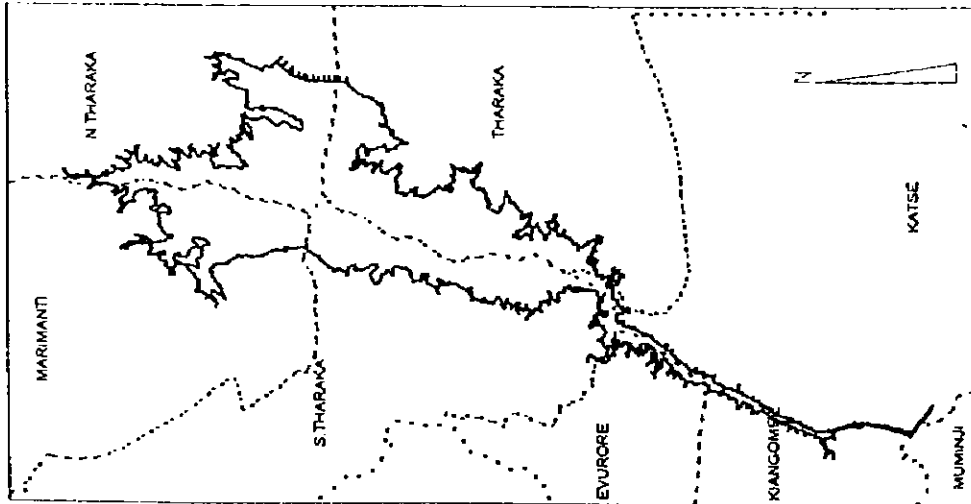
Fig. No.
 6.1.1



Mutonga



Low Grand Falls



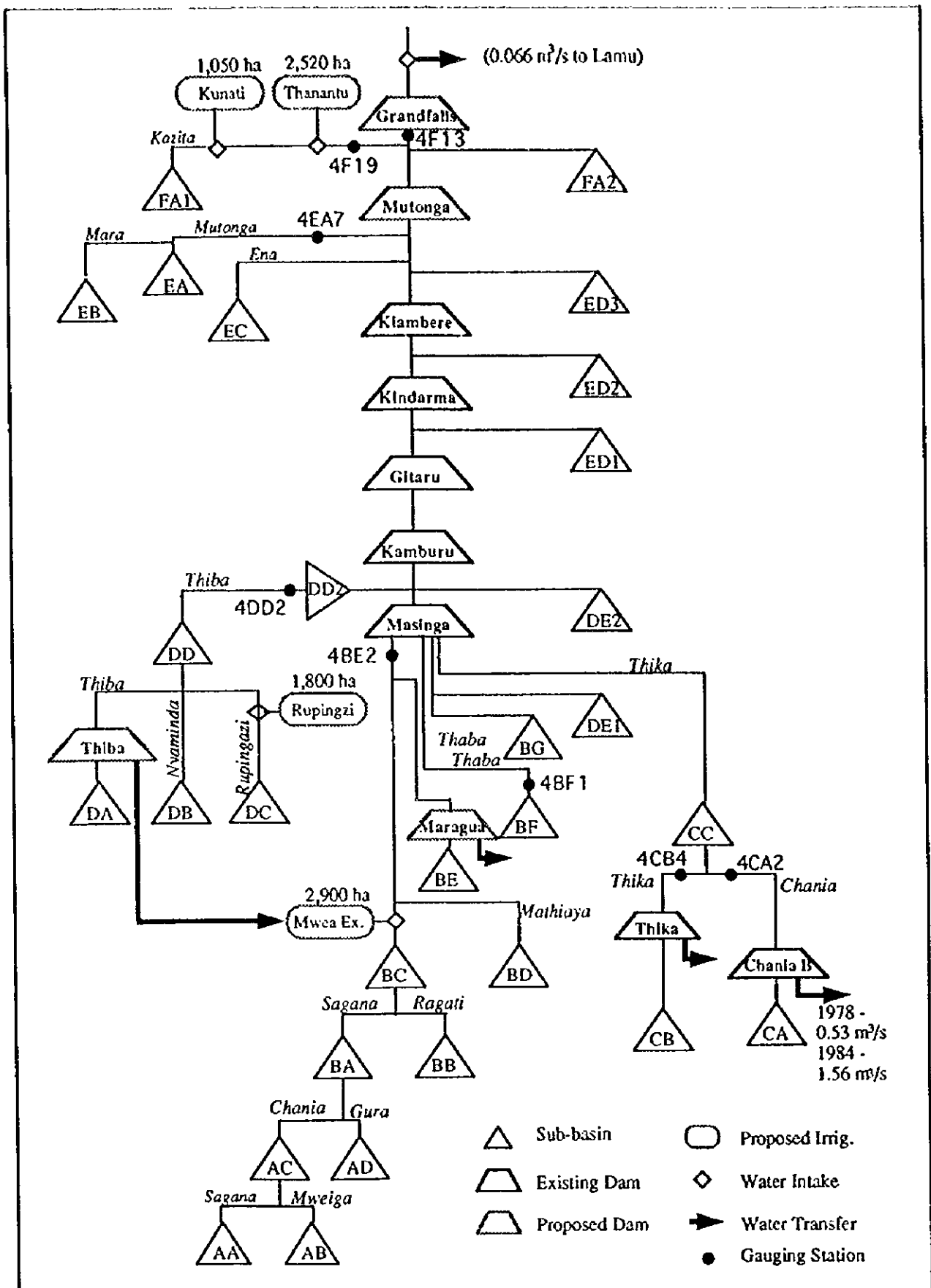
High Grand Falls

JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

Reservoir Scale by Options

Fig. No.

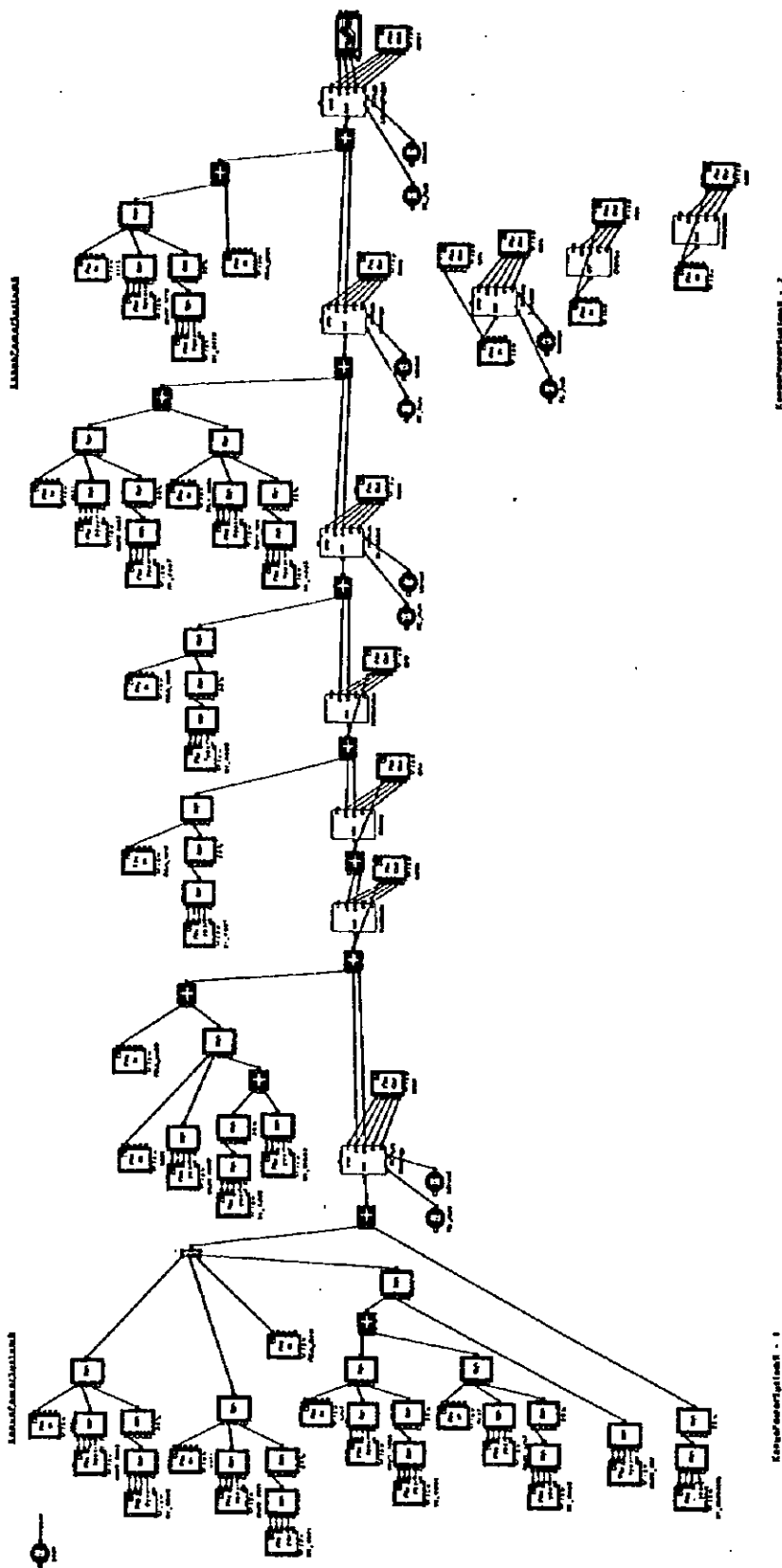
6.1.2



JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

Tana Upstream Catchment
 Basin Model

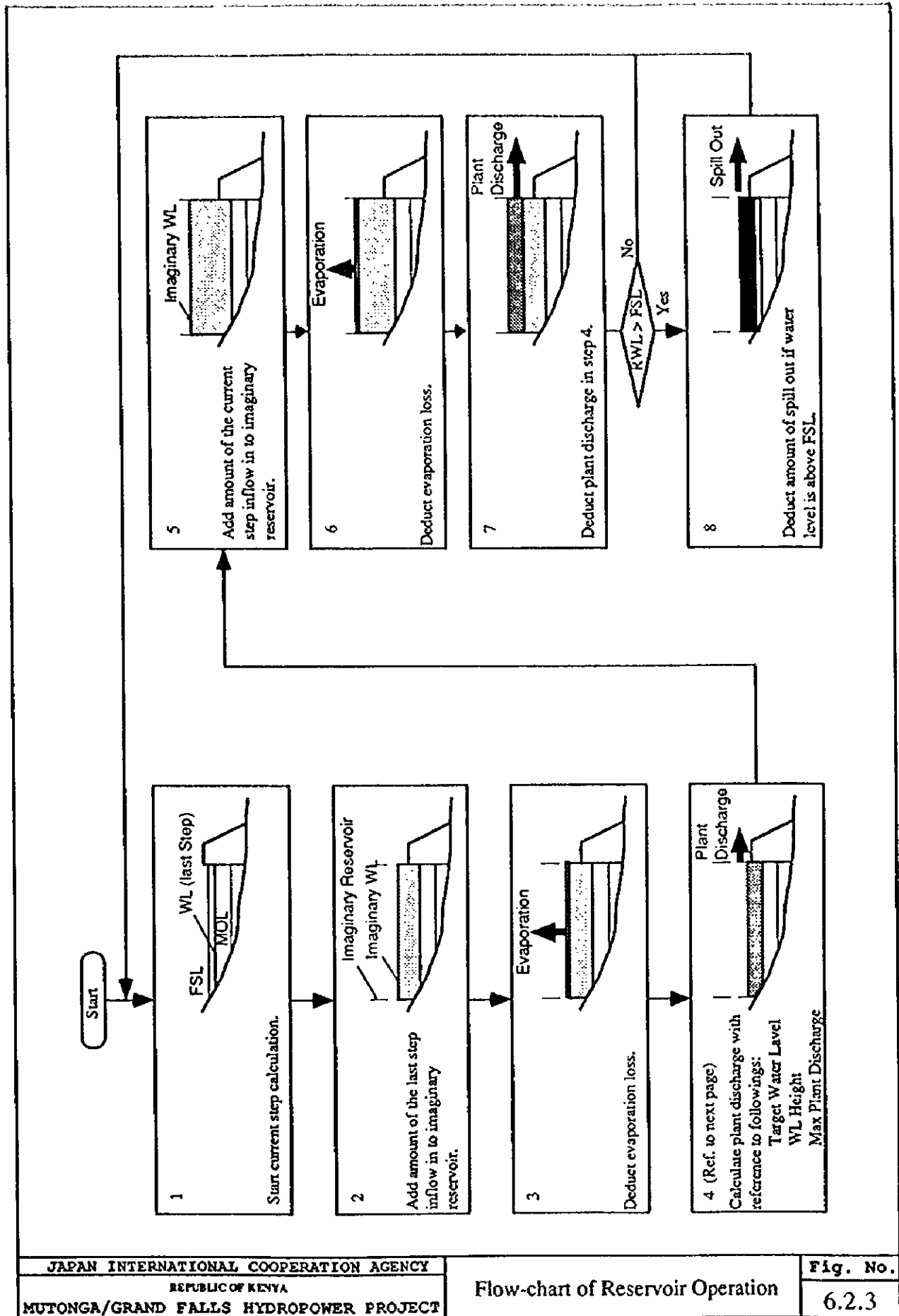
Fig. No.
 6.2.1



JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

Simulation Model

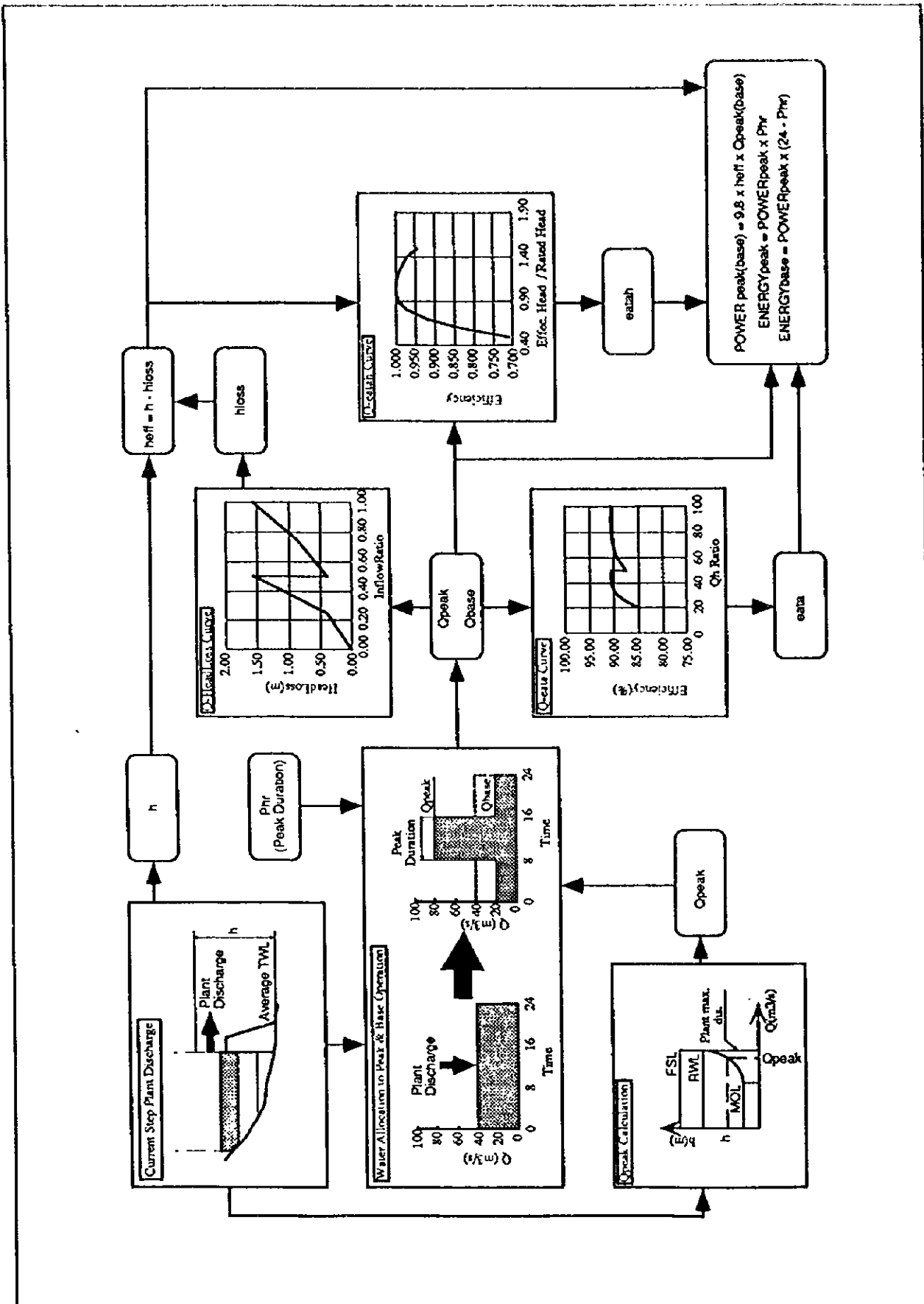
Fig. No.
 6.2.2

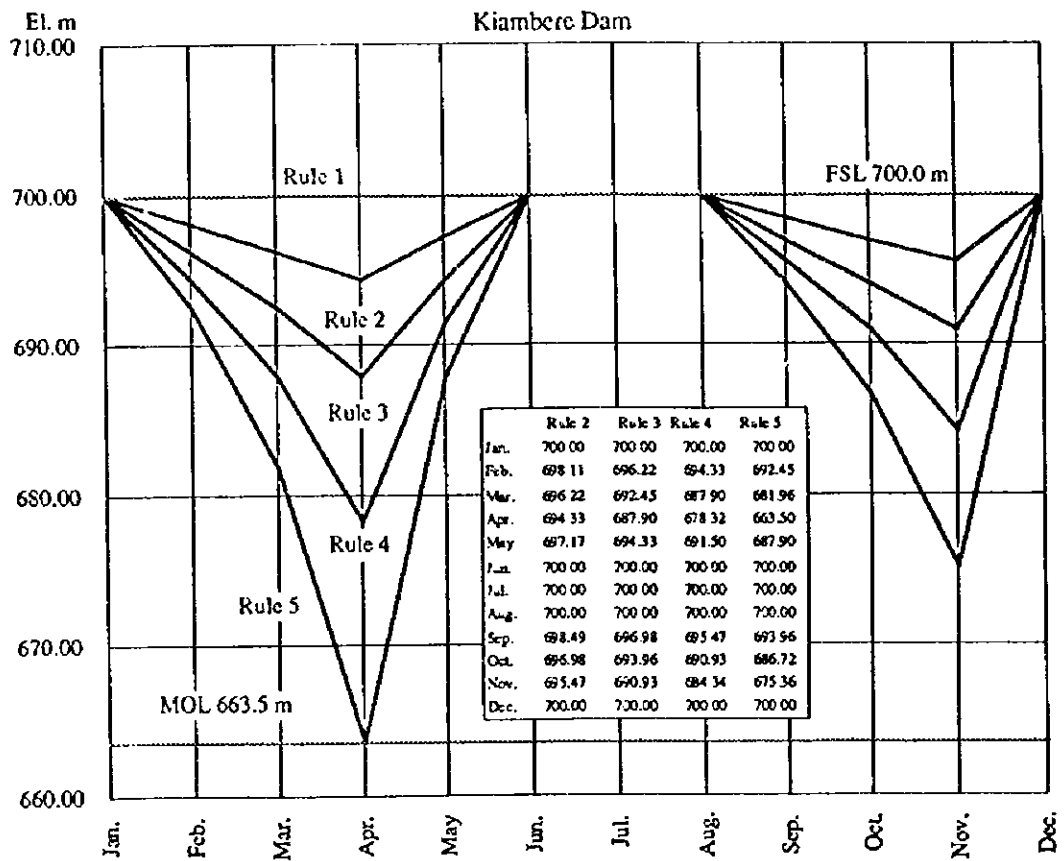
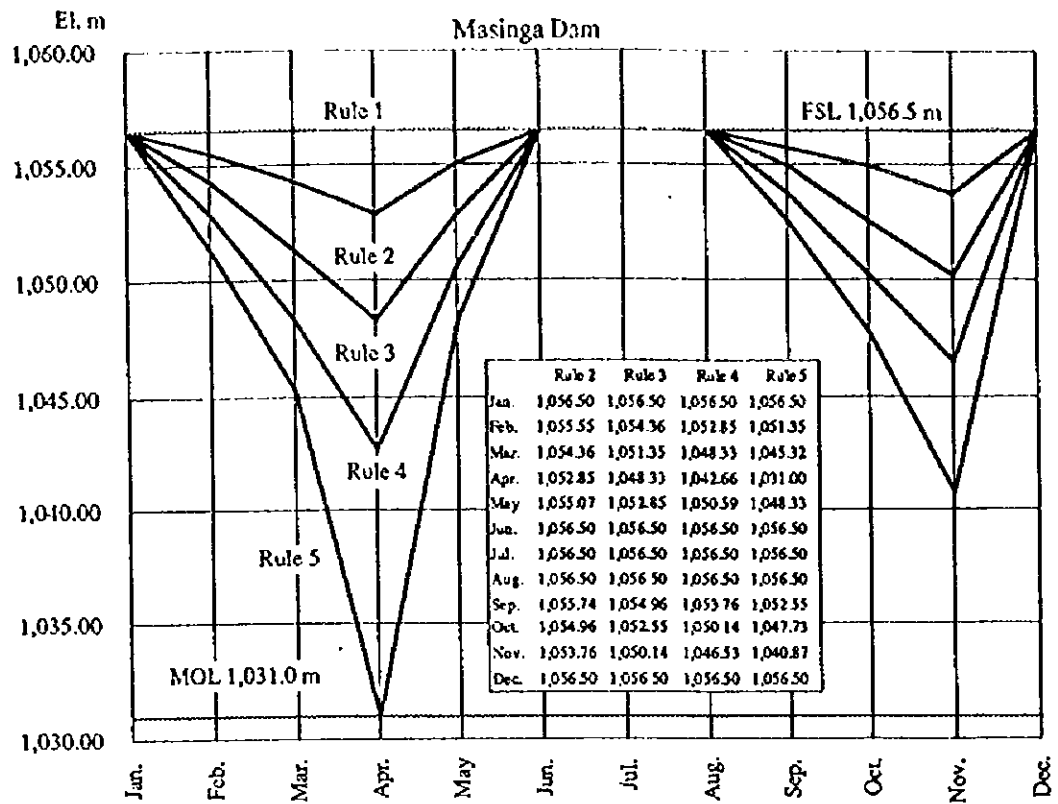


JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

Flow-chart of Reservoir Operation

Fig. No.
 6.2.3

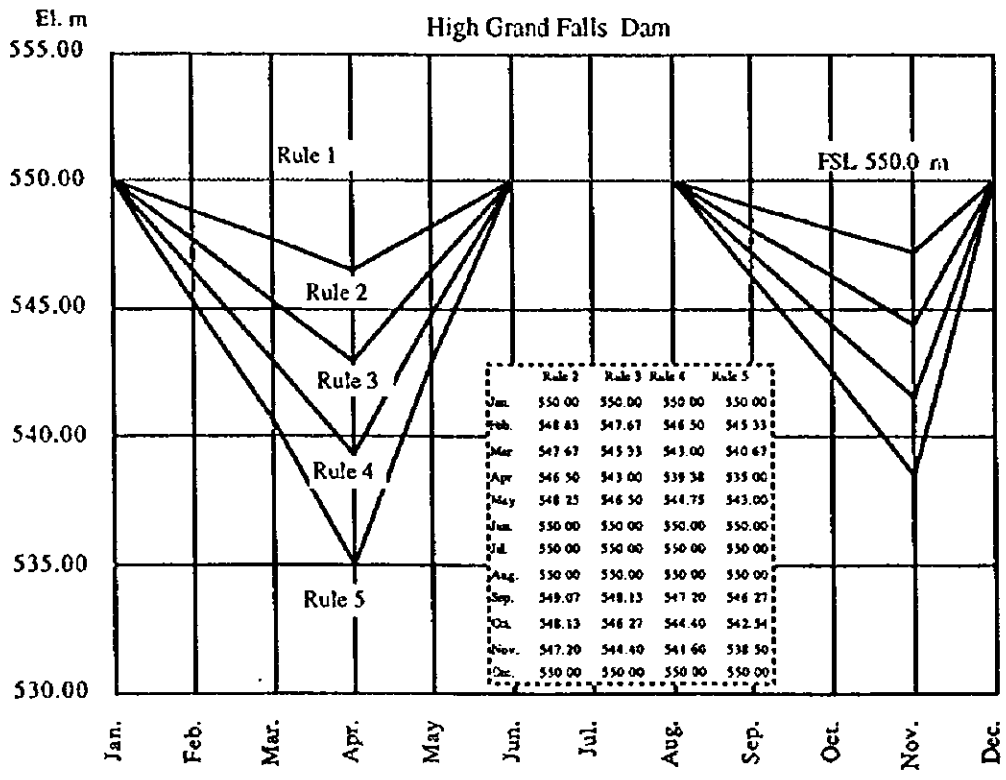
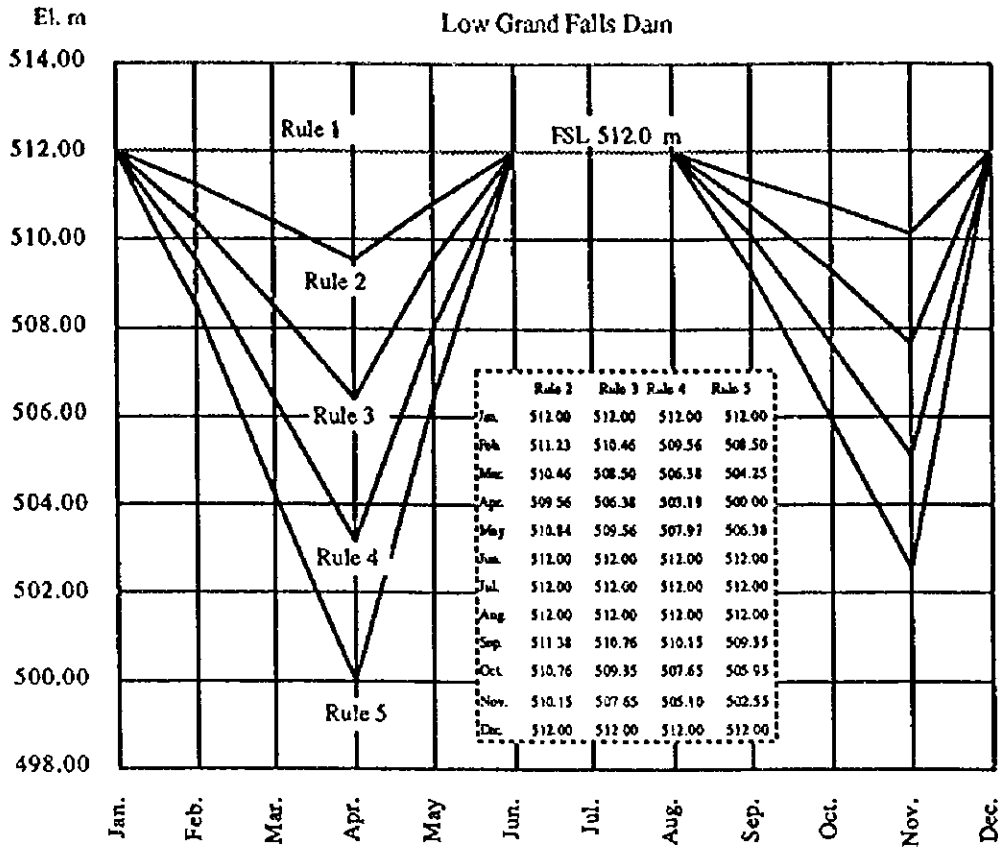




JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

Operation Rule Curves (1)

Fig. No.
6.2.5

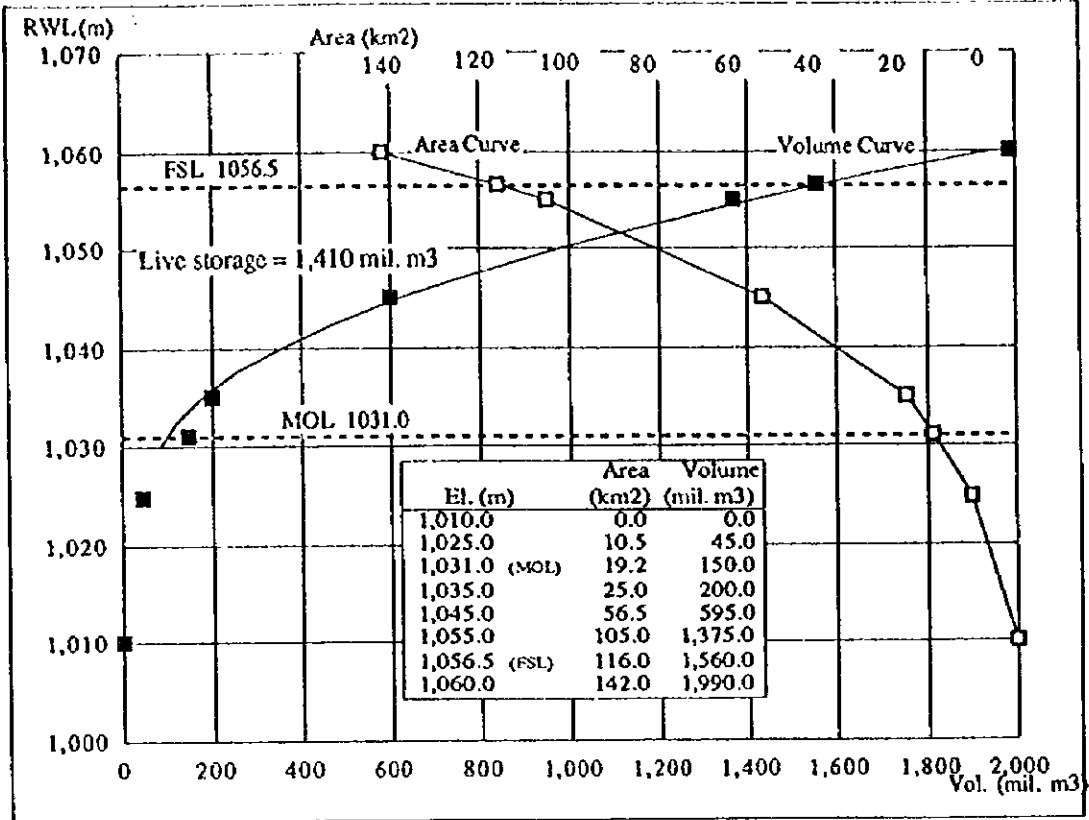


JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

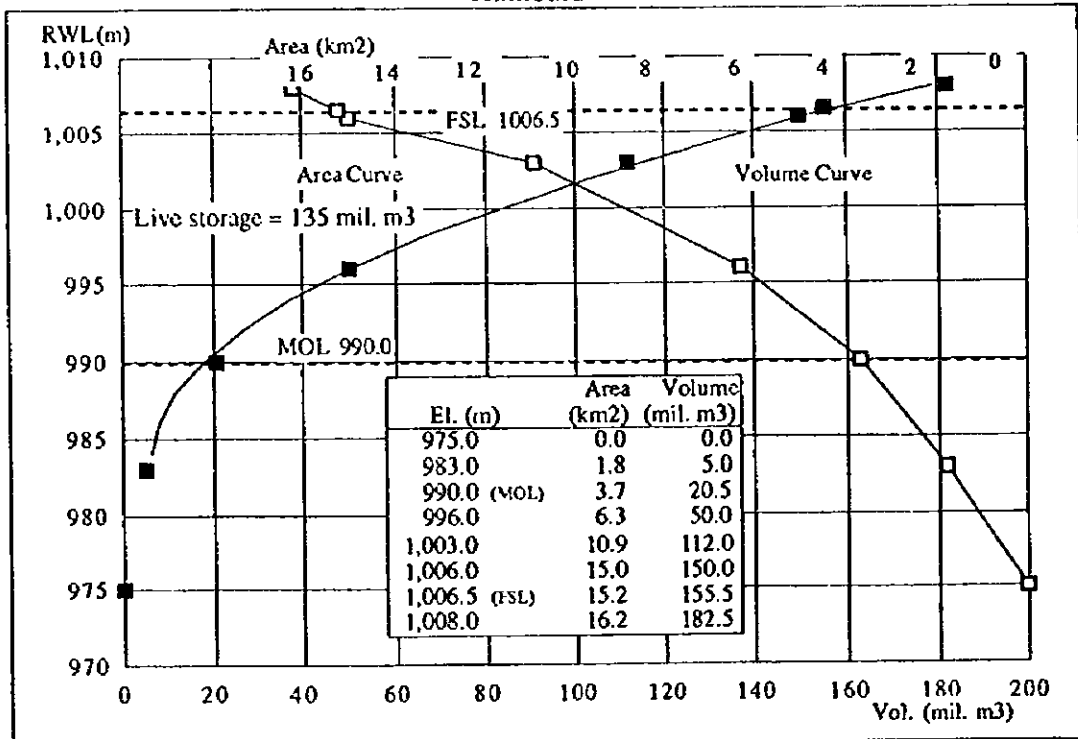
Operation Rule Curves (2)

Fig. No.
 6.2.6

Masinga



Kamburu

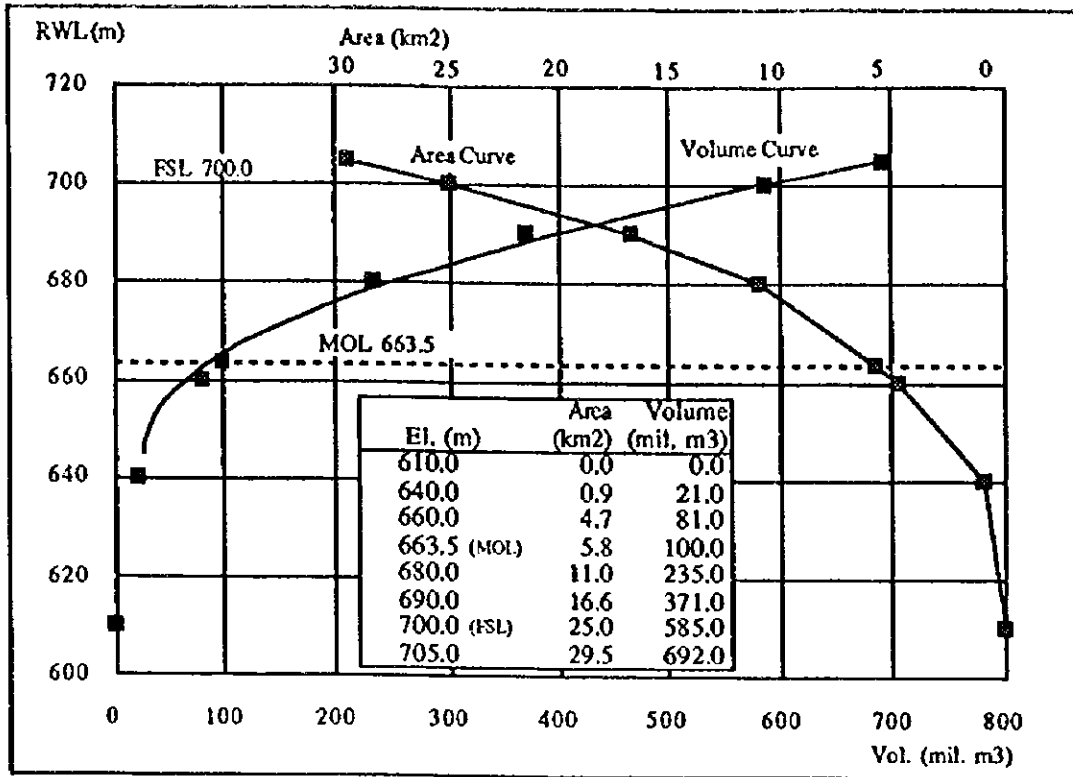


JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

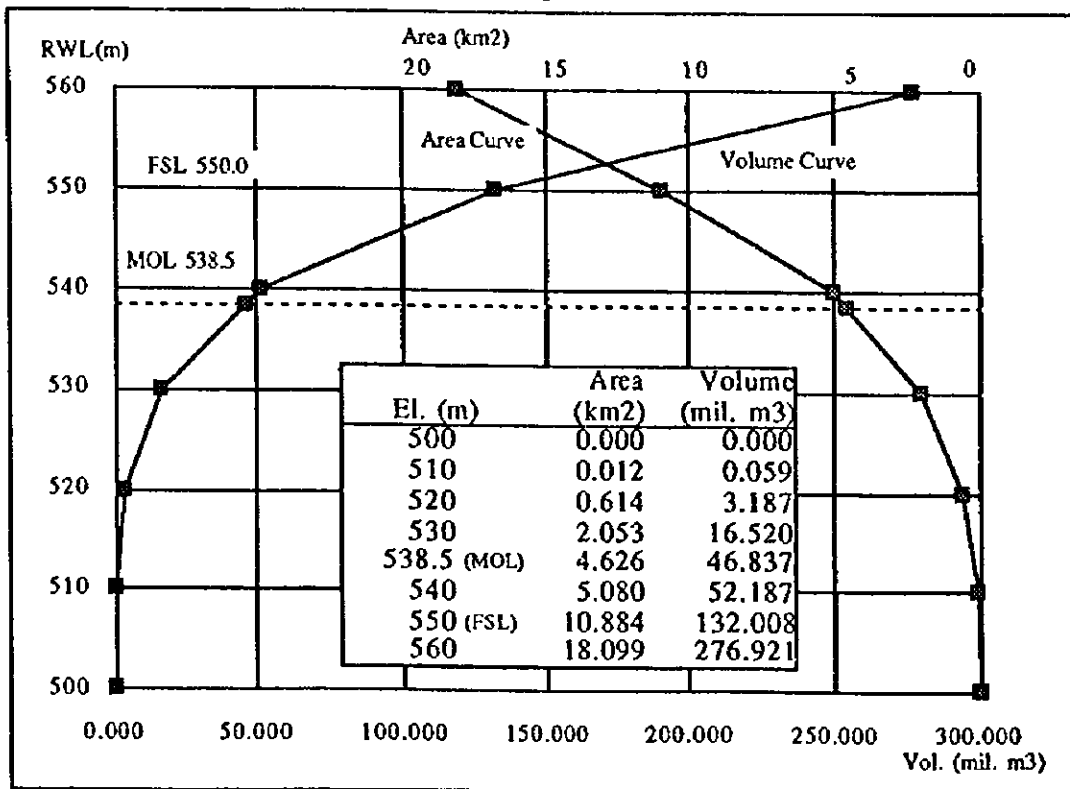
Reservoir Volume/Area Curve (1)

Fig. No.
 6.2.7

Kiambere



Mutonga

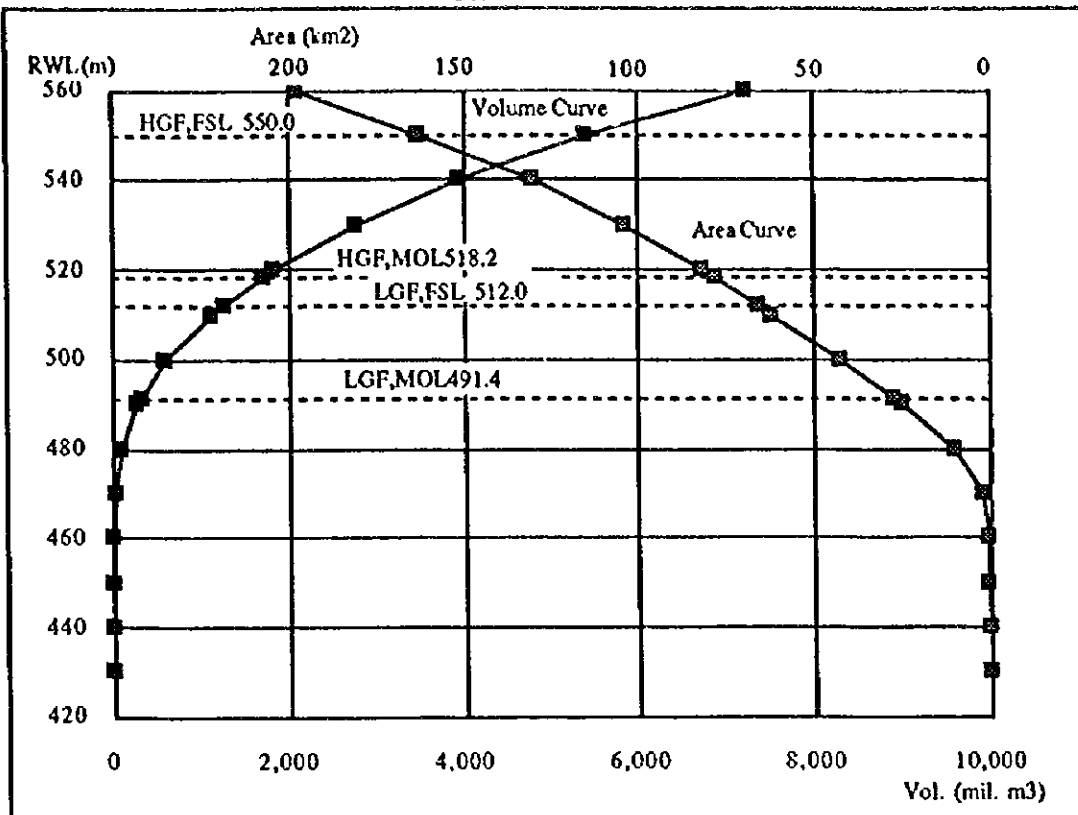


JAPAN INTERNATIONAL COOPERATION AGENCY
REPUBLIC OF KENYA
MUTONGA/GRAND FALLS HYDROPOWER PROJECT

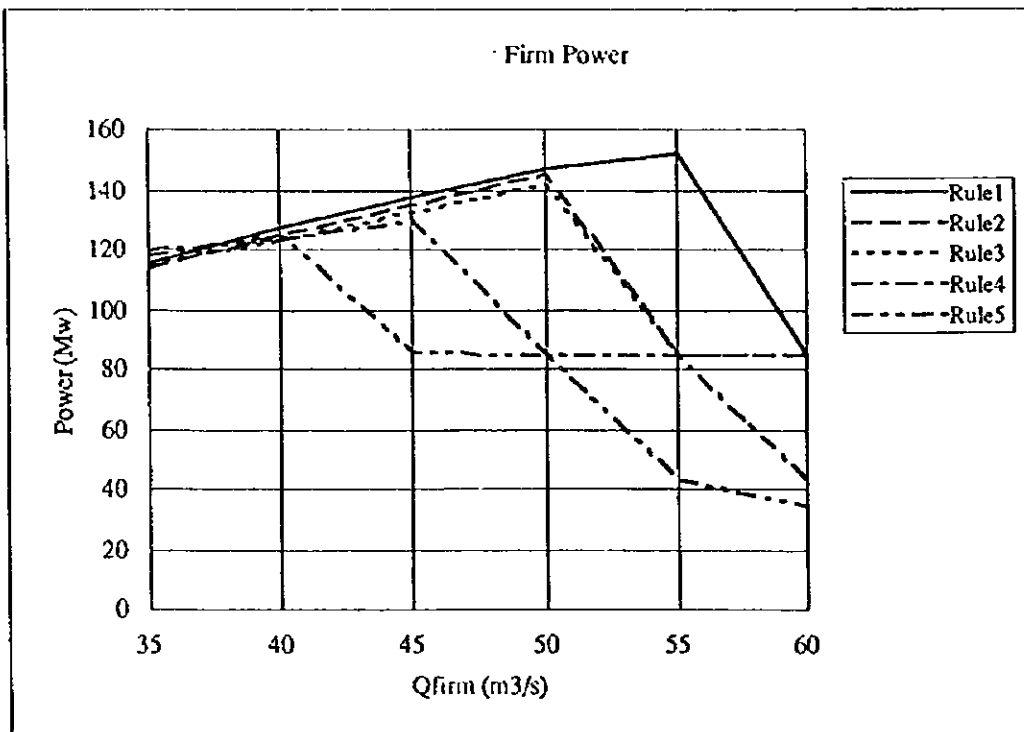
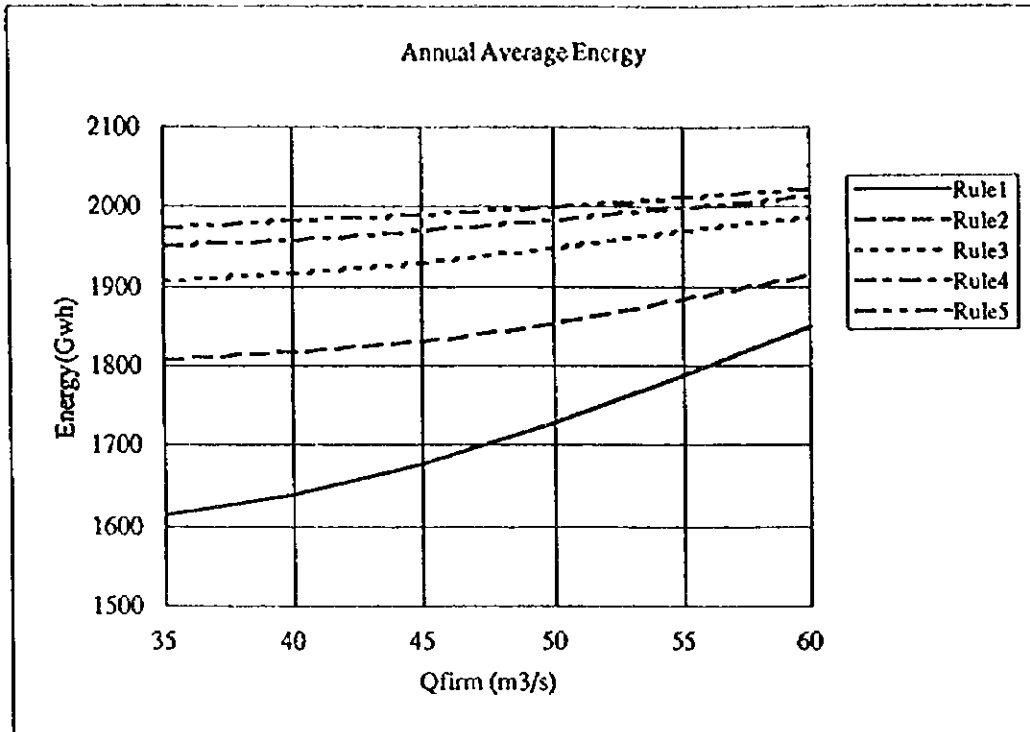
Reservoir Volume/Area Curve (2)

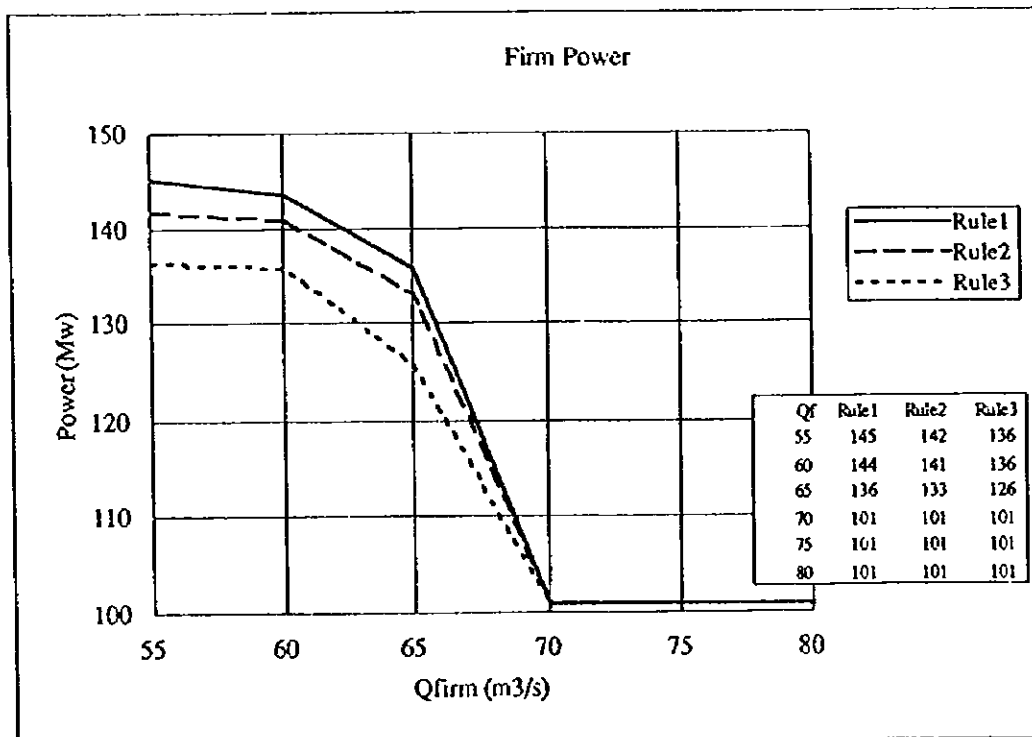
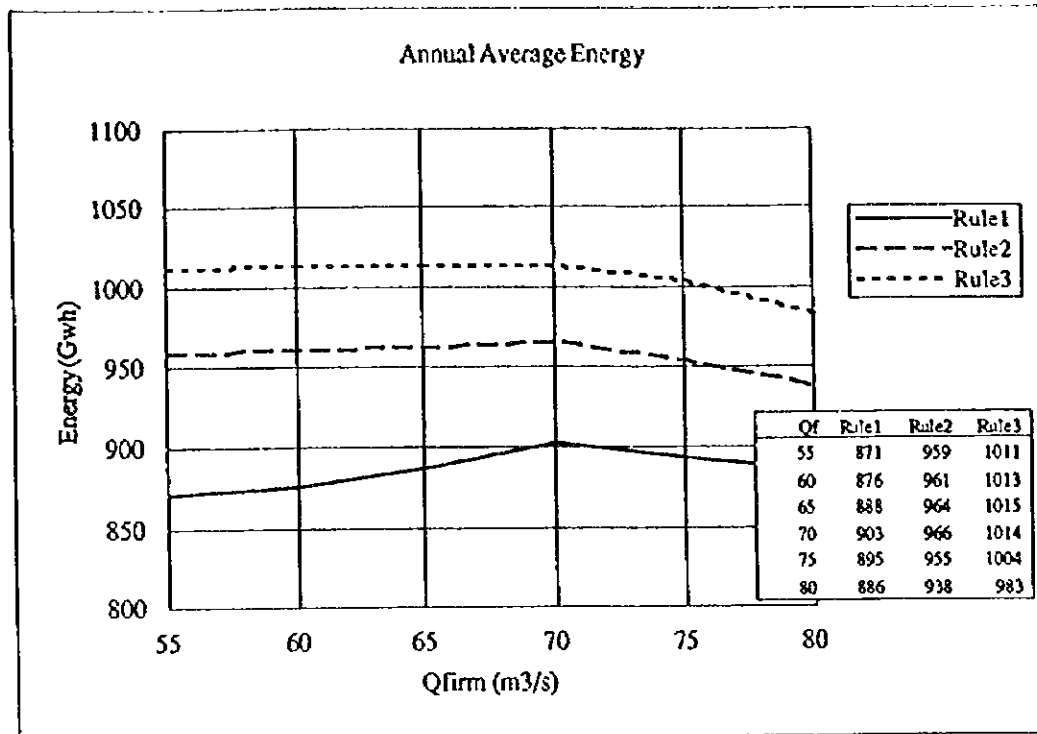
Fig. No.
6.2.8

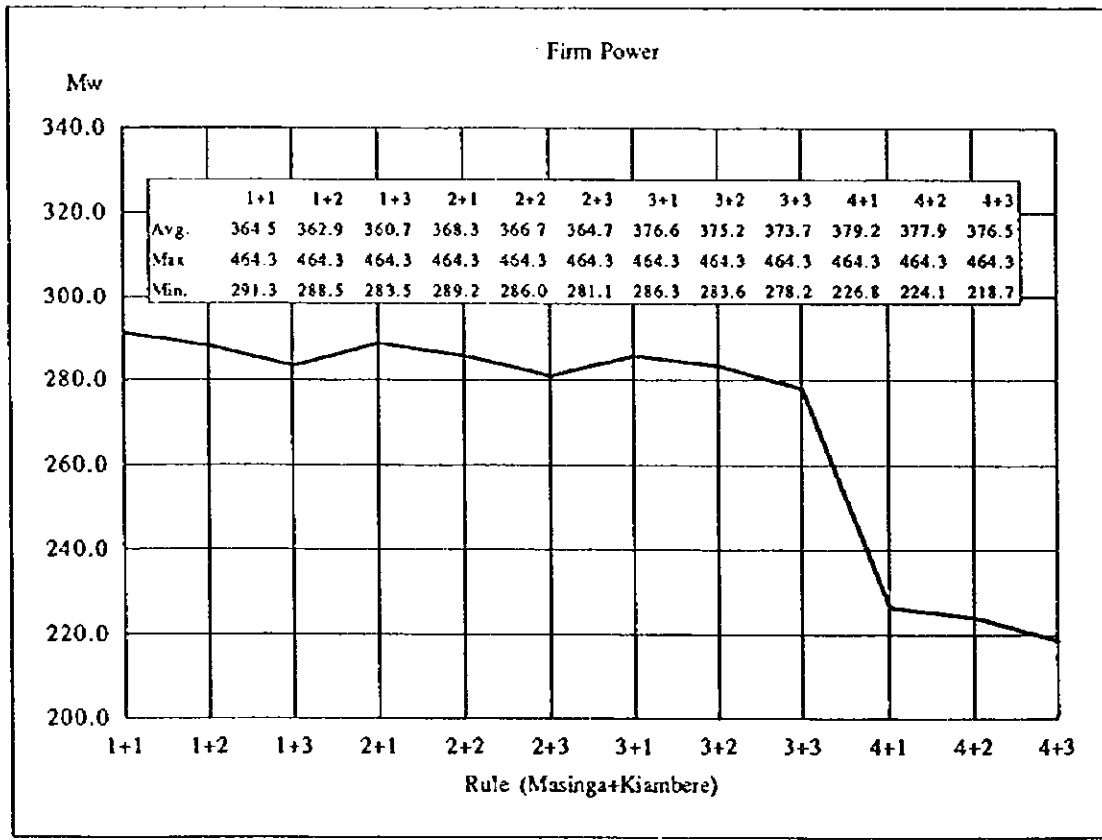
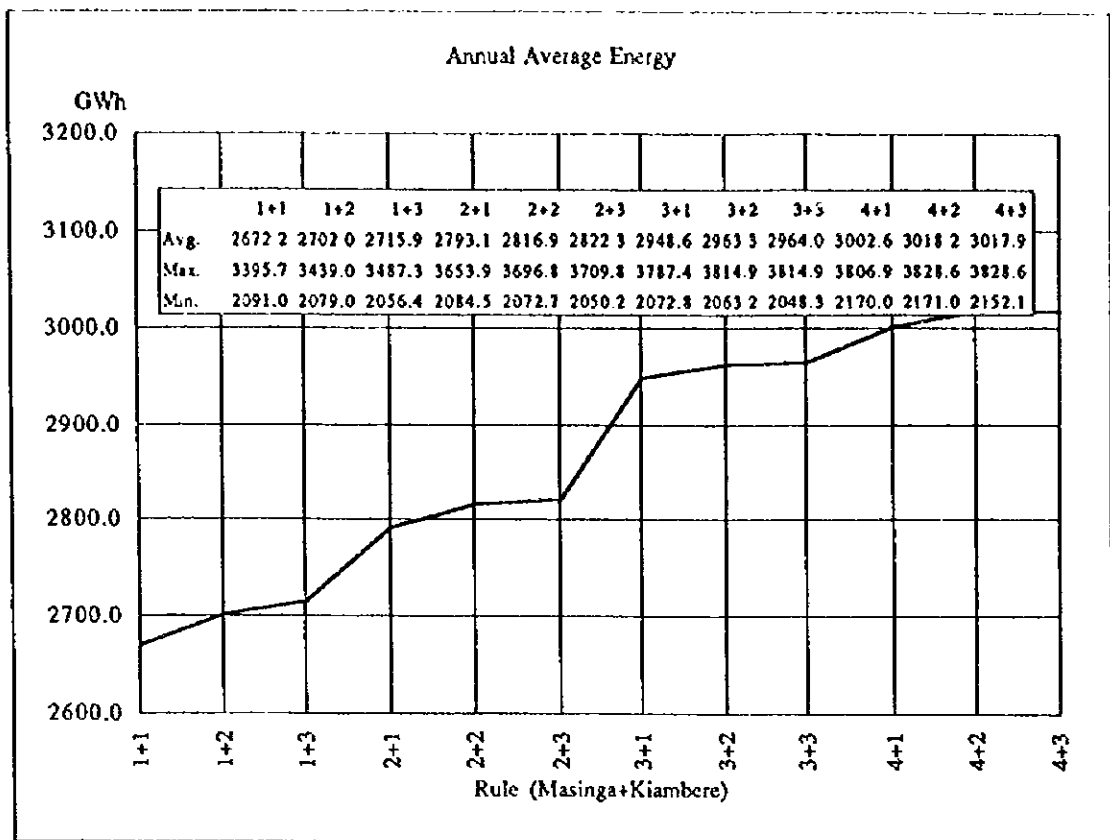
Grand Falls

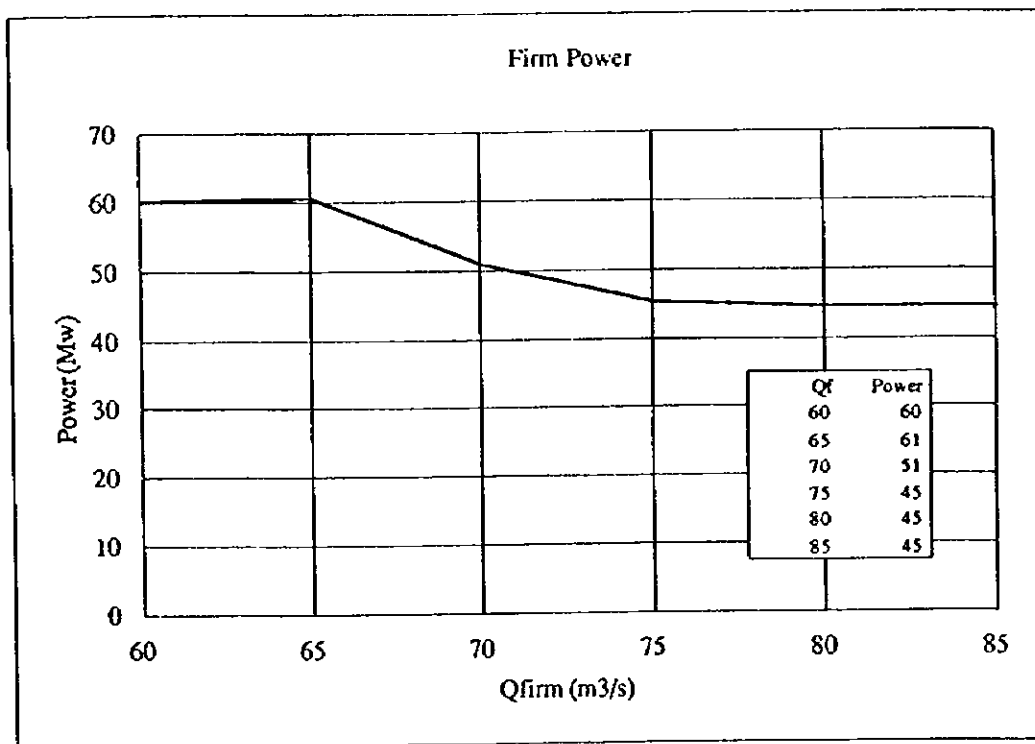
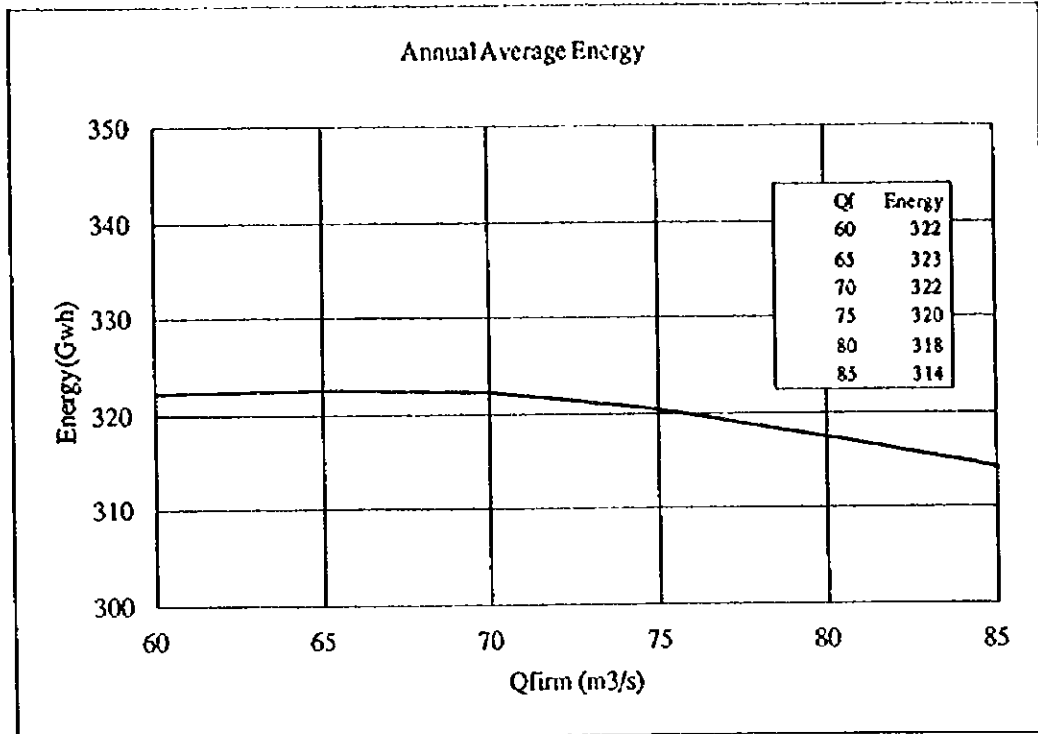


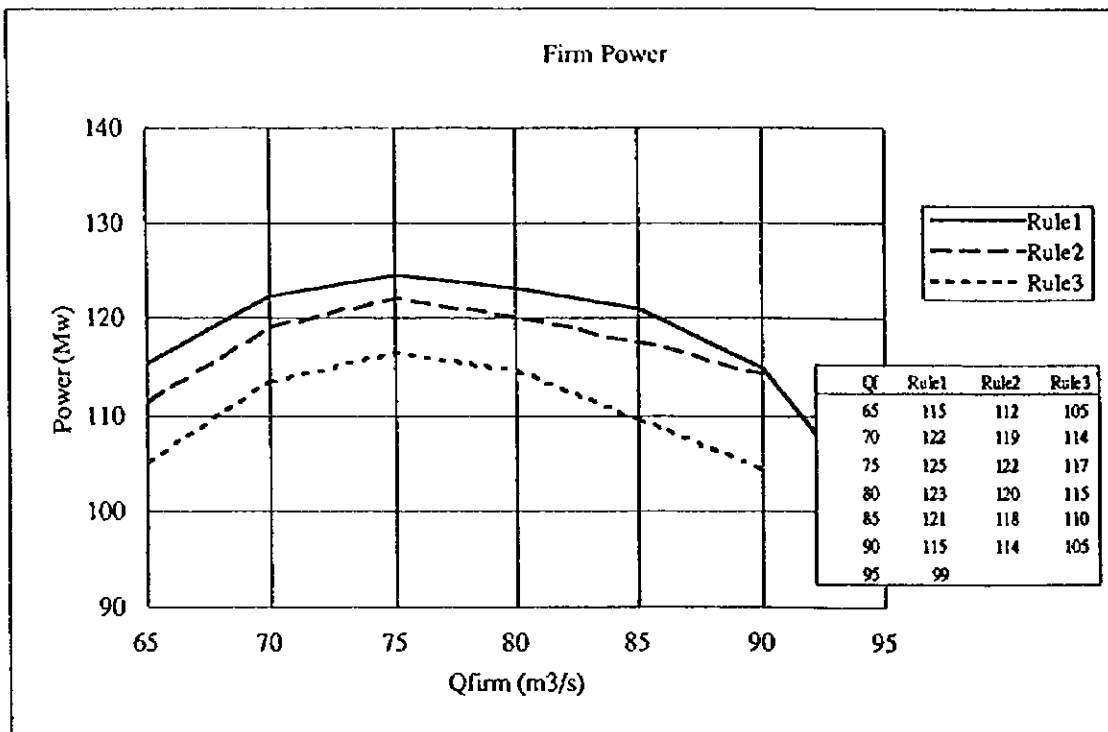
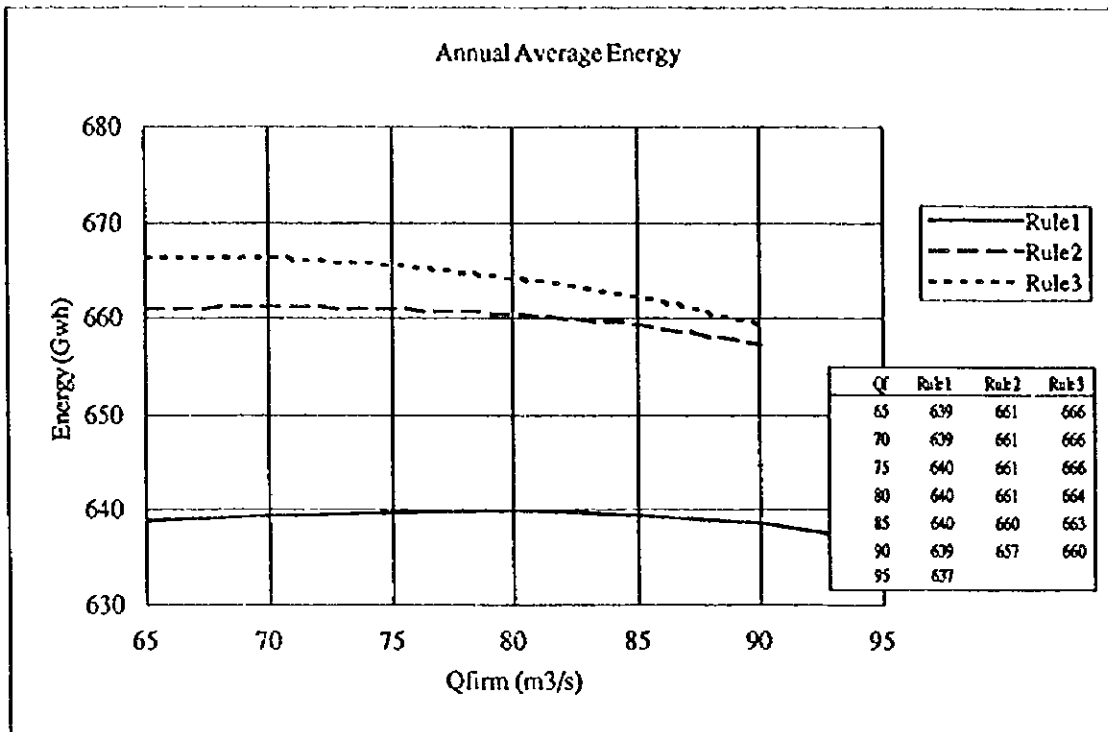
El. (m)	Area (km ²)	Volume (mil. m ³)
430	0.000	0.000
440	0.000	0.000
450	0.298	1.492
460	0.737	6.672
470	2.226	21.491
480	10.222	83.735
490	24.774	258.717
491.4 (MOL)	27.278	305.919
500	42.658	595.877
510	61.677	1,117.551
512 (FSL)	65.720	1,261.119
518.2 (MOL)	78.253	1,706.180
520	81.892	1,835.391
530	104.167	2,765.682
540	130.736	3,940.195
550 (FSL)	163.255	5,410.152
560	198.045	7,216.655

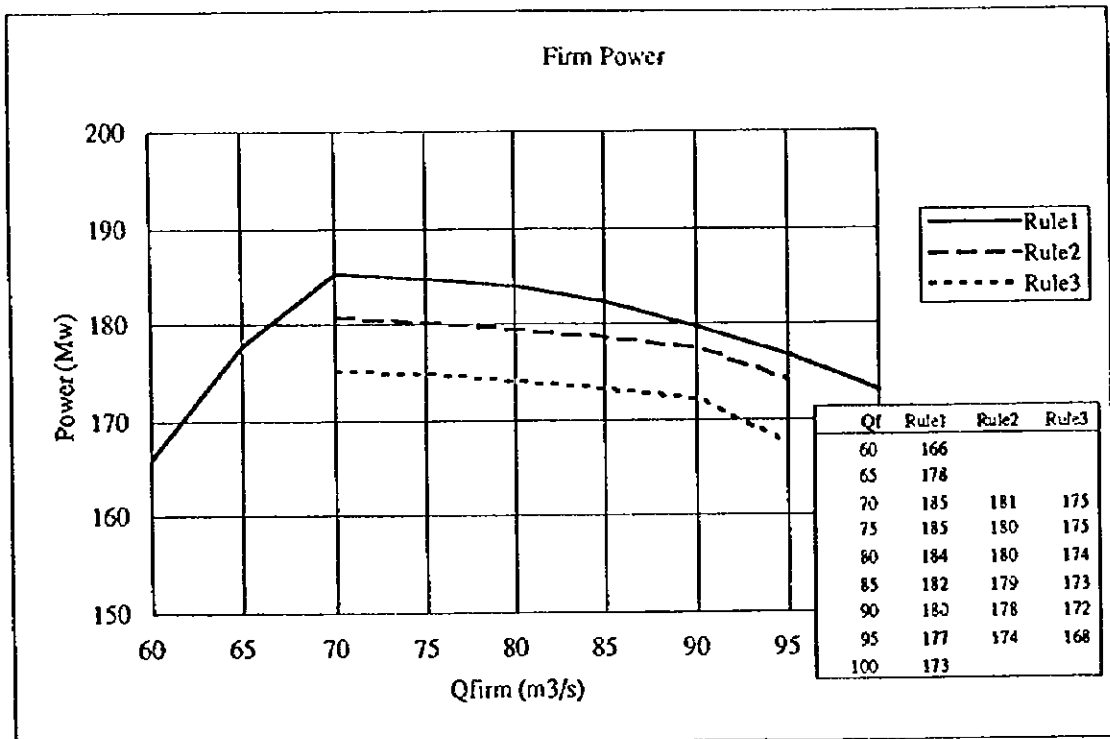
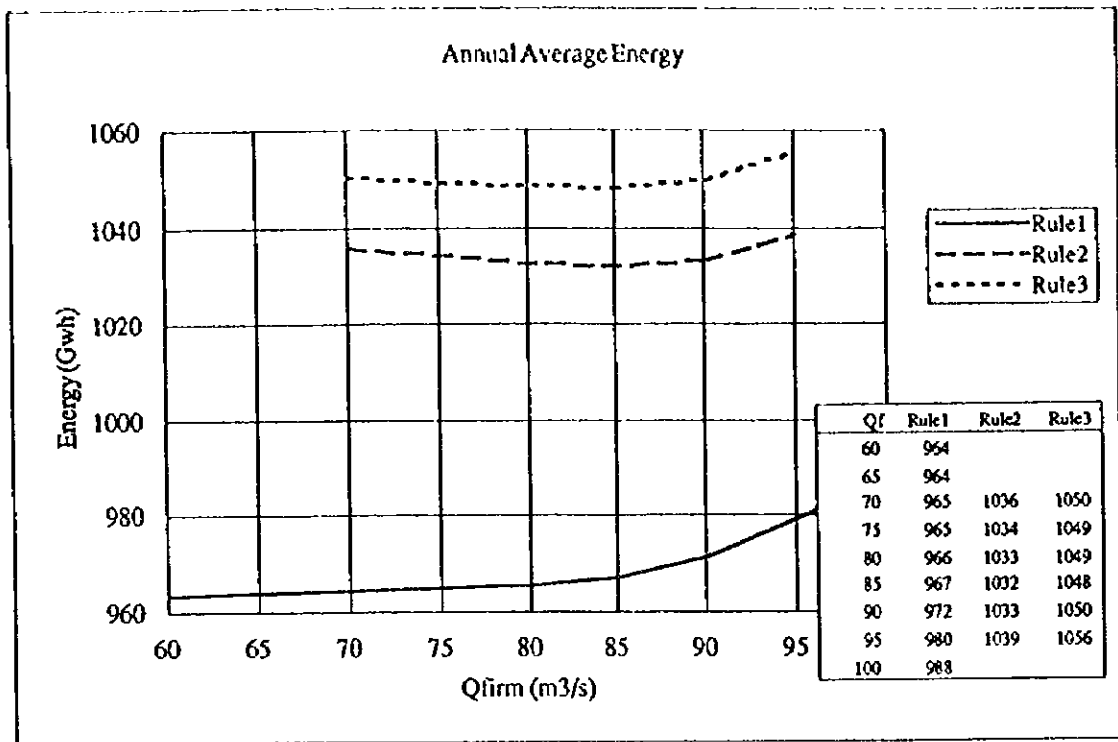


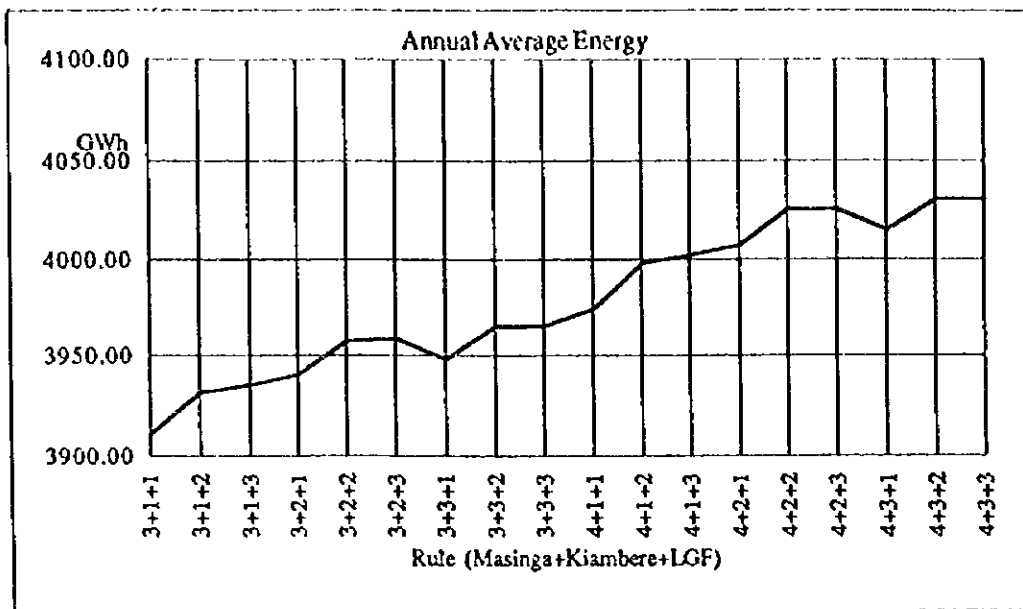




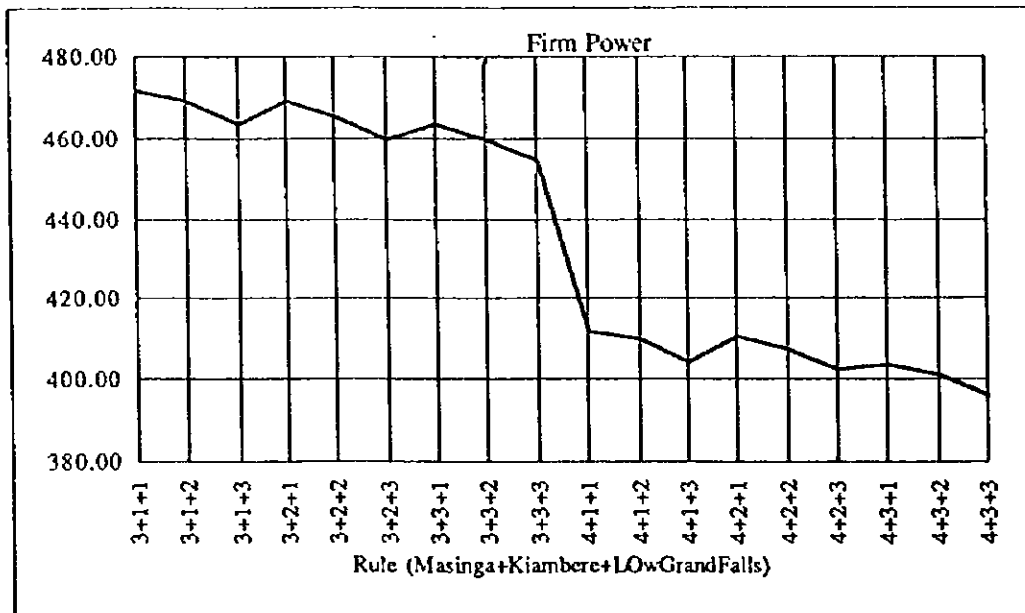




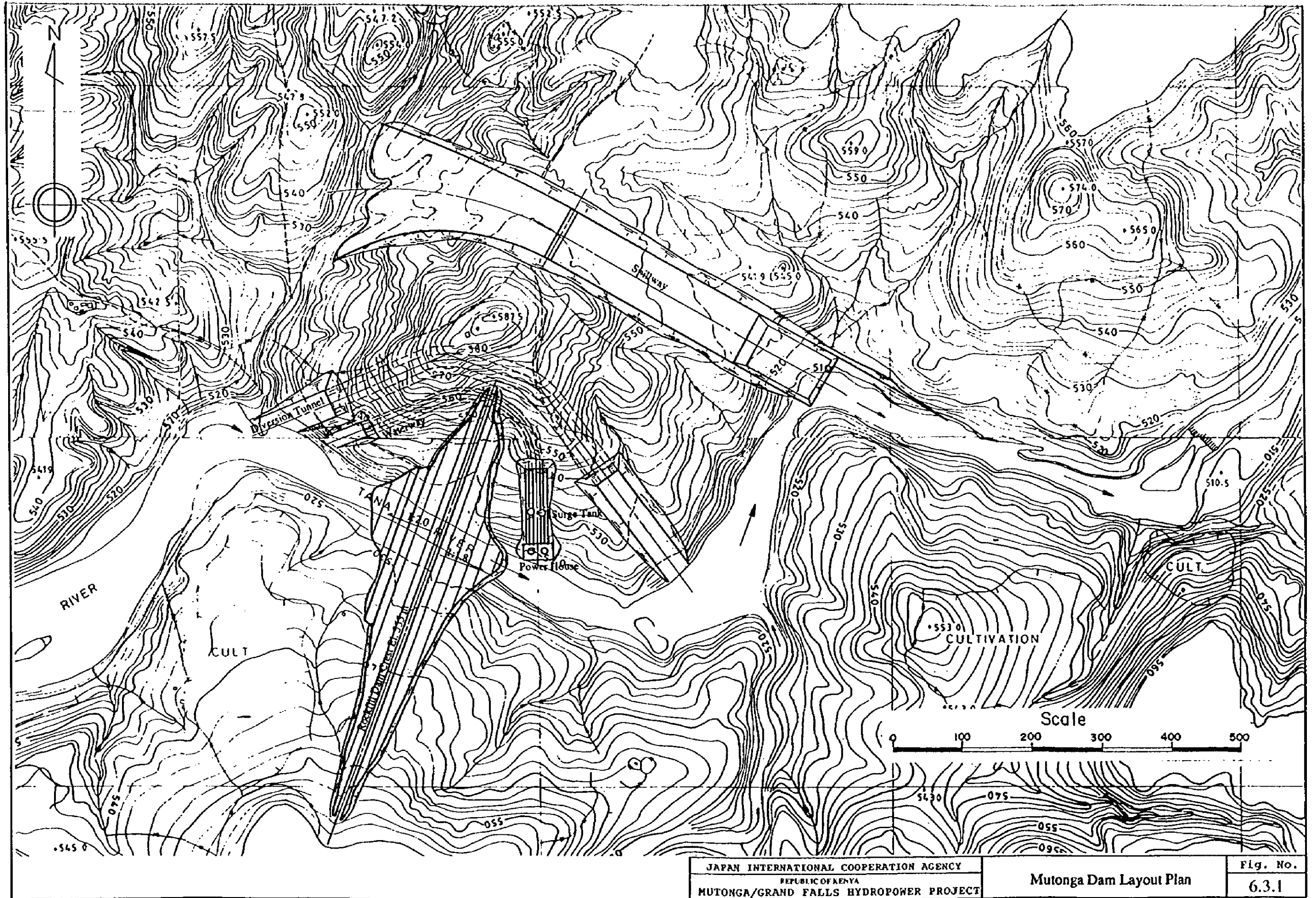




	3+1+1	3+1+2	3+1+3	3+2+1	3+2+2	3+2+3	3+3+1	3+3+2	3+3+3	4+1+1	4+1+2	4+1+3	4+2+1	4+2+2	4+2+3	4+3+1	4+3+2	4+3+3
Avg.	3911	3932	3937	3941	3958	3959	3949	3966	3965	3975	3998	4002	4007	4025	4025	4015	4031	4030
Max.	5159	5191	5214	5195	5227	5250	5195	5227	5250	5181	5213	5237	5209	5241	5264	5209	5241	5264
Min.	2704	2699	2689	2691	2688	2680	2677	2675	2666	2809	2804	2794	2806	2802	2794	2785	2784	2774



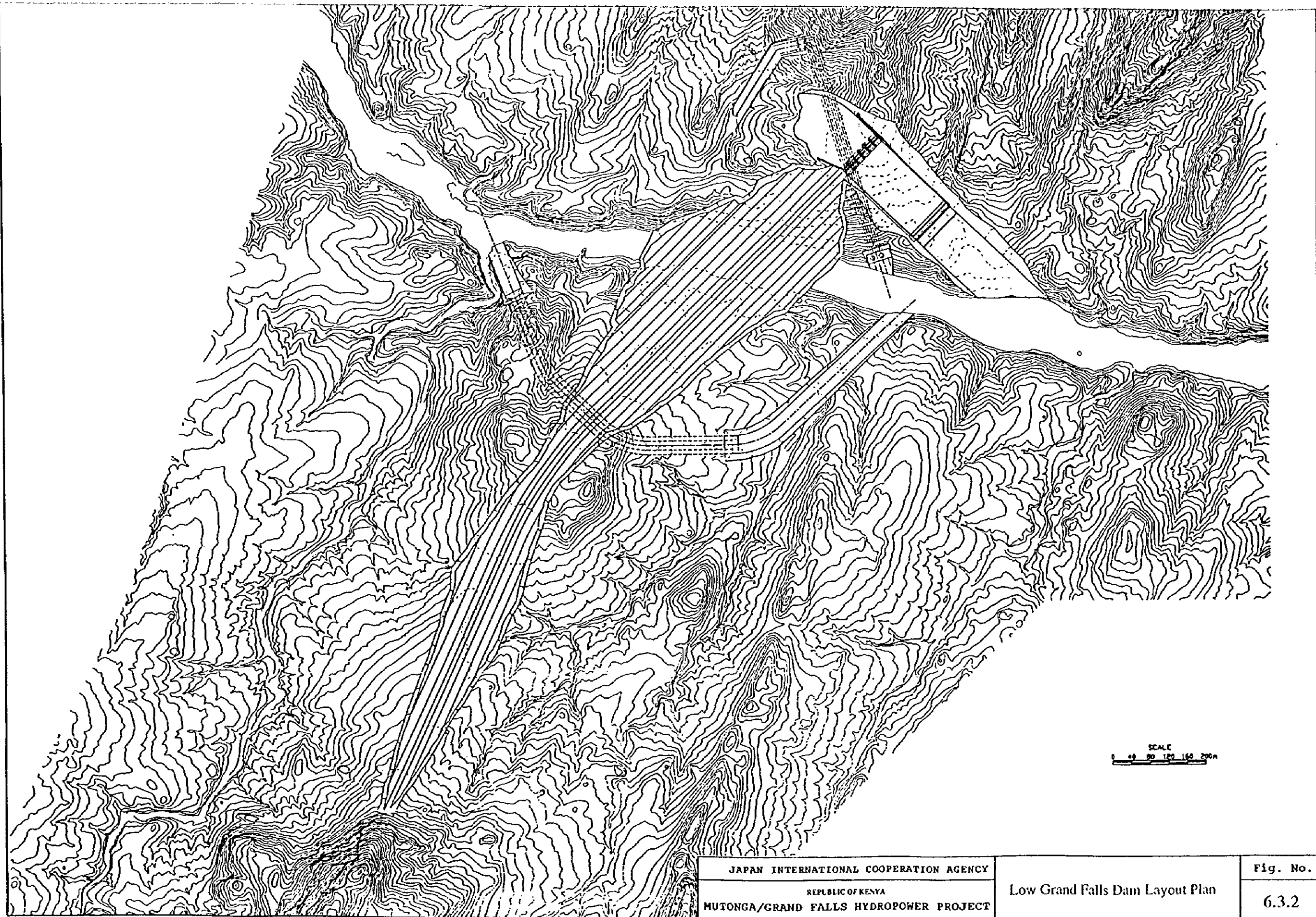
	3+1+1	3+1+2	3+1+3	3+2+1	3+2+2	3+2+3	3+3+1	3+3+2	3+3+3	4+1+1	4+1+2	4+1+3	4+2+1	4+2+2	4+2+3	4+3+1	4+3+2	4+3+3
Avg.	567	565	563	565	564	562	564	562	560	569	568	566	568	567	565	565	565	563
Max.	655	655	655	655	655	655	655	655	655	655	655	655	655	655	655	655	655	655
Min.	472	469	464	469	465	460	463	460	455	412	410	405	411	408	402	404	401	396



JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

Mutonga Dam Layout Plan

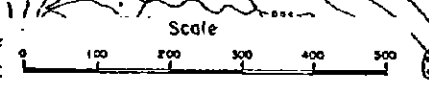
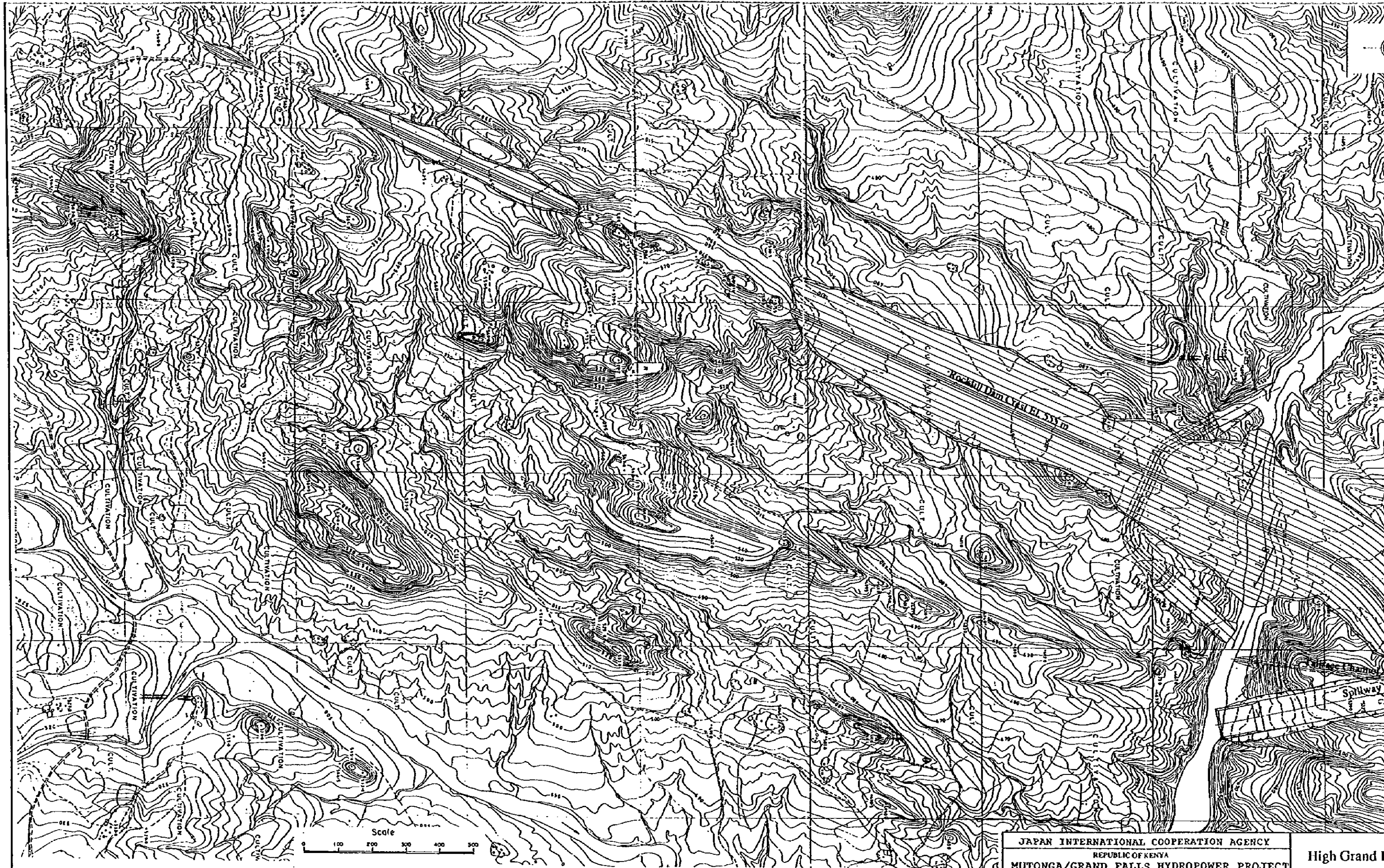
Fig. No.
 6.3.1



JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

Low Grand Falls Dam Layout Plan

Fig. No.
 6.3.2



JAPAN INTERNATIONAL COOPERATION AGENCY
REPUBLIC OF KENYA
MUTONGA/GRAND FALLS HYDROPOWER PROJECT

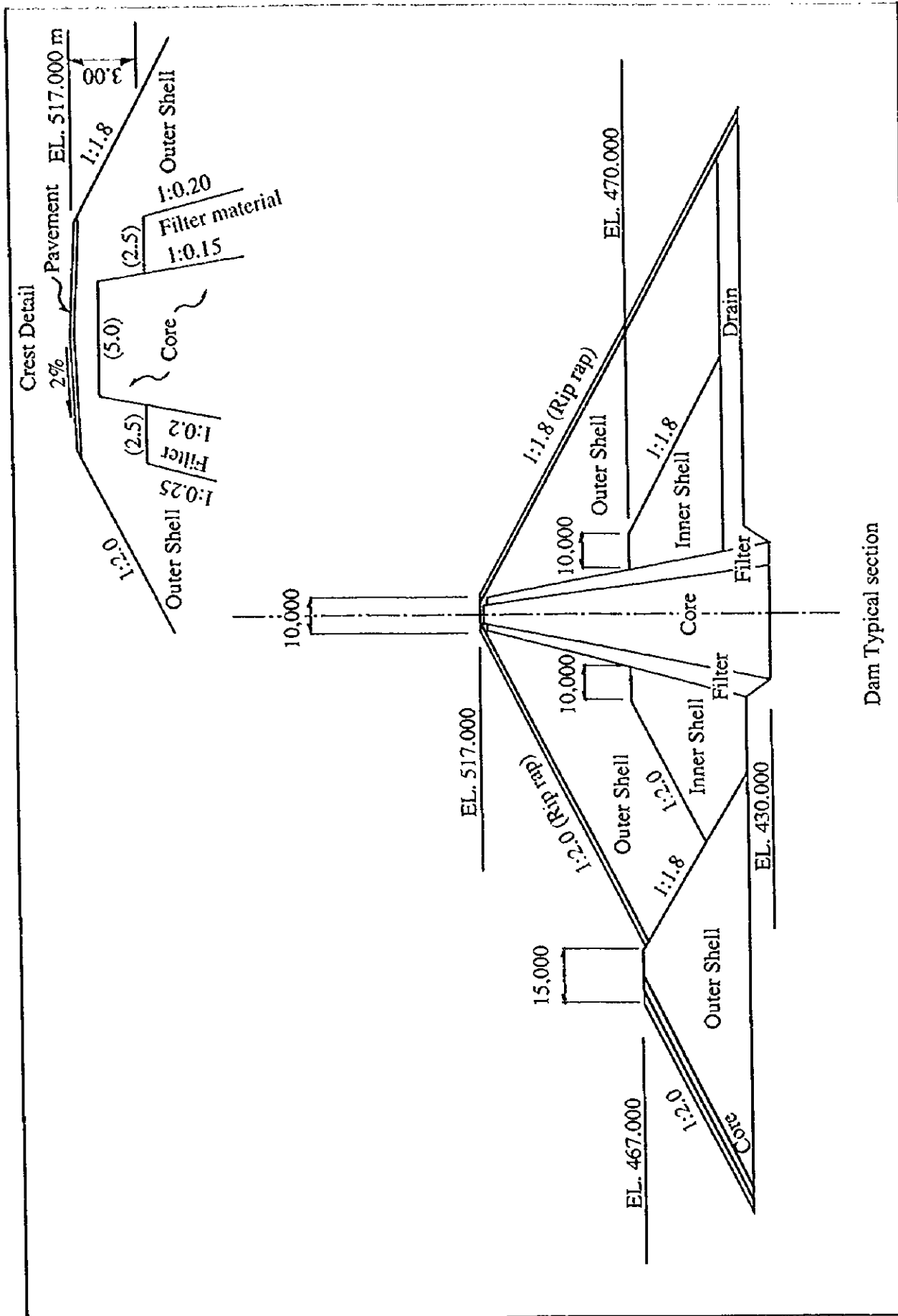
High Grand Falls



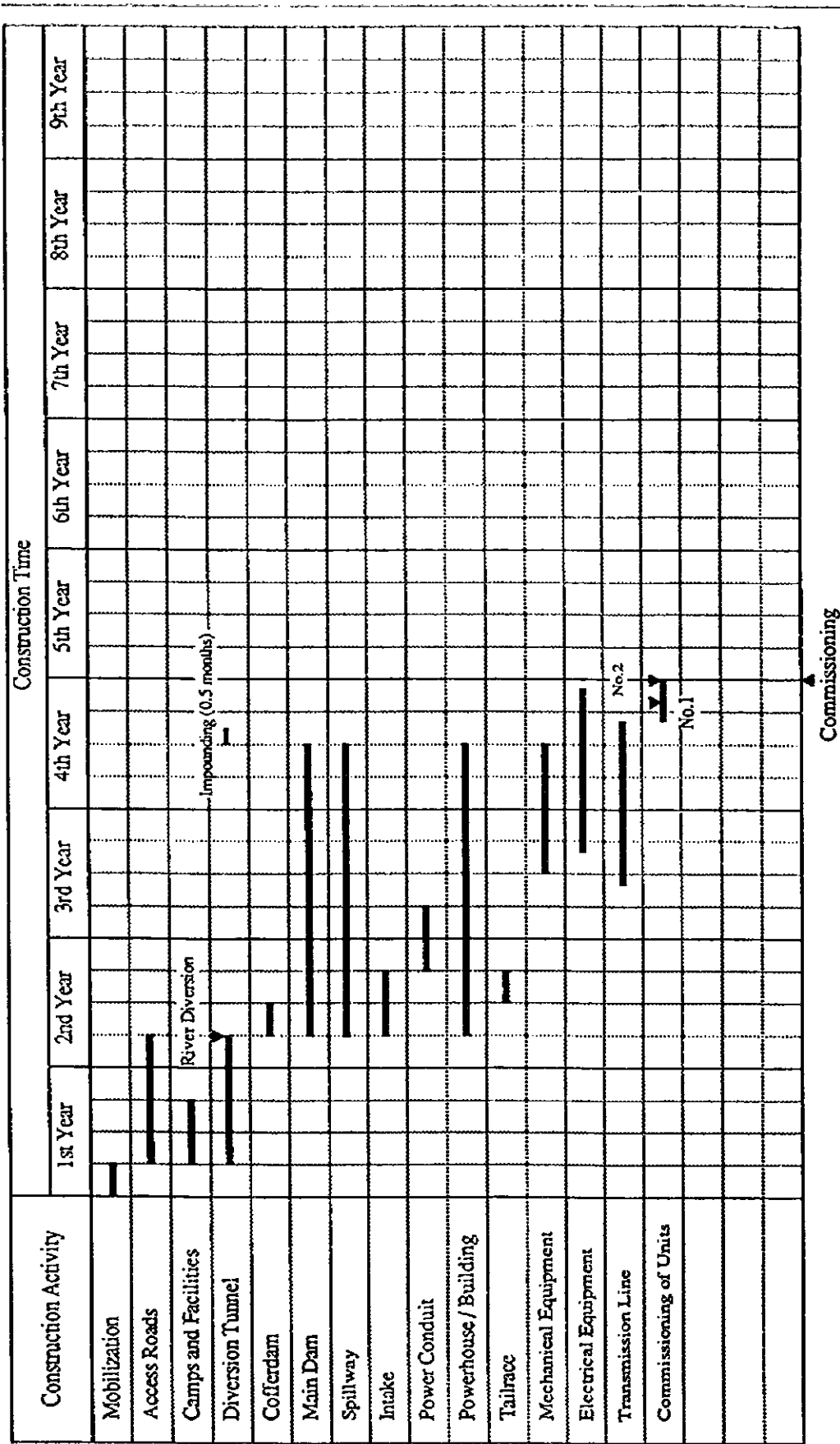
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 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

High Grand Falls Dam Layout Plan

Fig. No.
 6.3.3



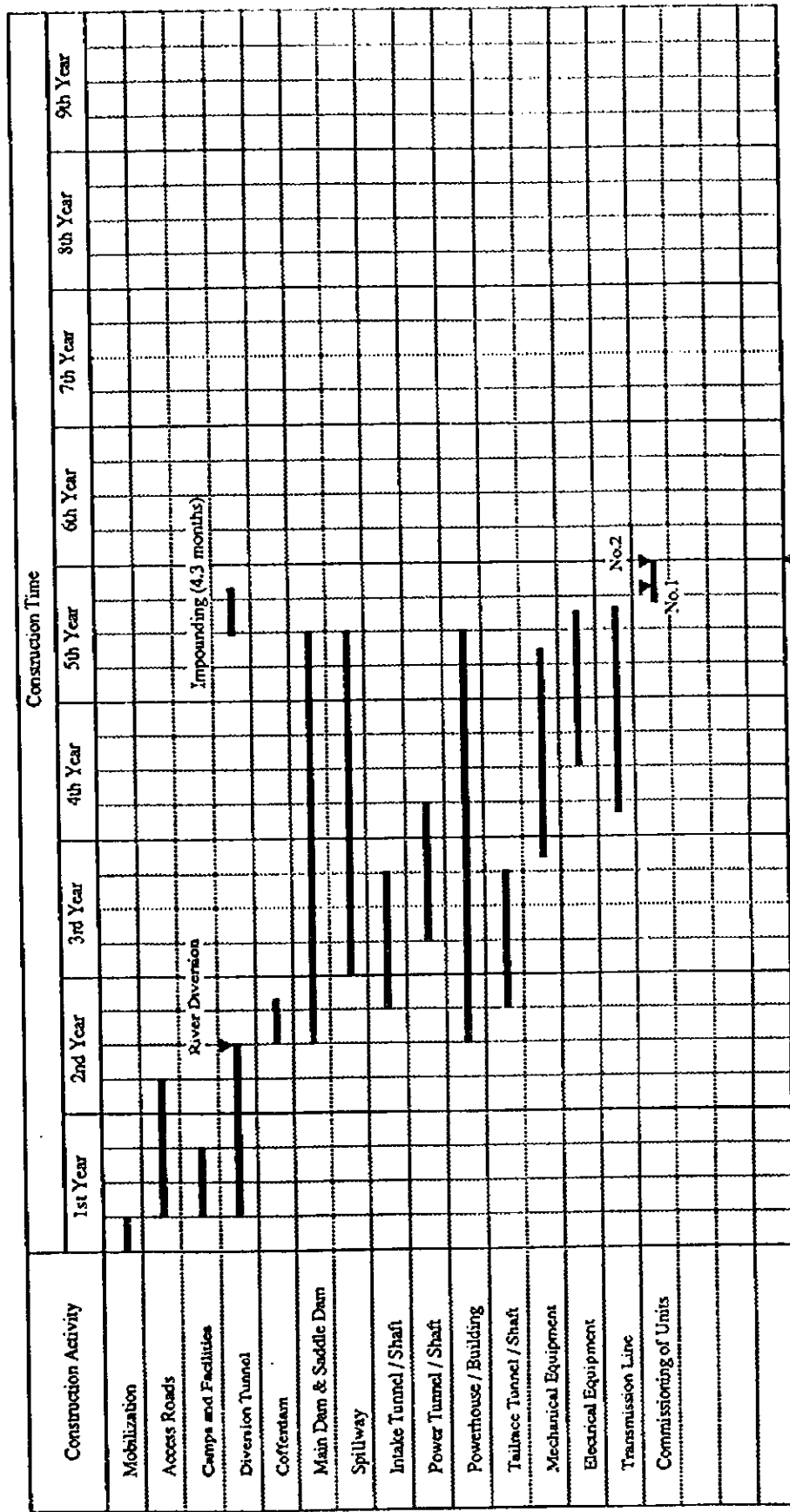
Dam Typical section



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Mutonga Dam Construction Schedule

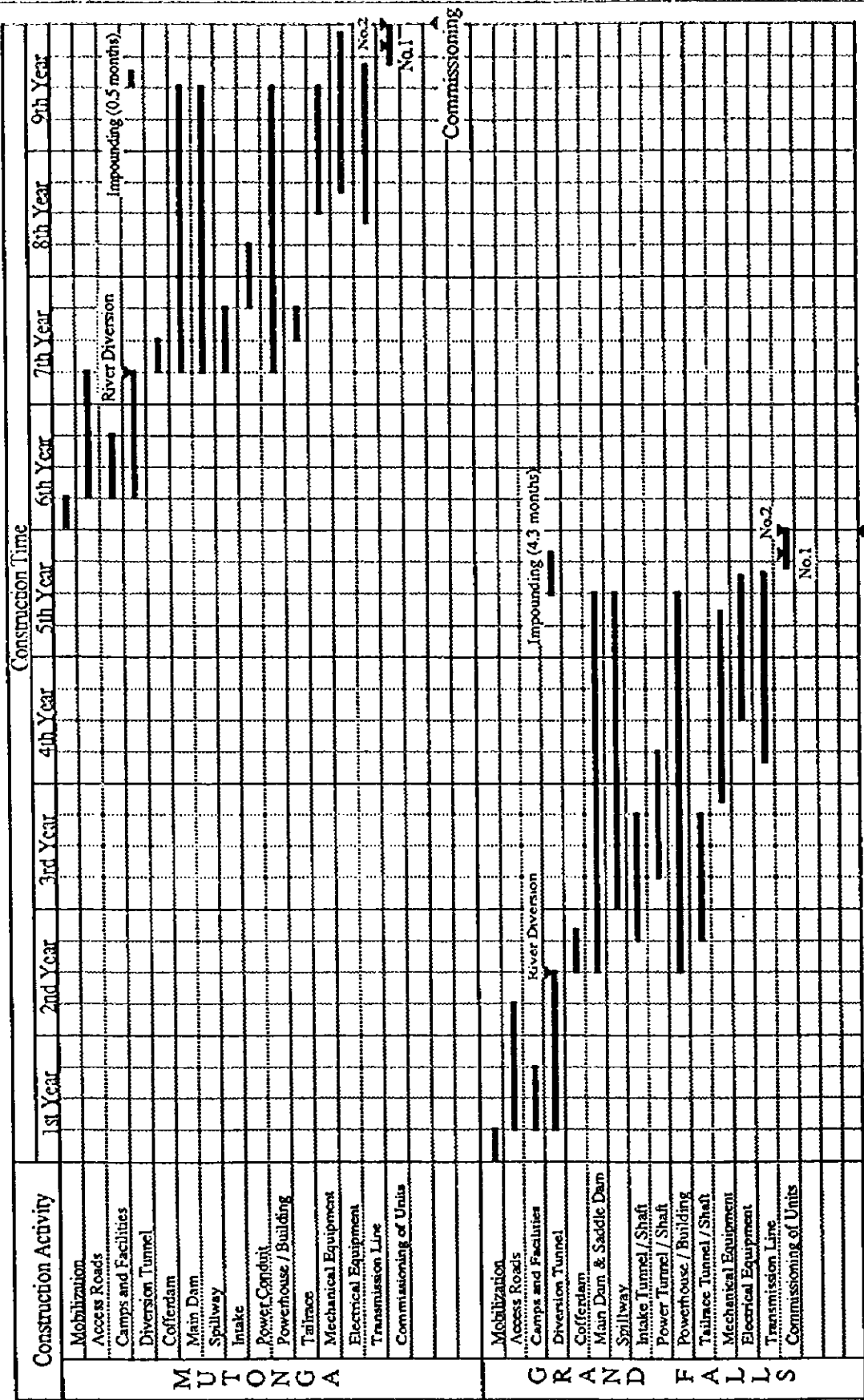
Fig. No.
 6.3.5



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Low Grand Falls Dam Construction
 Schedule

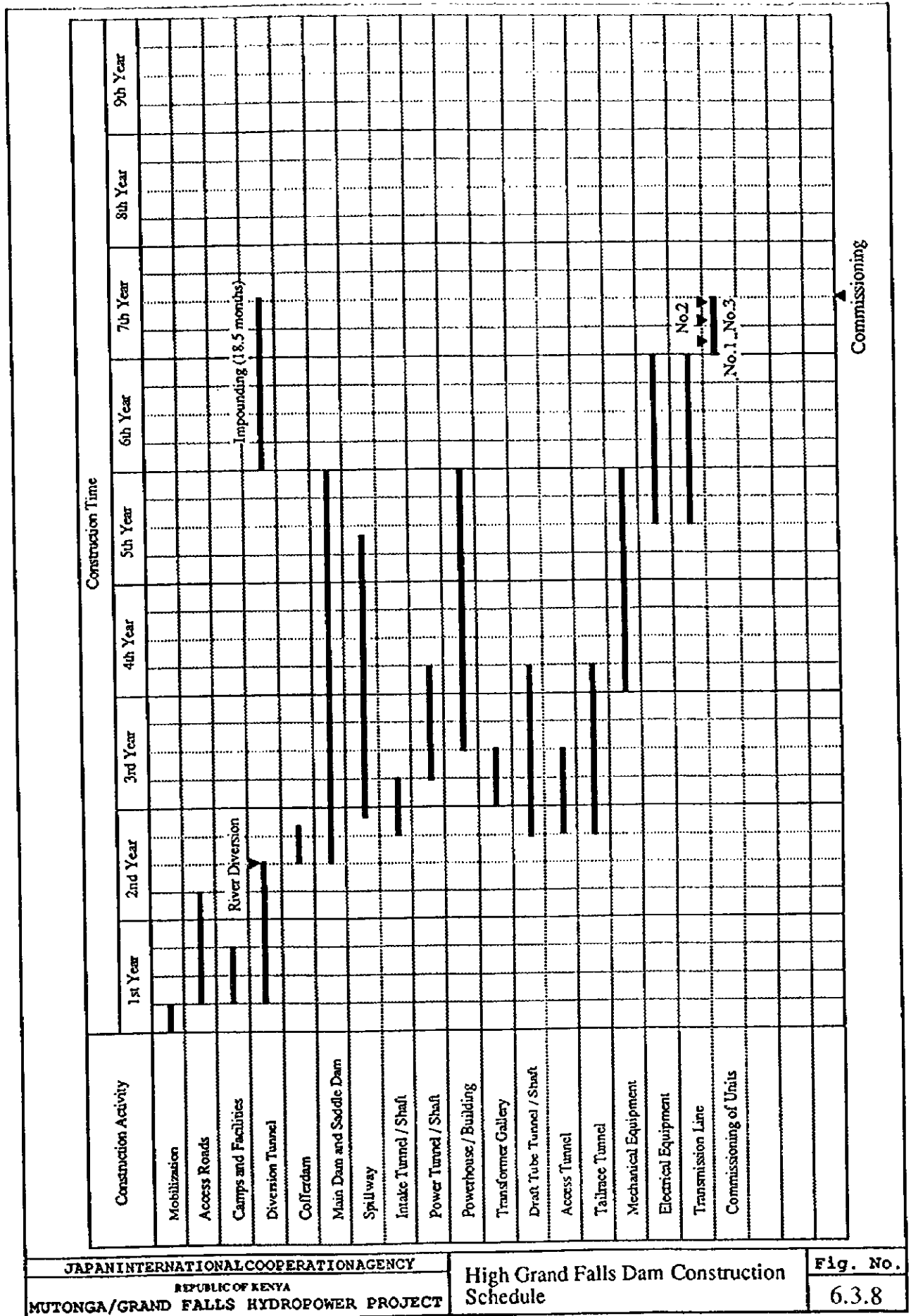
Fig. No.
 6.3.6



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Low Grand Falls and Mutonga
 Dams Construction Schedule

Fig. No.
 6.3.7



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High Grand Falls Dam Construction Schedule

Fig. No.
6.3.8



LEGEND

- High Suitable Land
- ▨ Moderately Suitable Land
- ▧ Marginally Suitable Land
- Not suitable Land
- ▩ National Park or Forest
- ⊞ Lake



Source : National Water Master Plan 1992, JICA

<p>JAPAN INTERNATIONAL COOPERATION AGENCY REPUBLIC OF KENYA MUTONGA/GRAND FALLS HYDROPOWER PROJECT</p>	<p>Irrigation Potential for Lowland Crops</p>	<p>Fig. No. 6.3.9</p>
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