

No. 49

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)  
THE REPUBLIC OF CAMEROON  
SOCIETE NATIONALE D'ELECTRICITE DU CAMEROUN

FEASIBILITY STUDY  
ON  
MEMVE ELE HYDROELECTRIC POWER  
DEVELOPMENT PROJECT

FINAL REPORT  
APPENDIX VI  
DRAWINGS

OCTOBER 1993

NIPPON KOEI CO., LTD.

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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)  
THE REPUBLIC OF CAMEROON  
SOCIETE NATIONALE D'ELECTRICITE DU CAMEROUN

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MEMVE ELE HYDROELECTRIC POWER  
DEVELOPMENT PROJECT**

**FINAL REPORT  
APPENDIX VI  
DRAWINGS**

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OCTOBER 1993

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THE REPUBLIC OF CAMEROON SOCIETE NATIONALE D'ELECTRICITE DU CAMEROUN		
MEMVE ELE HYDROELECTRIC POWER DEVELOPMENT PROJECT		DWG. NO.
		JAPAN INTERNATIONAL COOPERATION AGENCY

**NOTES:**

1. Unless otherwise specified, all dimensions are in millimeters, except elevations which are written in meters.
2. A period is used to denote the decimal point and commas denote multiples of thousands.

**SYMBOLS & ABBREVIATIONS**

Unless otherwise specified, the following symbols and abbreviations are used.

CLASSIFICATION	SYMBOLS & ABBREVIATIONS	EXAMPLES & NOTES
<b>I MEASUREMENT</b>		
Millimeters	mm , MM	
Centimeters	cm , CM	
Meters	m , M	
Kilometers	km , KM	
Square meters	m <sup>2</sup> , M <sup>2</sup>	
Cubic meters	m <sup>3</sup> , M <sup>3</sup>	
Kilograms	kg , KG	
Tons (Metric)	t , T	
Hours	hr , HR	
Minutes	min , Min	
Seconds	s , Sec	
Newton	N	N = 1.01972 x 10 <sup>-1</sup> kgf
Kilo - Newton	KN	KN = 1 x 10 <sup>3</sup> N
Pascal	Pa	Pa = 1N/m <sup>2</sup> = 1.01972 x 10 <sup>-5</sup> kgf/cm <sup>2</sup>
Kilo - Pascal	kPa	kPa = 1 x 10 <sup>3</sup> Pa = 1.01972 x 10 <sup>-2</sup> kgf/cm <sup>2</sup>
Mega - Pascal	MPa	MPa = 1 x 10 <sup>6</sup> Pa = 1.01972 x 10 kgf/cm <sup>2</sup>
<b>II SYMBOLS AND ABBREVIATION</b>		
<b>A COMMON</b>		
Roller steel plate	PL R	PL 110 x 11 x 300 (Width x Thickness x Length)
Roller steel angle	L	L 60 x 60 x 6 x 1,000 (Leg x Leg x Thickness x Length)
Roller steel channel	C C	C 300 x 90 x 9 x 5,000 (Depth x Flange width x Web thickness x Flange thickness)
Roller steel H - shape	H	H 450 x 200 x 9 x 14 (Depth x Flange width x Web thickness x Flange thickness)
Roller steel I - shape	I	I 600 x 190 x 13 x 26 (Depth x Flange width x Web thickness x Flange thickness)
Diameter of piers, holes	D Dia	100 D (100mm in dia meter)
Diameter of round bars, bolts	Ø	16 Ø (16mm in diameter)
Radius of curve	R	30,000 R (30,000mm in radius)
Repetition of same spacing (at)	@	7 @ 700 (7 spans each 700mm interval)
Center to Center	C.T.C. C to C	
Center line	⊗	
Minimum (or Maximum)	Min (Max)	1,000 Min (1,000 min at the minimum)
Elevation (above mean sea level)	EL	EL 215.000 or EL 215.00 (215 meters above sea level)
Slope	S =	S = 1:50 or 2% (1 vertical over 50 horizontal)
Length	L L	L = 10,000 (10,000mm in length)
Thickness	t thk	

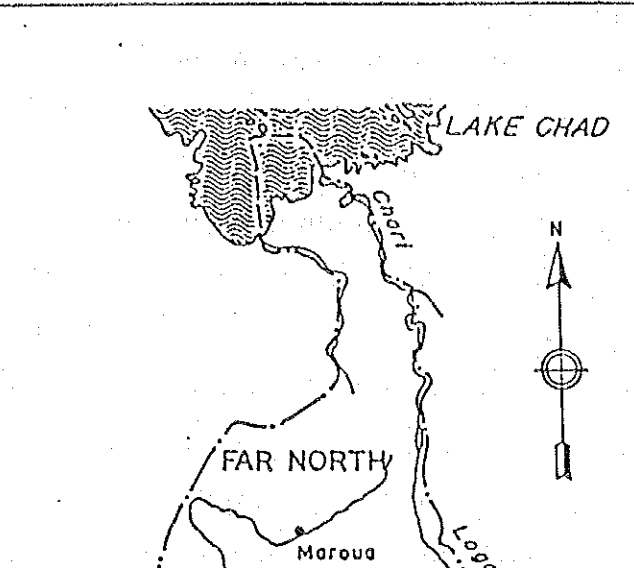
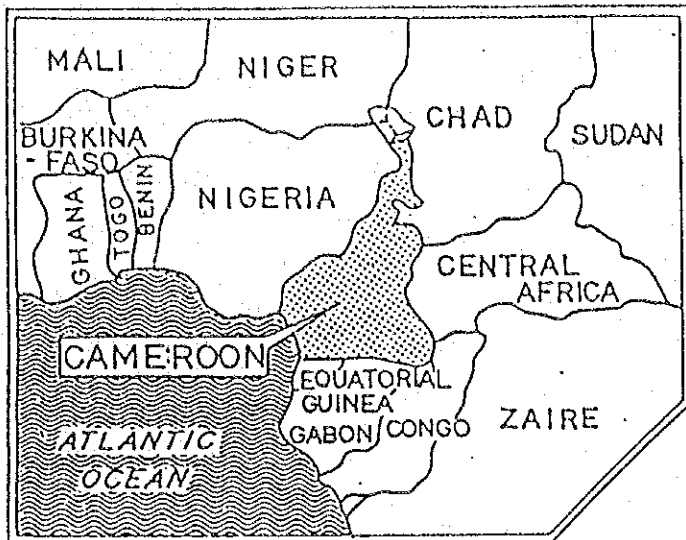
CLASSIFICATIONS	SYMBOLS & ABBREVIATIONS	EXAMPLES & NOTES
Angle (degrees, minutes, seconds)	° ' "	35° 02' 00"
Number (s)	NO (S), no (s)	
Flood water level	F.W.L	
High water level	H.W.L	
Low water level	L.W.L	
Polyvinyl chloride	P.V.C	
Galvanized	Galv.	
Expansion joint	Exp. Jt	
Contraction joint	Contr. Jt	
Construction joint	C. J.	
Concrete	Conc.	
Reinforced concrete	R.C.	
Waterstop	W.S	
Typical	typ	
Inside diameter (Outside diameter)	ID OD	
Drawing	DWG Dwg.	
<b>B CIVIL ENGINEERING</b>		
Original ground surface	O.G.S	
Assumed weathered rock surface	A.W.R.S	
Assumed rock surface	A.R.S	
Station	Sta.	Sta. 15 + 10.000
Beginning point	B.P	
Ending point	E.P	
Beginning point of Curve	B.C	
Ending point of Curve	E.C	
Intersection point	I.P	
Intersection angles	I.A	
Tangent length	T.L	
Curve length	C.L	
Tangent point	T.P	
High point	H.P	
Up - surging water level	U.S.W.L	
Down - surging water level	D.S.W.L	
West longitude	W -- °	W 100° (100 degrees west)
North latitude	N -- °	N 12° (12 degrees north)
Reinforcement (Reinforcement bar)	Reinf. (Re-bar)	

**LEGEND**

Unless otherwise specified, the following legends are used

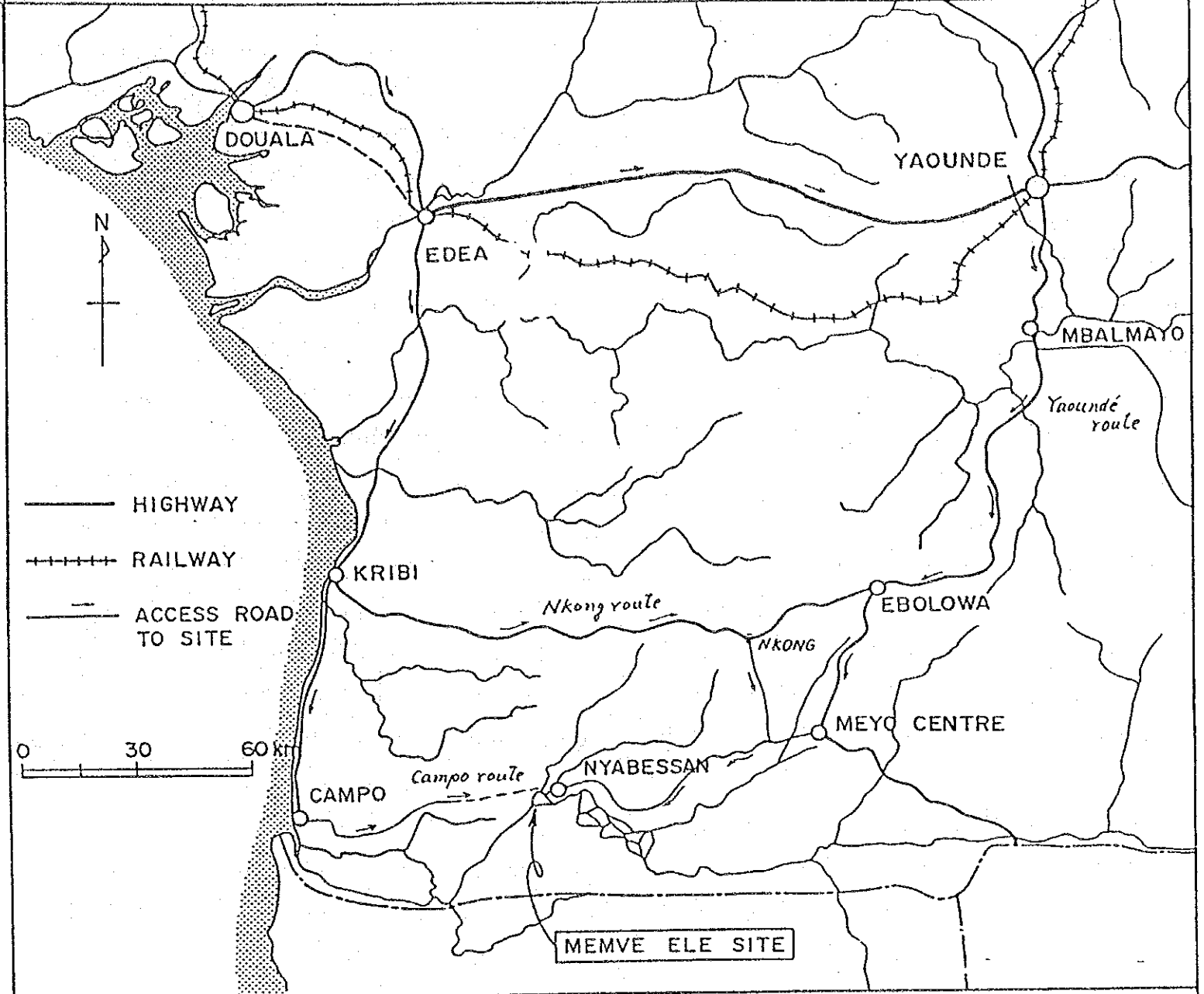
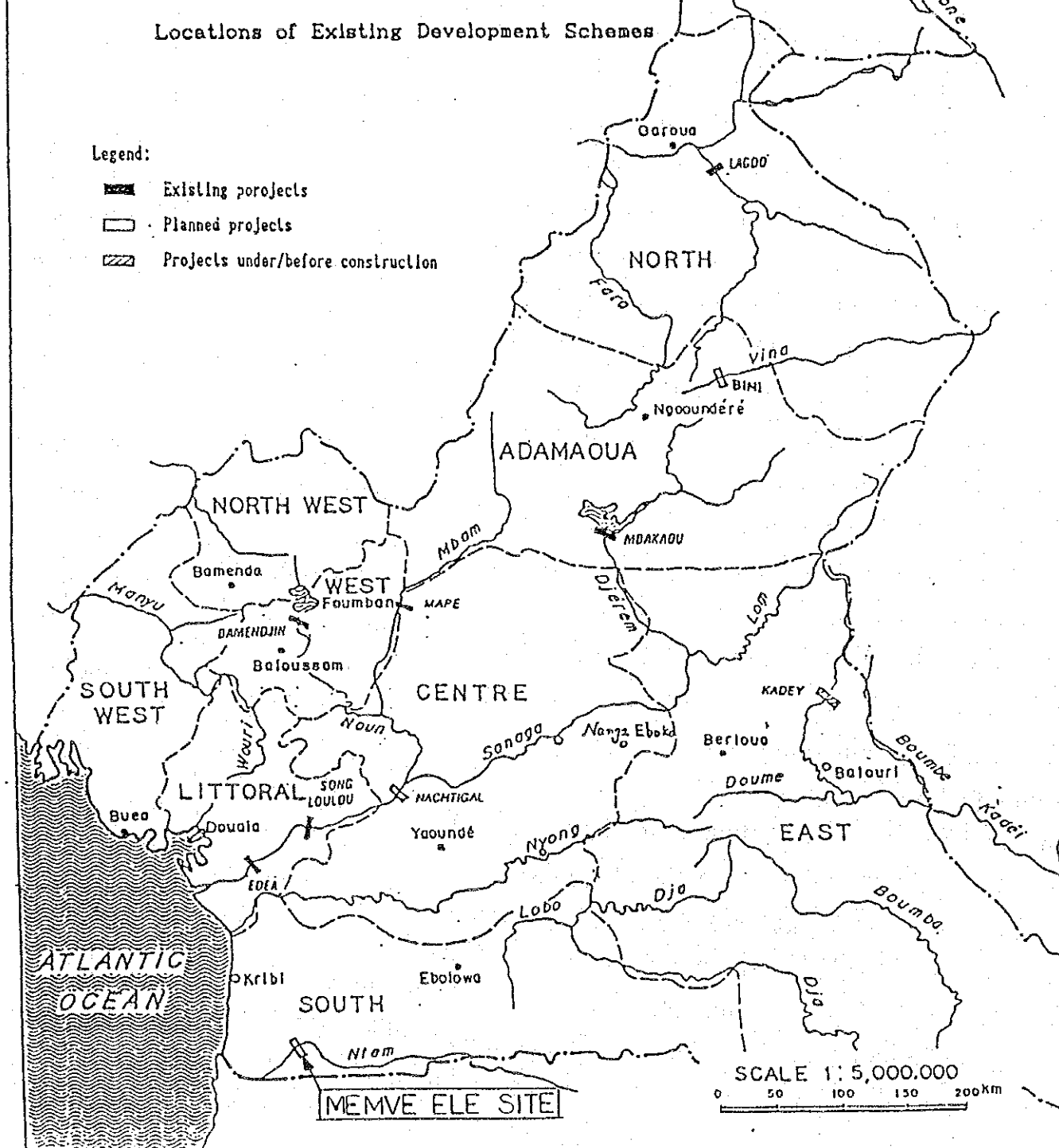
Rock surface	
Earth surface	
Concrete, first stage	
Concrete, second stage	
Excavation slope	
Embankment slope	
Timber	
Sand	
Gravel	
Reinforcement bar	
Break of section	
Visible line, out line, dimension line	
ground line, contr. jt, exp. jt	
Hidden line, weathered rock surface	
Center line, axis line, rock surface	
Imaginary line of structure on opposite projection	

THE REPUBLIC OF CAMEROON SOCIETE NATIONALE D'ELECTRICITE DU CAMEROUN		SYMBOL AND ABBREVIATIONS	
MEMVE ELE HYDROELECTRIC POWER DEVELOPMENT PROJECT			
		DWG. NO. 001	JAPAN INTERNATIONAL COOPERATION AGENCY

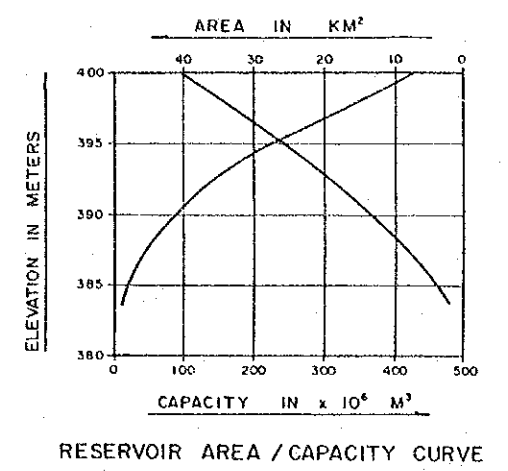
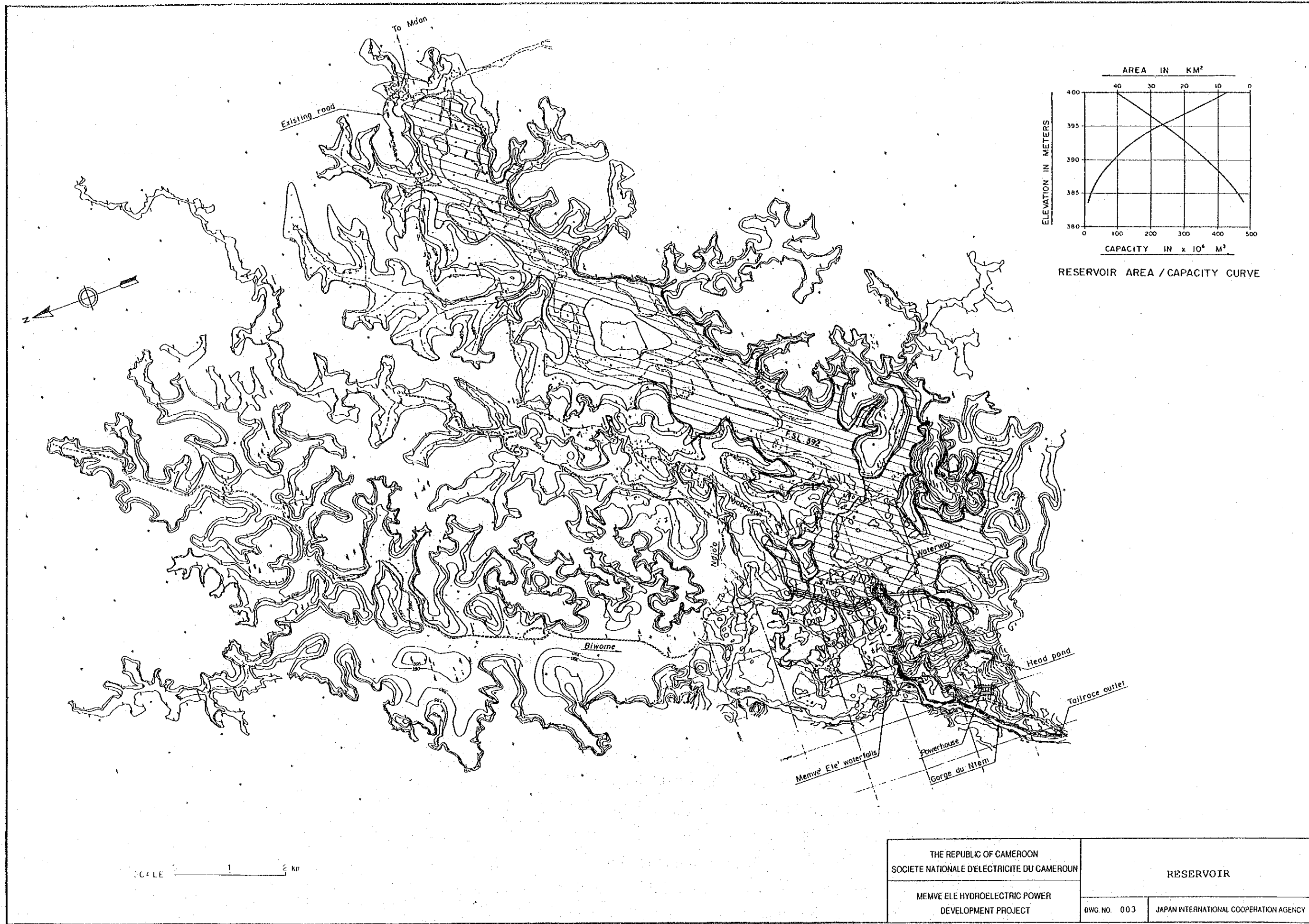


Locations of Existing Development Schemes

- Legend:
- Existing projects
  - Planned projects
  - Projects under/before construction

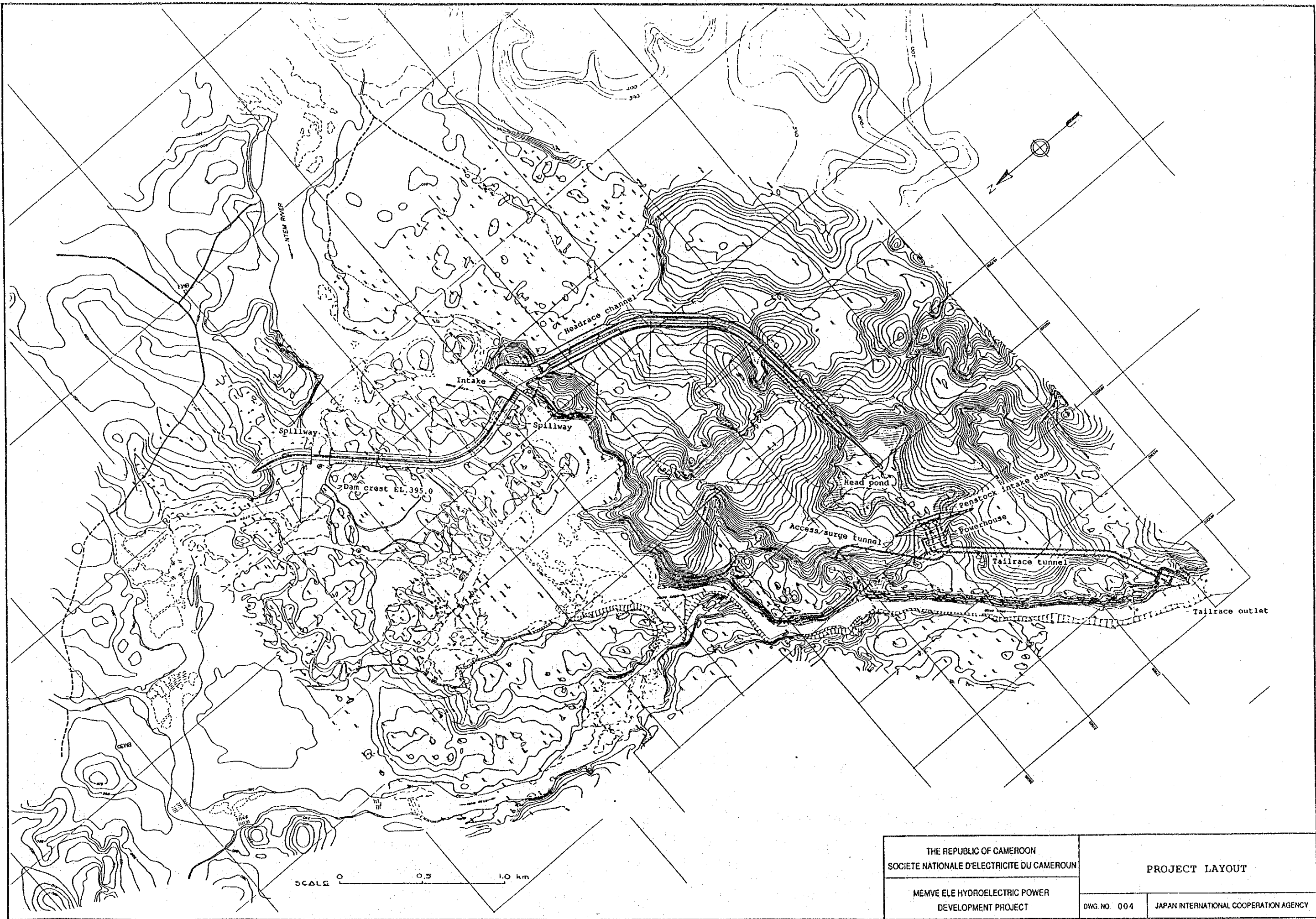


THE REPUBLIC OF CAMEROON SOCIETE NATIONALE D'ELECTRICITE DU CAMEROUN		LOCATION MAP	
MEMVE ELE HYDROELECTRIC POWER DEVELOPMENT PROJECT		DWG. NO. 002	JAPAN INTERNATIONAL COOPERATION AGENCY

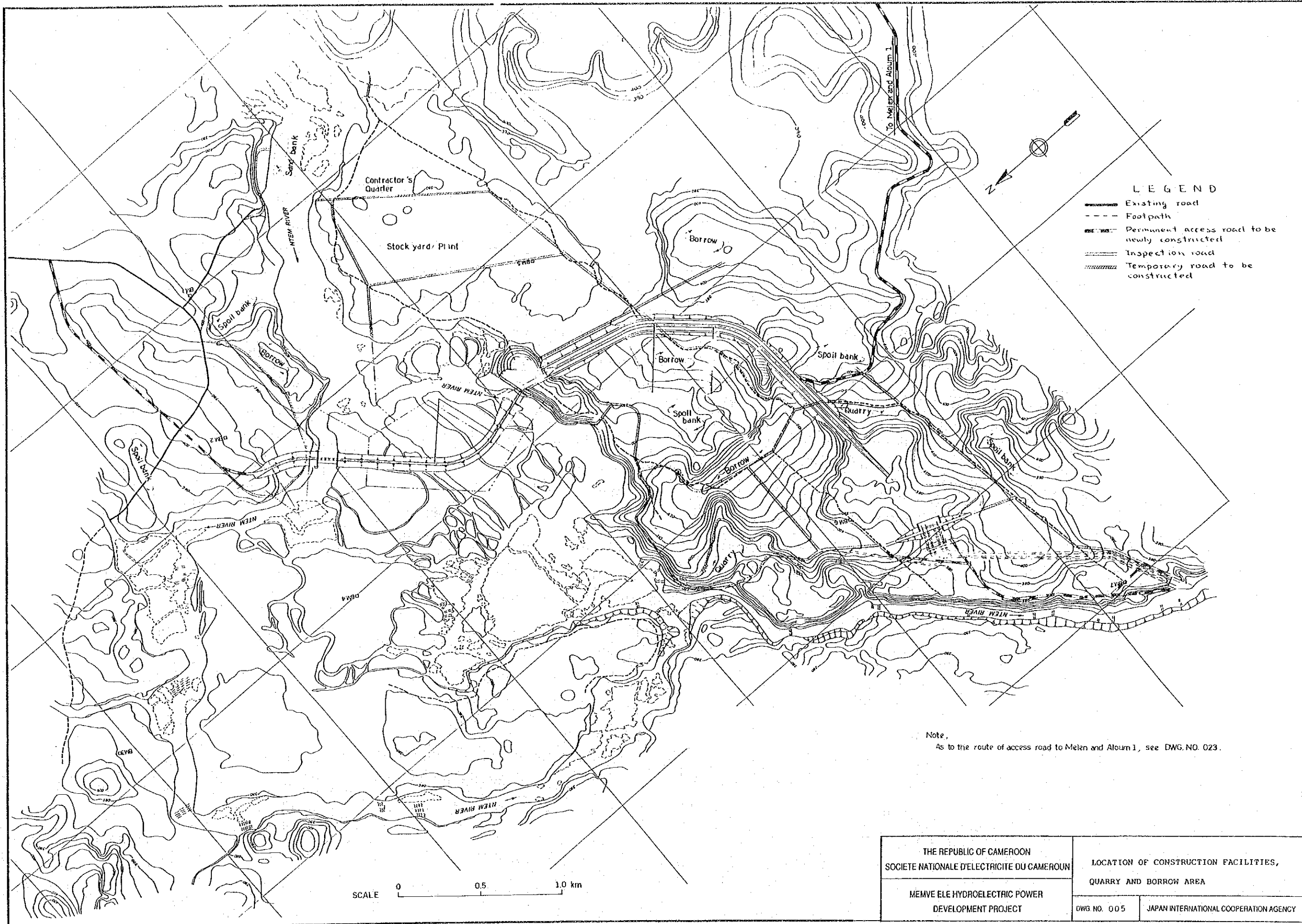


SCALE 1 km

THE REPUBLIC OF CAMEROON SOCIÉTÉ NATIONALE D'ÉLECTRICITÉ DU CAMEROUN		RESERVOIR	
MEMVE ELE HYDROELECTRIC POWER DEVELOPMENT PROJECT		DWG NO. 003	JAPAN INTERNATIONAL COOPERATION AGENCY



THE REPUBLIC OF CAMEROON SOCIETE NATIONALE D'ELECTRICITE DU CAMEROON		PROJECT LAYOUT	
MEMVE ELE HYDROELECTRIC POWER DEVELOPMENT PROJECT		DWG. NO. 004	JAPAN INTERNATIONAL COOPERATION AGENCY



- LEGEND**
- Existing road
  - - - Footpath
  - ▬ Permanent access road to be newly constructed
  - ▬ Inspection road
  - ▬ Temporary road to be constructed

Note,  
As to the route of access road to Melan and Aloum 1, see DWG. NO. 023.

SCALE 0 0.5 1.0 km

THE REPUBLIC OF CAMEROON SOCIETE NATIONALE D'ELECTRICITE DU CAMEROUN	LOCATION OF CONSTRUCTION FACILITIES, QUARRY AND BORROW AREA	
MEMVE ELE HYDROELECTRIC POWER DEVELOPMENT PROJECT	DWG. NO. 005	JAPAN INTERNATIONAL COOPERATION AGENCY

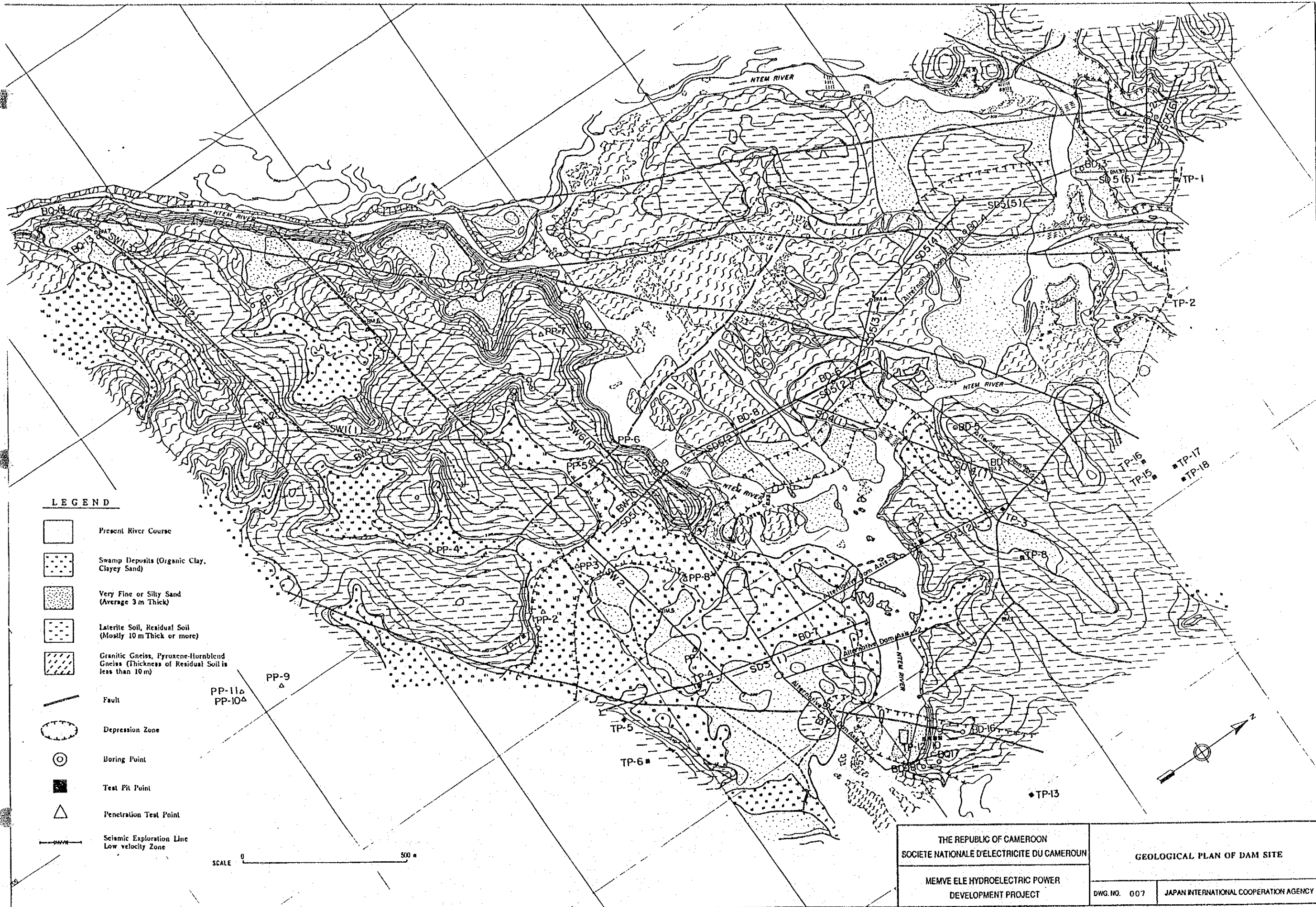


Contract Package	W o r k s	Q'ty	Year							
			2004	2005	2006	2007	2008	2009		
Lot I Civil Works	Contractual Process									
	Preparatory Works									
	Dam									
	River diversion	72,000 m <sup>3</sup>								
	Excavation	454,000 m <sup>3</sup>								
	Foundation treat.	5,400 m								
	Embankment	884,000 m <sup>3</sup>								
	Spillway									
	Excavation	23,000 m <sup>3</sup>								
	Foundation treat	90,400 m <sup>3</sup>								
	Concrete									
	Intake									
	Excavation	644,000 m <sup>3</sup>								
	Concrete	39,000 m <sup>3</sup>								
	Headrace Channel									
	Excavation	L = 2.5 km 1,193,000 m <sup>3</sup>								
	Embankment	353,000 m <sup>3</sup>								
	Concrete	26,000 m <sup>3</sup>								
	Head Pond(Rock Quarry)	A = 60 ha								
	Excavation									
Lot II Hydro-mechanical Works	Penstock Intake/Dam									
	Excavation	176,000 m <sup>3</sup>								
	Foundation treat.	162,000 m <sup>3</sup>								
	Embankment	41,000 m <sup>3</sup>								
	Concrete									
	Penstock Line									
	Excavation	L = 95 m 21,000 m <sup>3</sup>								
	Concrete	3,500 m <sup>3</sup>								
	Powerhouse									
	Excavation	233,000 m <sup>3</sup>								
	Concrete	54,000 m <sup>3</sup>								
	Draft Tunnel									
	Excavation	L = 40 m								
	Concrete									
	Lot III Generating Equip.	Access/Surge Tunnel								
Excavation		L = 770 m 47,000 m <sup>3</sup>								
Concrete		54,000 m <sup>3</sup>								
Tailrace Tunnel										
Excavation		L = 1,350 m 264,000 m <sup>3</sup>								
Concrete		52,000 m <sup>3</sup>								
Tailrace Outlet										
Excavation		268,000 m <sup>3</sup>								
Concrete		16,000 m <sup>3</sup>								
Switchyard										
Lot IV Transmission Line and Substation Equip.	Excavation									
	Concrete									
	Access Road									
	Excavation	L = 4 km								
	Concrete									
	Contractual Process									
	Spillway Gates	5 sets								
	Sand Flush Gates	1 set								
	Intake Trashracks	12 sets								
	Intake Gates	4 sets								
Scoure Valve	1 set									
Penstock Intake Trash	8 sets									
Penstock Intake Gates	4 sets									
Penstock	4 lanes									
Draft Tube Gate	1 set									
Tailrace Outlet Gates	2 sets									
Contract Package	Contractual Process									
	Turbines	2 units								
	Generators	2 units								
	Transformers	2 units								
	Switchgears, etc									
Contract Package	Test									
	Contractual Process									
Contract Package	Transmission Line	285 km								
	Substation Equip.									












SYMBOL

- T N Tendering
- A ▼ Award of Contract
- C ▼ Commencement of work
- W ▼ Completion of work
- DMT Design, manufacturing & transportation

CONSTRUCTION TIME SCHEDULE

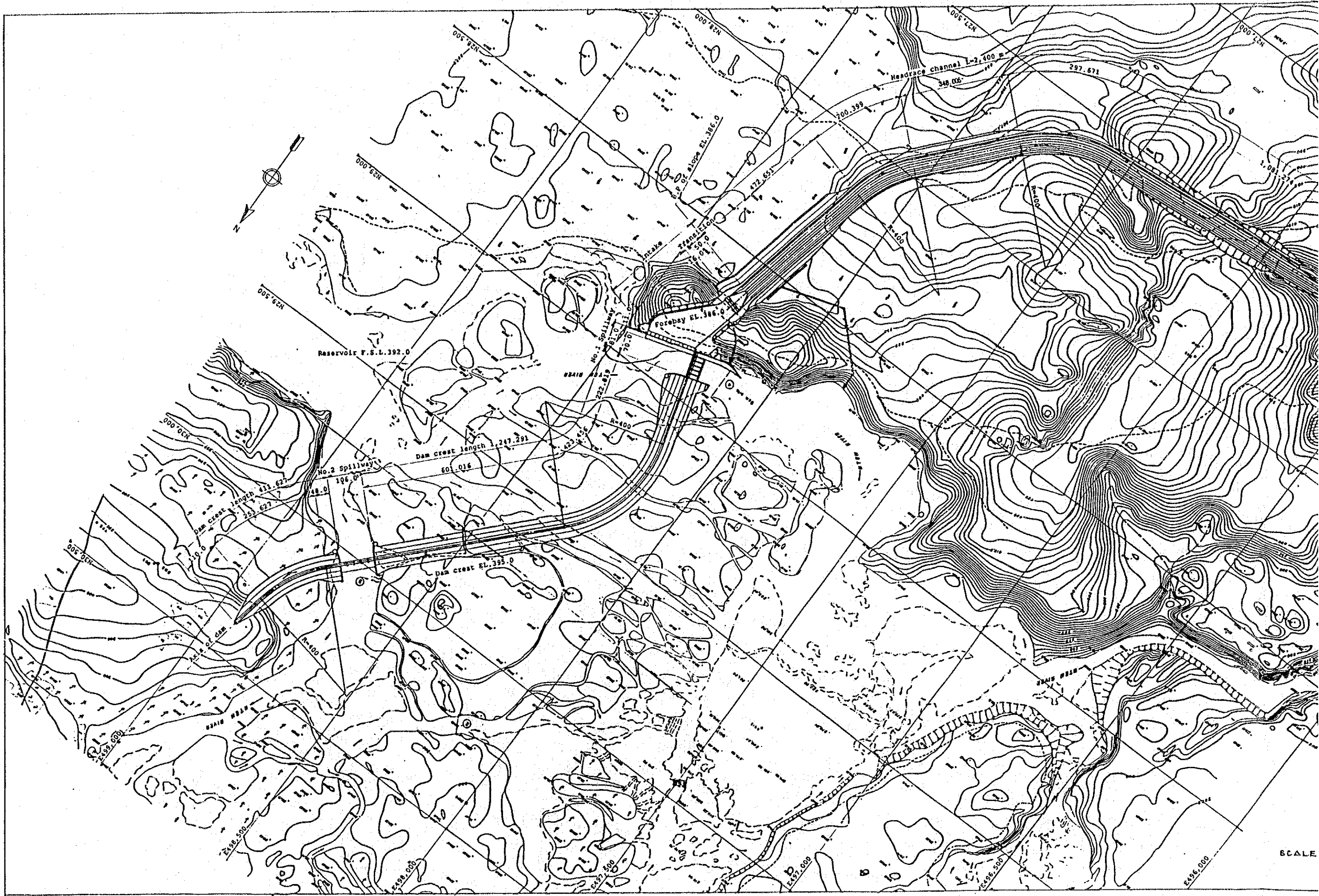


**LEGEND**

-  Present River Course
-  Swamp Deposits (Organic Clay, Clayey Sand)
-  Very Fine or Silty Sand (Average 3 m Thick)
-  Laterite Soil, Residual Soil (Mostly 10 m Thick or more)
-  Granitic Gneiss, Pyroxene-Hornblend Gneiss (Thickness of Residual Soil is less than 10 m)
-  Fault
-  Depression Zone
-  Boring Point
-  Test Pit Point
-  Penetration Test Point
-  Seismic Exploration Line Low velocity Zone

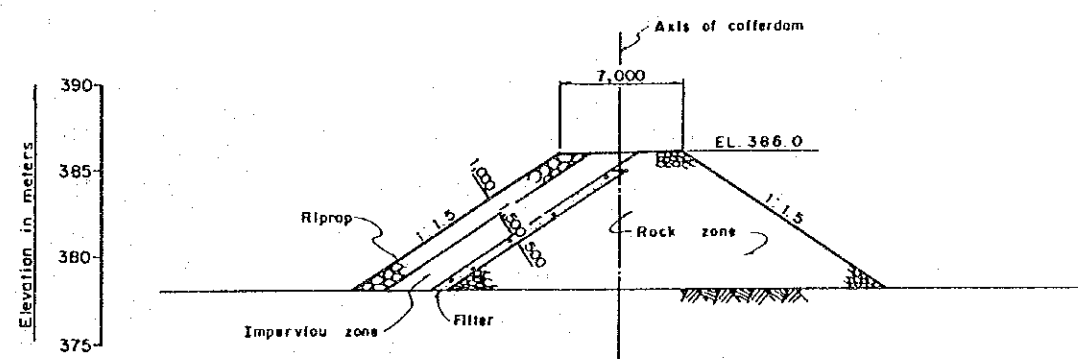
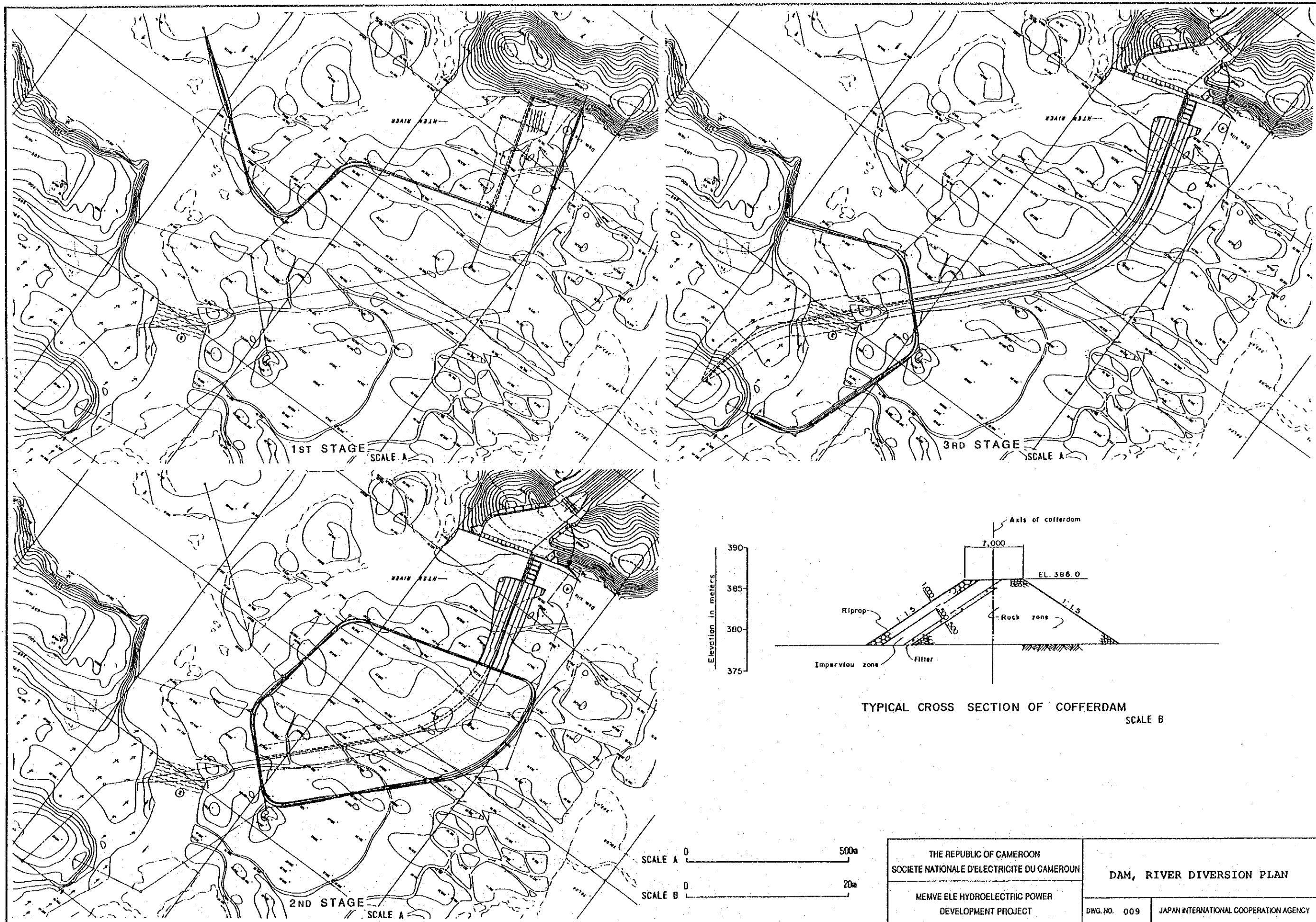
SCALE 0 500 m

THE REPUBLIC OF CAMEROON SOCIETE NATIONALE D'ELECTRICITE DU CAMEROUN		GEOLOGICAL PLAN OF DAM SITE	
MEMVE ELE HYDROELECTRIC POWER DEVELOPMENT PROJECT		DWG. NO. 007	JAPAN INTERNATIONAL COOPERATION AGENCY

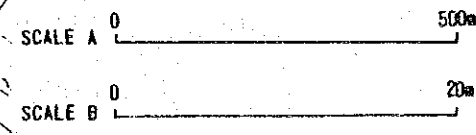


SCALE

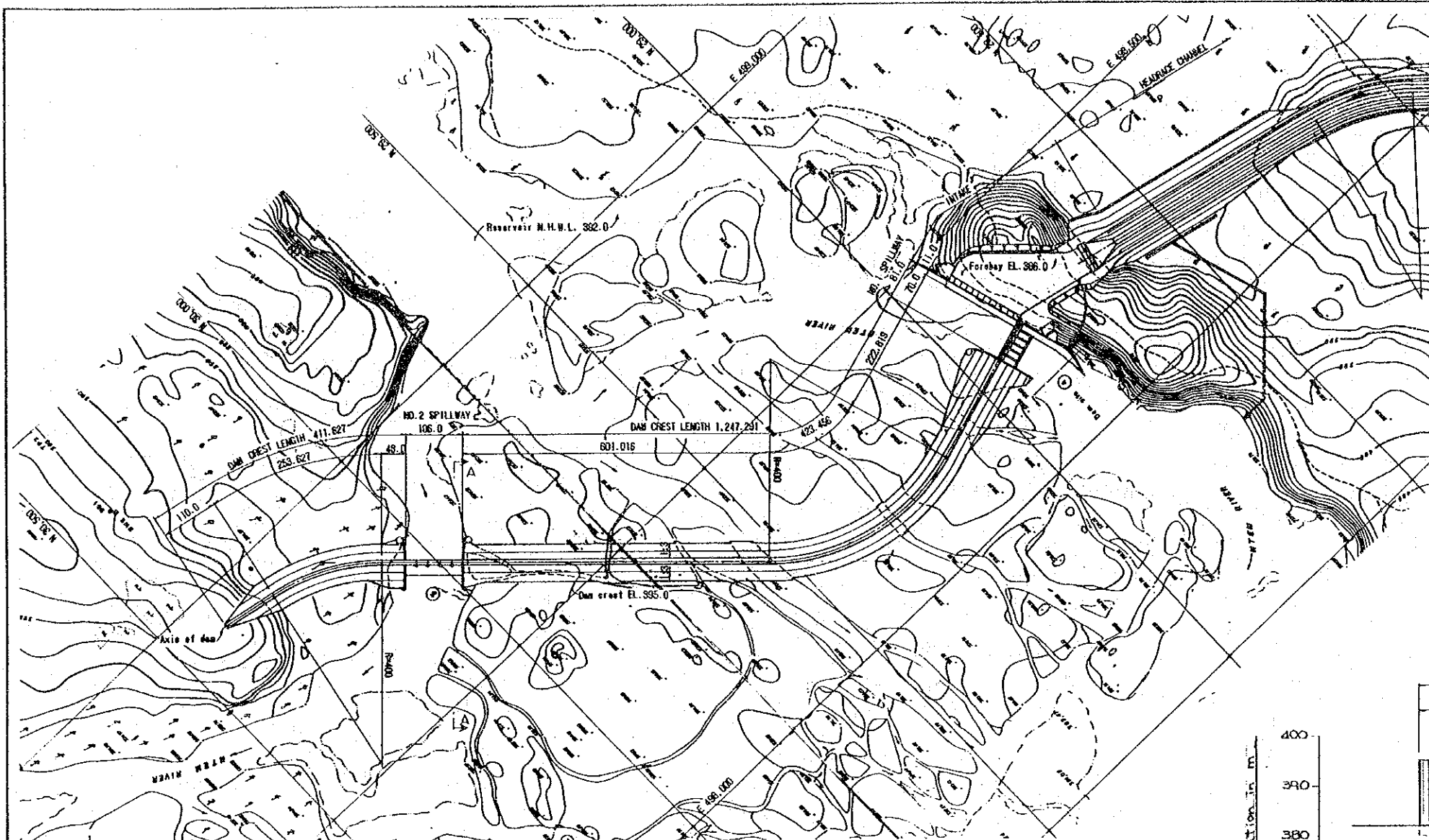




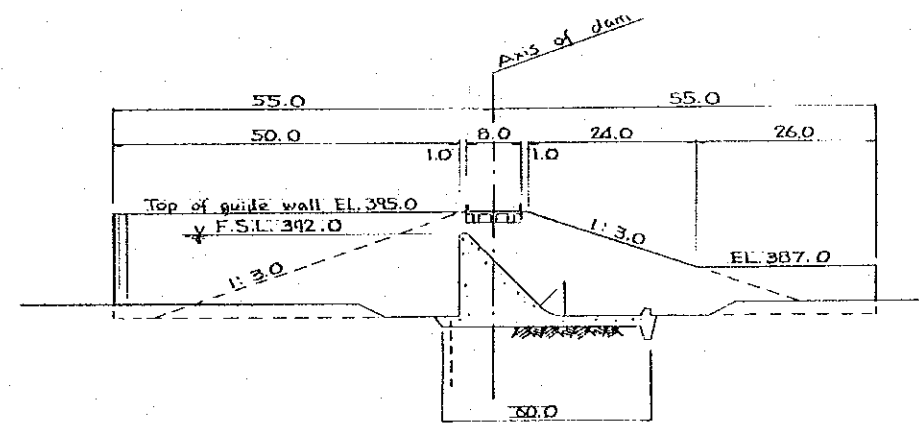
TYPICAL CROSS SECTION OF COFFERDAM  
SCALE B



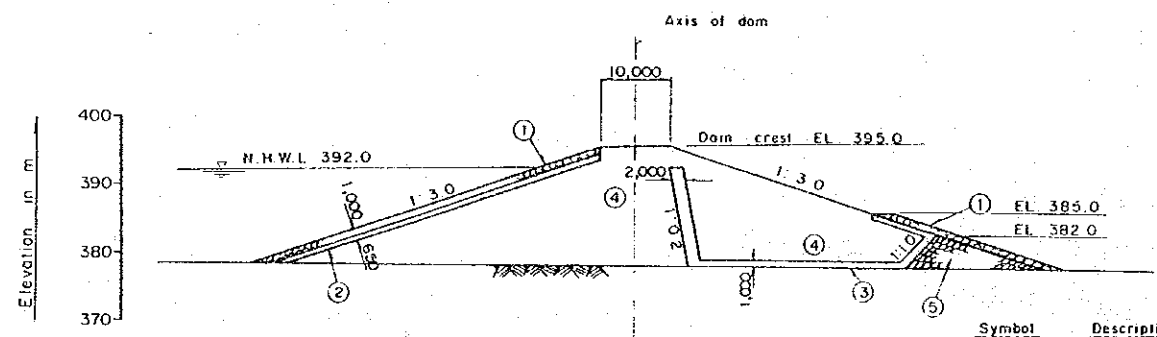
THE REPUBLIC OF CAMEROON SOCIETE NATIONALE D'ELECTRICITE DU CAMEROON	DAM, RIVER DIVERSION PLAN	
MEMVE ELE HYDROELECTRIC POWER DEVELOPMENT PROJECT	DWG. NO. 009	JAPAN INTERNATIONAL COOPERATION AGENCY



PLAN SCALE A

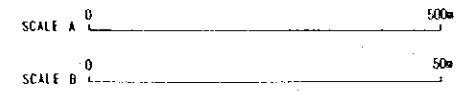


SECTION A - A SCALE B

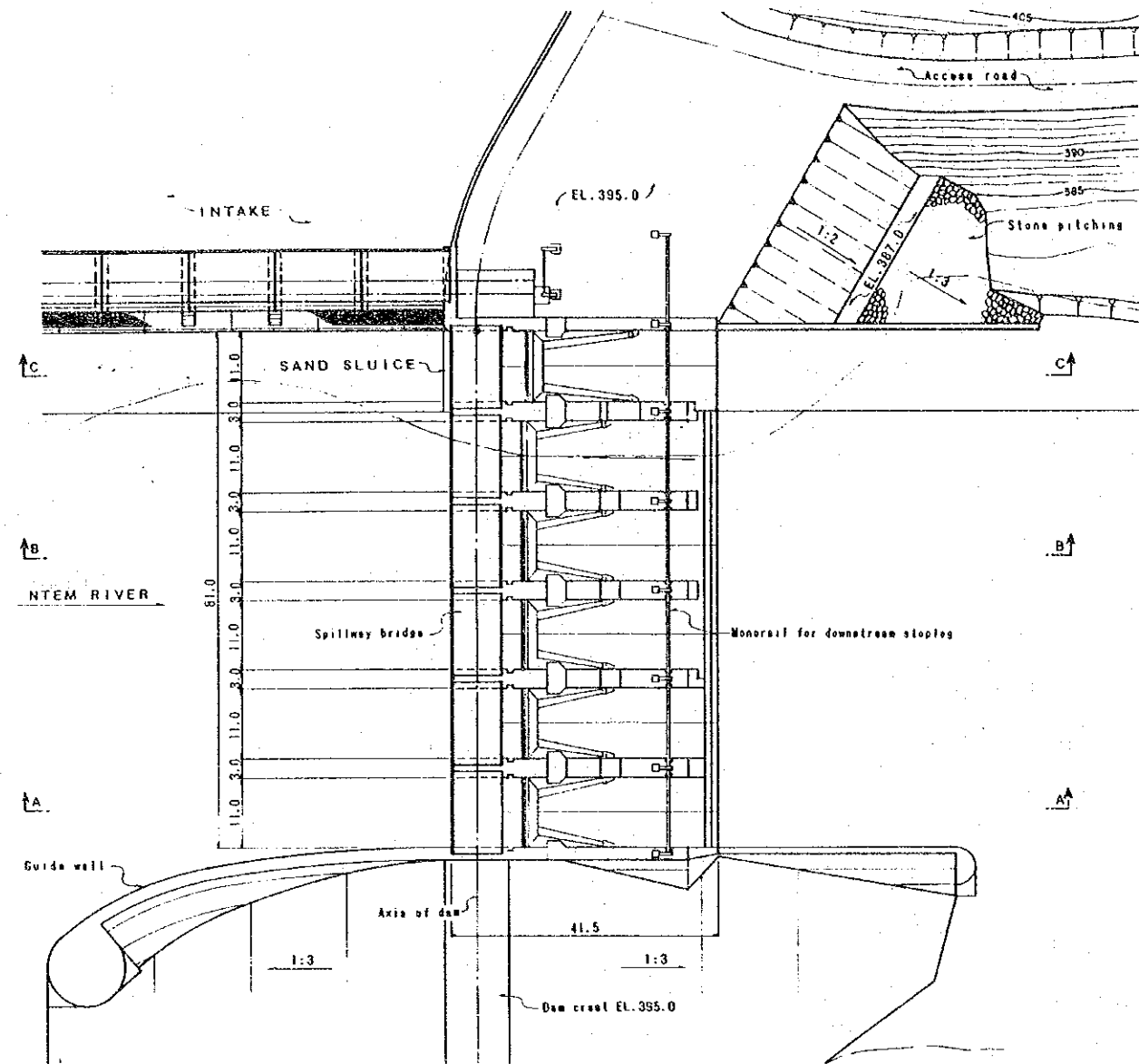


TYPICAL CROSS SECTION

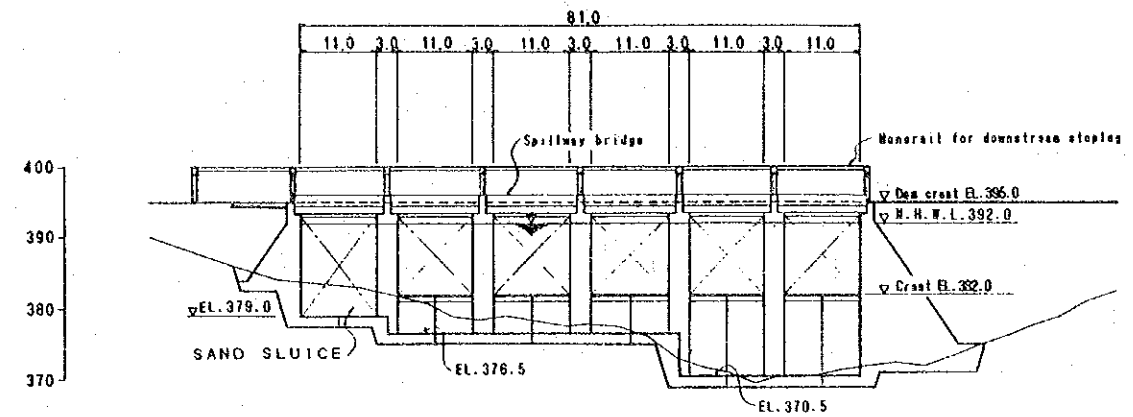
Symbol	Description
①	Riprap
②	Transition
③	Filter
④	Impervious material
⑤	Rockfill



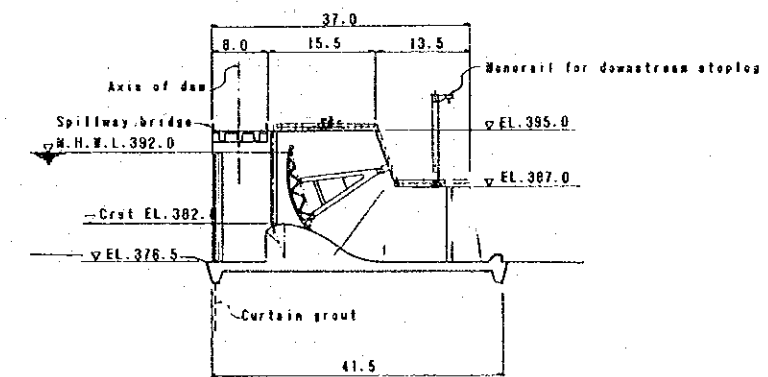
THE REPUBLIC OF CAMEROON SOCIETE NATIONALE D'ELECTRICITE DU CAMEROUN		DAM, PLAN AND TYPICAL SECTION	
MEMVE ELE HYDROELECTRIC POWER DEVELOPMENT PROJECT		DWG NO. 010	JAPAN INTERNATIONAL COOPERATION AGENCY



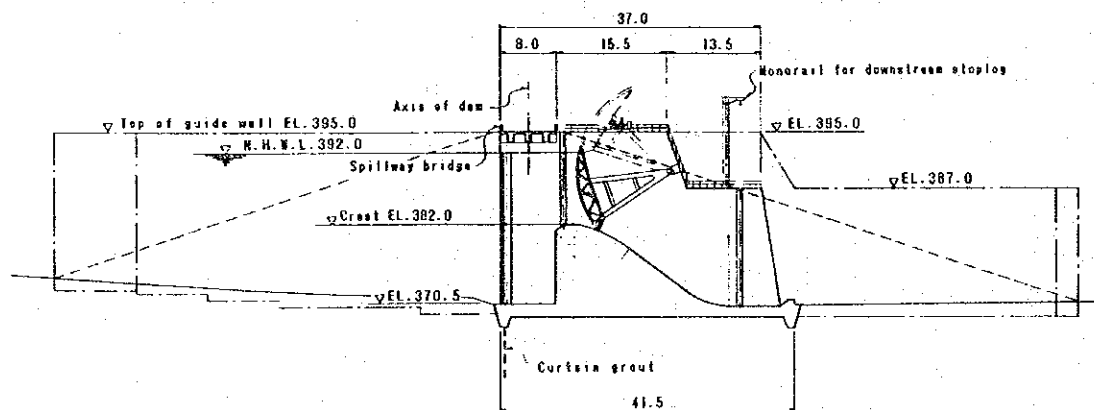
PLAN SCALE A



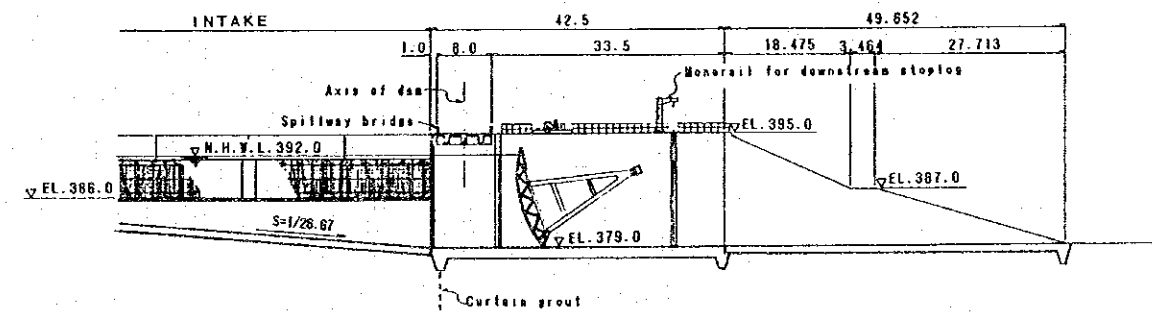
DOWNSTREAM ELEVATION SCALE A



SECTION B-B SCALE A



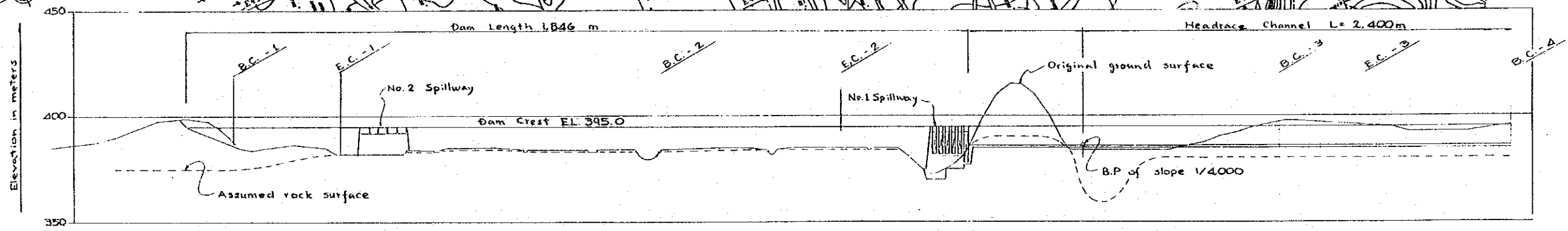
SECTION A-A SCALE A



SECTION C-C (SAND SLUICE) SCALE A



THE REPUBLIC OF CAMEROON SOCIETE NATIONALE D'ELECTRICITE DU CAMEROON	SPILLWAY PLAN, PROFILE AND SECTIONS	
MEMVE ELE HYDROELECTRIC POWER DEVELOPMENT PROJECT	OWG. NO. 011	JAPAN INTERNATIONAL COOPERATION AGENCY

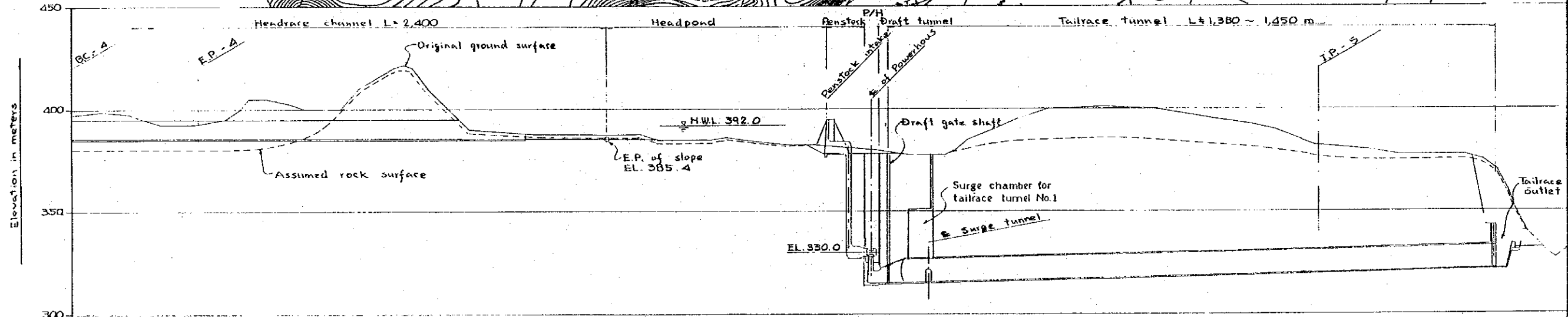
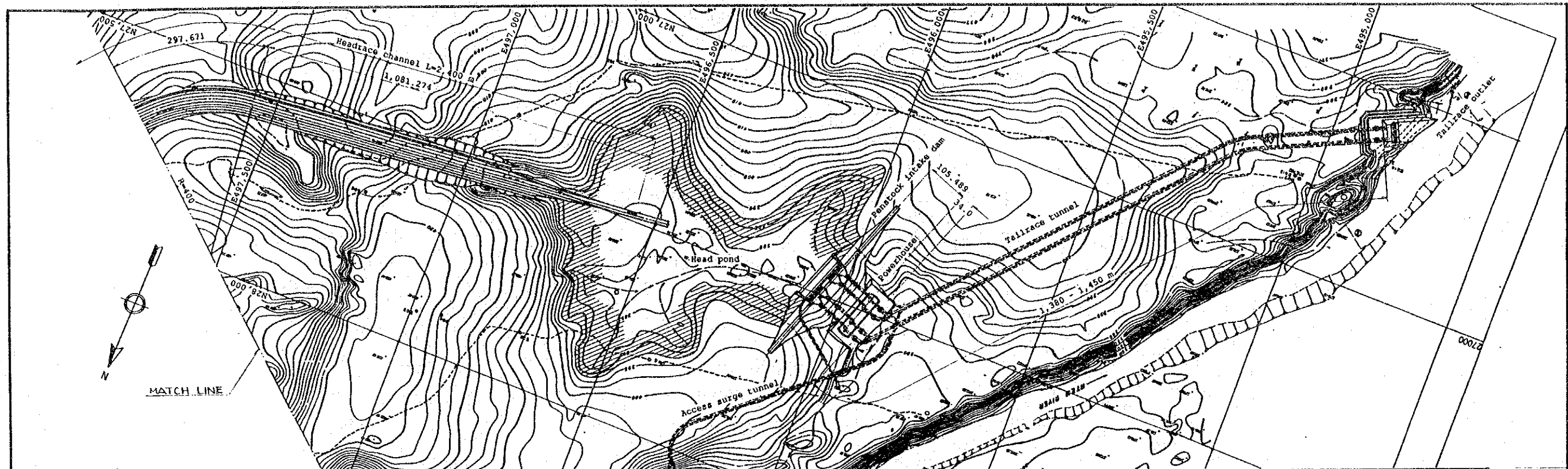


STATION NO.	DISTANCE (M)	ACCUMULATED DISTANCE (M)	FORMATION HEIGHT (M)	ORIGINAL GROUND HEIGHT (M)
-18	50	-1,850	395.0	399
-16	200	-1,600	395.0	398
-14	200	-1,400	395.0	386
-12	200	-1,200	395.0	382
-10	200	-1,000	395.0	385
-8	200	-800	395.0	384
-6	200	-600	395.0	384
-4	200	-400	395.0	385
-2	200	-200	395.0	385
0	200	0	395.0	385
2	200	200	386.0	396
4	200	400	386.0	384
6	200	600	386.0	395
8	200	800	385.9	397
10	200	1,000	385.8	395
11	200	1,200	385.8	393

SCALE A 0 500 m

THE REPUBLIC OF CAMEROON SOCIETE NATIONALE D'ELECTRICITE DU CAMEROON		WATERWAY, PLAN AND PROFILE (1)	
MEMVE ELE HYDROELECTRIC POWER DEVELOPMENT PROJECT		DWG NO. 012	JAPAN INTERNATIONAL COOPERATION AGENCY



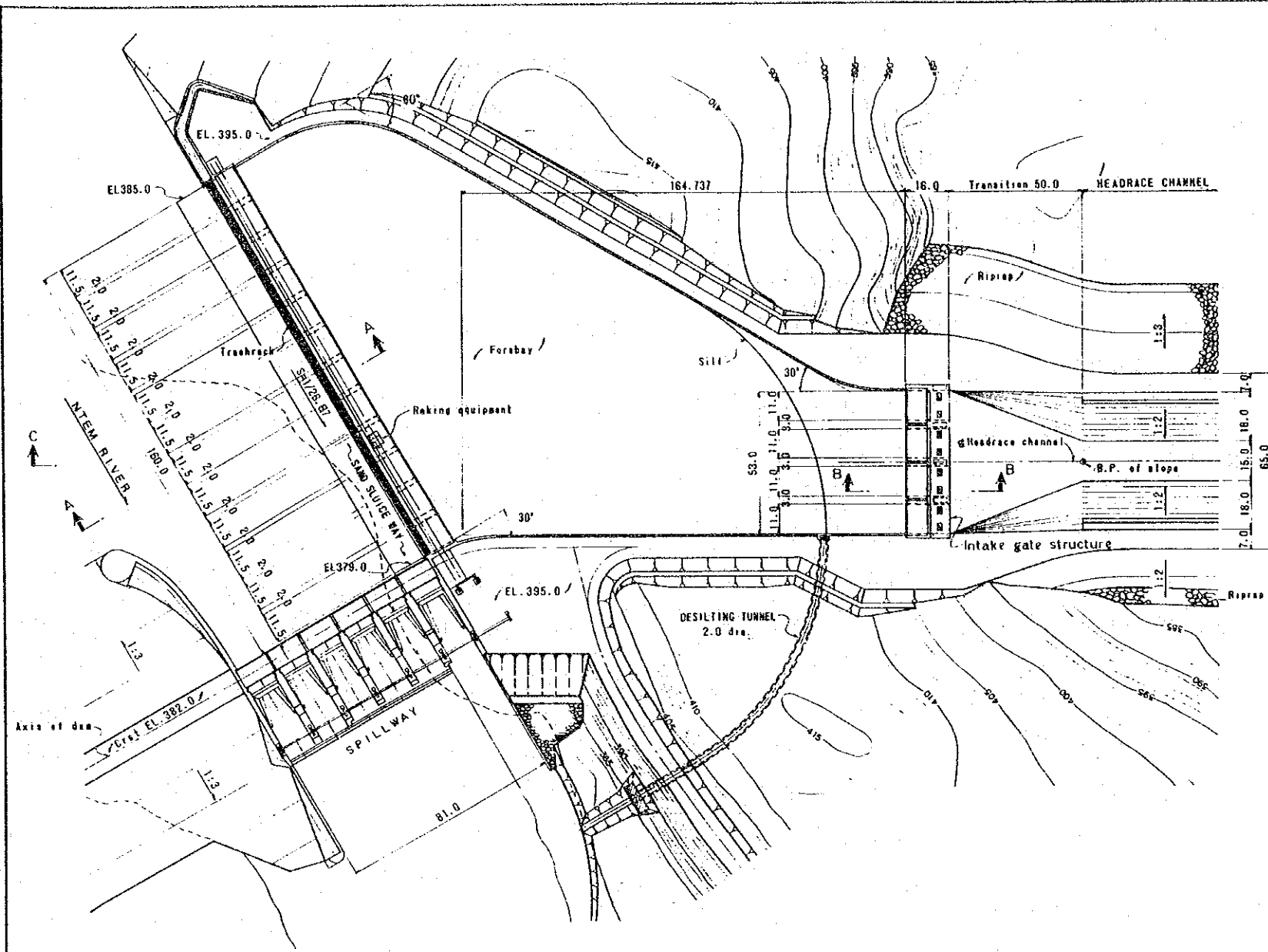


ORIGINAL GROUND HEIGHT (M)	398	397	403	412	400	388	387	385	383	381	377	395	401	398	391	381	378	351
FORMATION HEIGHT (M)	385.7	385.7	385.6	385.6	385.5	385.5	385.4											
ACCUMULATED DISTANCE (M)	1,400	1,600	1,800	2,000	2,200	2,400	2,600	2,800	3,000	3,200	3,400	3,600	3,800	4,000	4,200	4,400	4,600	4,800
DISTANCE (M)	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
STATION NO. (M)	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48

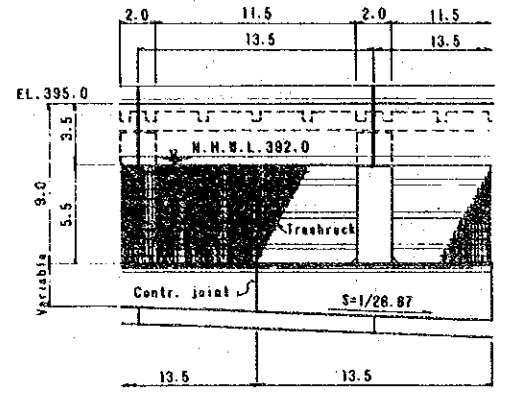
SCALE A 0 500 m

THE REPUBLIC OF CAMEROON  
 SOCIETE NATIONALE D'ELECTRICITE DU CAMEROUN  
 WATERWAY, PLAN AND PROFILE (2)

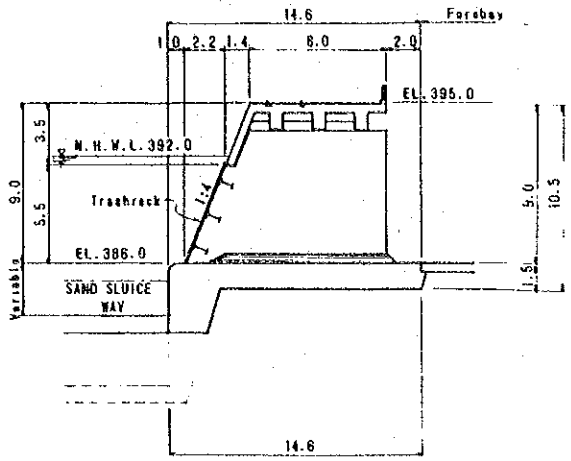
MEMVE ELE HYDROELECTRIC POWER  
 DEVELOPMENT PROJECT  
 DWG. NO. 013 JAPAN INTERNATIONAL COOPERATION AGENCY



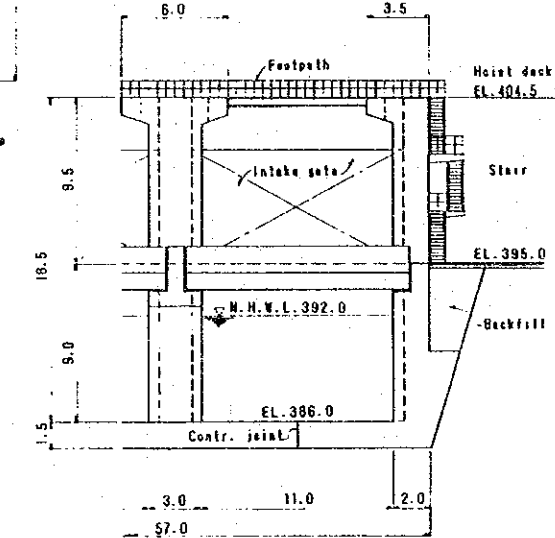
PLAN SCALE A



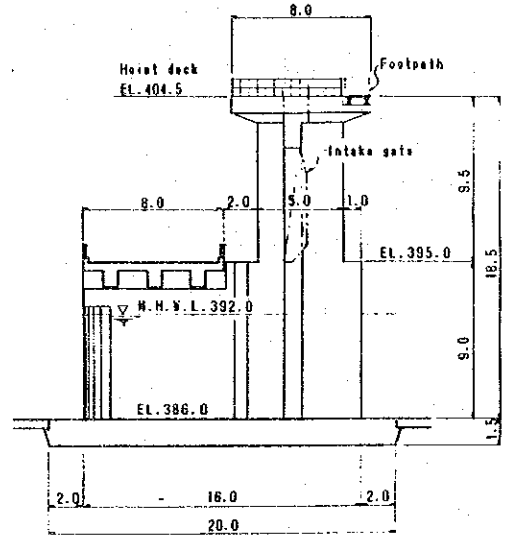
ELEVATION SCALE B



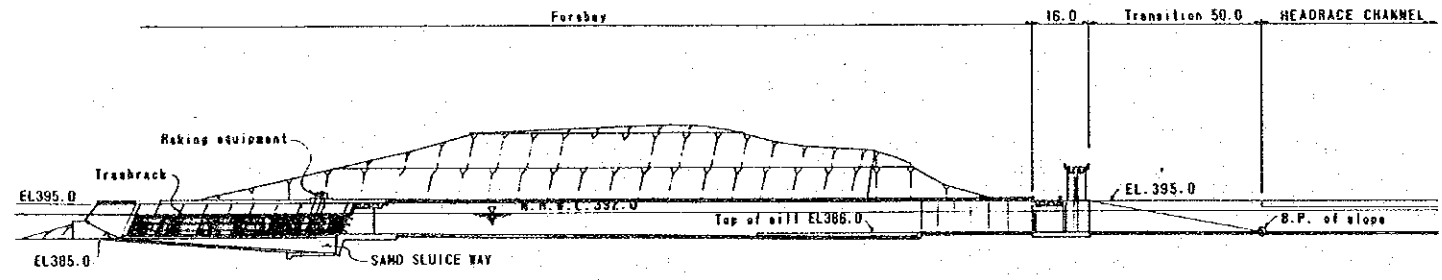
SECTION A-A SCALE B



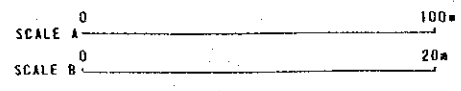
ELEVATION SCALE B



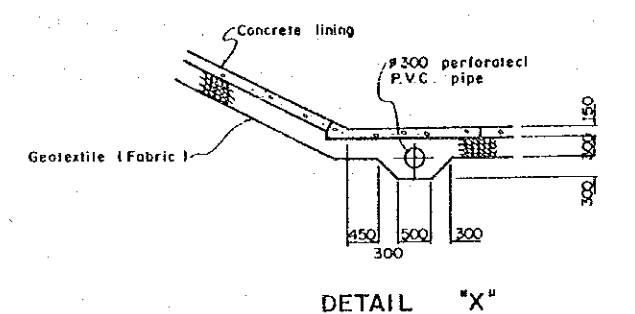
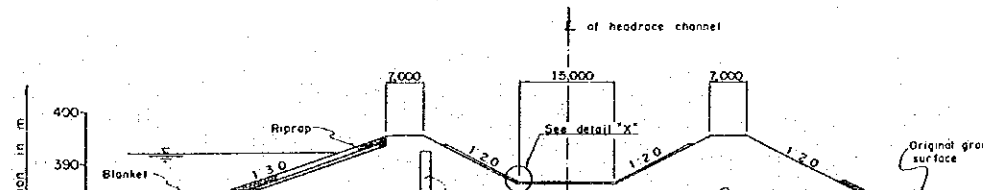
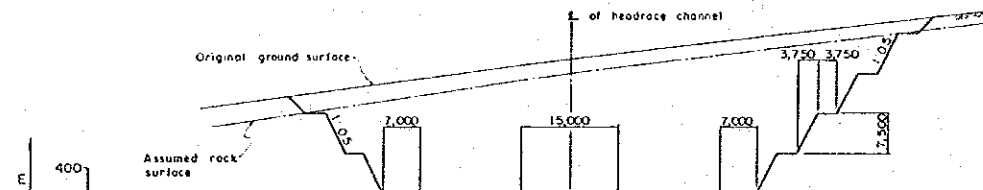
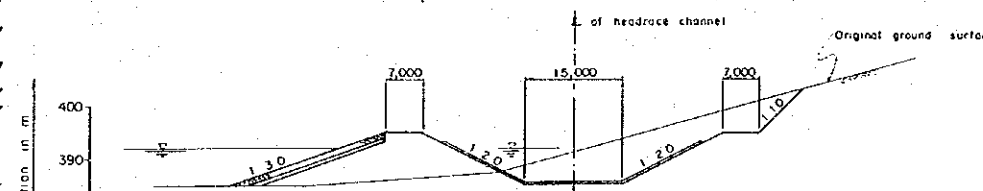
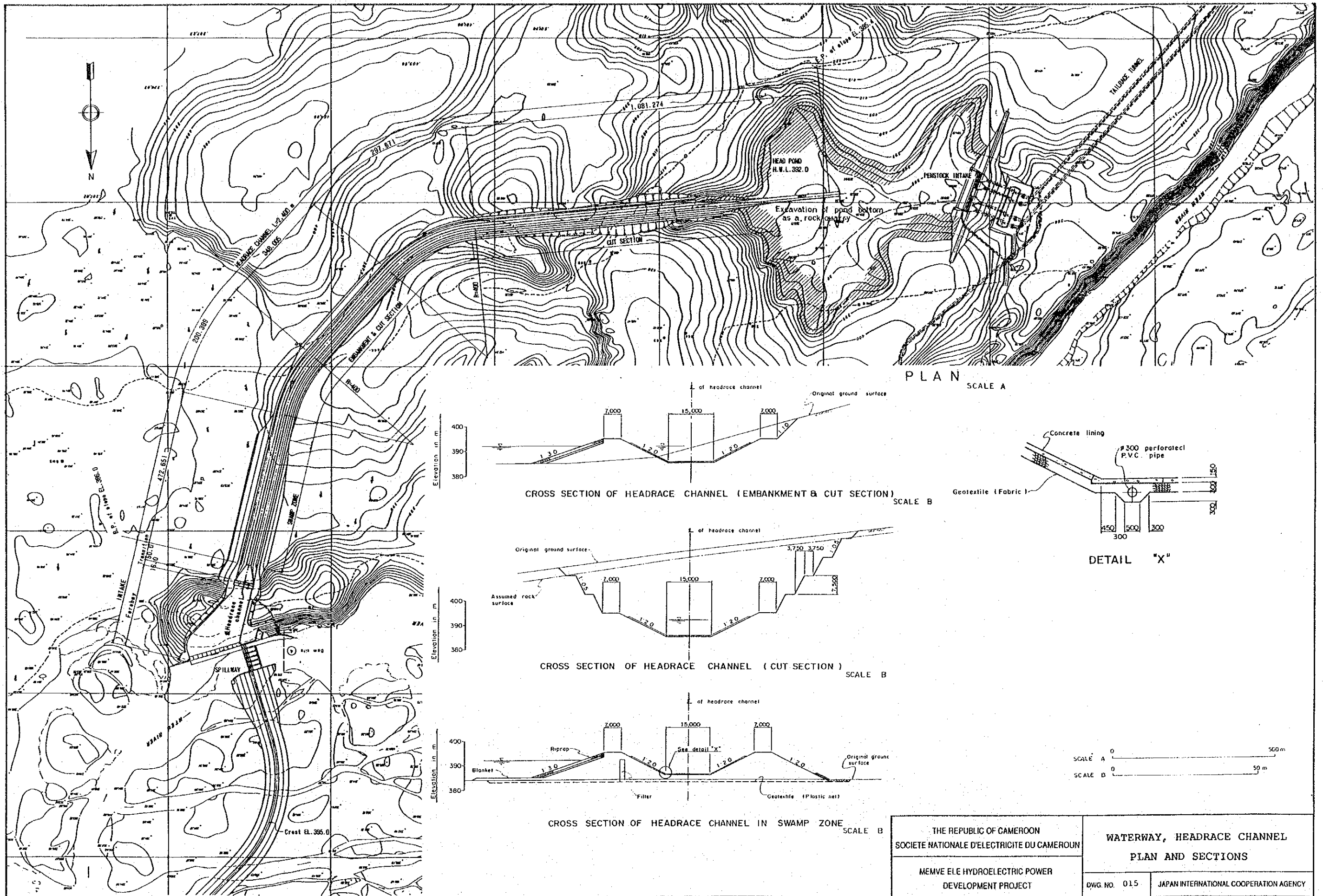
SECTION B-B SCALE B



PROFILE (SECTION C-C) SCALE A



THE REPUBLIC OF CAMEROON SOCIETE NATIONALE D'ELECTRICITE DU CAMEROUN	WATERWAY, INTAKE PLAN, PROFILE AND SECTIONS	
MEMVE ELE HYDROELECTRIC POWER DEVELOPMENT PROJECT	DWG. NO. 014	JAPAN INTERNATIONAL COOPERATION AGENCY



THE REPUBLIC OF CAMEROON SOCIÉTÉ NATIONALE D'ÉLECTRICITÉ DU CAMEROUN	WATERWAY, HEADRACE CHANNEL PLAN AND SECTIONS	
MEMVE ELE HYDROELECTRIC POWER DEVELOPMENT PROJECT	DWG. NO. 015	JAPAN INTERNATIONAL COOPERATION AGENCY