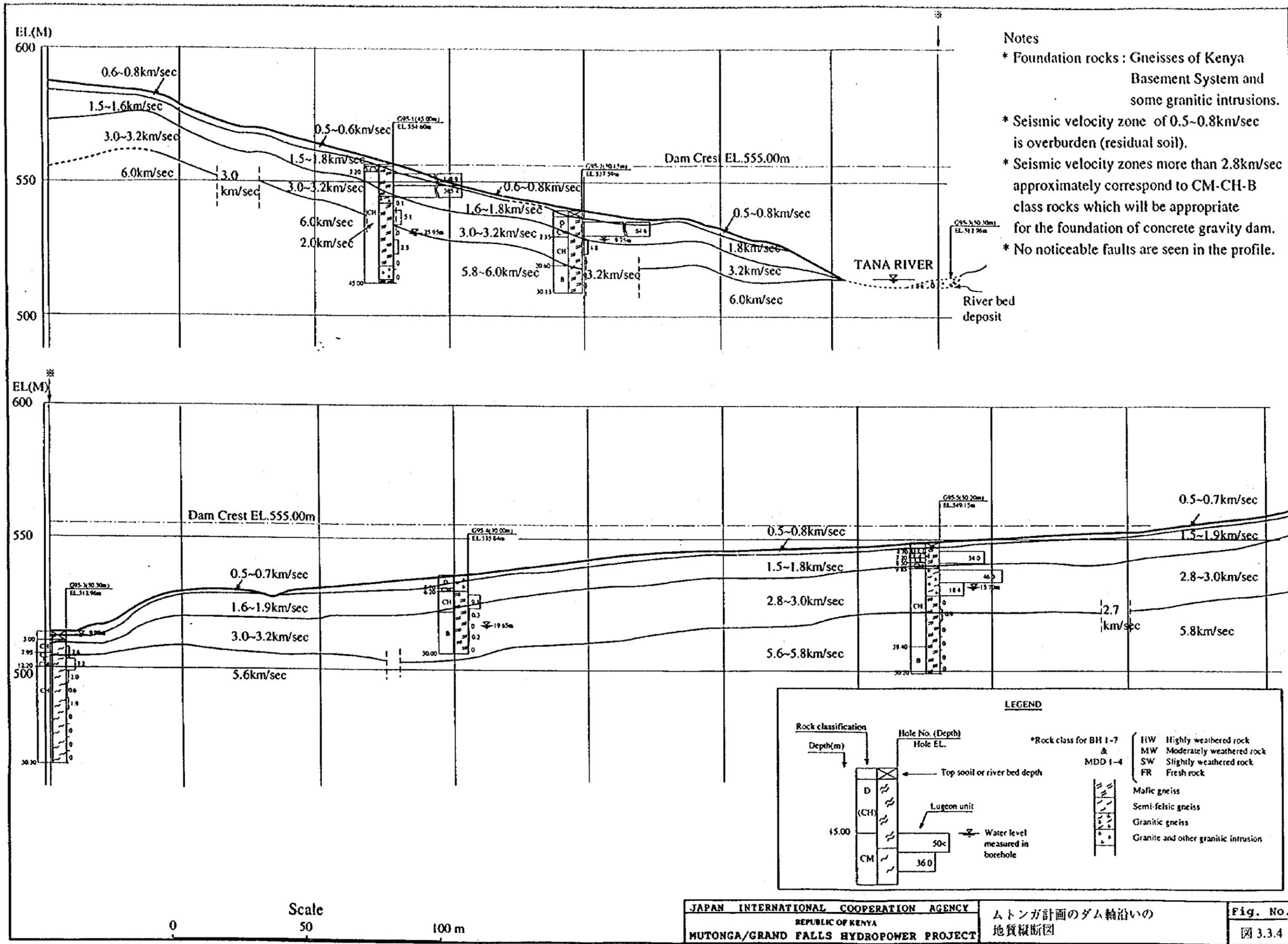
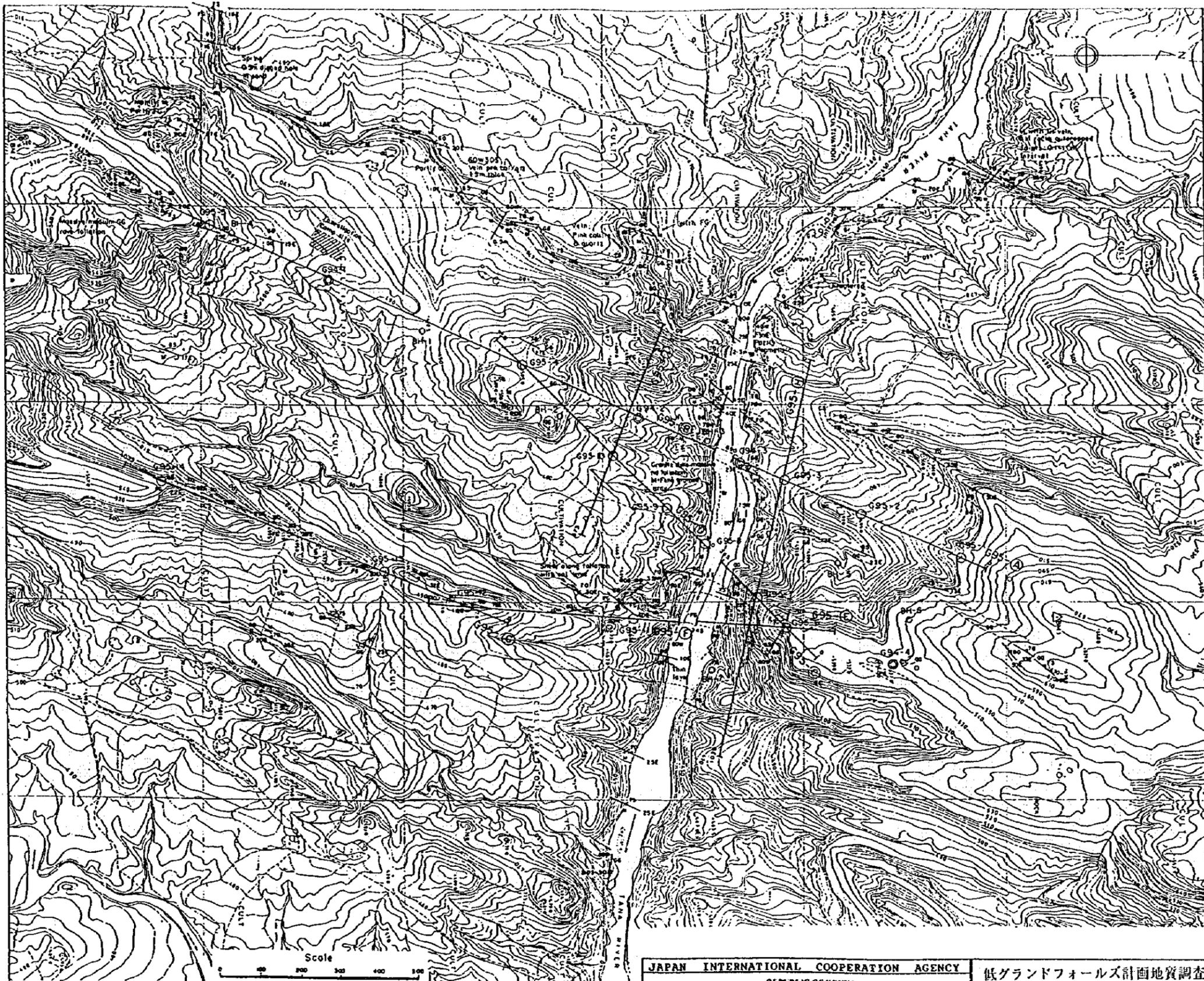


JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

ムトンガ計画の地質調査の位置
 及び地質平面図

Fig. No.
 図 3.3.3

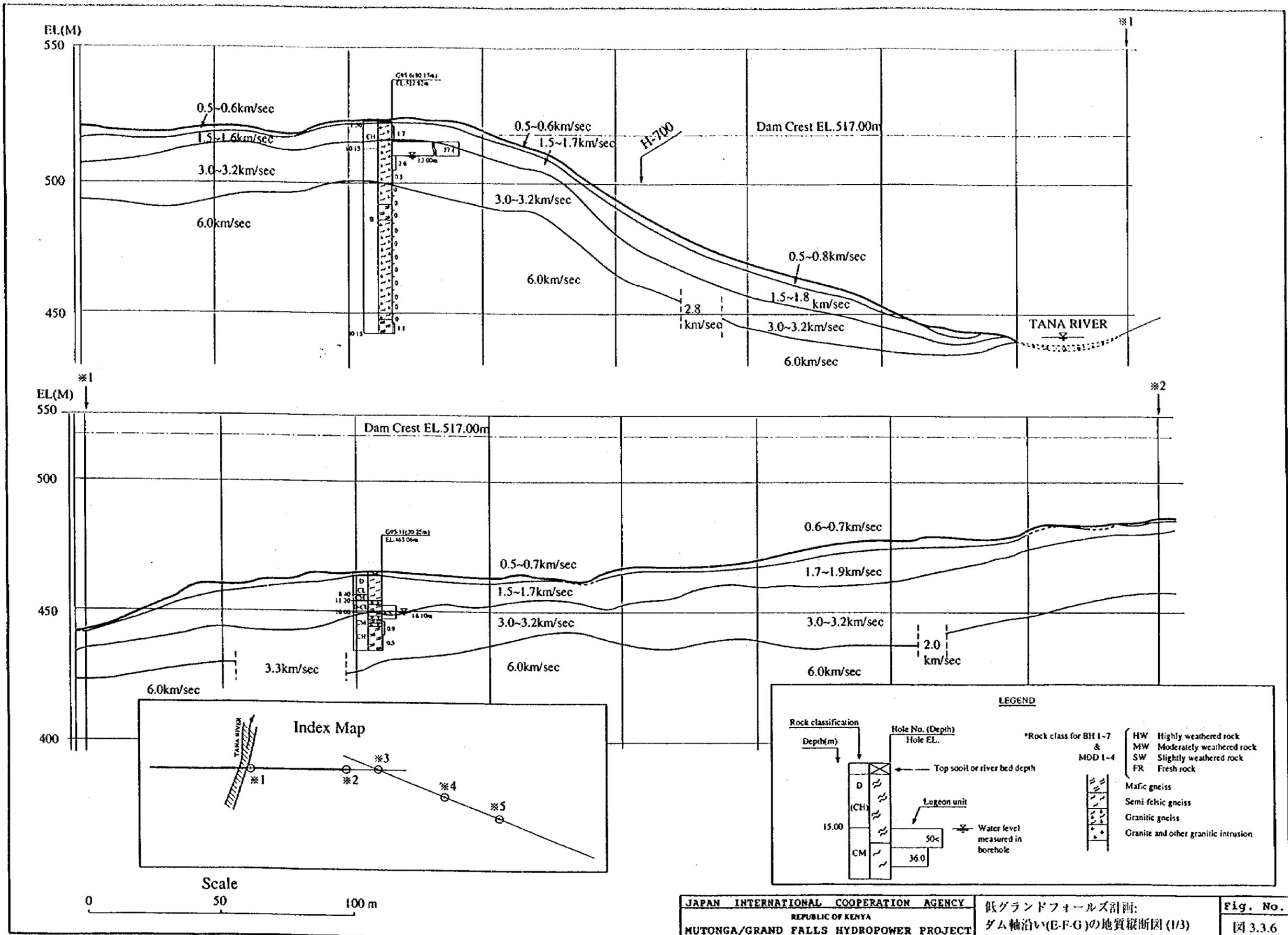




JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

低グランドフォールズ計画地質調査の
 位置及び地質平面図

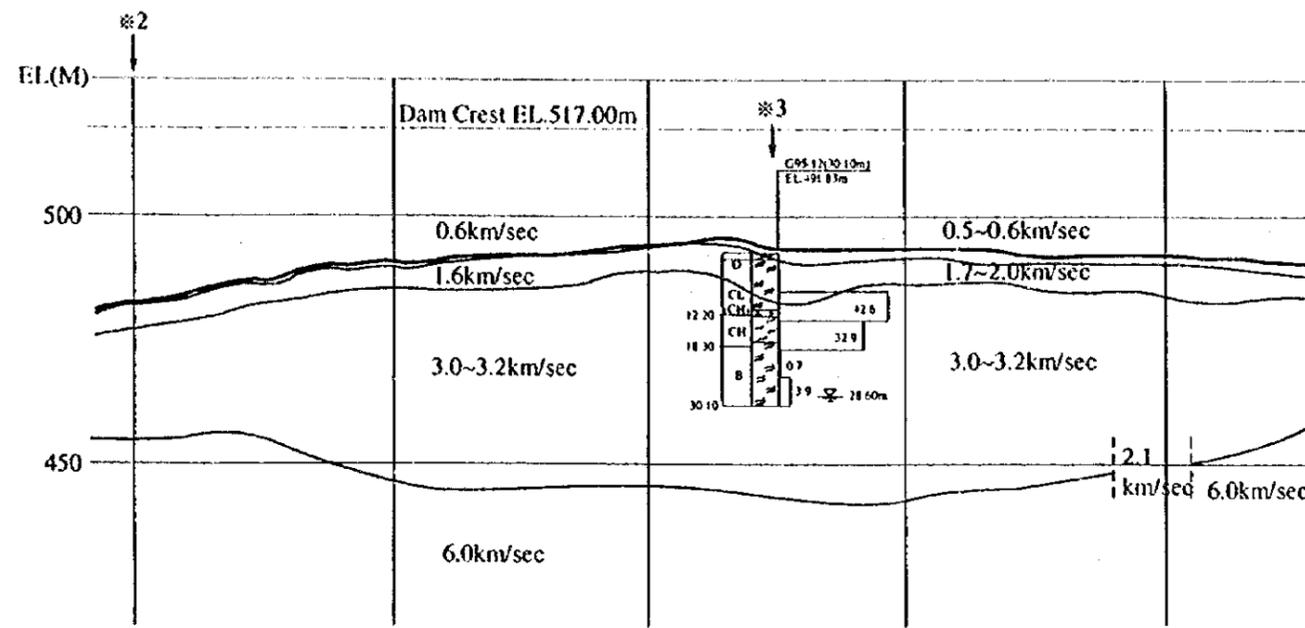
Fig. No.
 図 3.3.5



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

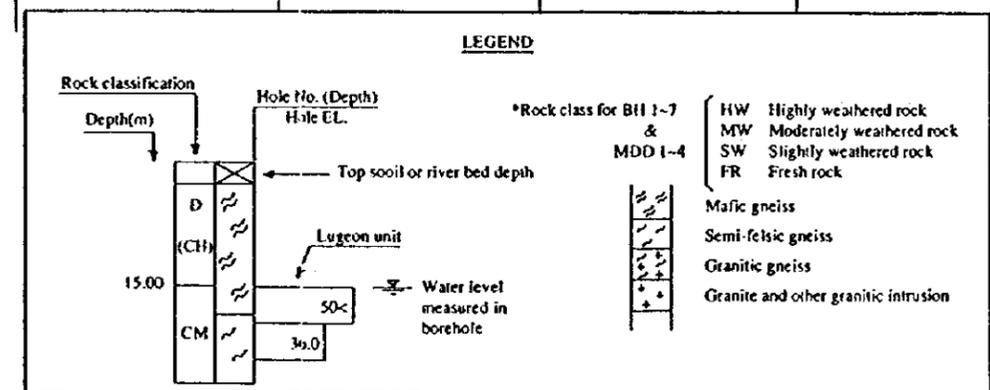
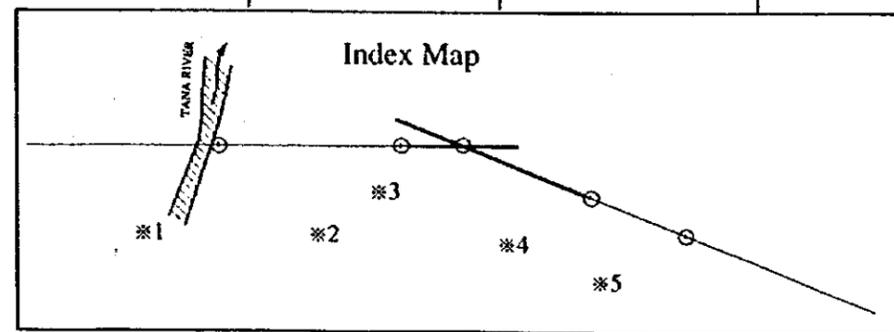
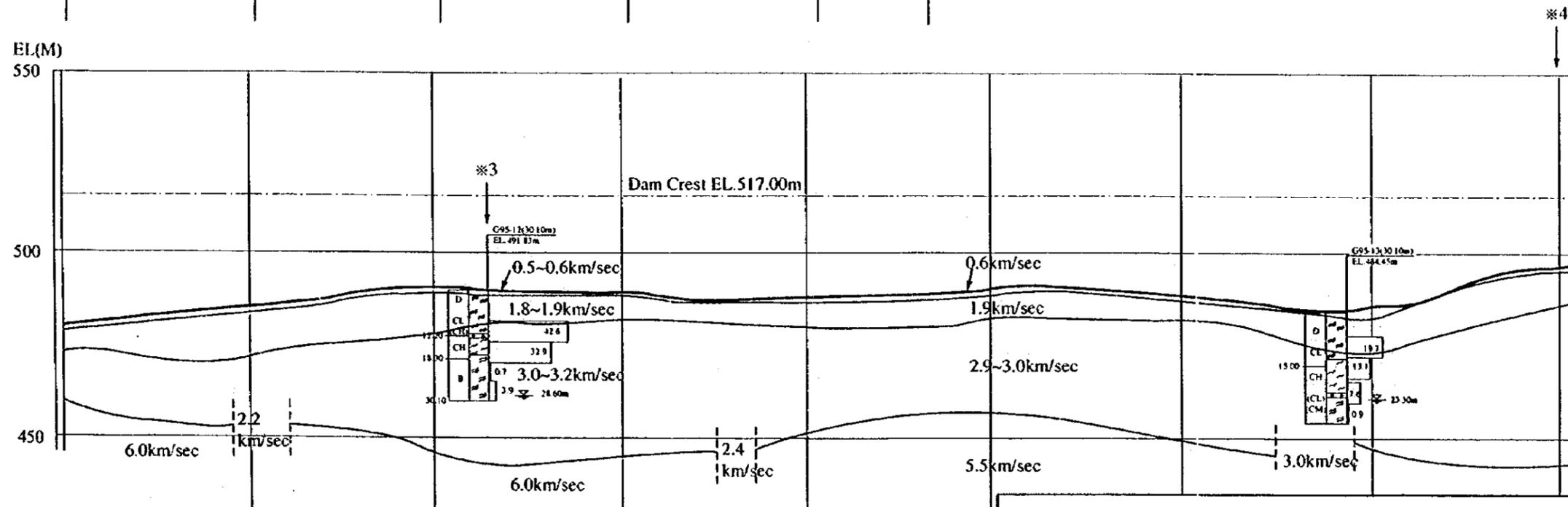
低グランドフォールズ計画:
 ダム軸沿い(E-F-G)の地質縦断面図(1/3)

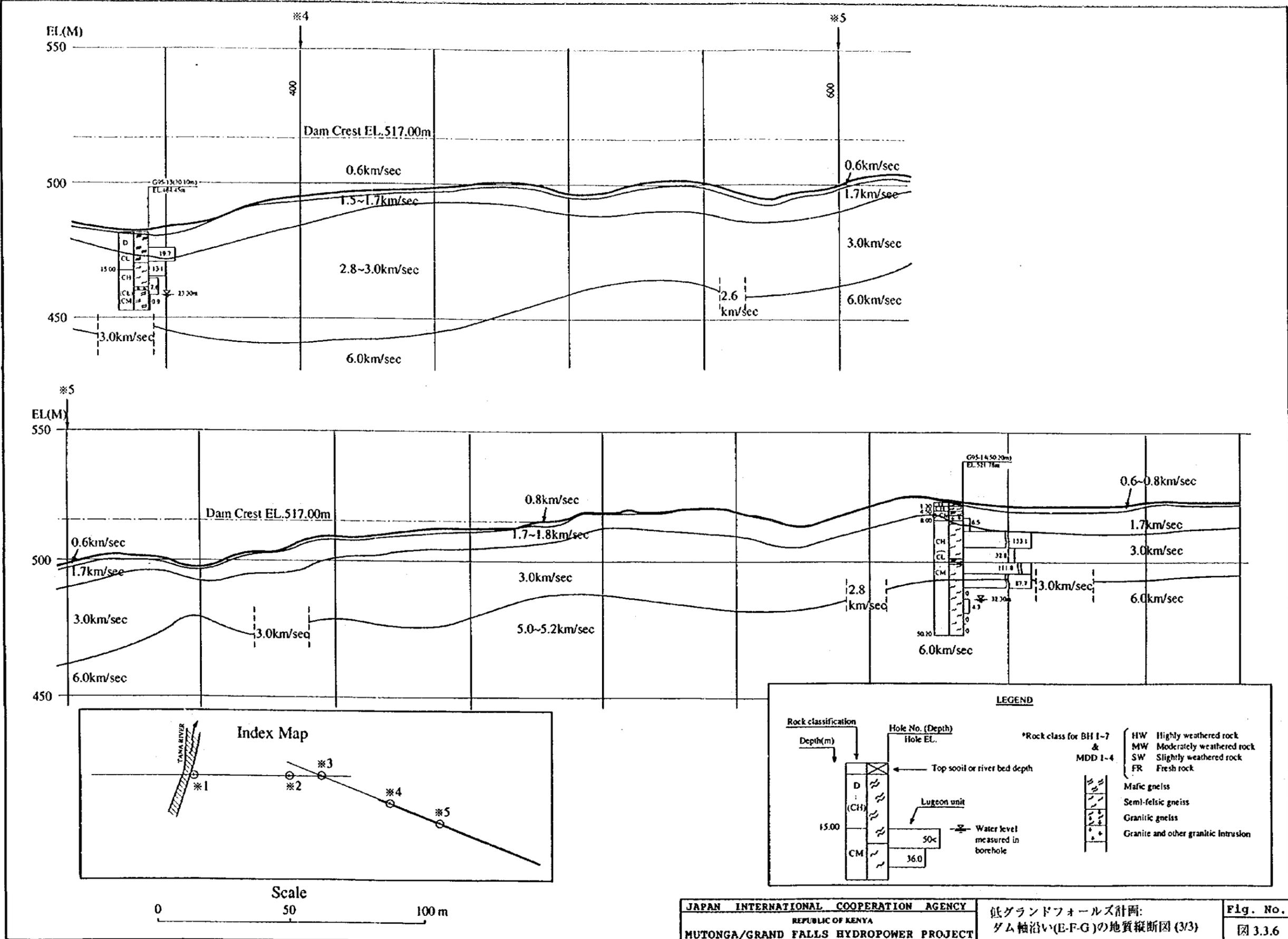
Fig. No.
 図 3.3.6



Notes for Dam axis E-F-G

- * Foundation rocks : Gneisses of Kenyan Basement System and some granitic intrusions.
- * Seismic velocity zone of 0.5~0.8km/sec is overburden (residual soil).
- * Seismic velocity zones more than 2.8km/sec approximately correspond to CM-CH-B class rocks which will be appropriate for the foundation of core zone (rock fill section), and for the foundation of concrete gravity dam.
- * No noticeable faults are seen in the profile along dam axis E-F-G.

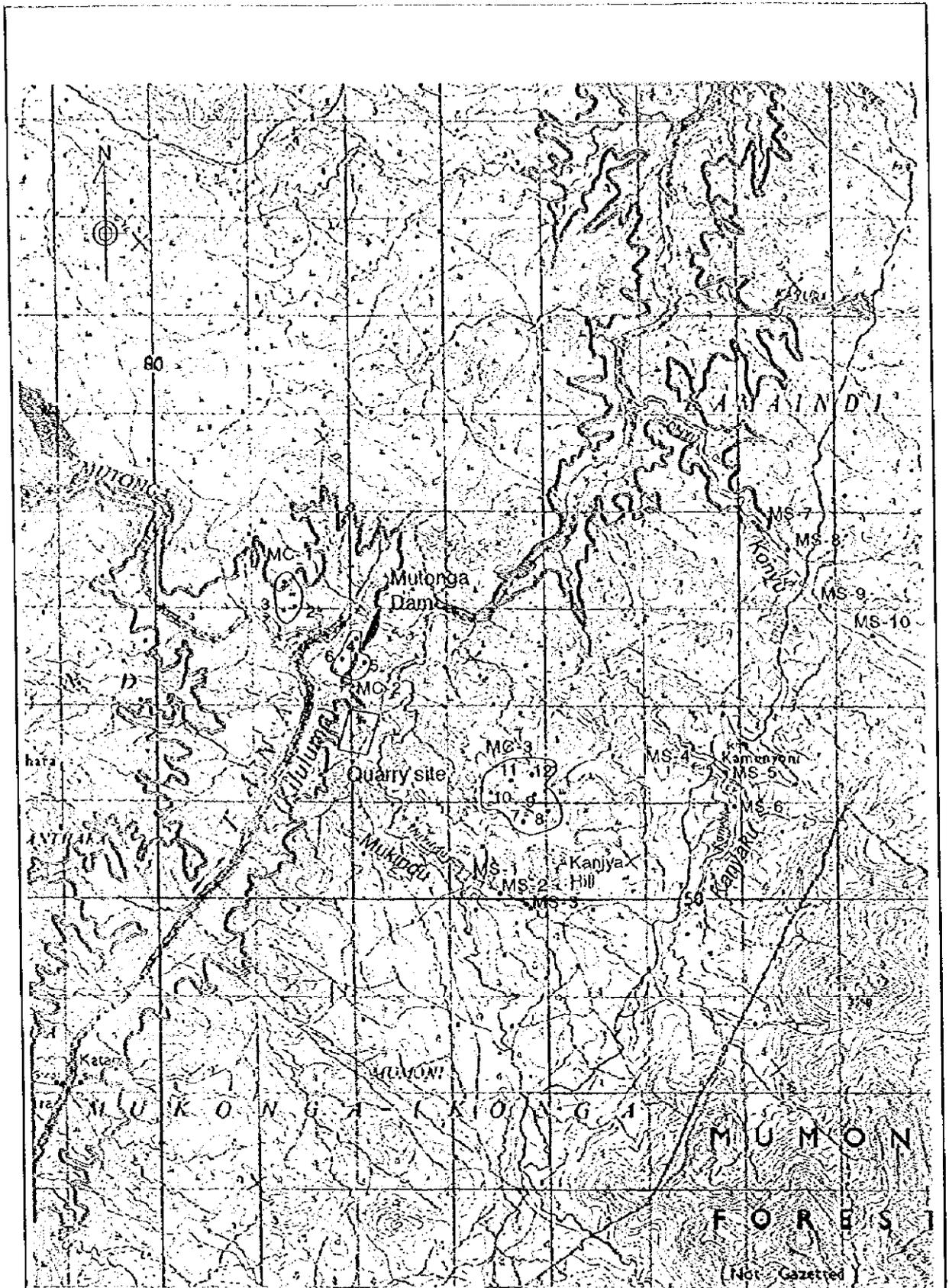




JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

低グランドフォールズ計画:
 ダム軸沿い(E-F-G)の地質縦断面図(3/3)

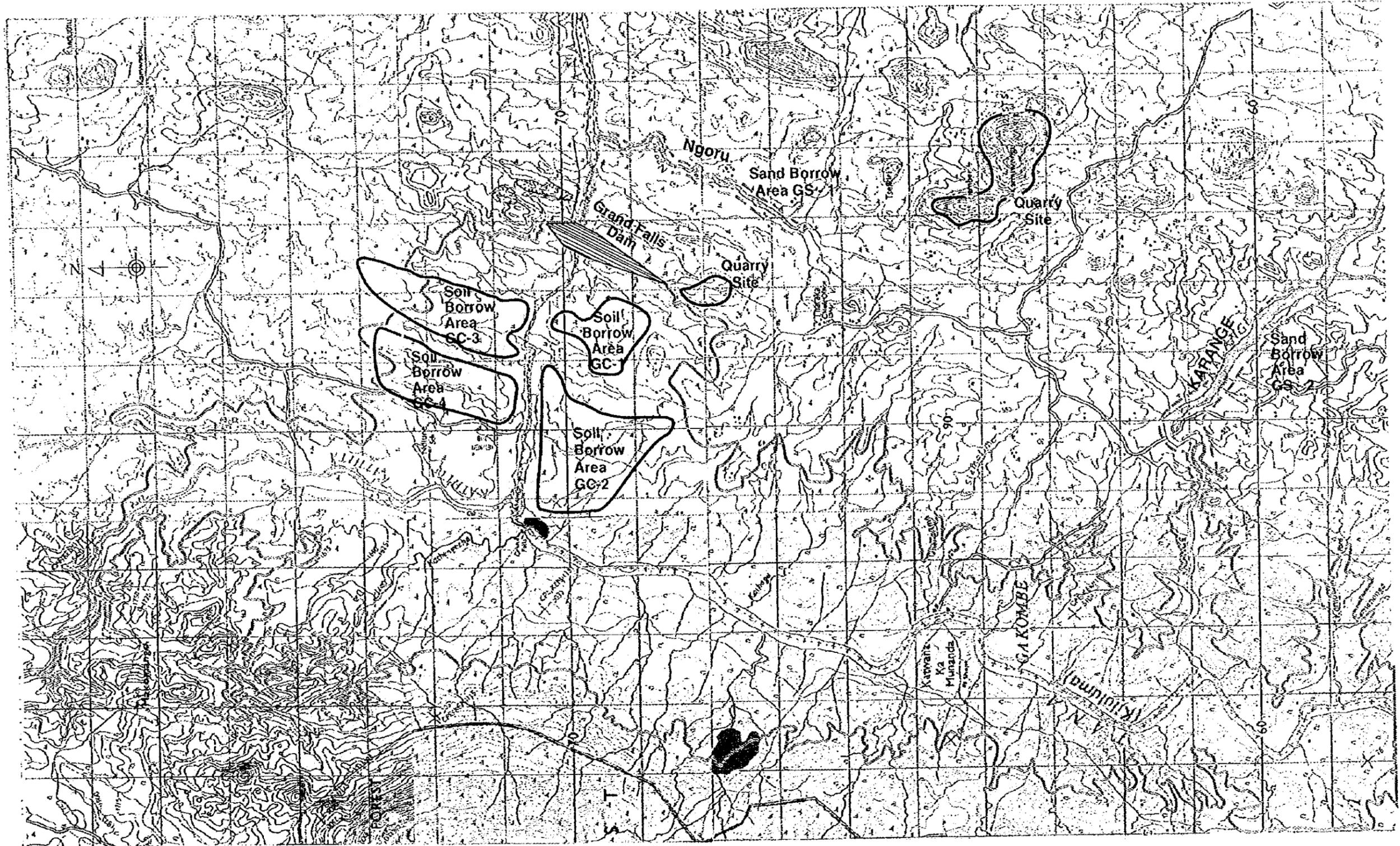
Fig. No.
 図 3.3.6



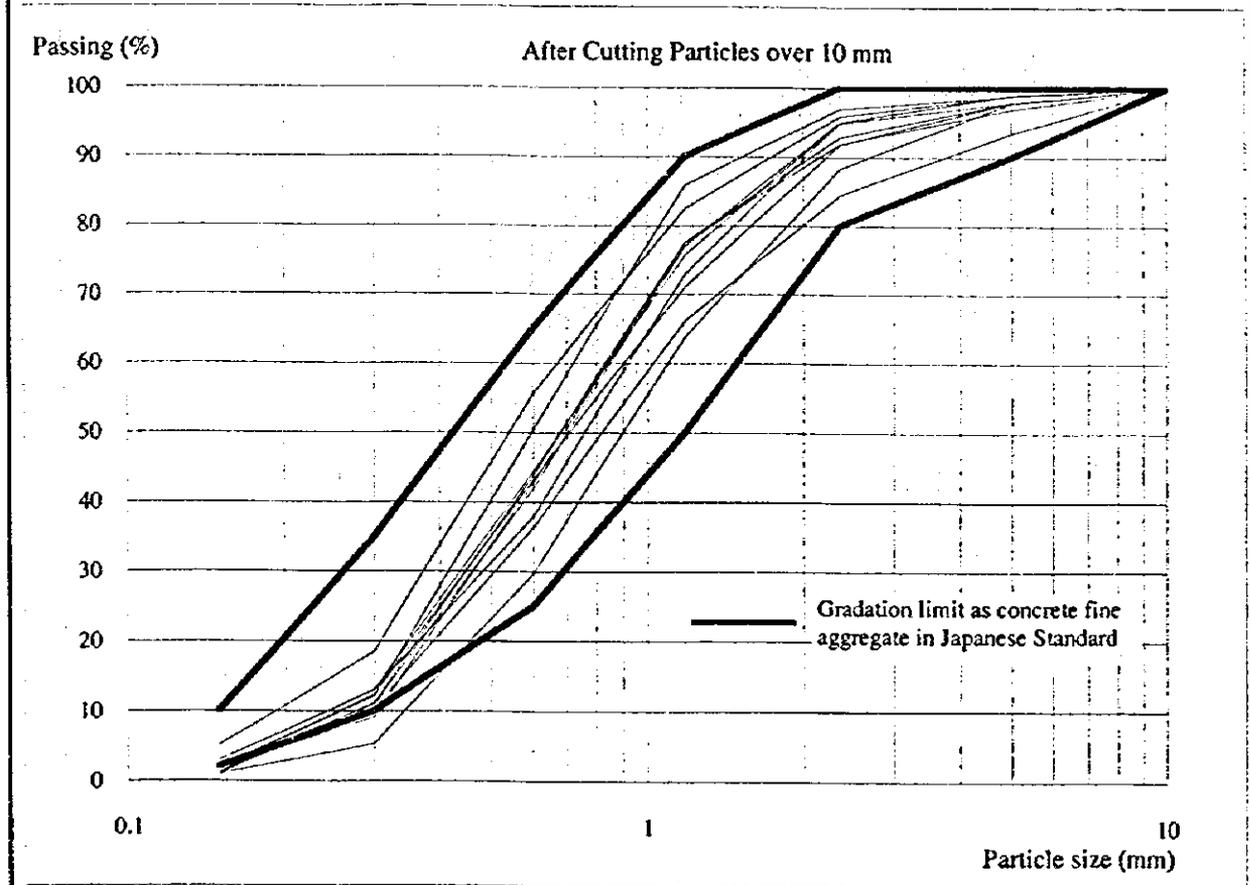
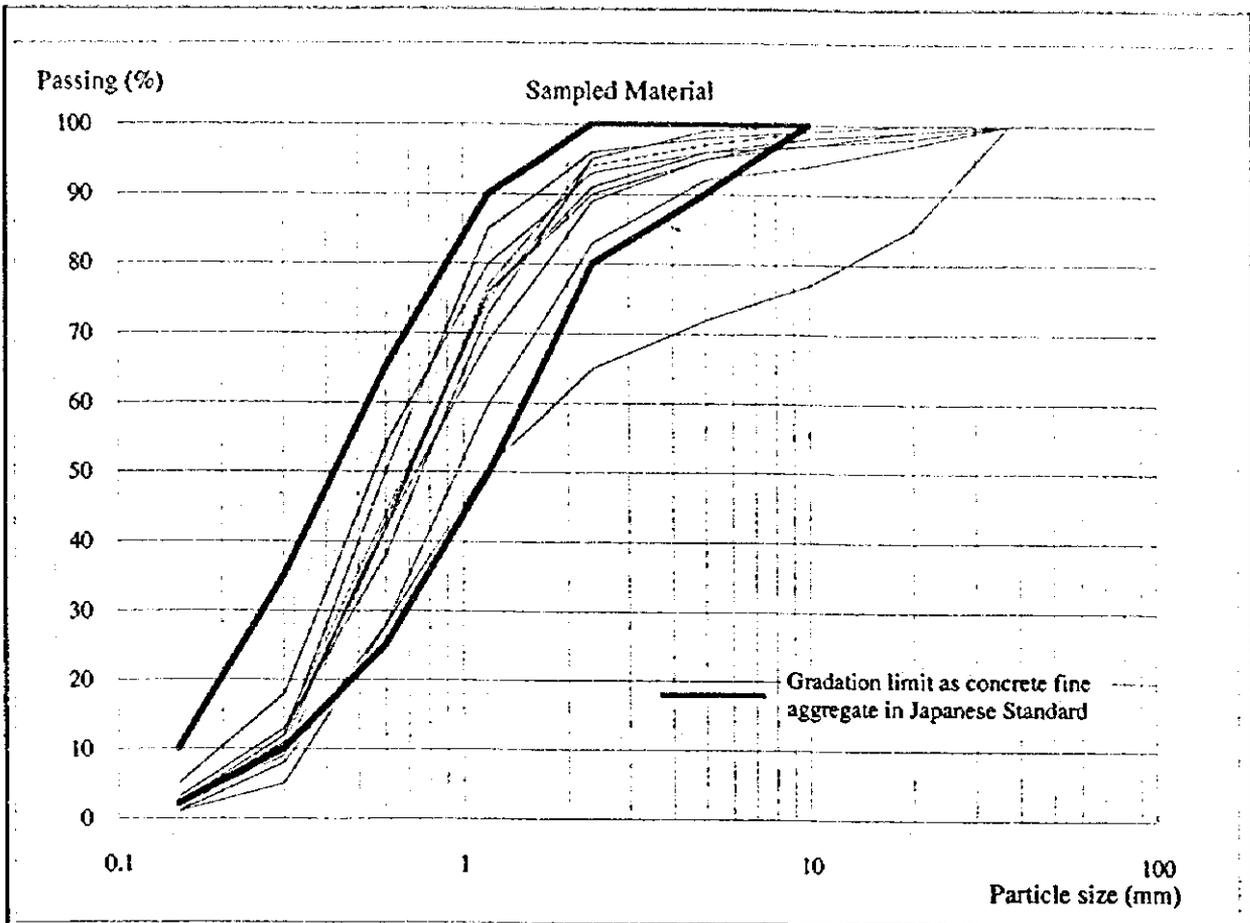
JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

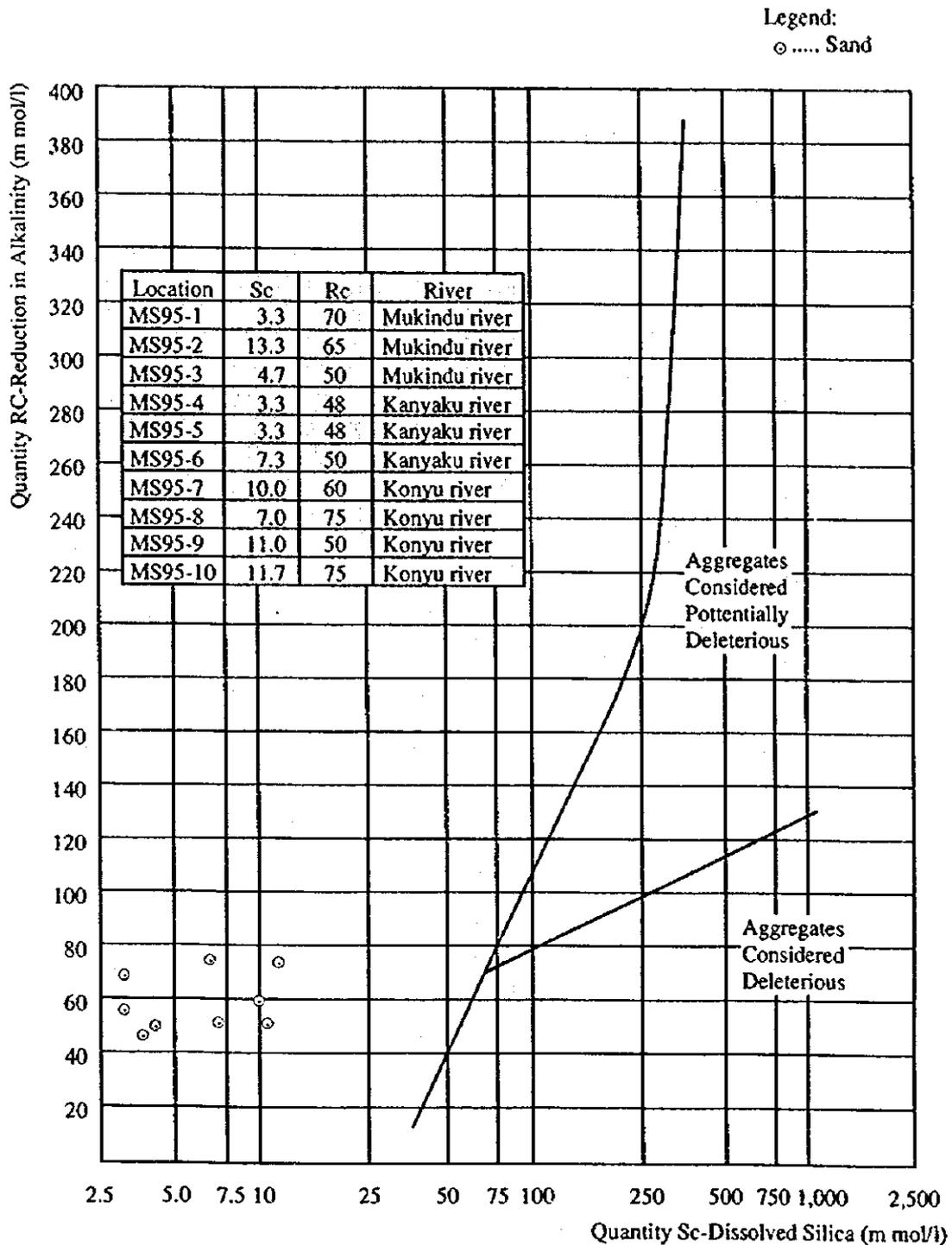
ムトンガダムの材料調査図

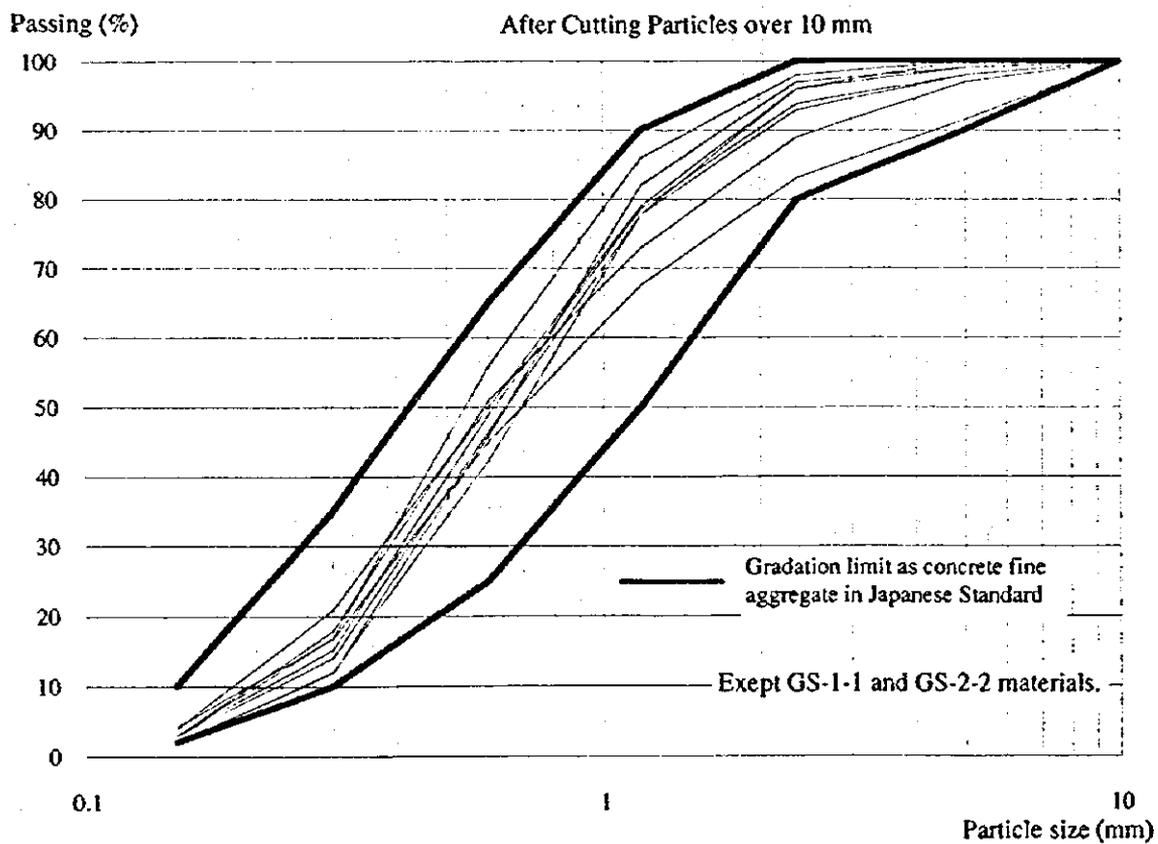
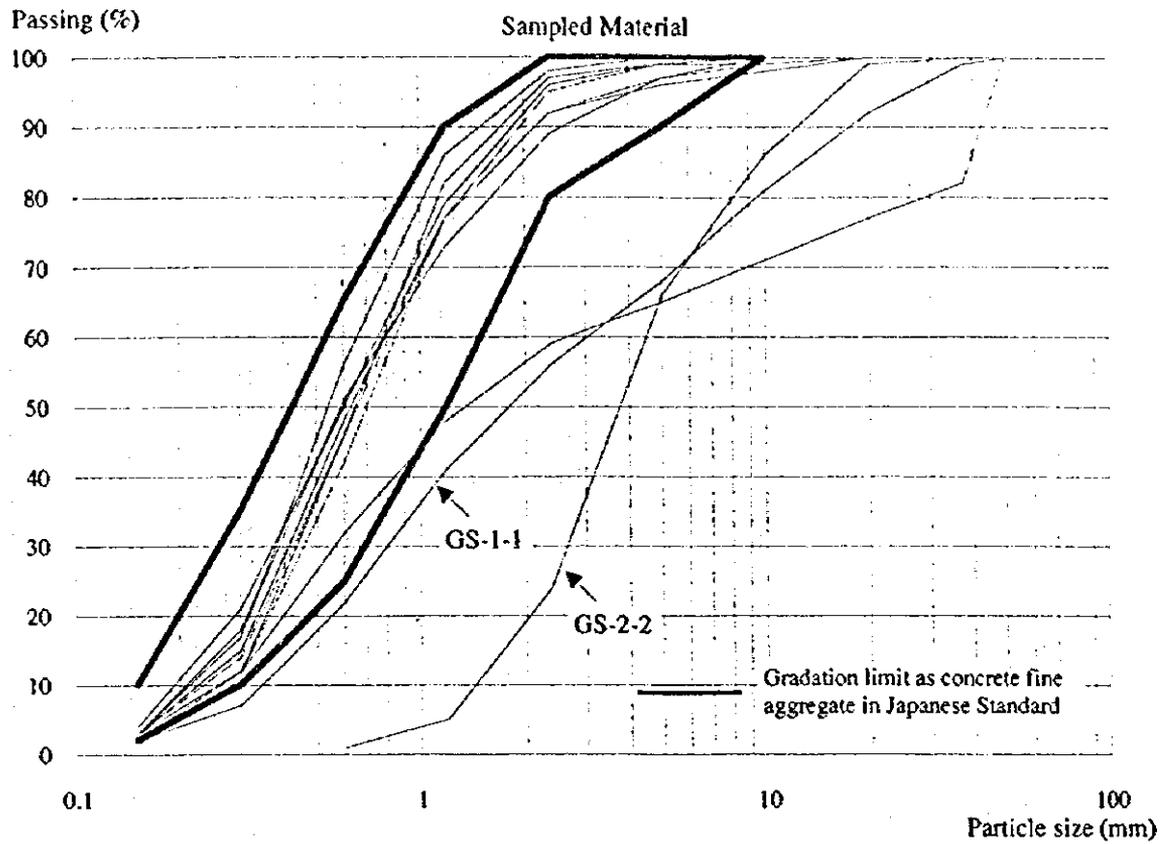
Fig. No.
 図 3.4.1

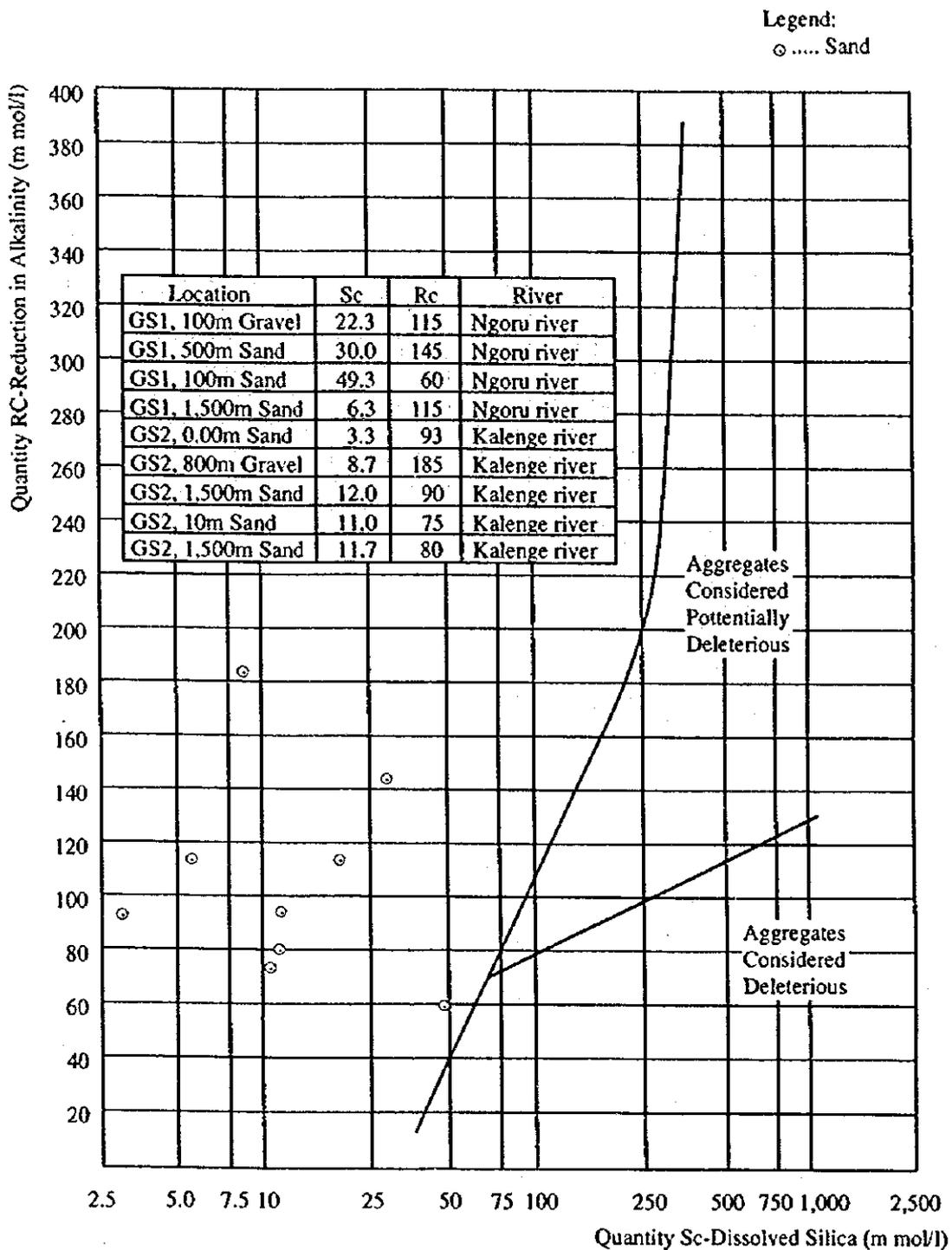


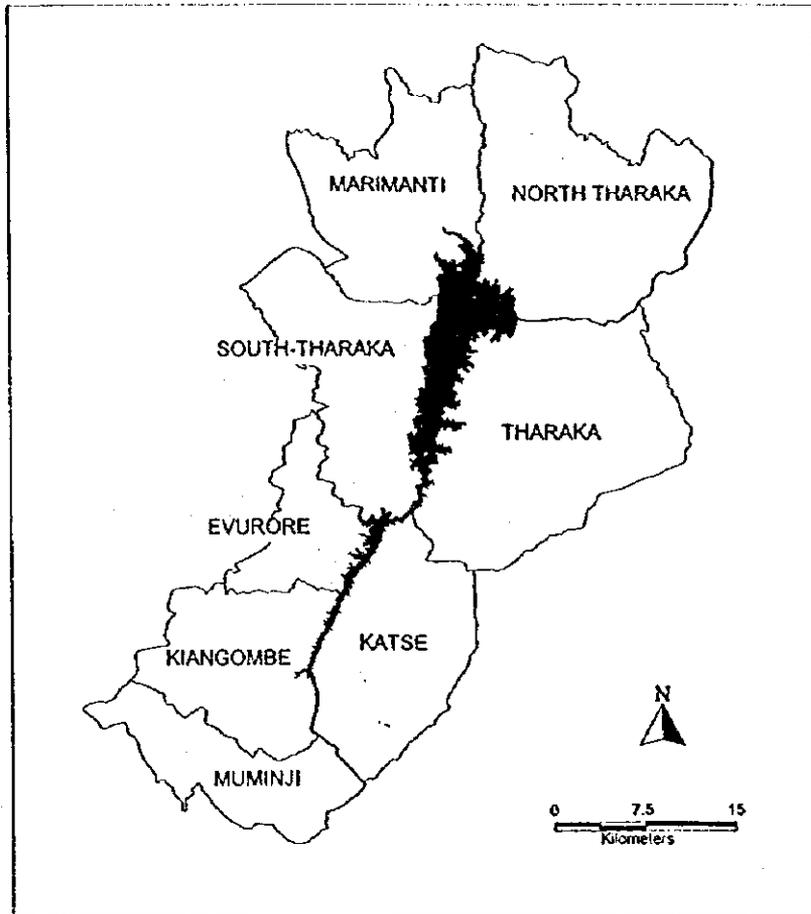
JAPAN INTERNATIONAL COOPERATION AGENCY REPUBLIC OF KENYA MUTONGA/GRAND FALLS HYDROPOWER PROJECT	グランドフォールズダムの材料調査図	Fig. No. 図 3.4.2
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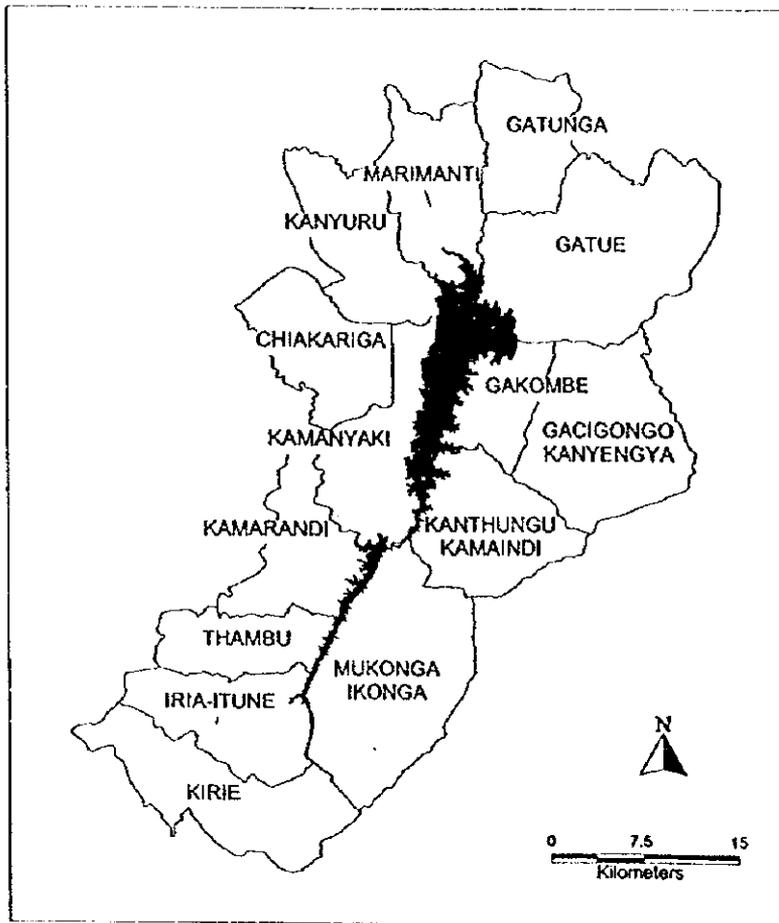




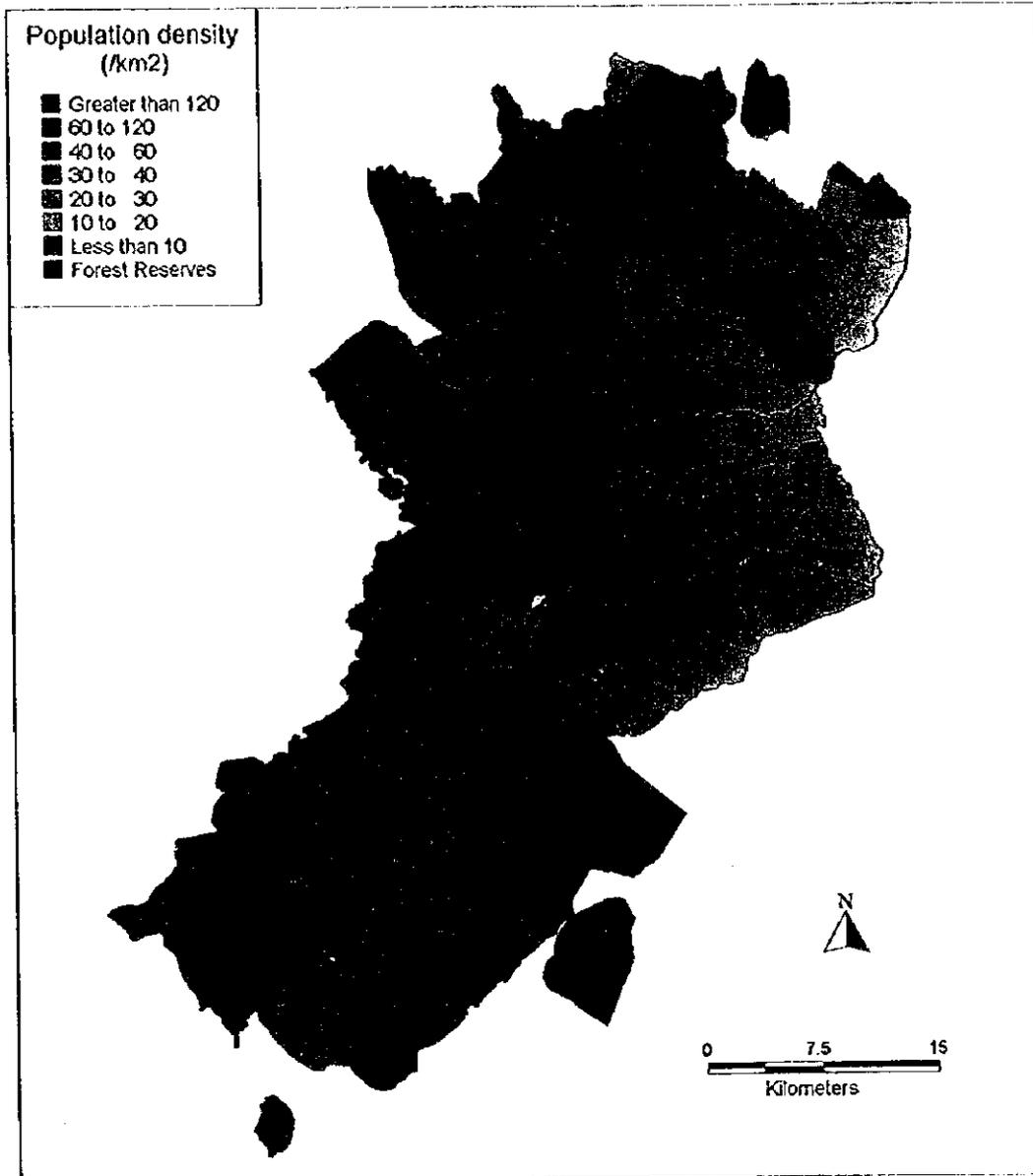
JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

ムトンガ/低グランドフォールズ貯水池の
 位置する行政区

Fig. No.
 図 4.2.1



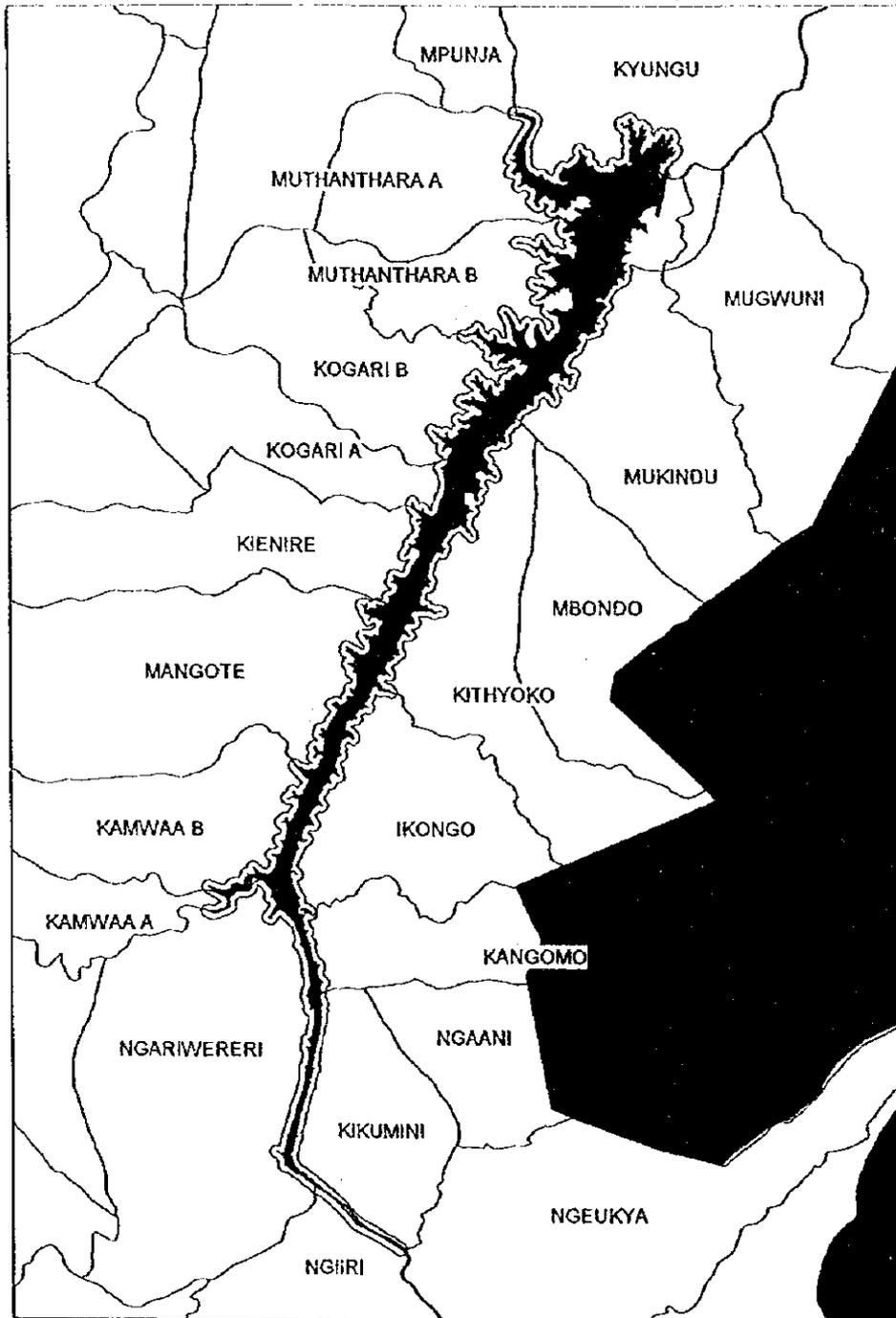
JAPAN INTERNATIONAL COOPERATION AGENCY	ムトンガ/低グランドフォールズ貯水池の 位置する小行政区	Fig. No.
REPUBLIC OF KENYA MUTONGA/GRAND FALLS HYDROPOWER PROJECT		図 4.2.2



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

調査地域の人口密度

Fig. No.
 図 4.2.3

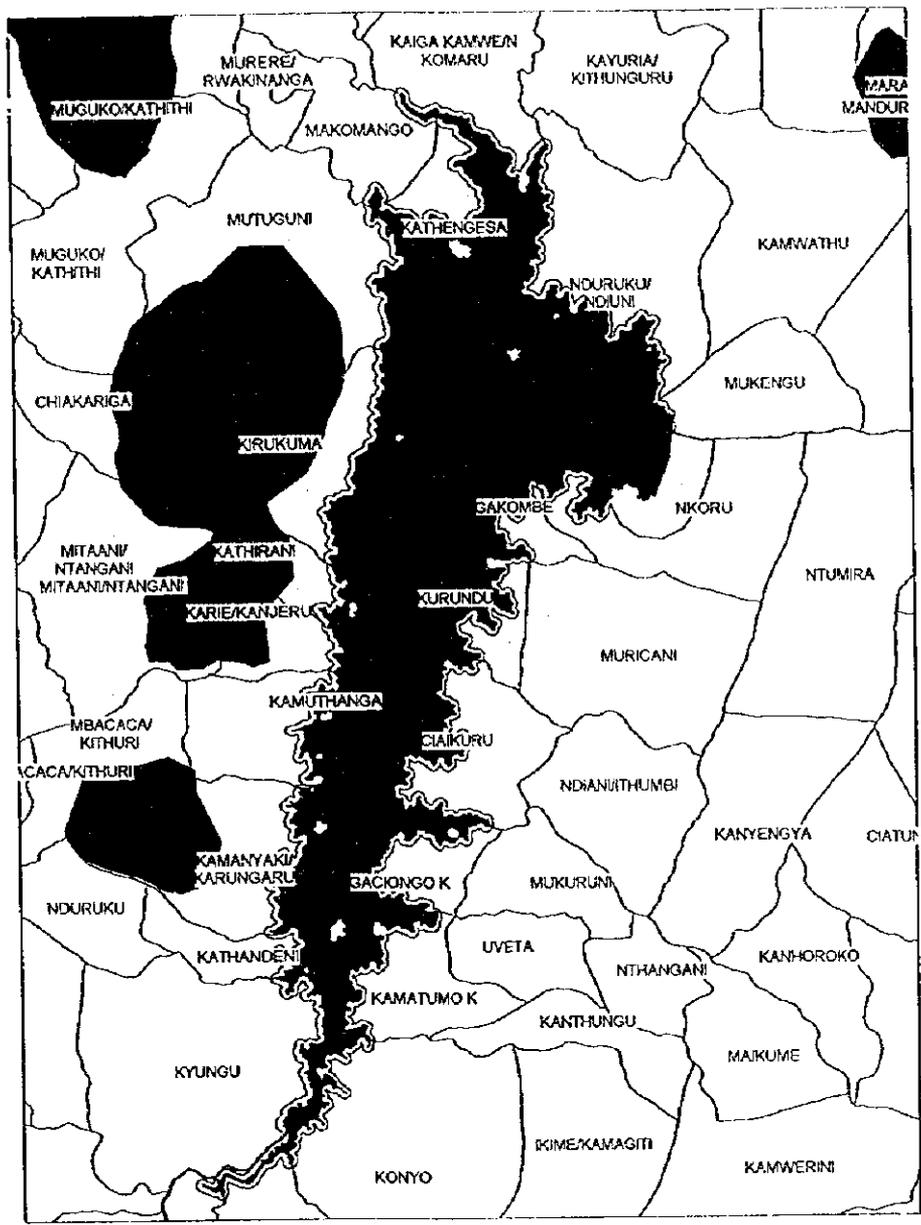


JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

ムトンガ貯水池の影響を受ける村落

Fig. No.

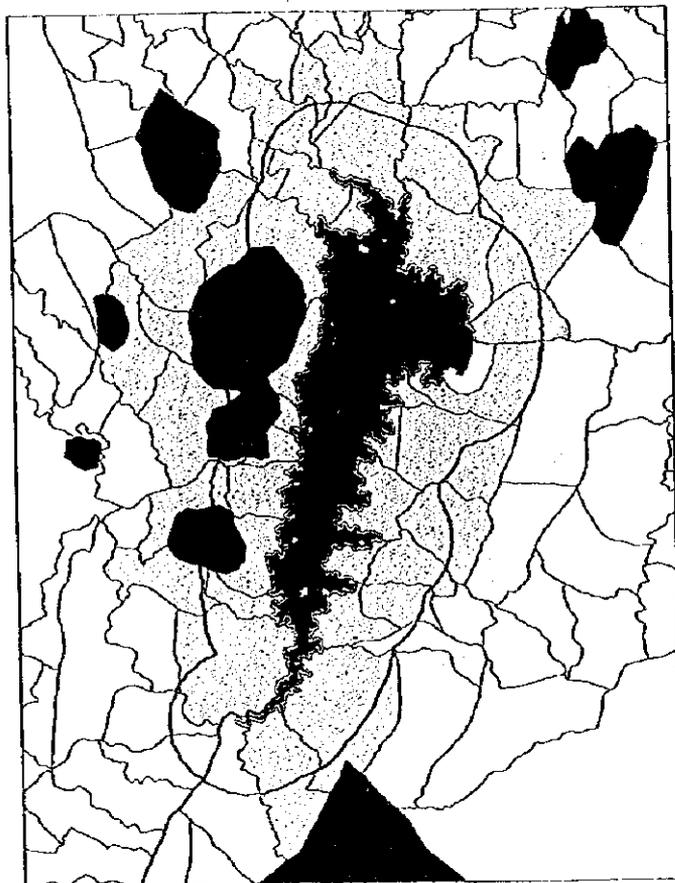
図 4.2.4



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

低グランドフォールズ貯水池の
 影響を受ける村落

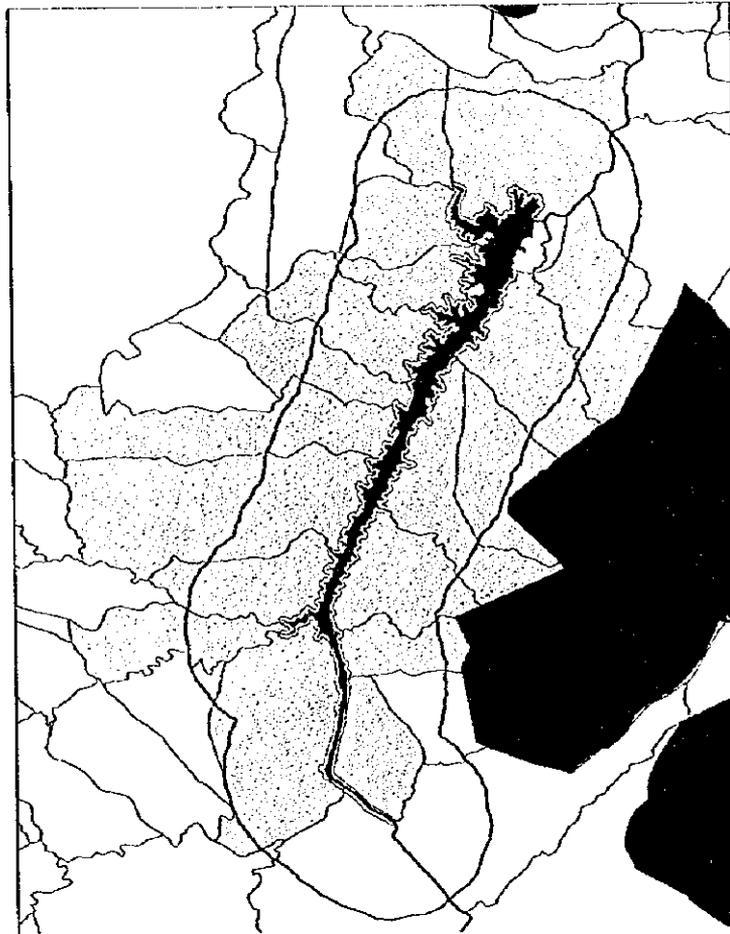
Fig. No.
 図 4.2.5



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

低グランドフォールズ貯水池の影響を
 受ける村落地域と3kmの境界線
 (SMZと緩衝帯を含む)

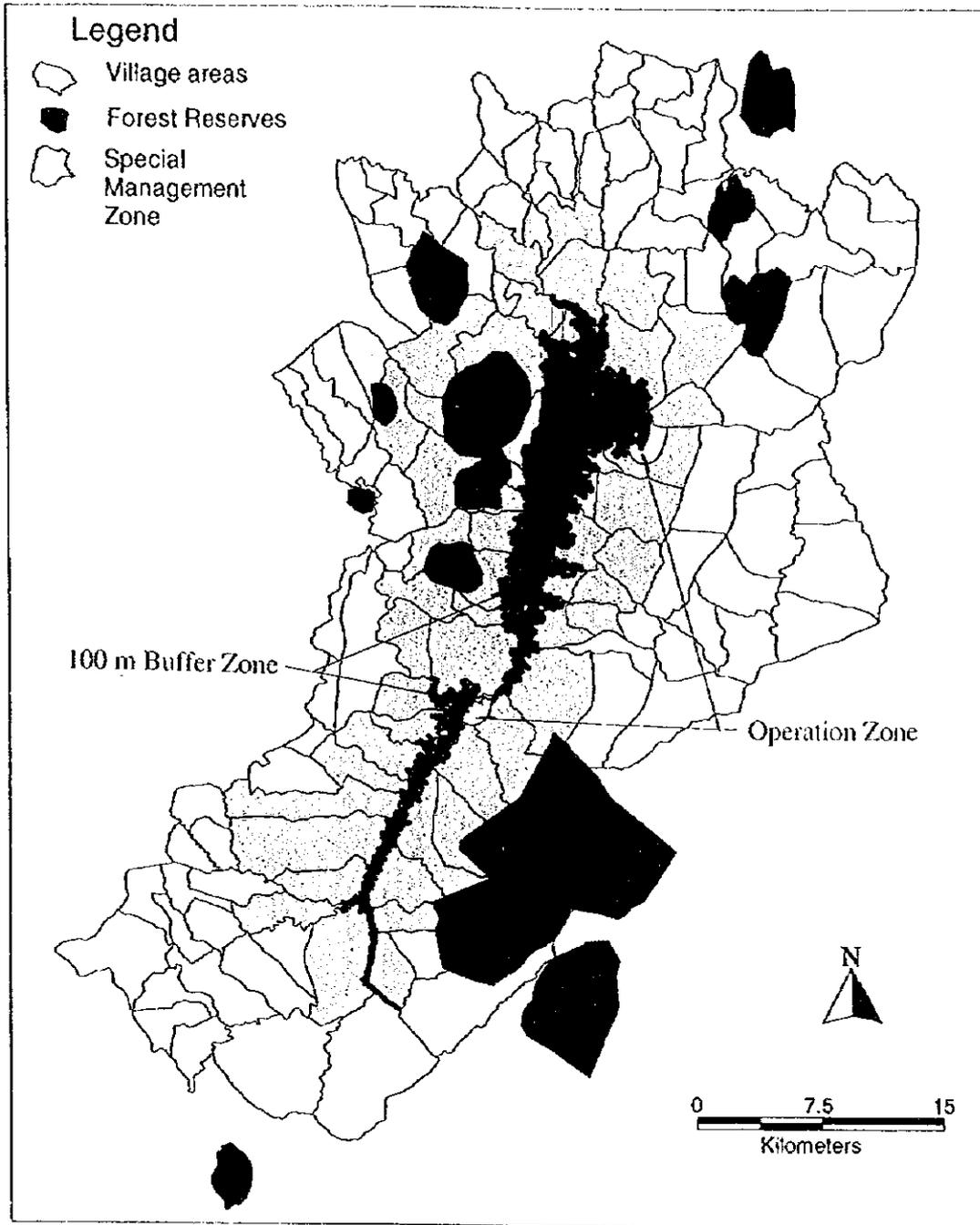
Fig. No.
 図 4.2.6



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

ムトンガ貯水池の影響を受ける
 村落地域と3kmの境界線
 (SMZと緩衝帯を含む)

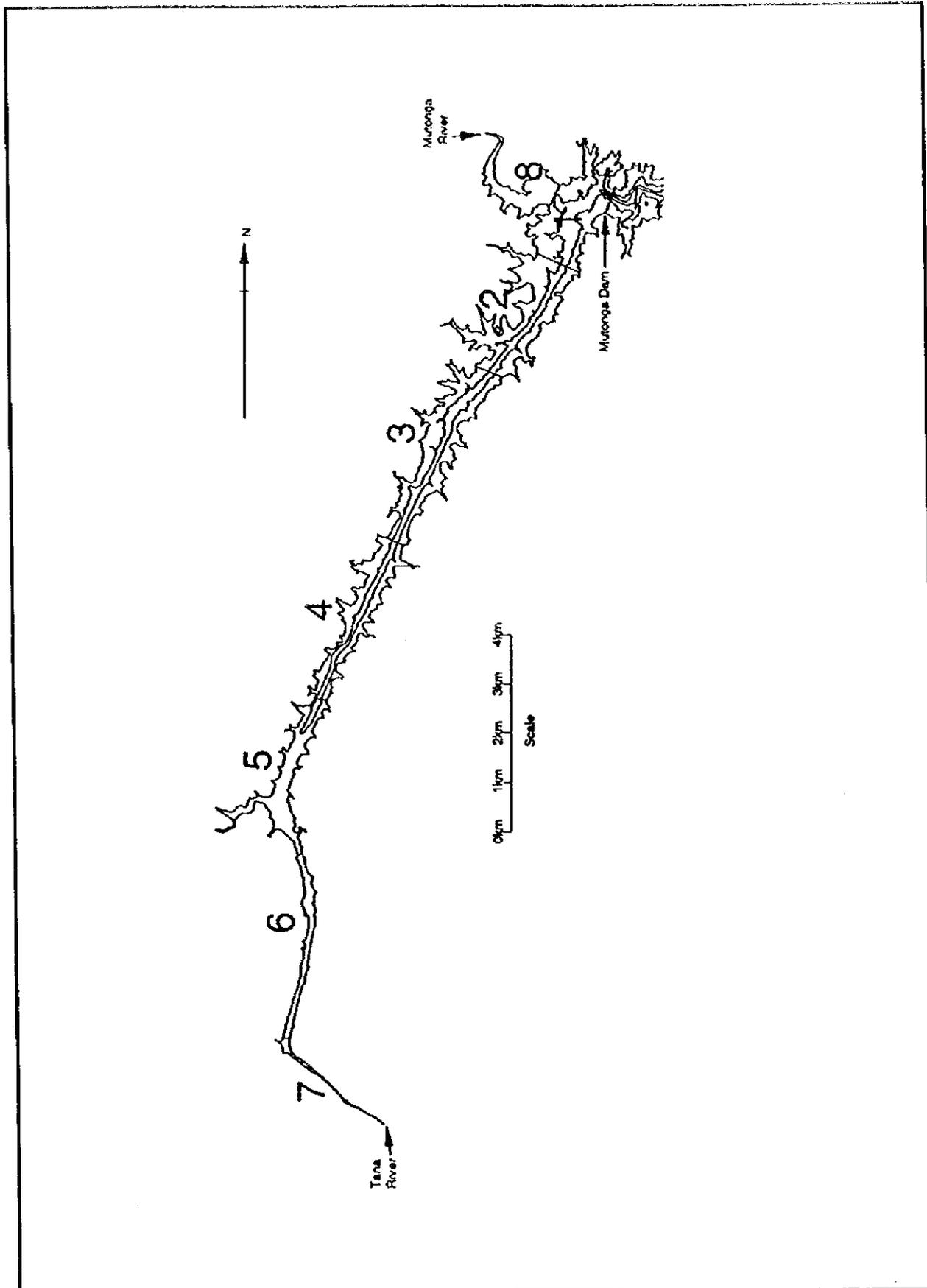
Fig. No.
 図 4.2.7



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

ムトンガ及び低グランドフォールズ
 両貯水池における特別管理地域 (SMZ)

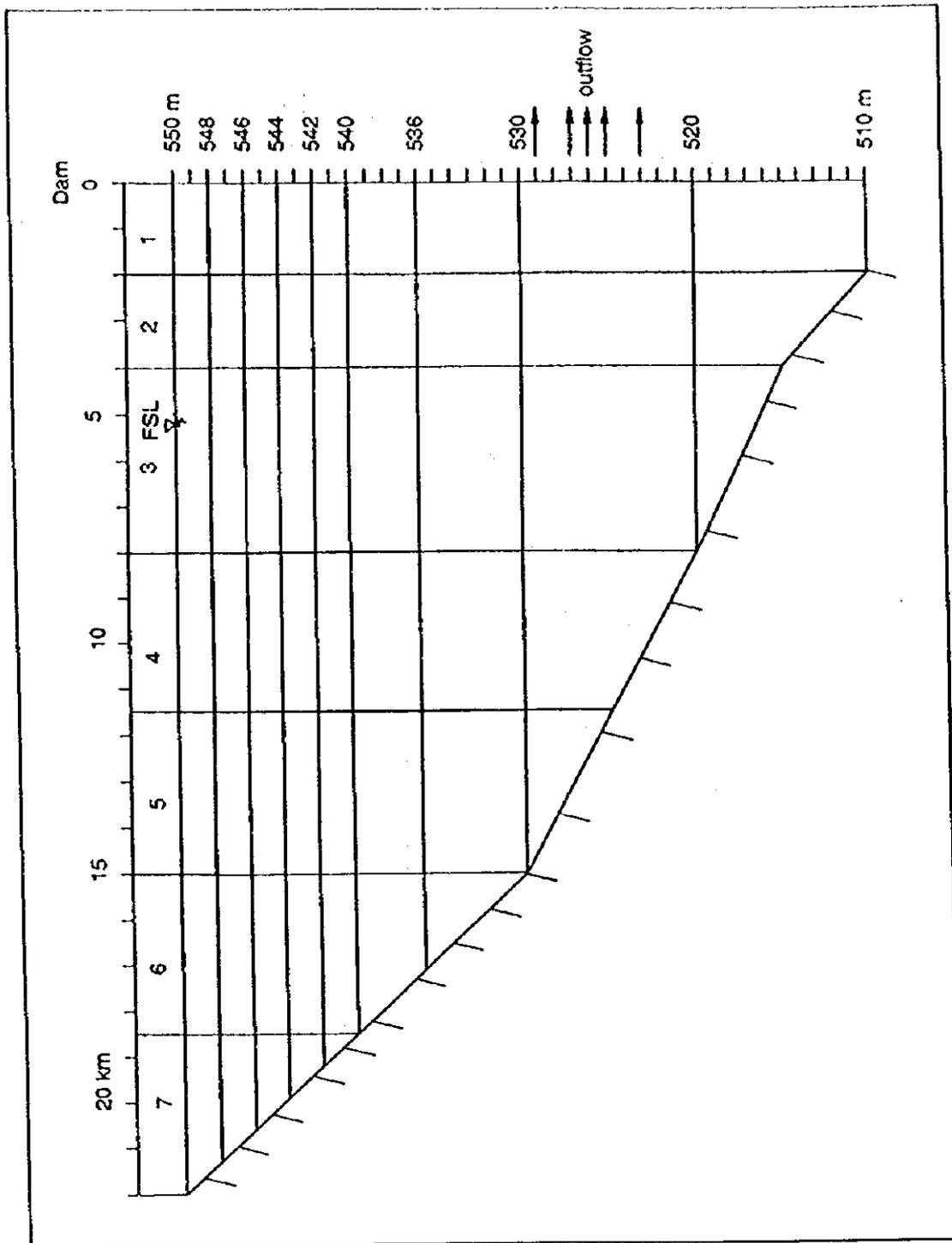
Fig. No.
 図 4.2.8



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

ムトンガ貯水池でのモデル化
 のための区分

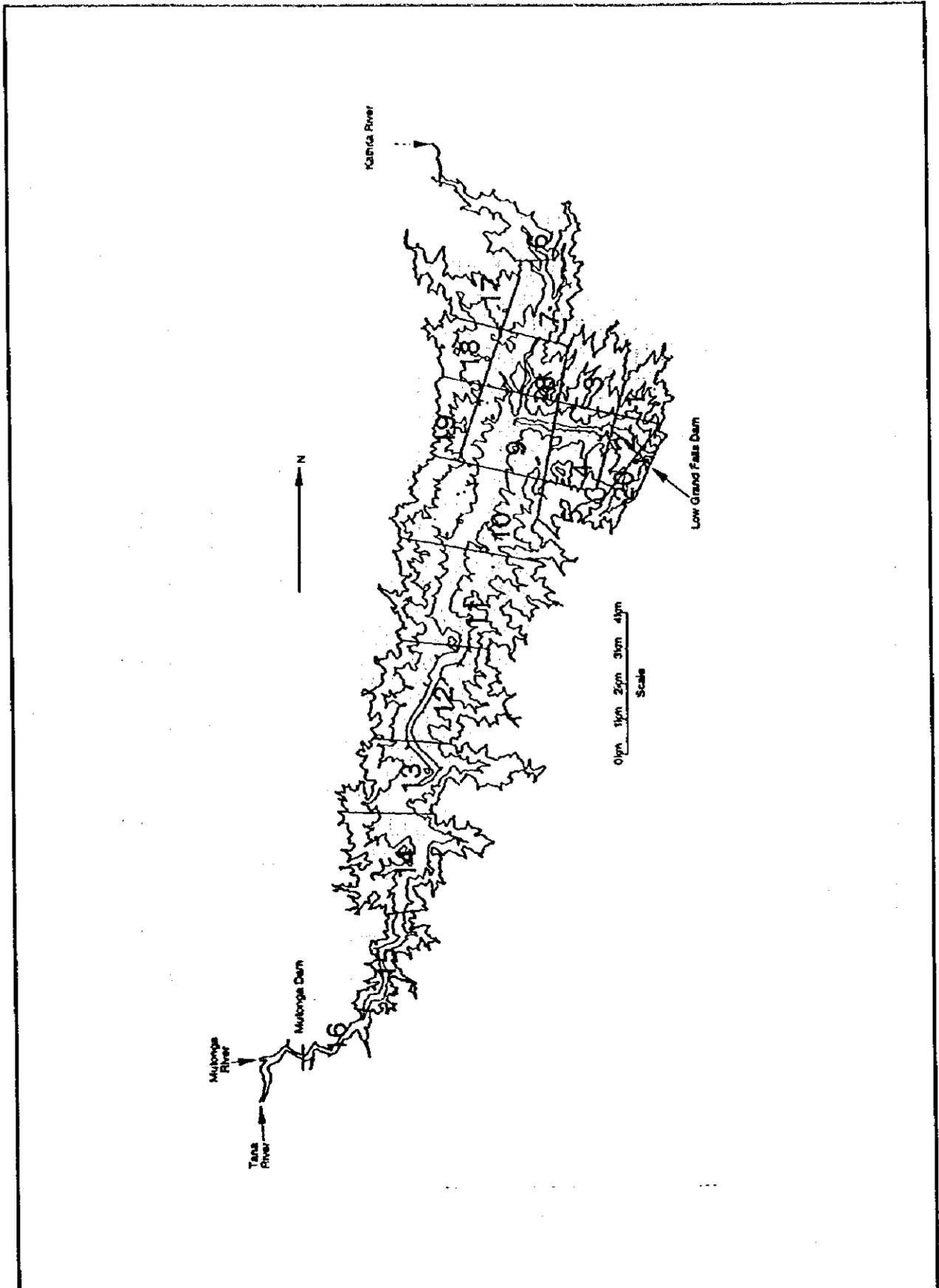
Fig. No.
 図 4.3.1



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

ムトンガ貯水池の縦断面図

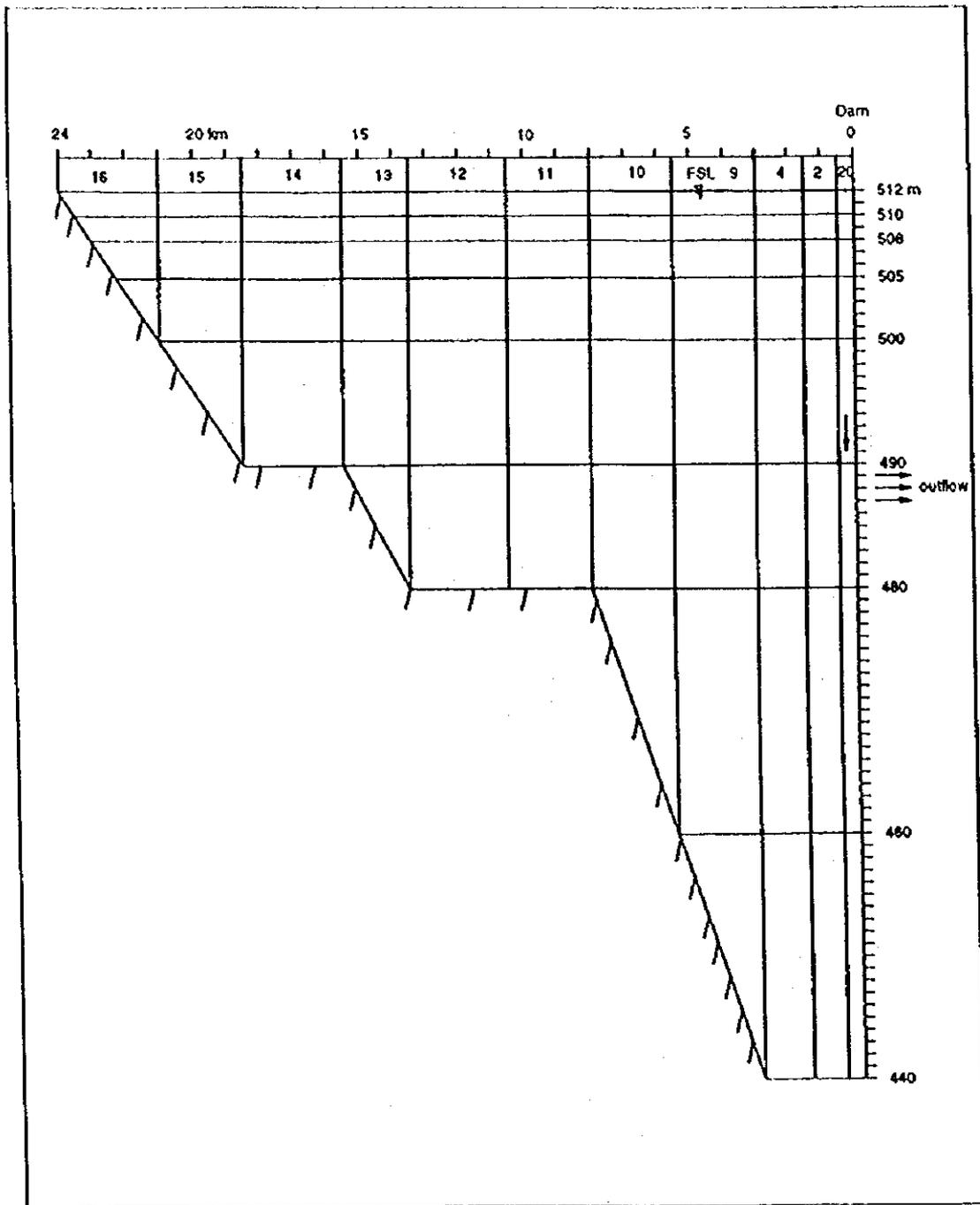
Fig. No.
 図 4.3.2



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

低グランド・フォールズの貯水池の
 モデル化のための区分

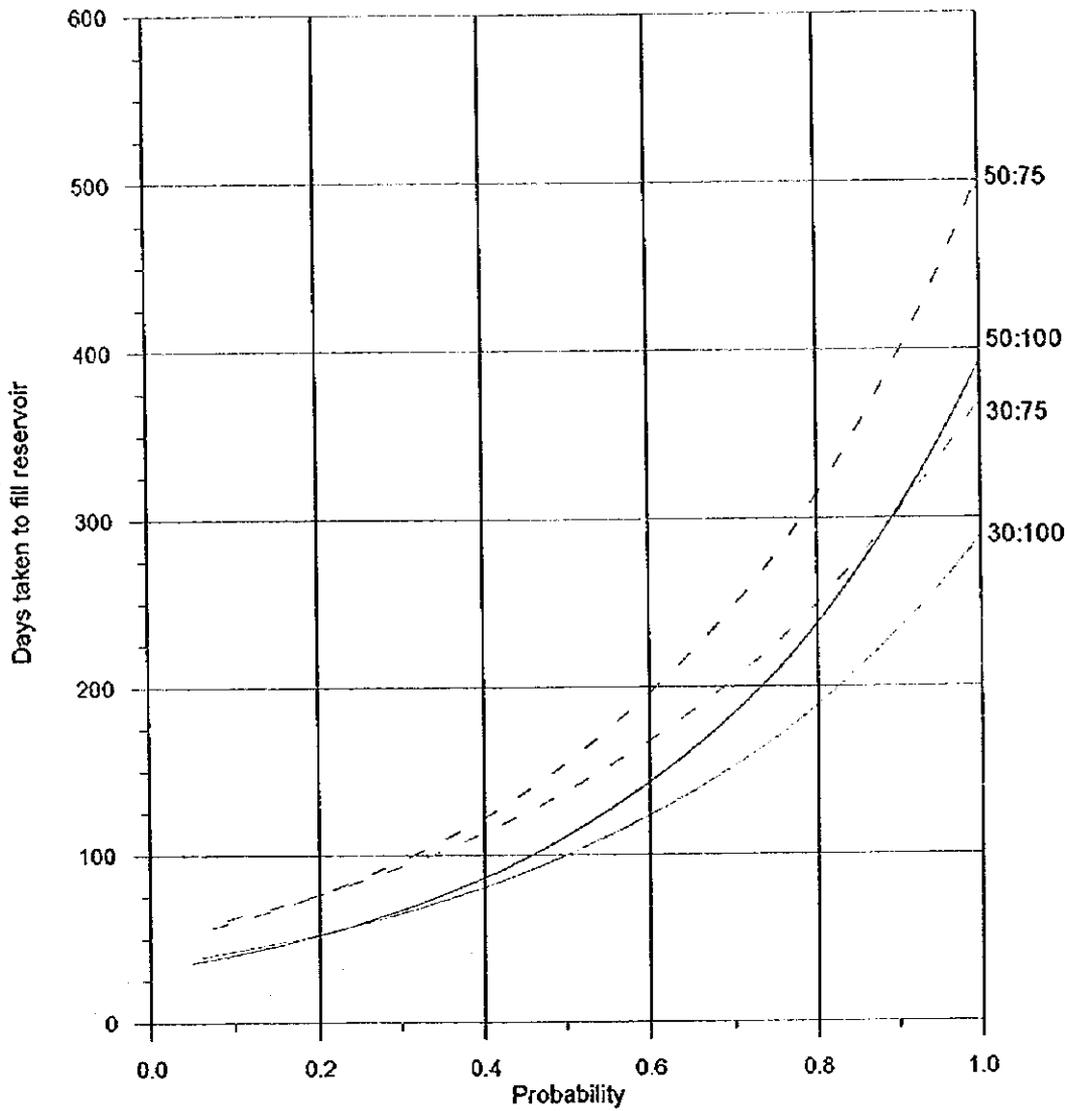
Fig. No.
 図 4.3.3



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

低グランド・フォールズの貯水池の
 縦断面図

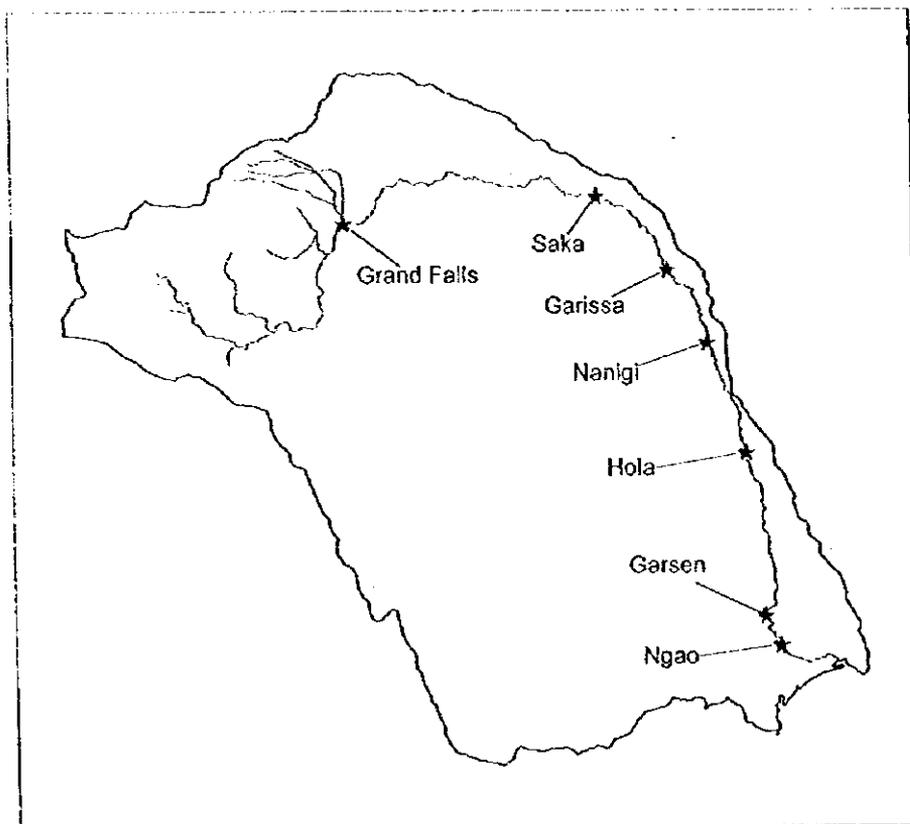
Fig. No.
 4.3.4



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

異なる4操作基準によるグランド
 フォールズ (LGF) 貯水池湛水の確率

Fig. No.
 図 4.3.5

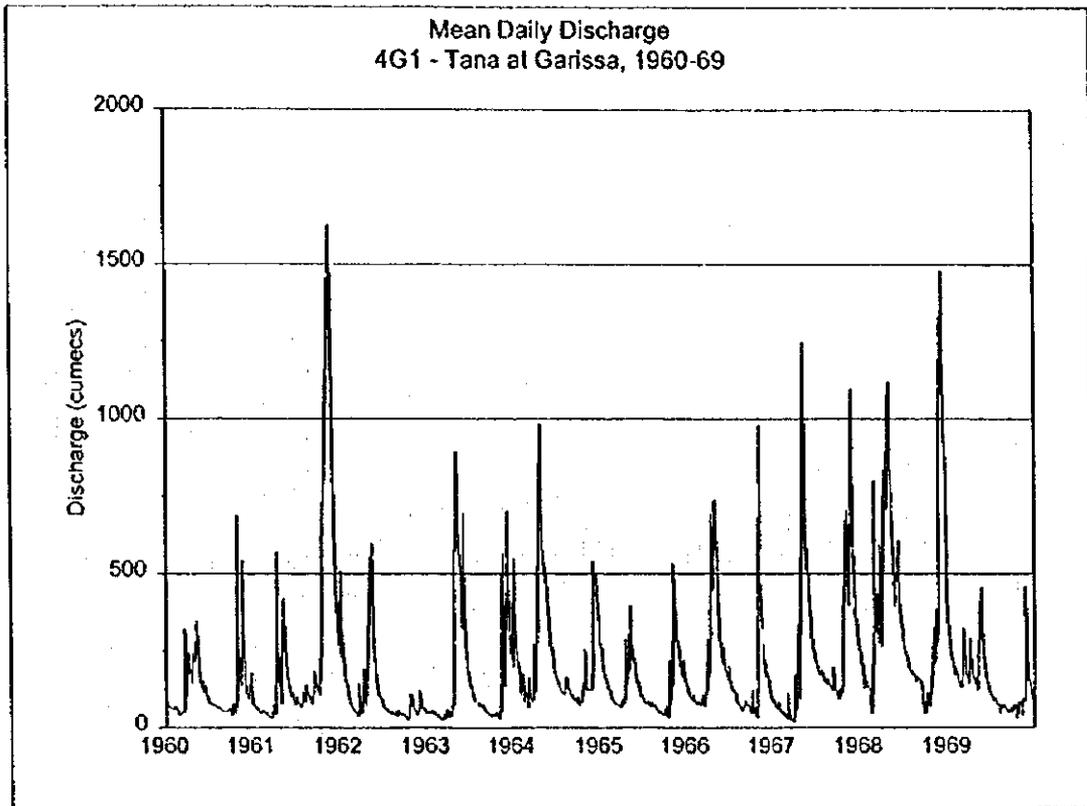


Station Number	Station Name	Period of Gaugings	Period of Stage Data
4F13	Grand Falls	07/62-01/81	1962 - 1993
4G01	Garissa	03/44 - 03/95	1933 - 1993
4G02	Garsen	03/46 - 11/91	1950 - 1985
4G04	Hola	None available from MOWD	
4G06	?	None available from MOWD	1966 - 1974
4G08	Nanigi	10/74 - 09/79	1973 - 1985
4G09	Ngao	None available from MOWD	1973 - 1985
4G10	Saka	02/84 - 05/85	1983 - 1985

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

タナ川下流域水位観測所の位置

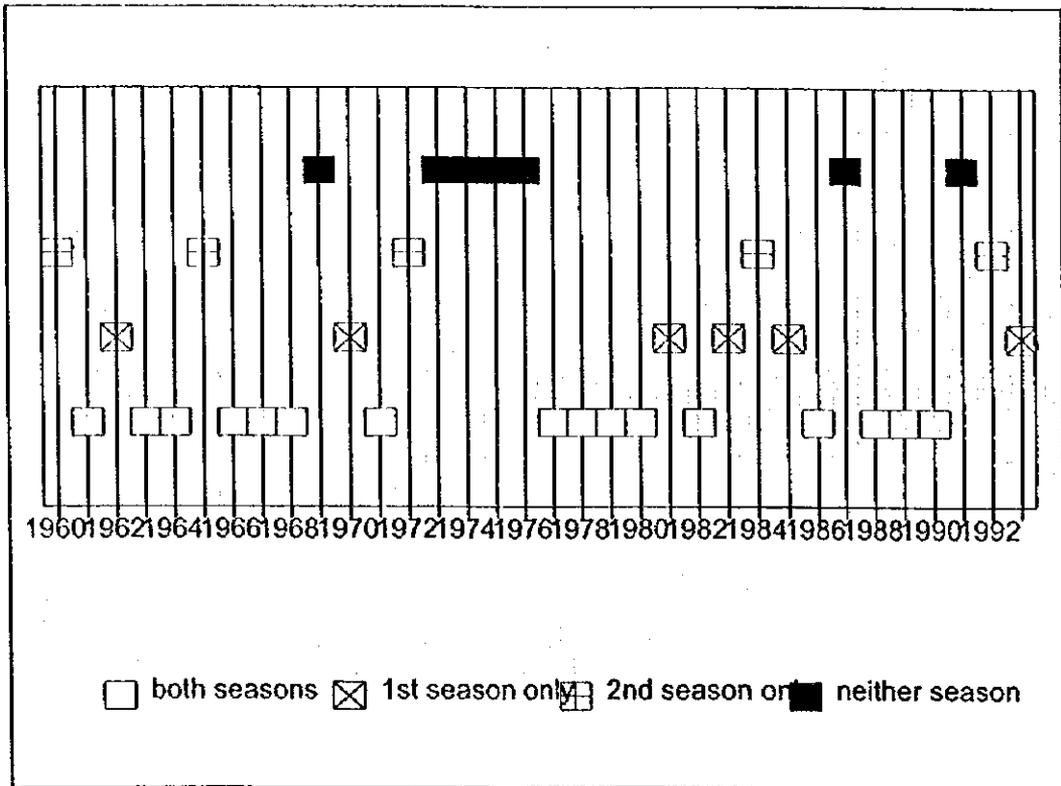
Fig. No.
 図 4.5.1



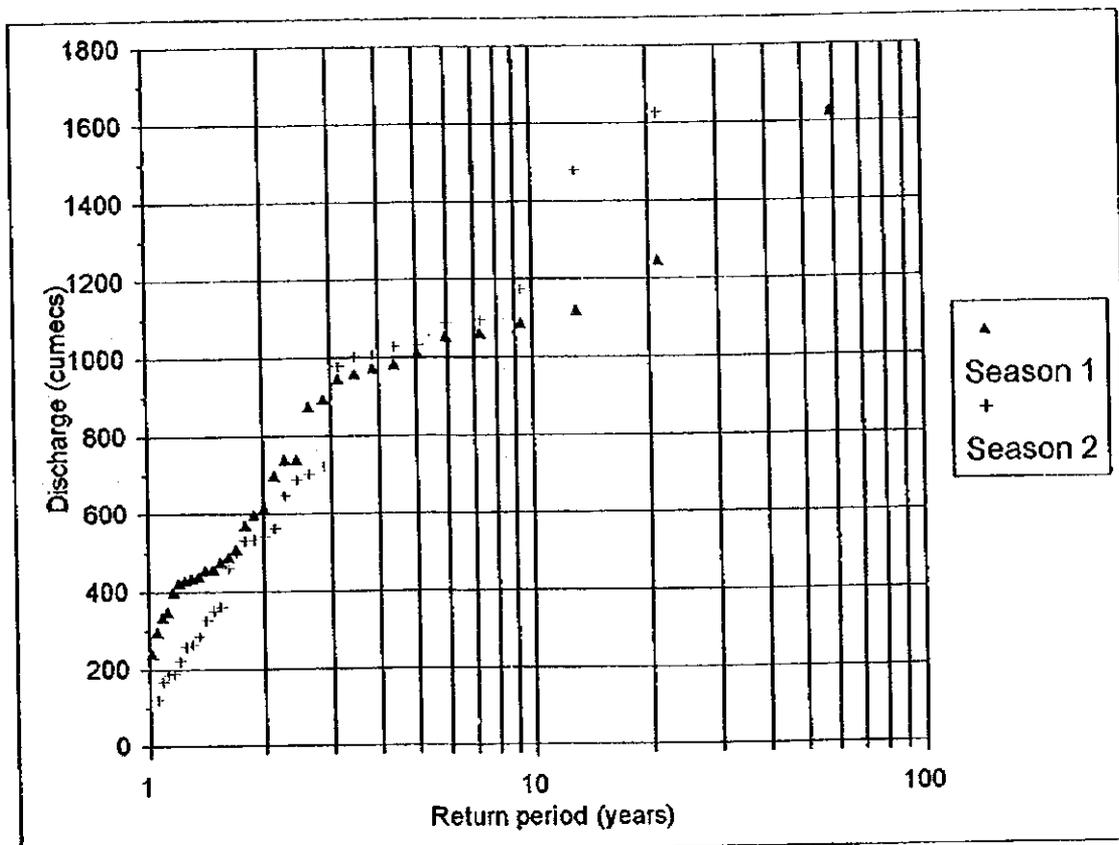
JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

ガリッサにおける平均日流量
 : 1960年-1969年

Fig. No.
 図 4.5.2



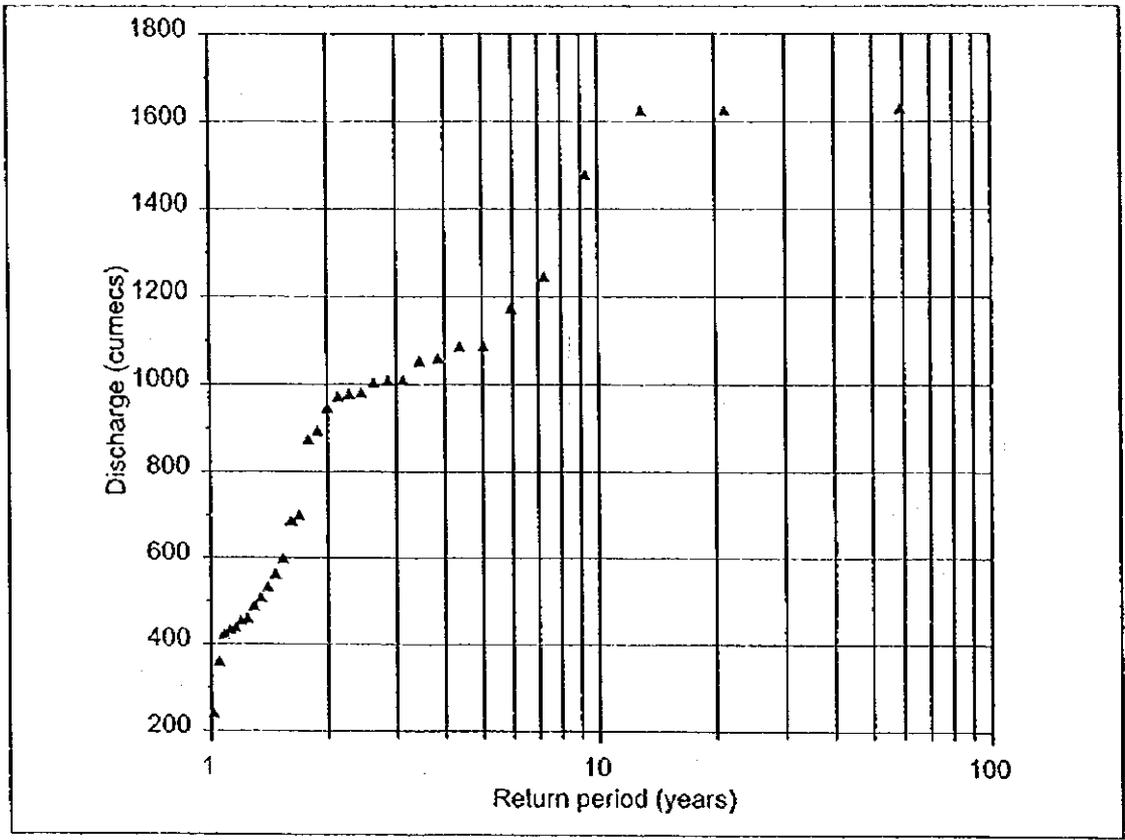
JAPAN INTERNATIONAL COOPERATION AGENCY REPUBLIC OF KENYA MUTONGA/GRAND FALLS HYDROPOWER PROJECT	ガリッサにおける500m ³ /秒以上の洪水 パターン : 1860年-1993年	Fig. No. 図 4.5.3
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JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

洪水頻度図
 : ガリッサにおける季節最大

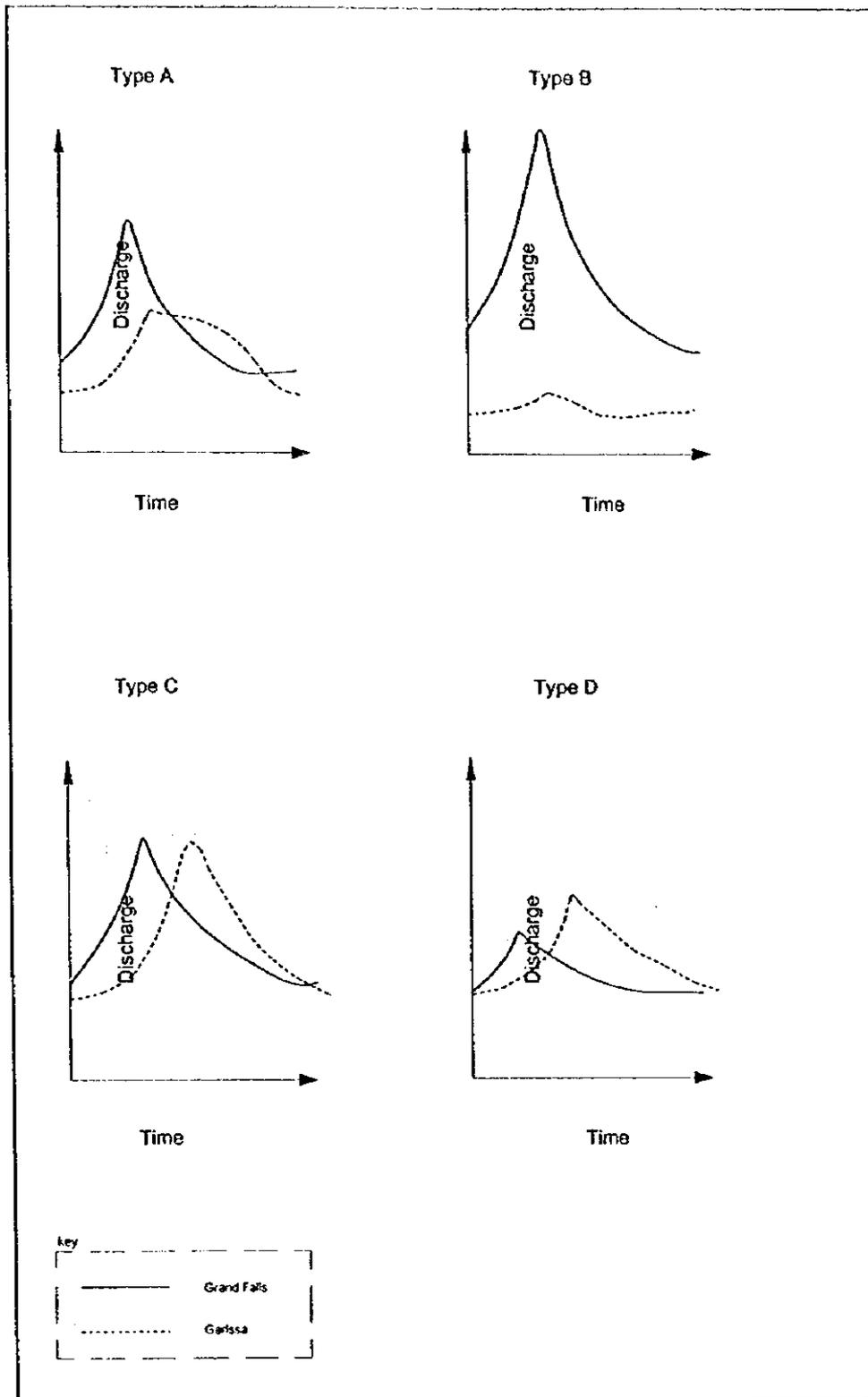
Fig. No.
 図 4.5.4

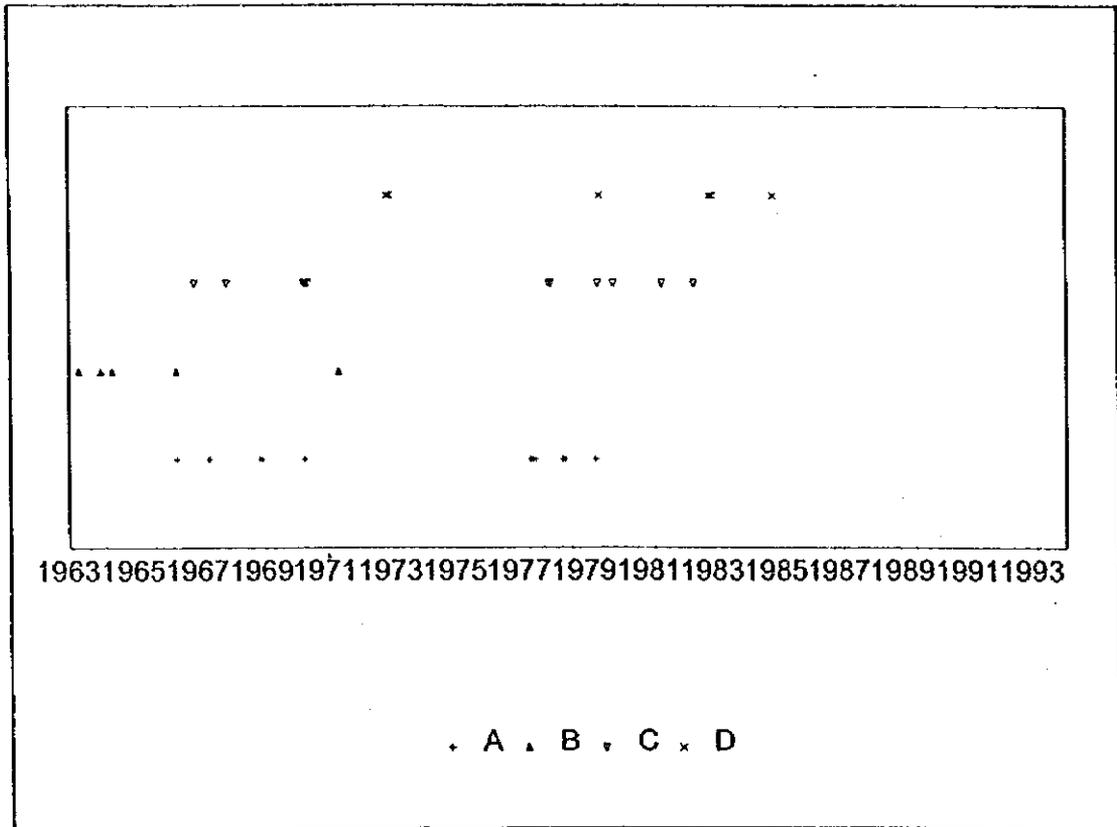


JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

洪水頻度図
 : ガリッサにおける年間最大

Fig. No.
 図 4.5.5

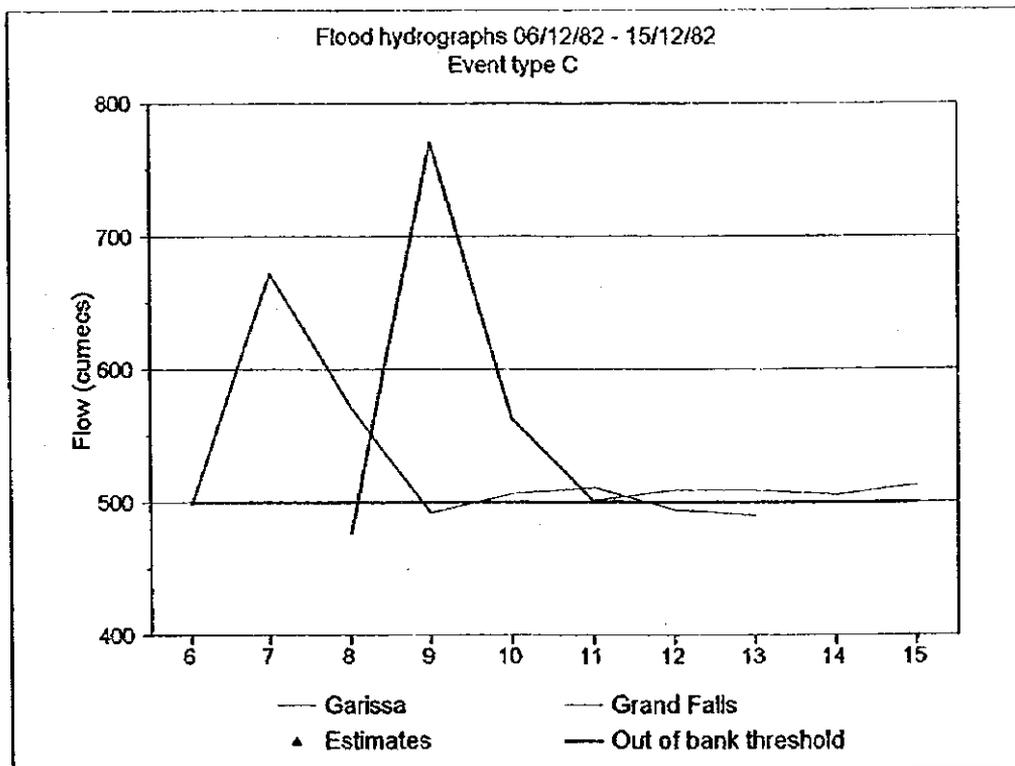
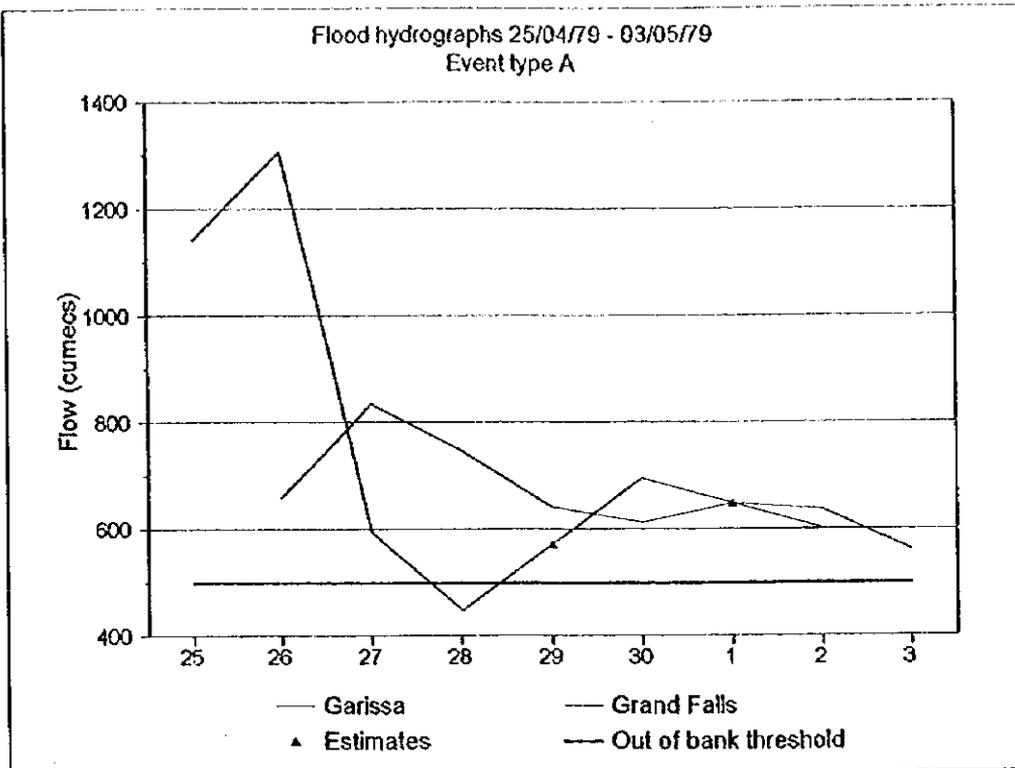


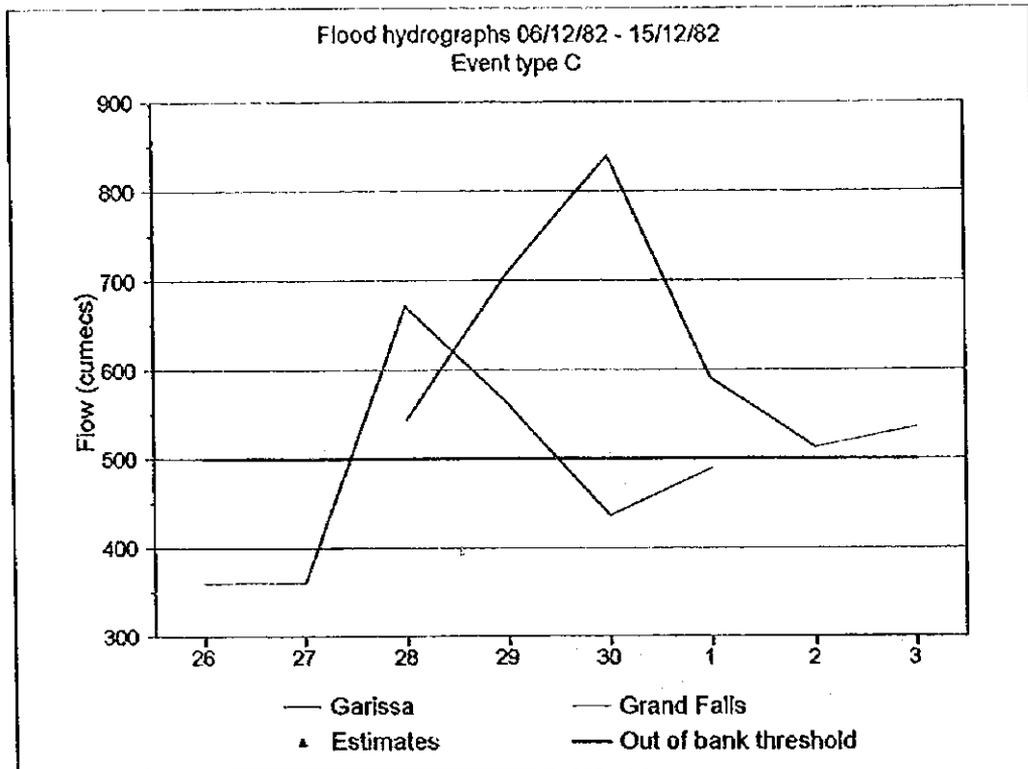


JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

解析した洪水事例の分布

Fig. No.
 図 4.5.7

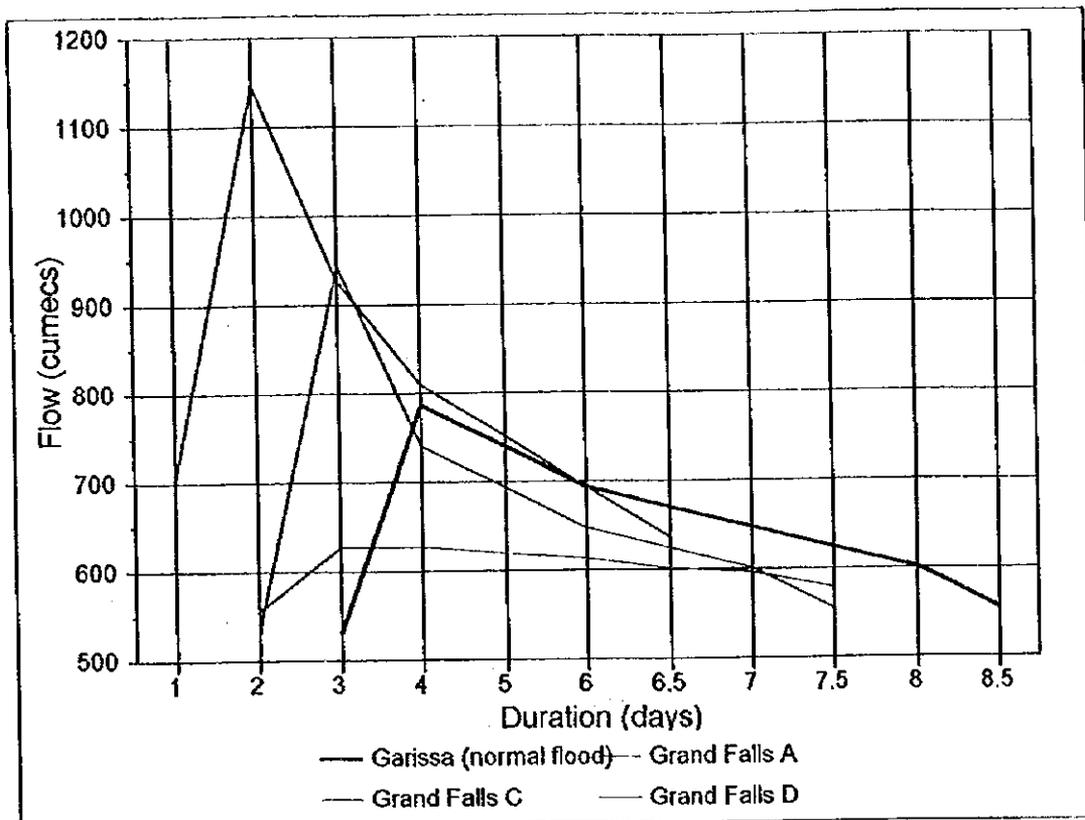




JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

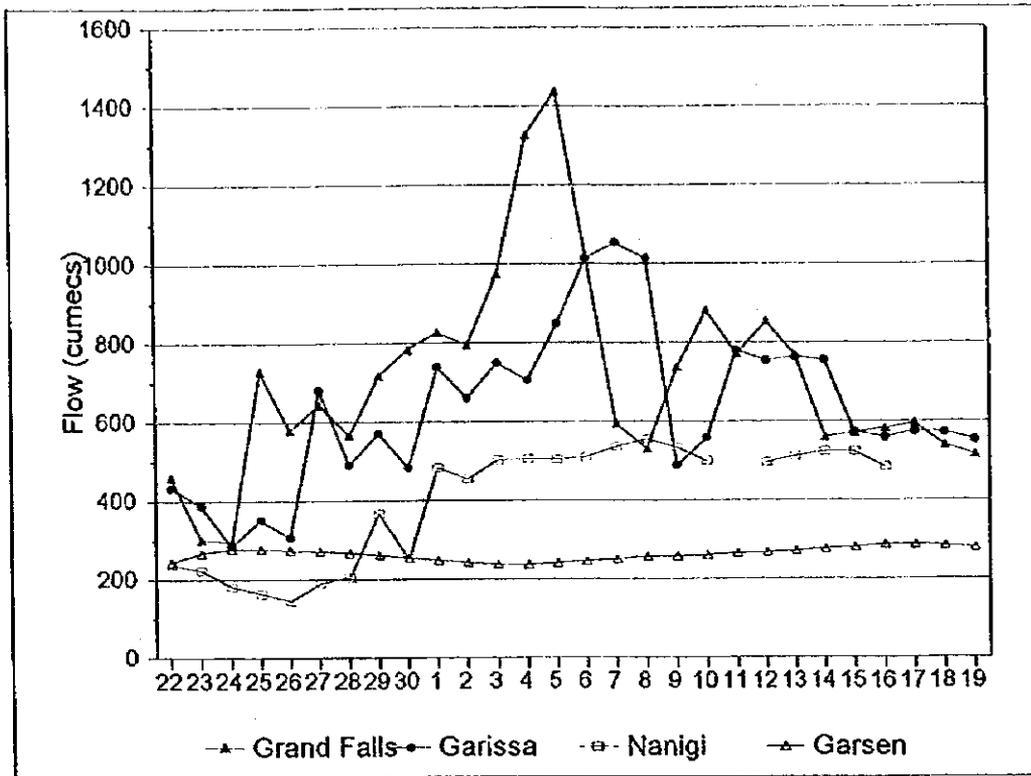
中間タイプ事例の洪水ハイドログラフ
 (2/2)

Fig. No.
 図 4.5.8

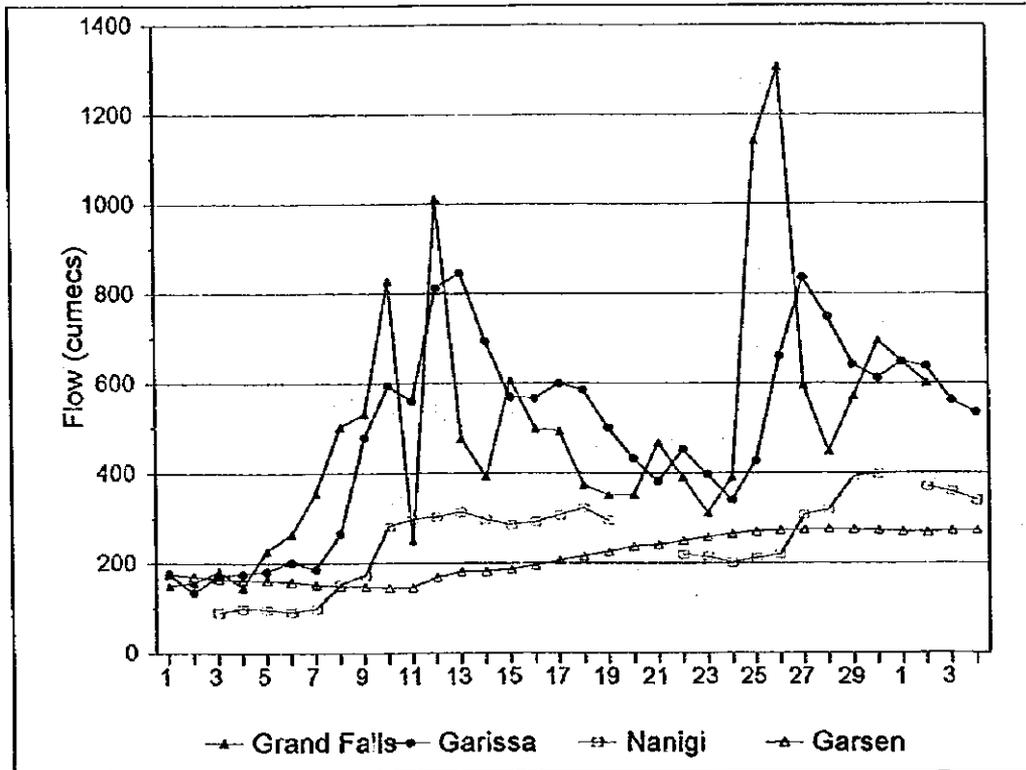


JAPAN INTERNATIONAL COOPERATION AGENCY	ガリッサにおける「通常」洪水と関連した グランドフォールズにおける 洪水ハイドログラフ	Fig. No.
REPUBLIC OF KENYA		図 4.5.9
MUTONGA/GRAND FALLS HYDROPOWER PROJECT		

A.



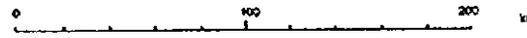
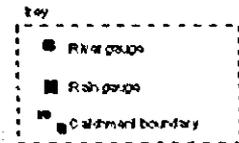
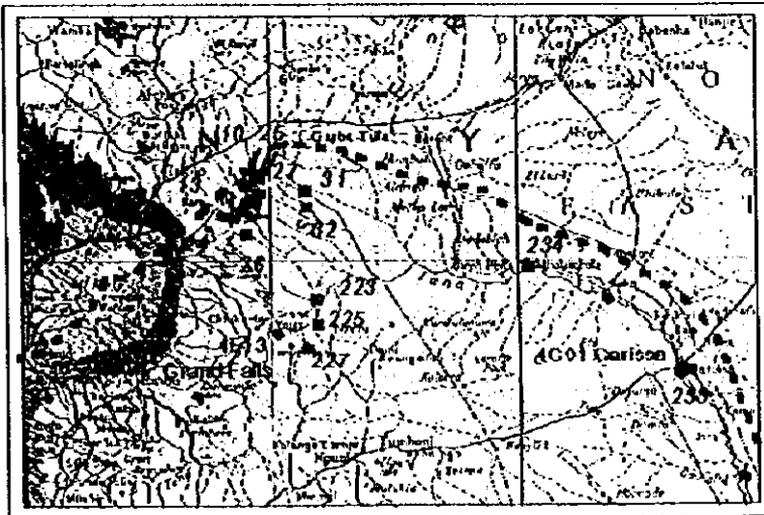
B.



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

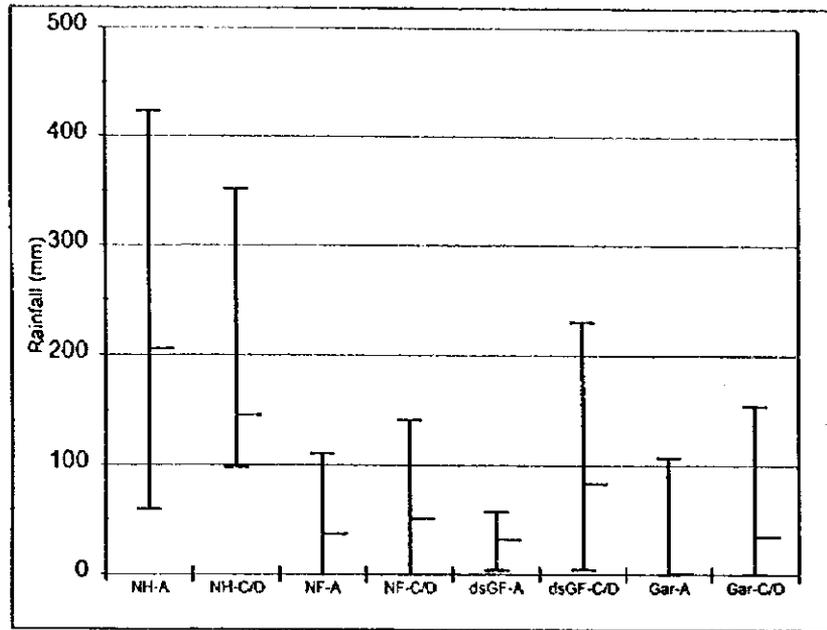
ガリッサ下流の流量減衰を示す
 洪水ハイドログラフ
 (A:77年4月22日-77年5月19日、および
 B:79年4月1日-79年5月4日)

Fig. No.
 4.5.10

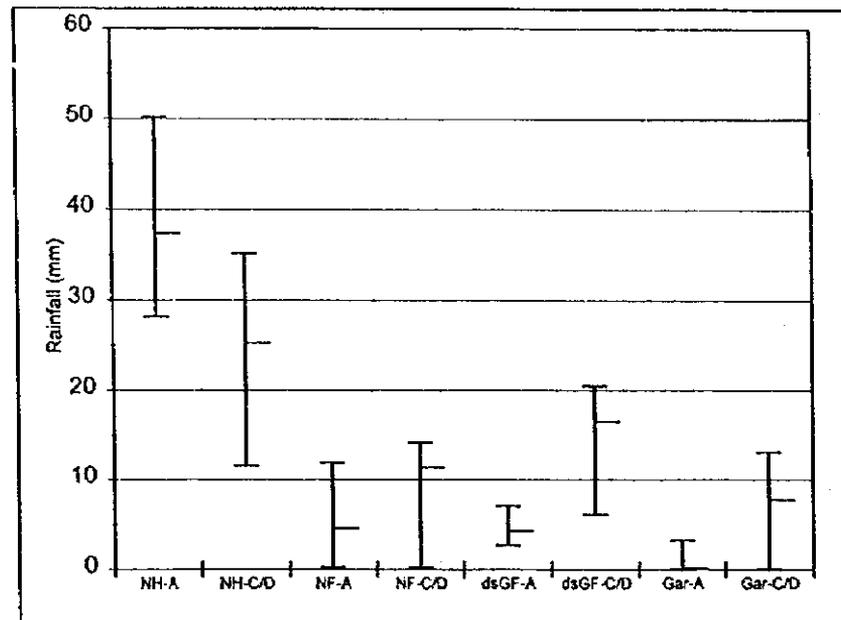


JAPAN INTERNATIONAL COOPERATION AGENCY	タイプA, C, Dの洪水事例に先立つ雨量解析	Fig. No.
REPUBLIC OF KENYA	のために使用した降水観測所の位置	図 4.5.11
MUTONGA/GRAND FALLS HYDROPOWER PROJECT		

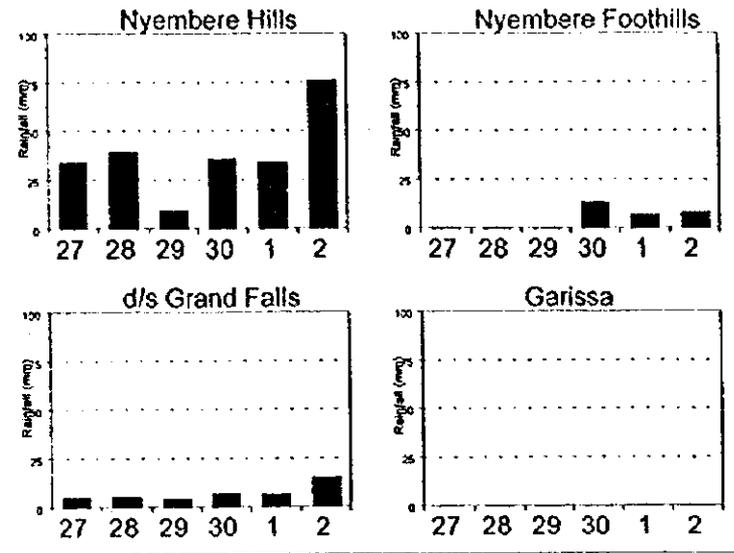
A:



B:

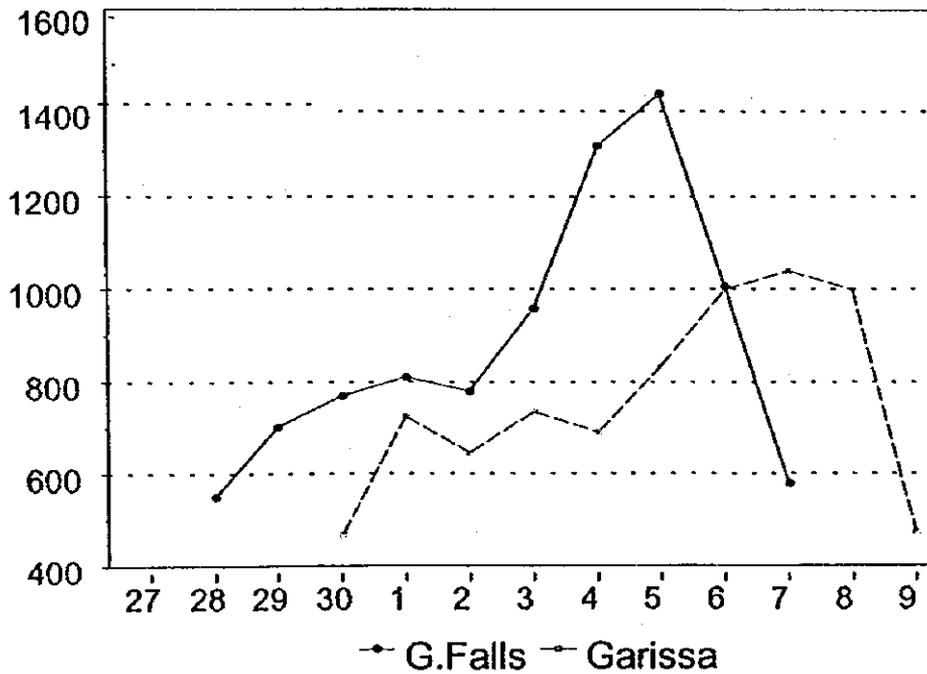


Typical Rainfall Pattern for Event Type A: (27/04/77 - 09/05/77)



Resulting Flows at Grand Falls and Garissa:

Flow (cumecs)

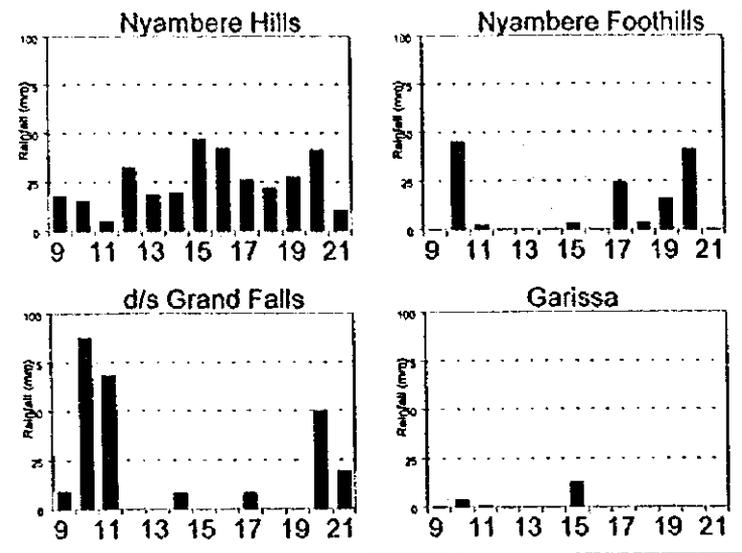


JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

タイプ A, C, D 洪水の事例が続く間の
 雨量および流量のプロット (1/3)

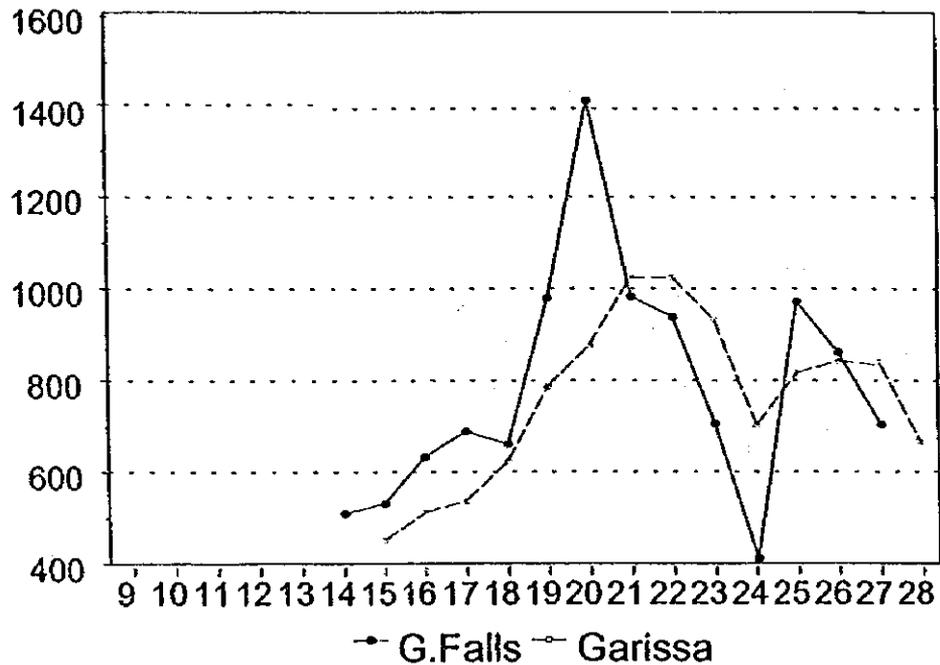
Fig. No.
 図 4.5.13

Typical Rainfall Pattern for Event Type C: (09/11/77 - 28/11/77)

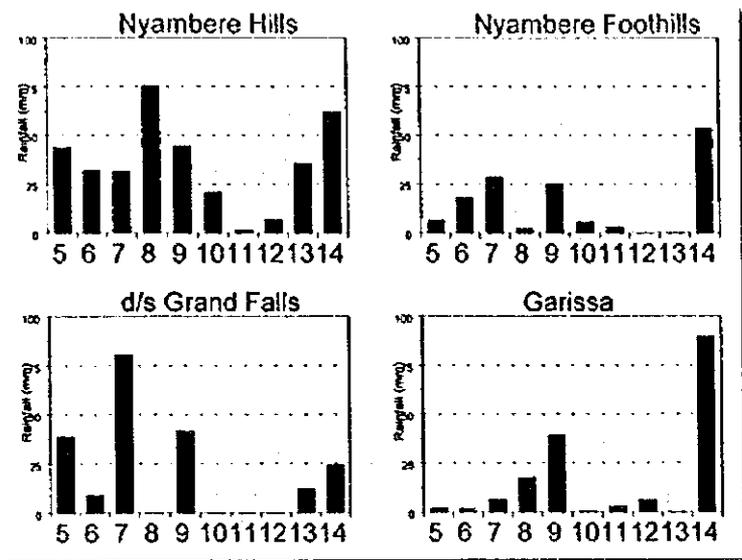


Resulting Flows at Grand Falls and Garissa:

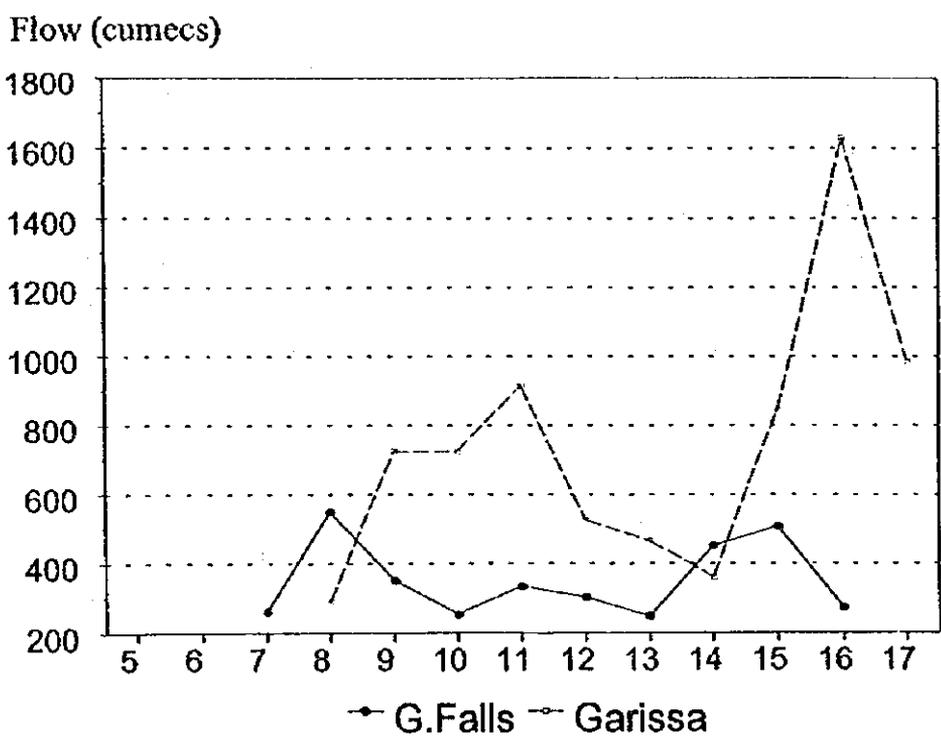
Flow (cumecs)



Typical Rainfall Pattern for Event Type D: (05/11/84 - 17/11/84)



Resulting Flows at Grand Falls and Garissa:

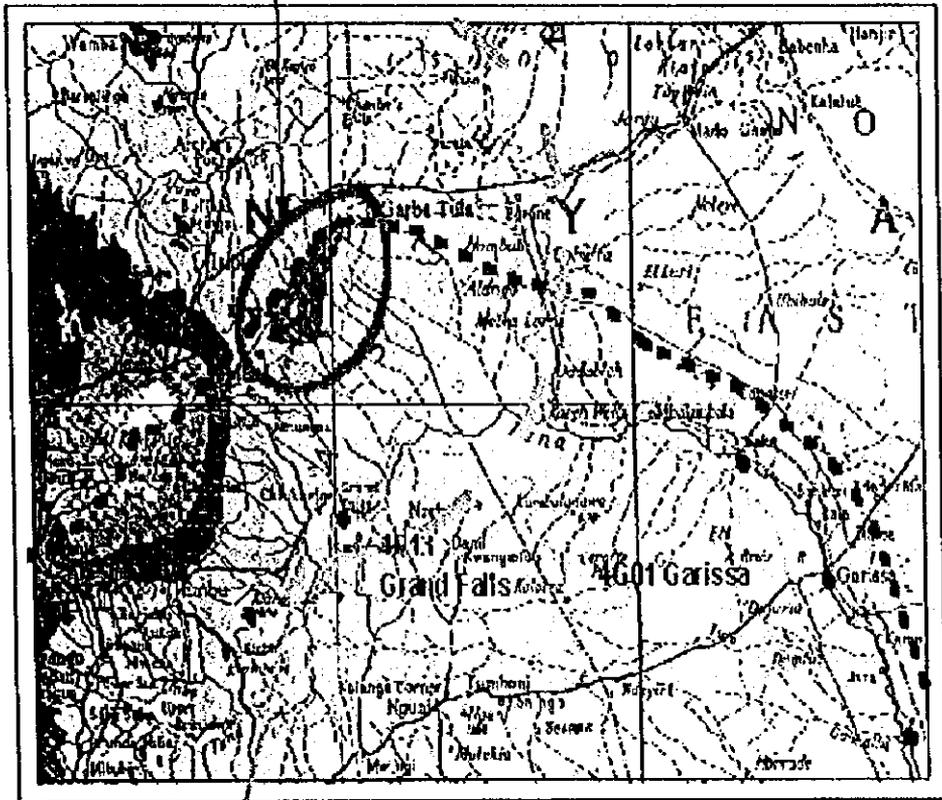


JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

タイプ A, C, D 洪水の事例が続く間の
 雨量および流量のプロット (3/3)

Fig. No.
 図 4.5.13

Type A flood: rainfall concentrated on Nyambere Hills.
 Losses relatively high

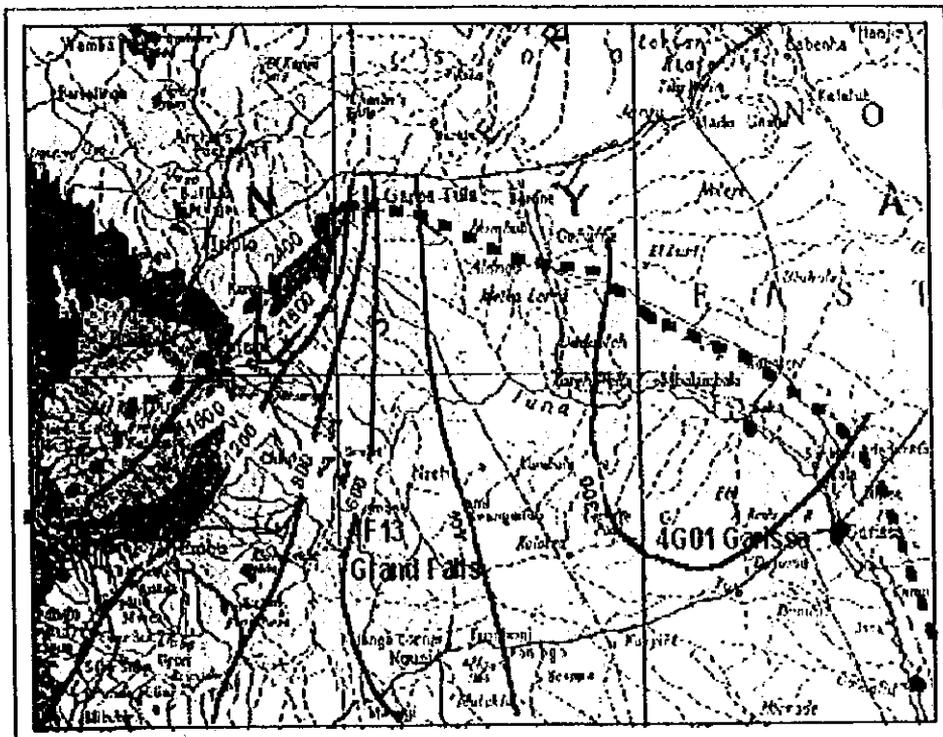


Type OD flood: rainfall more evenly distributed
 over top end of lower Tana catchment
 Losses relatively low

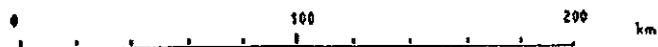
JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

降雨分布の変動が洪水パターンに
 及ぼす影響

Fig. No.
 図 4.5.14



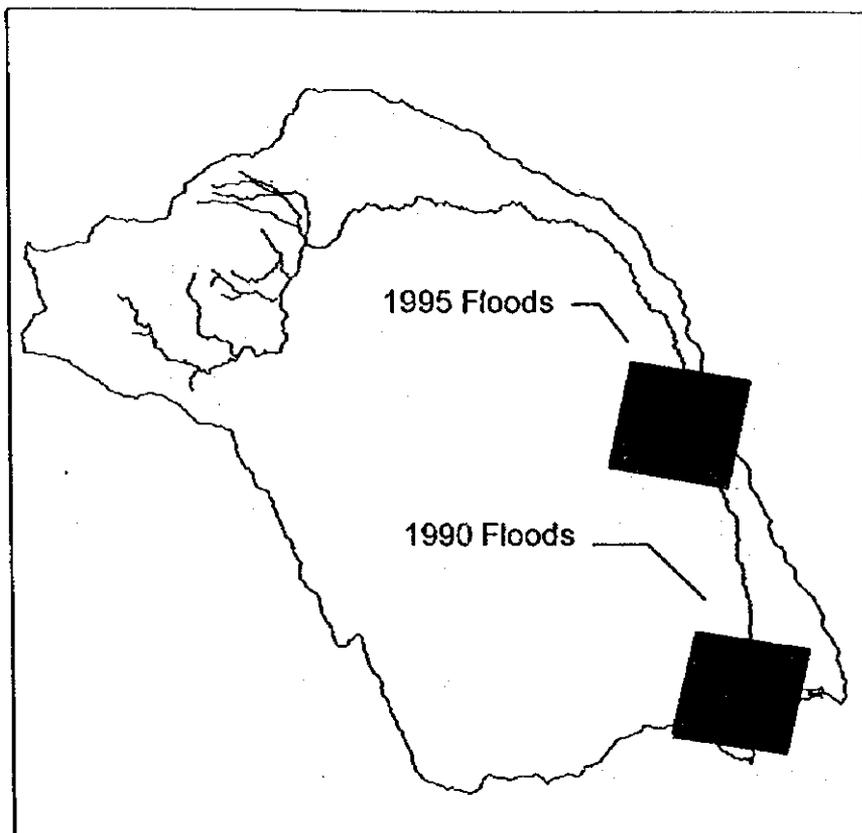
Source: Hippon Kosi (1995a)



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

ニエンベレヒルズとガリッサとの間の
 タナ集水地点における年間平均降雨

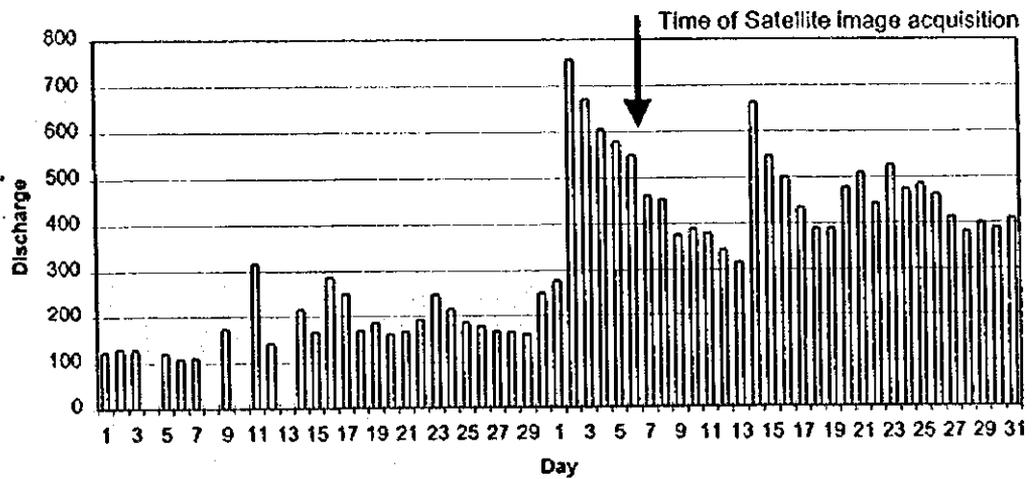
Fig. No.
 図 4.5.15



JAPAN INTERNATIONAL COOPERATION AGENCY
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 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

洪水解析を行った高解像度衛星イメージング
 (SPOT) の位置および利用可能な範囲を
 示すタナ盆地図

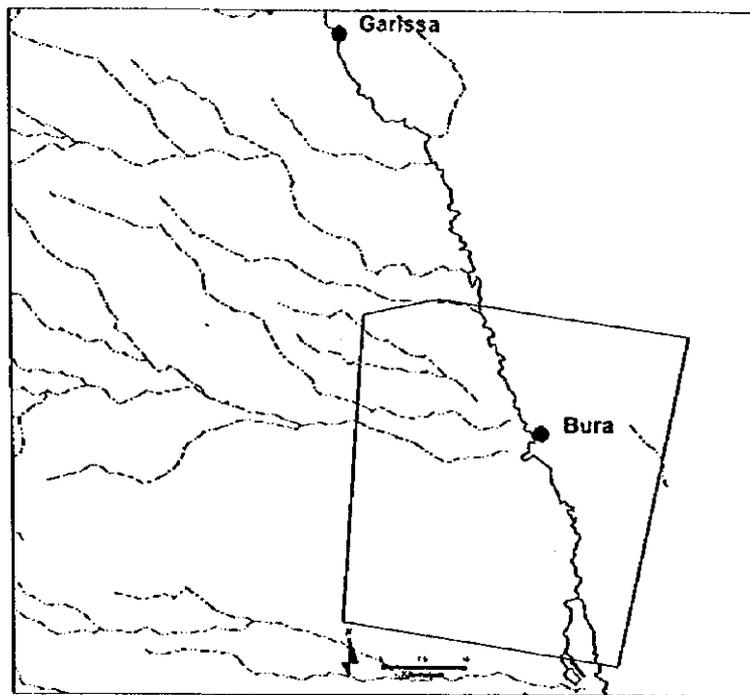
Fig. No.
 図 4.5.16



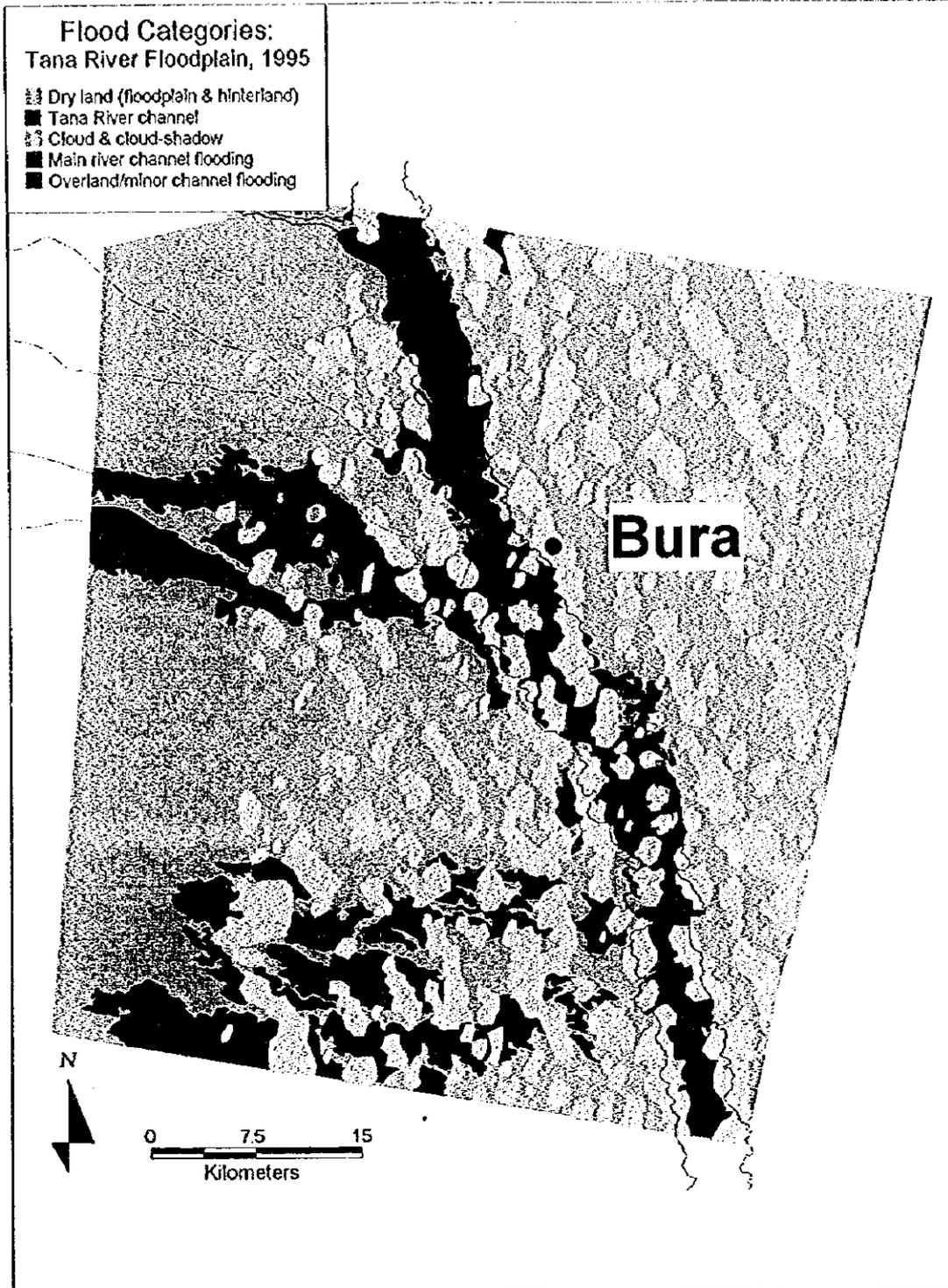
JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

平均日：4GI、
 ガリッサ - 1995年4-5月

Fig. No.
 図 4.5.17



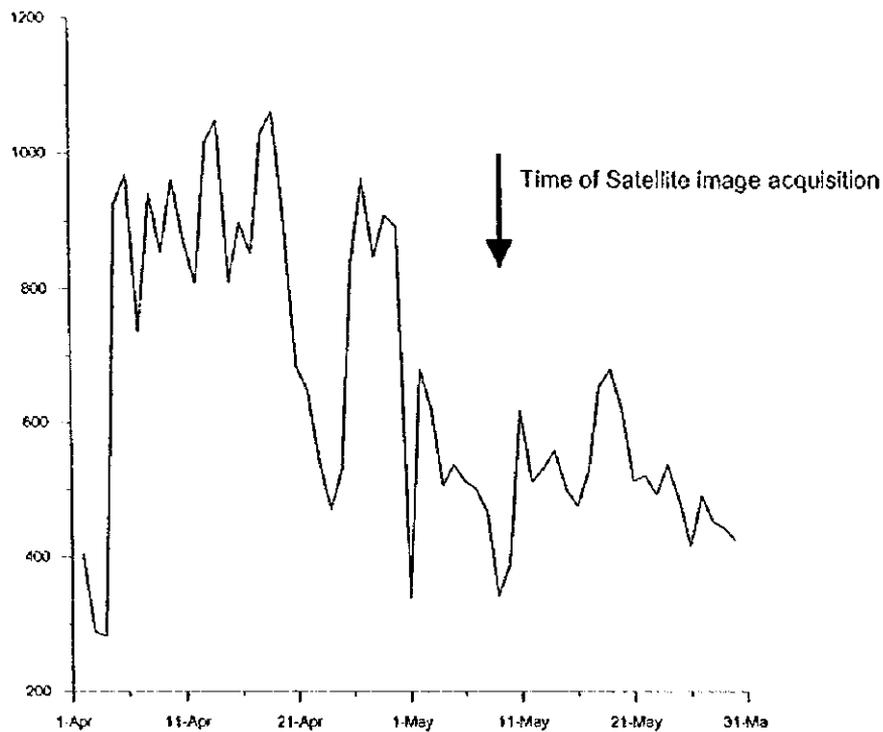
JAPAN INTERNATIONAL COOPERATION AGENCY	主タナ川流路およびガリッサとブラの間の	Fig. No.
REPUBLIC OF KENYA	laghas衛星イメージにより1995年5月6日に	図 4.5.18
MUTONGA/GRAND FALLS HYDROPOWER PROJECT	カバーされた地域の概要を含む	



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

解釈を行ったSPOT衛星イメージの
対象カテゴリー：タナ川
ホラ近くの氾濫原、1995年5月6日

Fig. No.
図 4.5.19

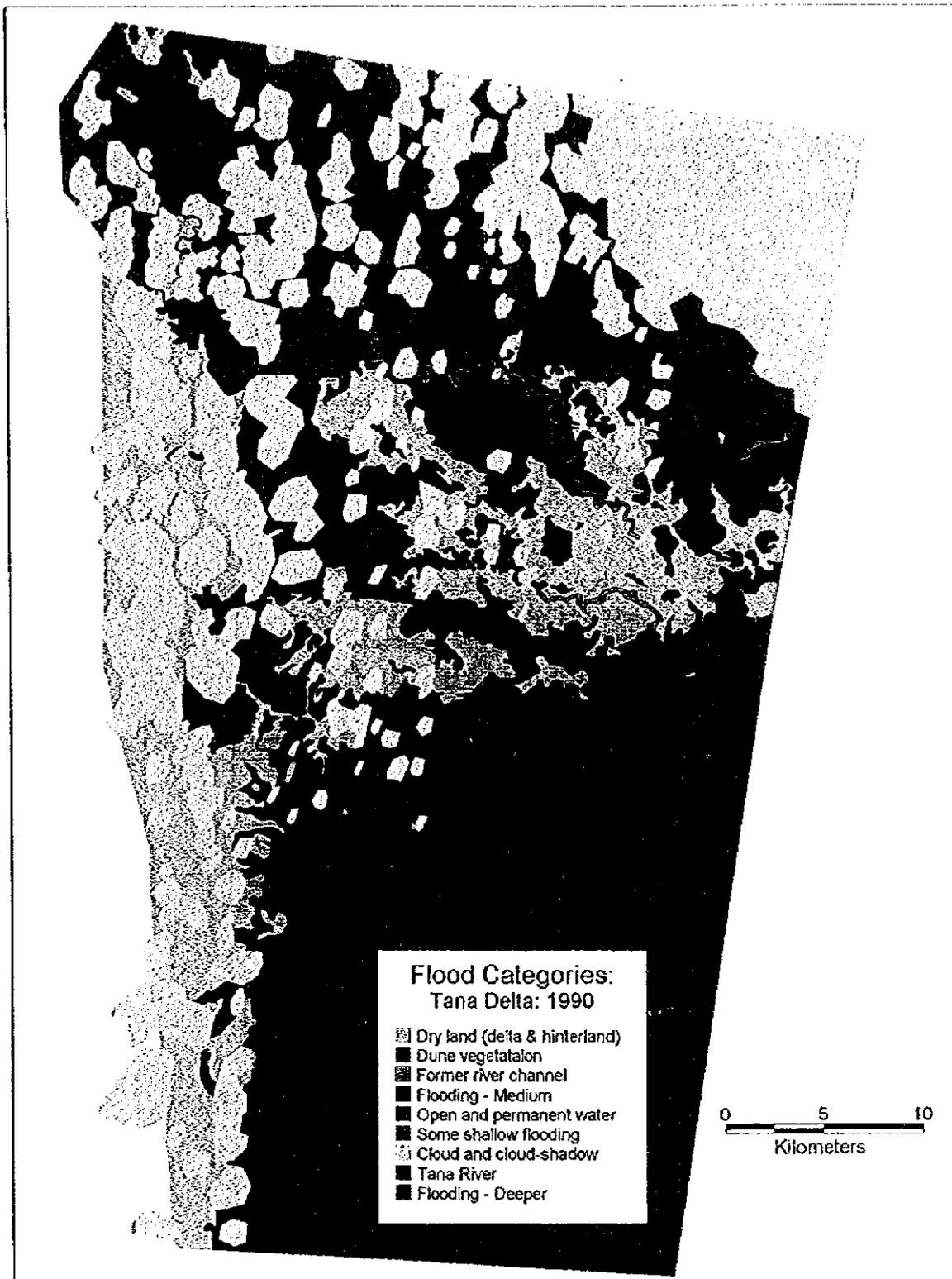


Flood Categories	Hectares	Cover (%)	
		Full Scene	Land cover less cloud & cloud-shadow
Dry land	25,671	13.04	25.07
Dune vegetation	10,445	5.30	10.20
Tana River	889	0.45	0.87
Former river channel	761	0.39	0.74
Some Flooding	17,948	9.11	17.53
Medium Flooding	11,843	6.01	11.56
Deeper Flooding	29,190	14.82	28.50
Open / permanent water	5,663	2.88	5.53
Ocean	40,850	20.74	-
Cloud & cloud-shadow	53,669	27.25	-
Total	196,929	100	100.00

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

平均日流出、4GI
 ガリッサ、1995年4-5月

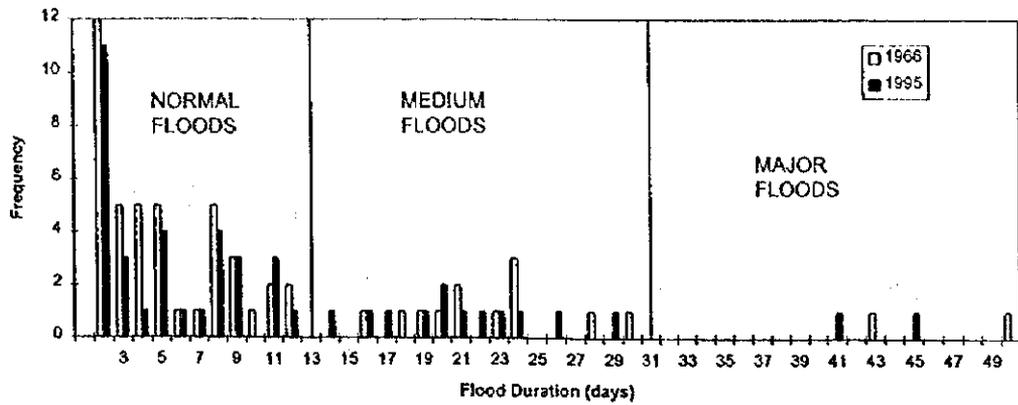
Fig. No.
 図 4.5.20



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

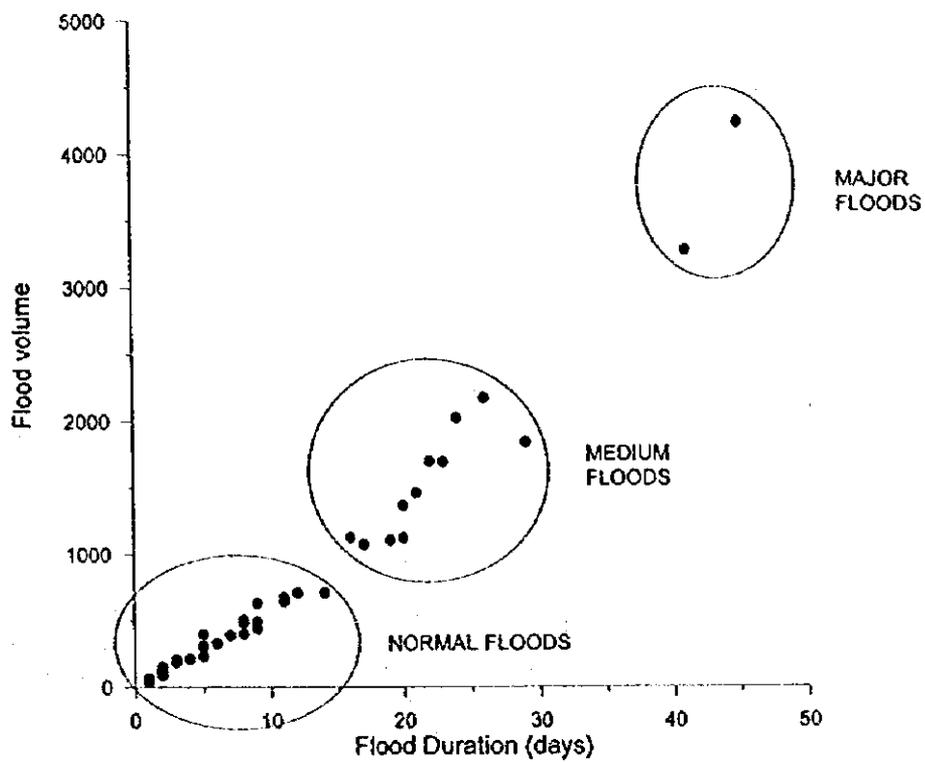
解釈を行ったSPOT衛星イメージの
 対象カテゴリー タナデルタ
 1995年5月

Fig. No.
 図 4.5.21



Floods of less than 24 hours are not included. Source: Estimated 25 year discharge series at Garissa: 1966-90

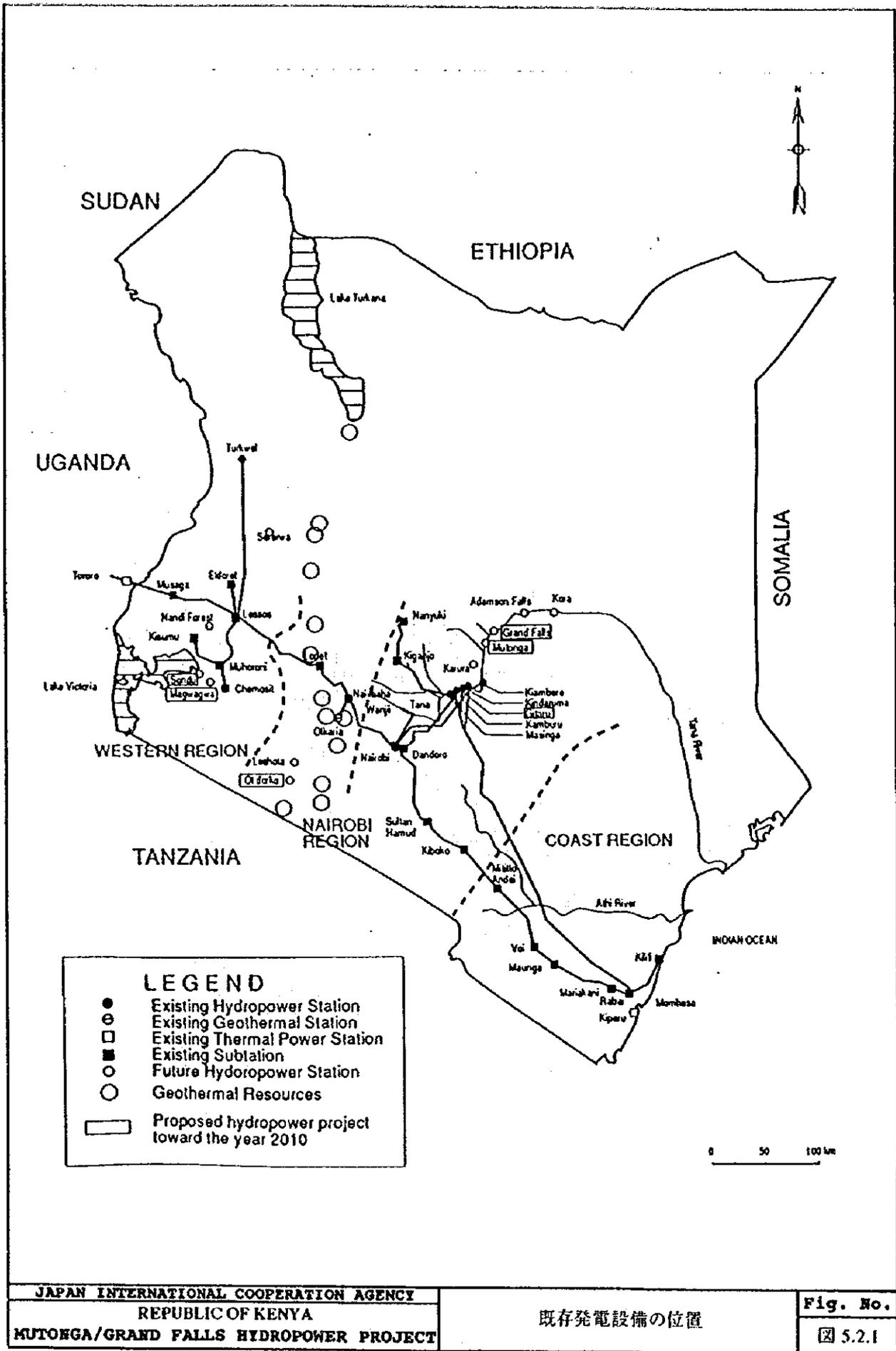
JAPAN INTERNATIONAL COOPERATION AGENCY	既存の上流貯水池を有している場合（1995年のシミュレーション）、自然環境下（1966年のシミュレーション）でガリッサで起きた洪水継続期間別の頻度	Fig. No.
REPUBLIC OF KENYA MUTONGA/GRAND FALLS HYDROPOWER PROJECT		図 4.5.22

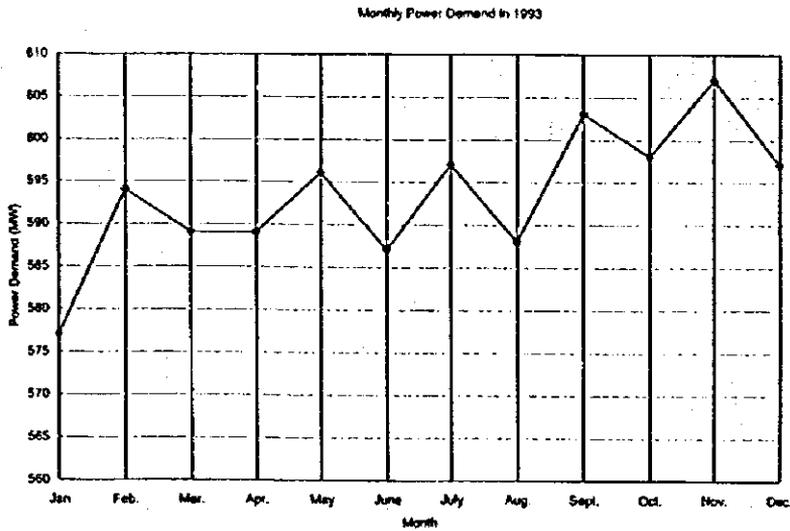
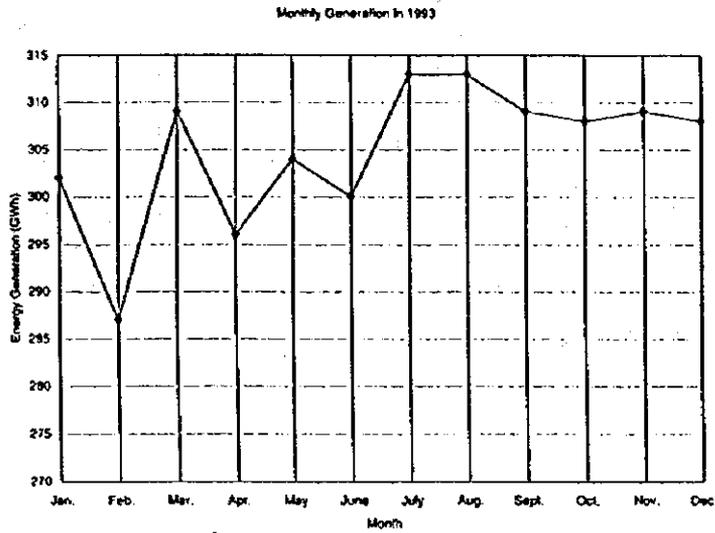
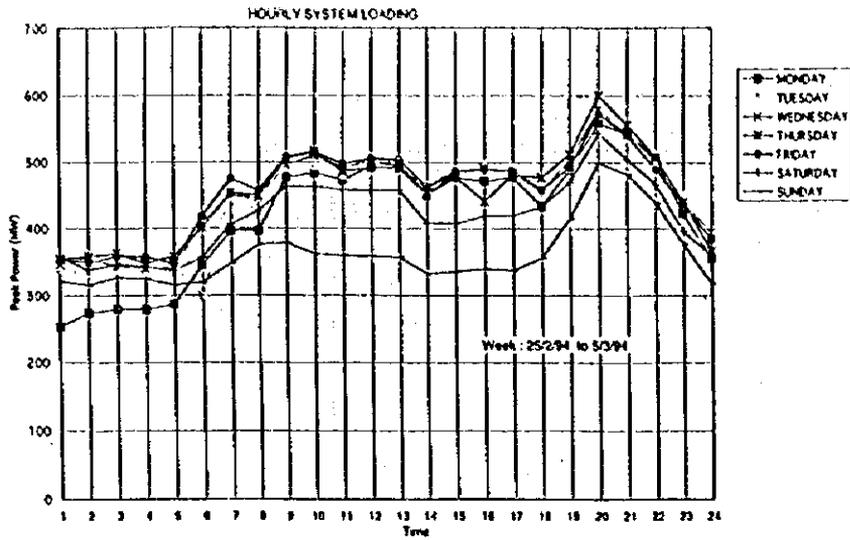


JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

カリガの洪水継続期間 (500m³/秒以上の洪水
 が起こった日数)、総洪水量 (100万m³)、
 1995年のシエーションからの概算

Fig. No.
 図 4.5.23

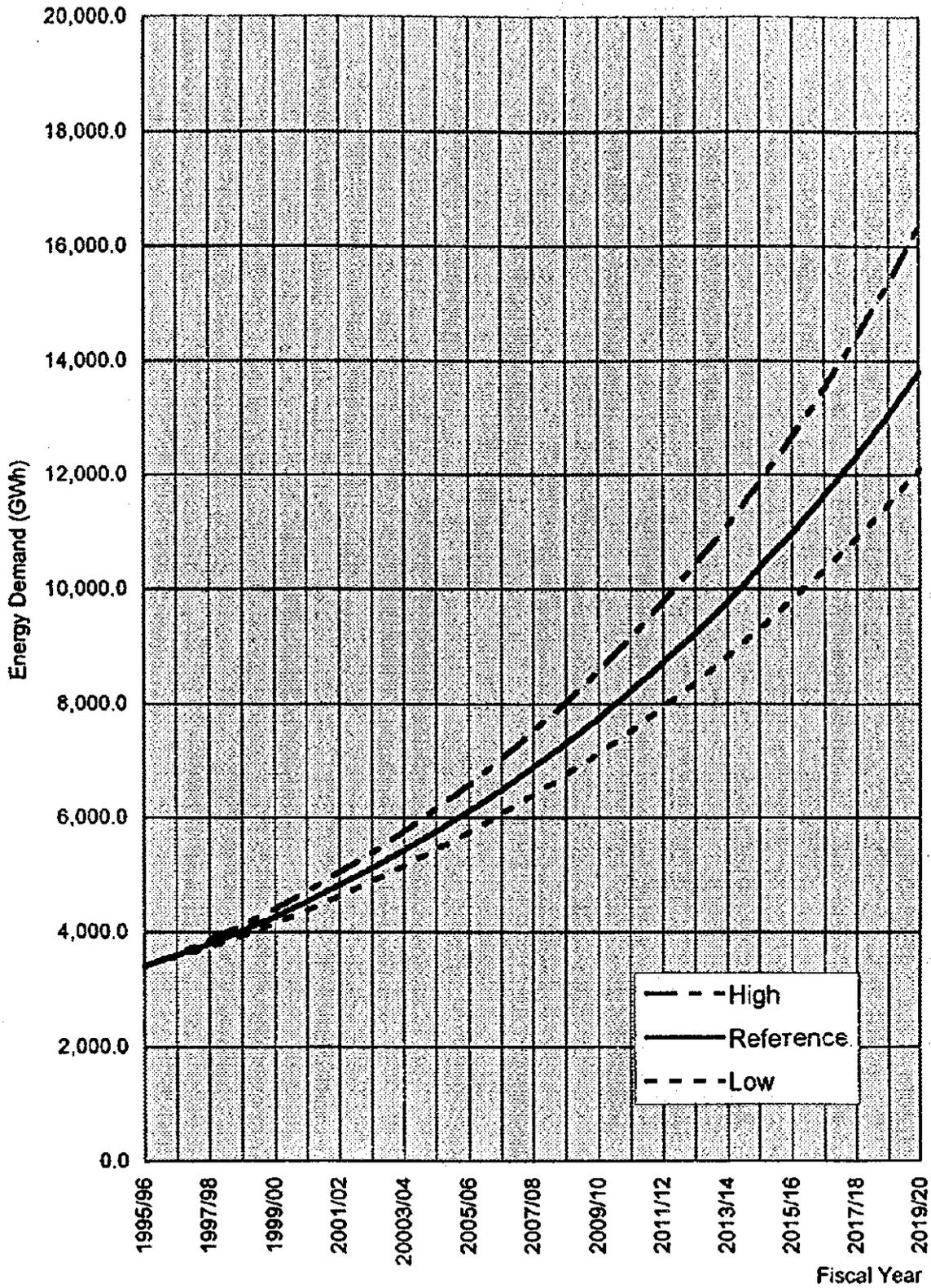




JAPAN INTERNATIONAL COOPERATION AGENCY
 REPUBLIC OF KENYA
 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

負荷変動パターン

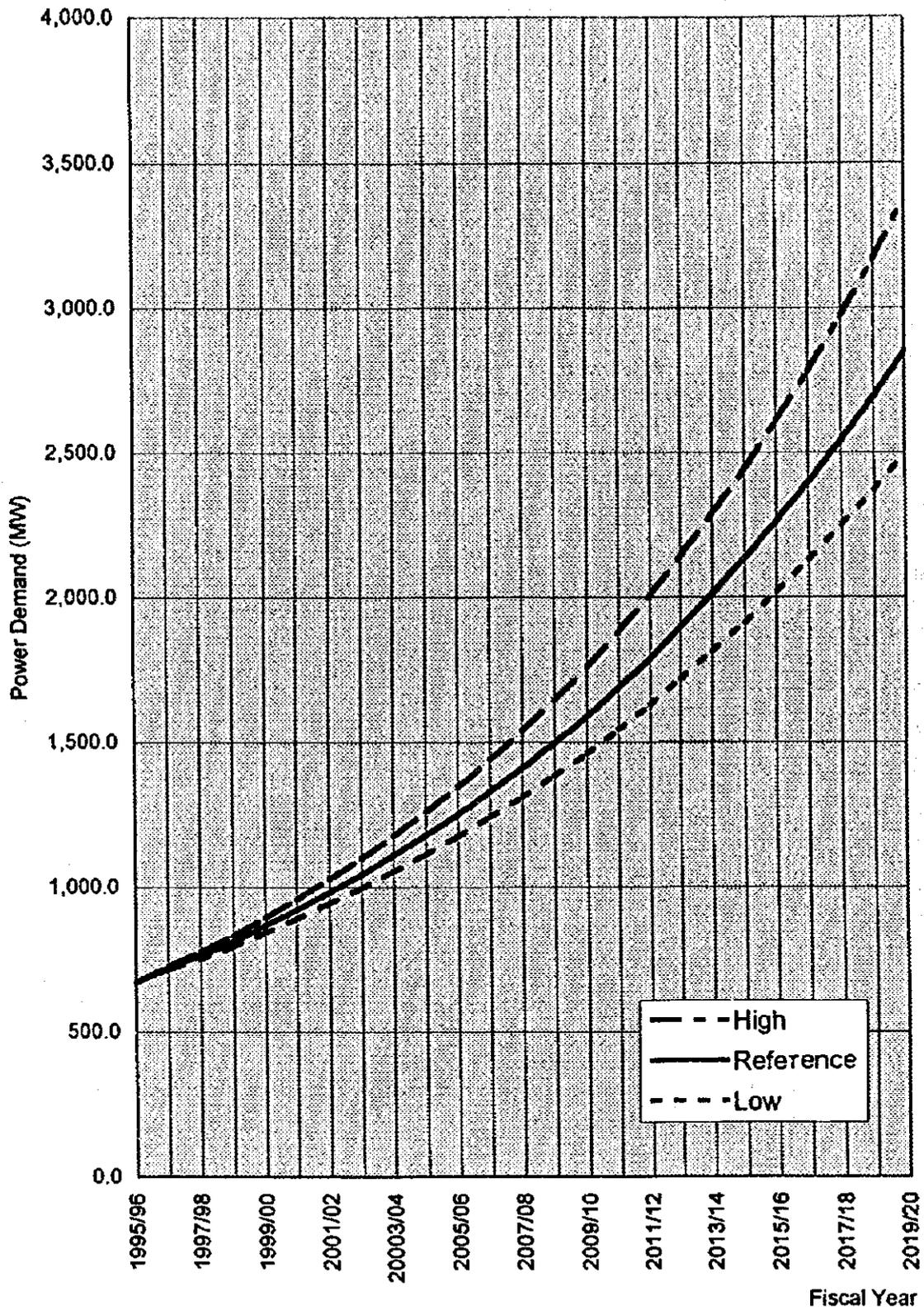
Fig. No.
 図 5.2.3



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

電力量需要予測

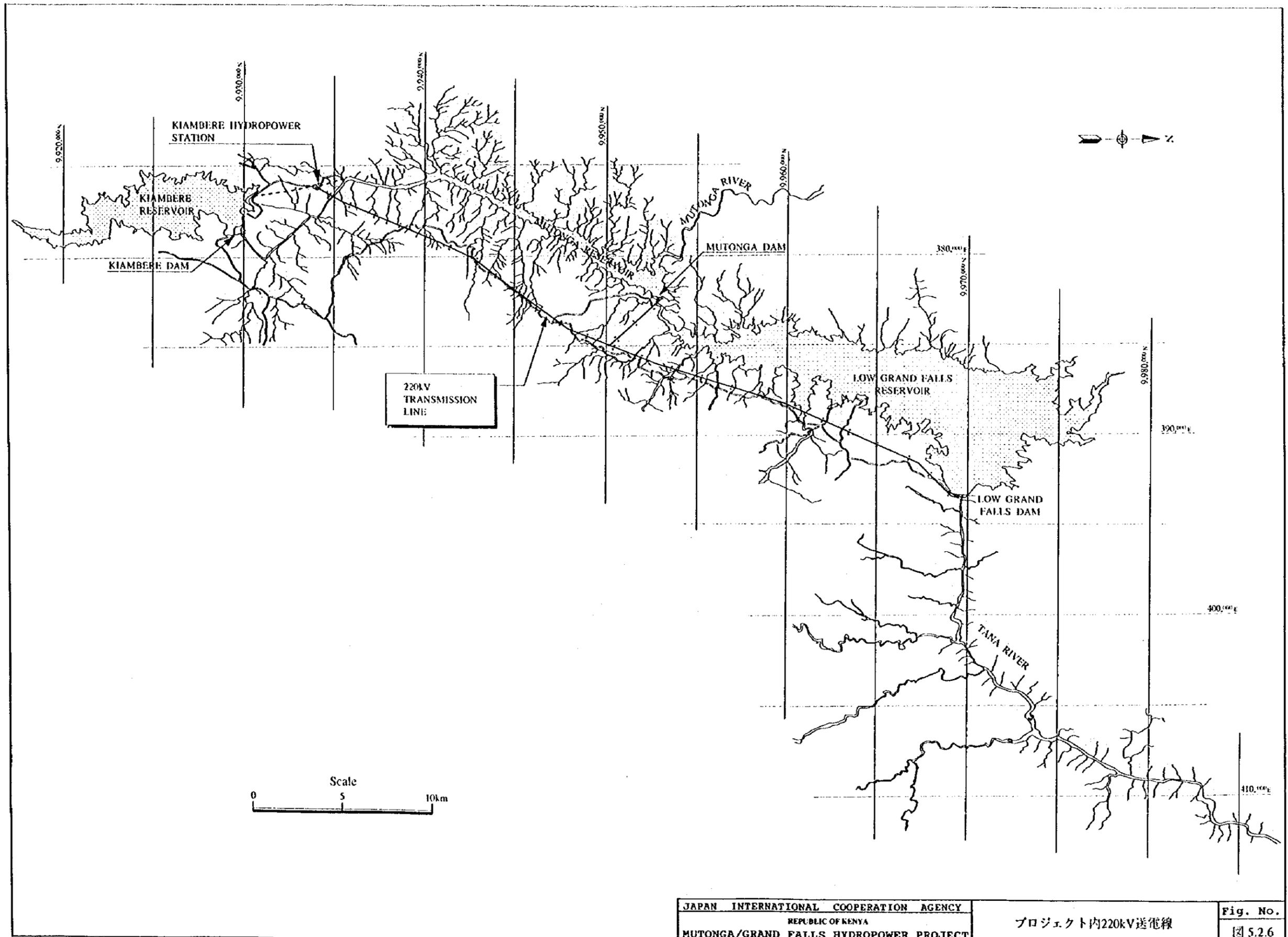
Fig. No.
 図 5.2.4



JAPAN INTERNATIONAL COOPERATION AGENCY
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 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

電力需要予測

Fig. No.
 図 5.2.5



JAPAN INTERNATIONAL COOPERATION AGENCY
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 MUTONGA/GRAND FALLS HYDROPOWER PROJECT

プロジェクト内220kV送電線

Fig. No.
 図 5.2.6