List of Figures

List of Tables

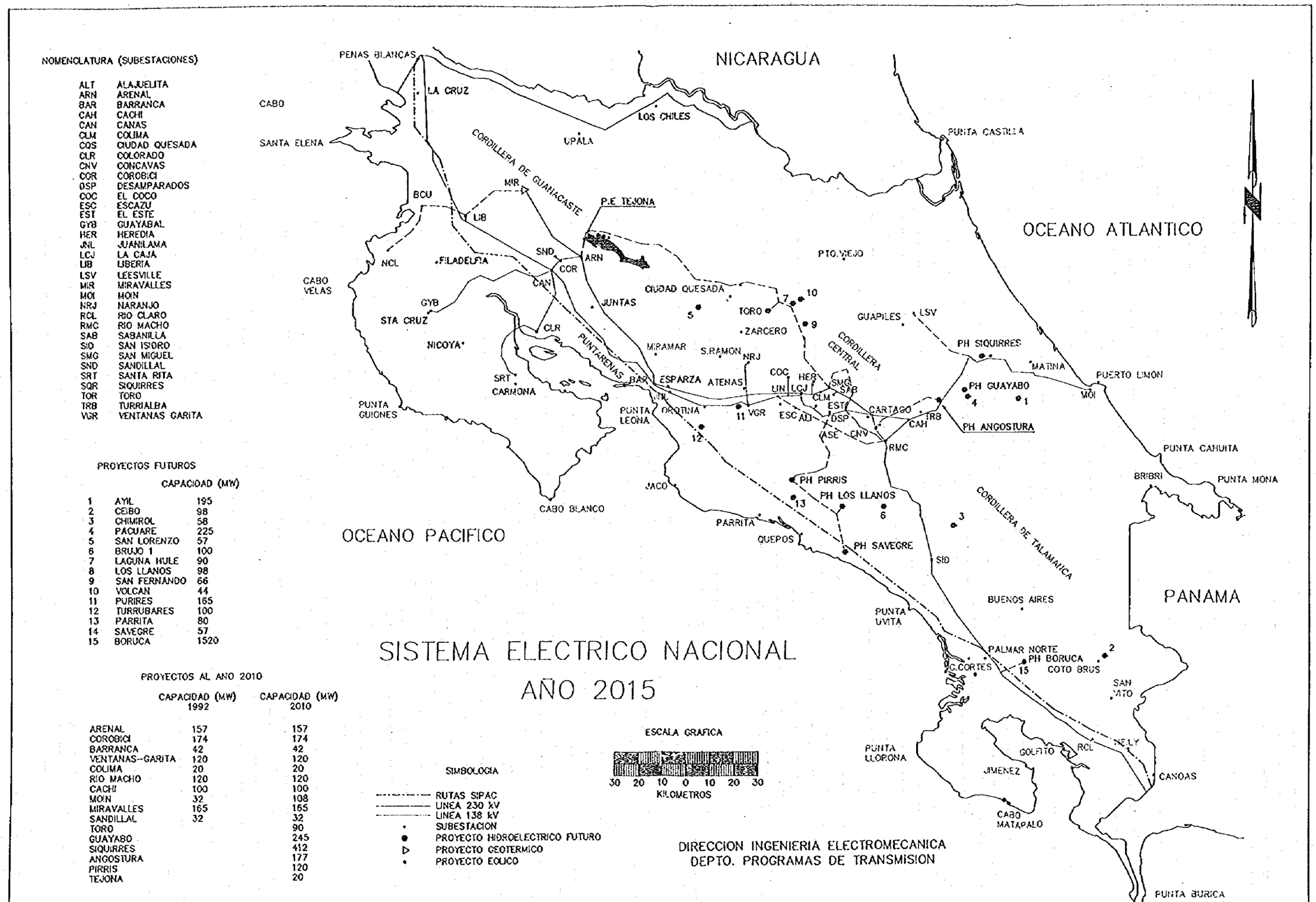


Fig. 4-2 Electric Power System in Costa Rica (2005)

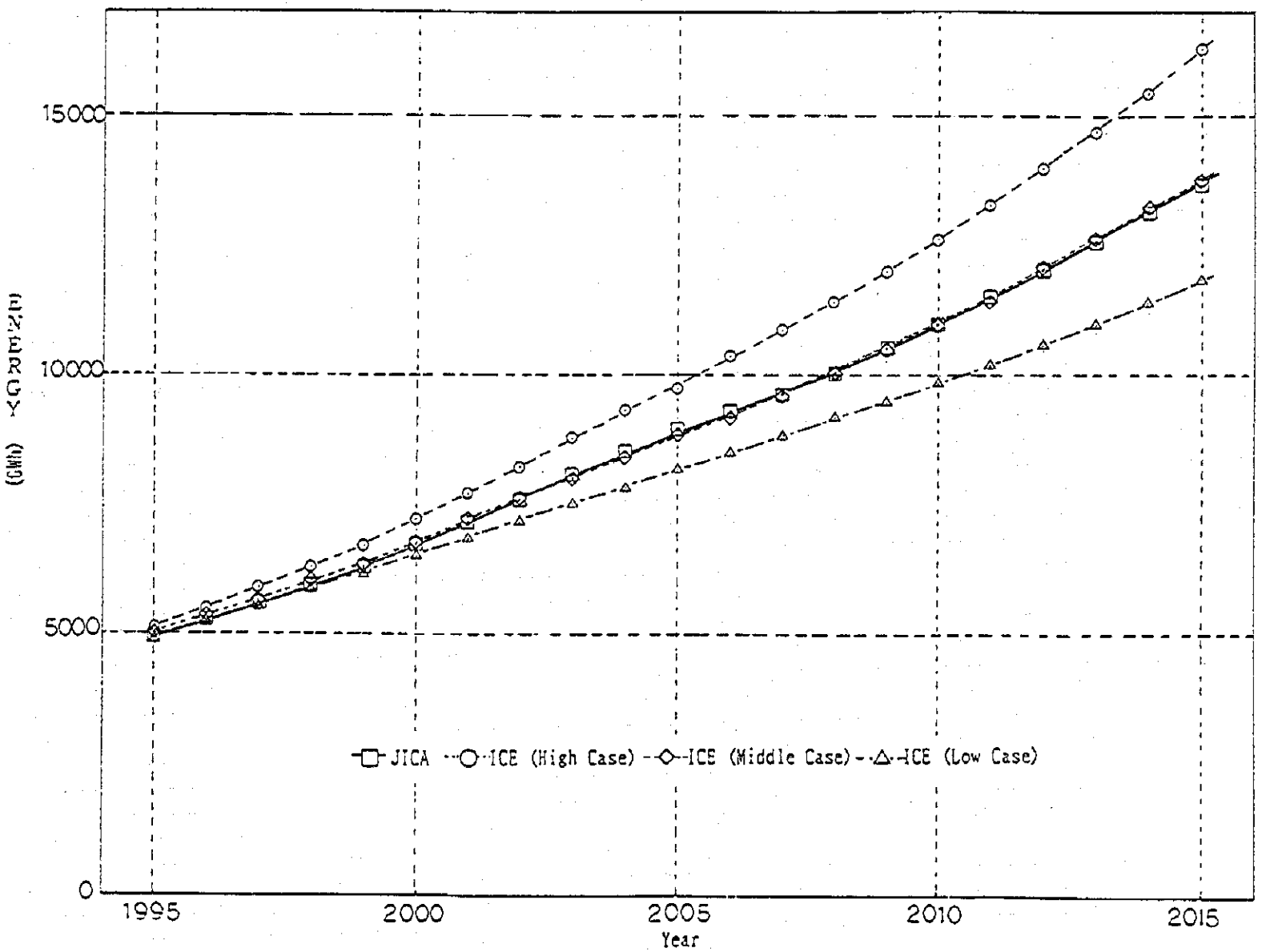
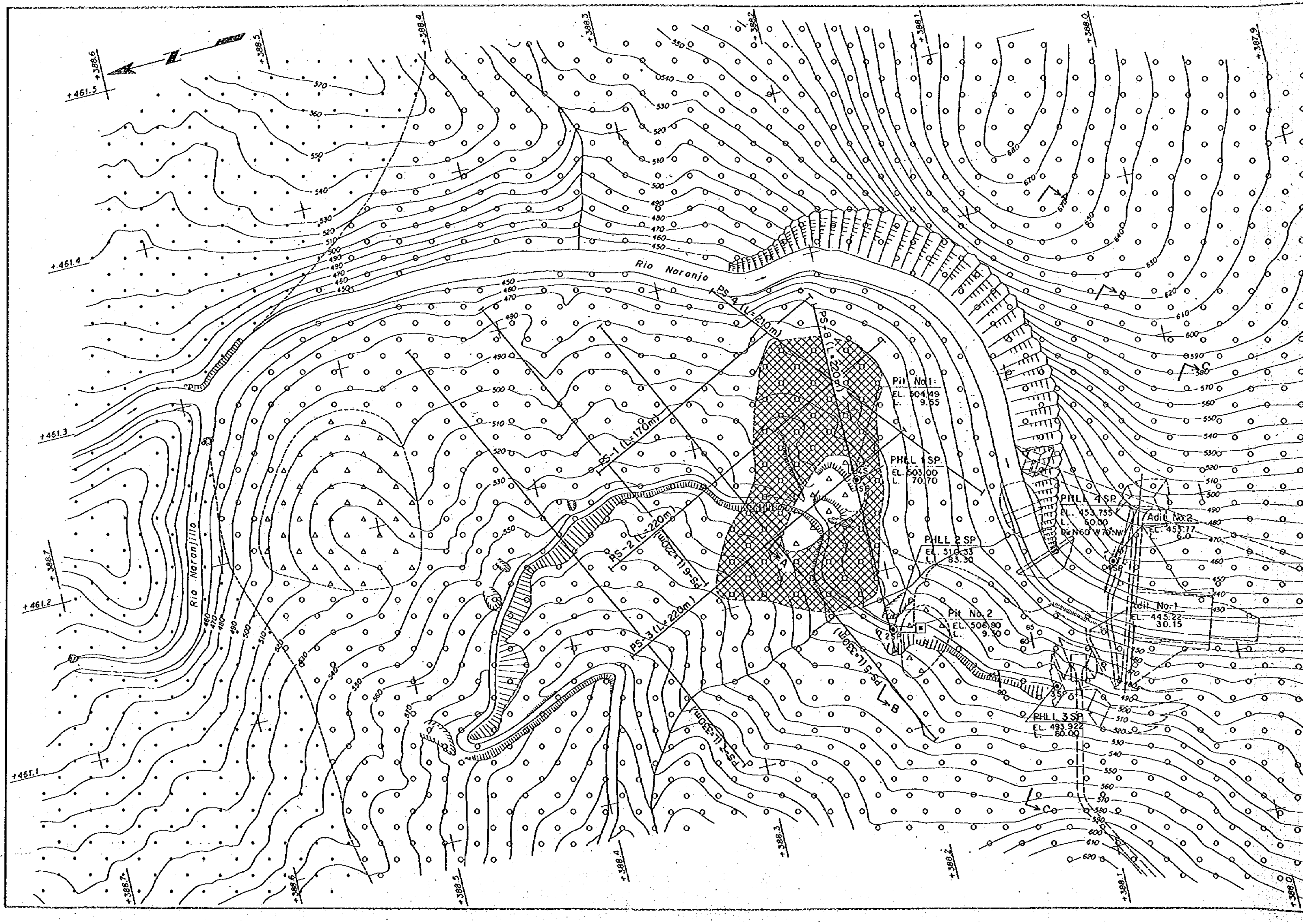
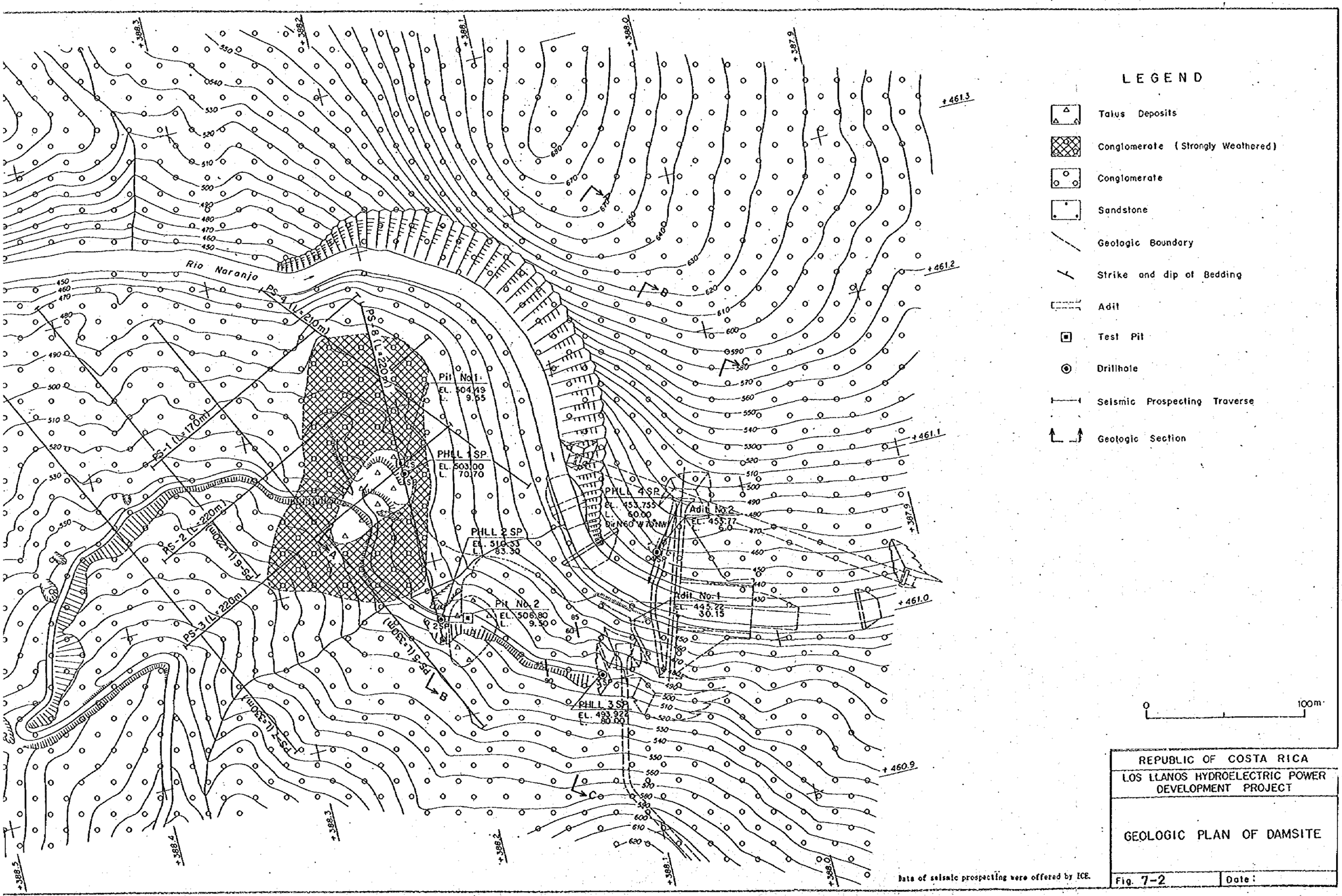


Fig. 5-4 Demand Forecast of Costa Rica 1995-2015



N
+388.6
+388.5
+388.4
+388.3
+388.2
+388.1
+388.0
+387.9
+461.5
+461.4
+461.3
+461.2
+461.1
+388.7
Rio Naranjo
Rio Naranjillo
PS-1 (L=170m)
PS-2 (L=220m)
PS-3 (L=220m)
PS-4 (L=210m)
PS-5 (L=330m)
PS-6 (L=220m)
PS-7 (L=330m)
PS-8 (L=320m)
Pit No.1
EL. 504.49
L. 9.55
PHLL 1 SP.
EL. 503.00
L. 70.70
PHLL 2 SP
EL. 510.33
L. 83.30
Pit No. 2
EL. 506.80
L. 9.30
PHLL 3 SP
EL. 493.922
L. 80.00
PHLL 4 SP
EL. 453.755
L. 60.00
Dir N60 W70 NW
Adit No. 2
EL. 453.77
L. 6.0
Adit No. 1
EL. 445.22
L. 30.15



LEGEND

- Talus Deposits
- Conglomerate (Strongly Weathered)
- Conglomerate
- Sandstone
- Geologic Boundary
- Strike and dip of Bedding
- Adit
- Test Pit
- Drillhole
- Seismic Prospecting Traverse
- Geologic Section

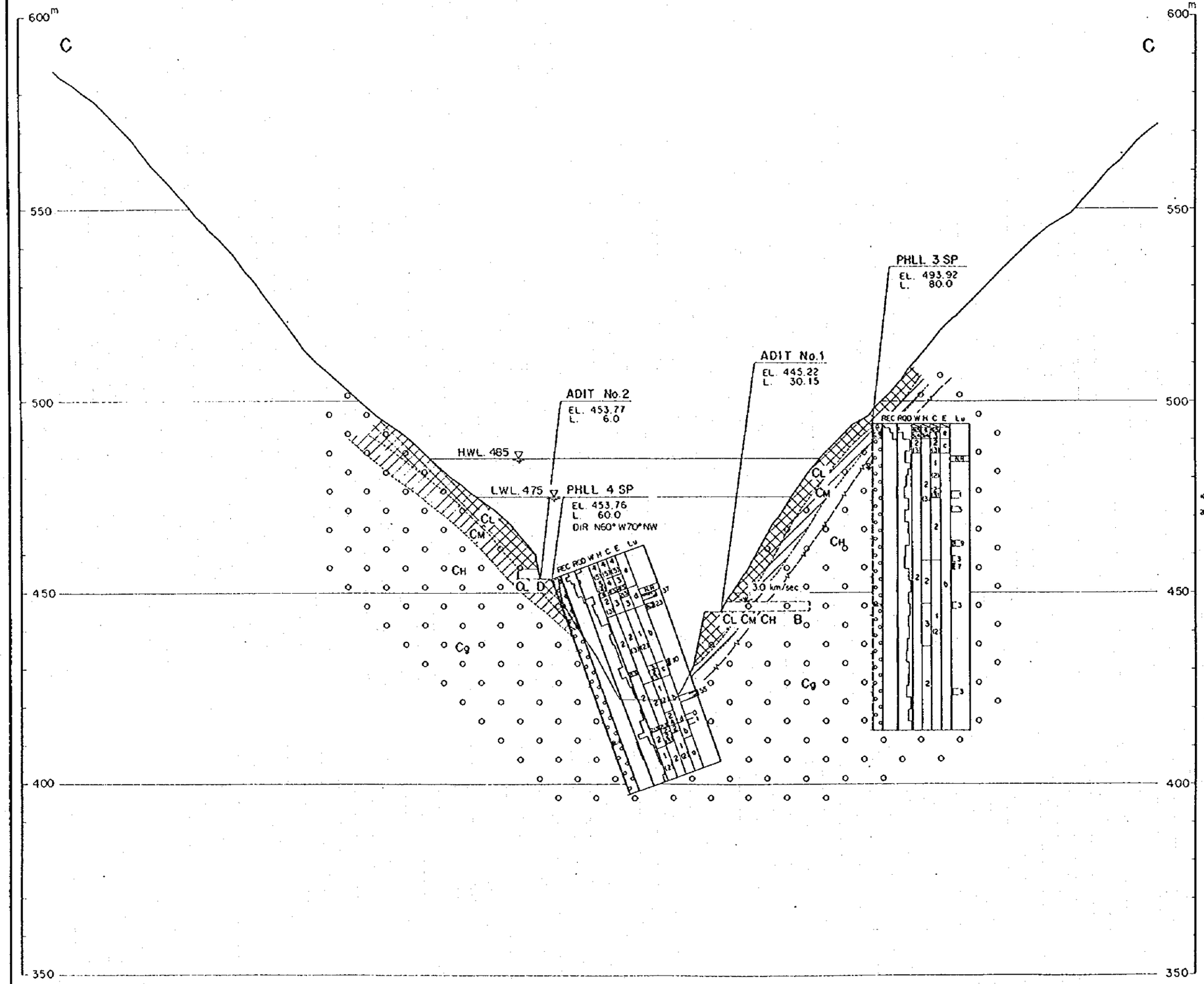
Data of seismic prospecting were offered by ICE.

REPUBLIC OF COSTA RICA

LOS LLANOS HYDROELECTRIC POWER DEVELOPMENT PROJECT

GEOLOGIC PLAN OF DAMSITE

Fig. 7-2 | Date :



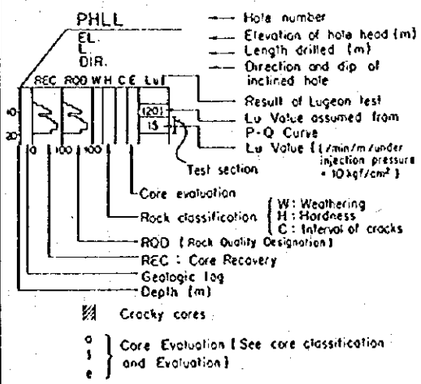
LEGEND

- Cg — Conglomerate
- Geologic boundary
- Boundary of rock mass classification
- Ground water level
- Adit No. / EL. / L. — EL.: Elevation (m), L.: Length (m)

(Rock Mass Classification)

- CH — Somewhat cracky but not loosened rocks
- CM — Somewhat cracky and slighty loosened rocks
- CL — Cracky and loosened rocks due to weathering and/or creeping
- D — Soft or brittle rocks due to weathering or shearing

(Drillhole Log)



0 — 50m

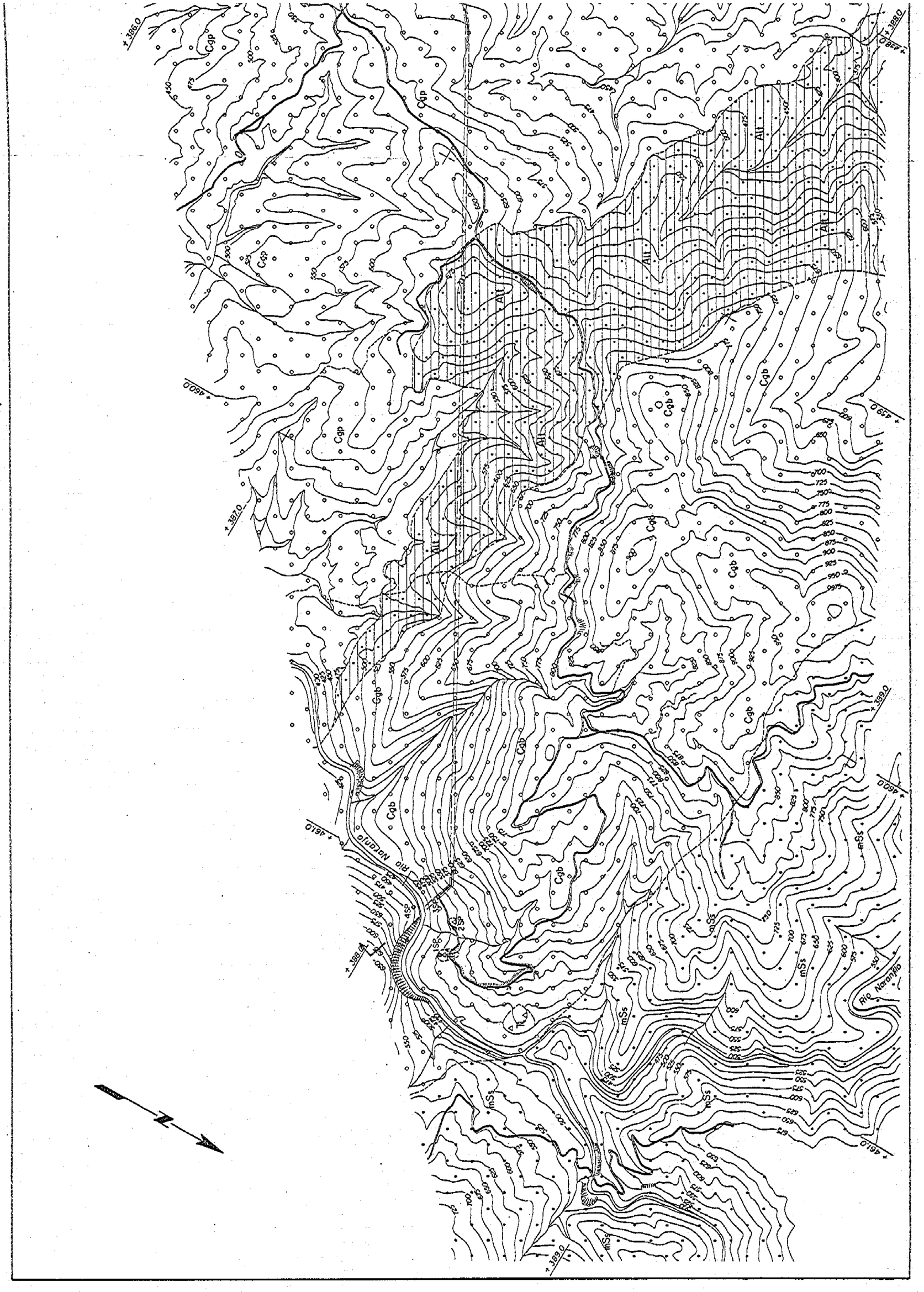
REPUBLIC OF COSTA RICA

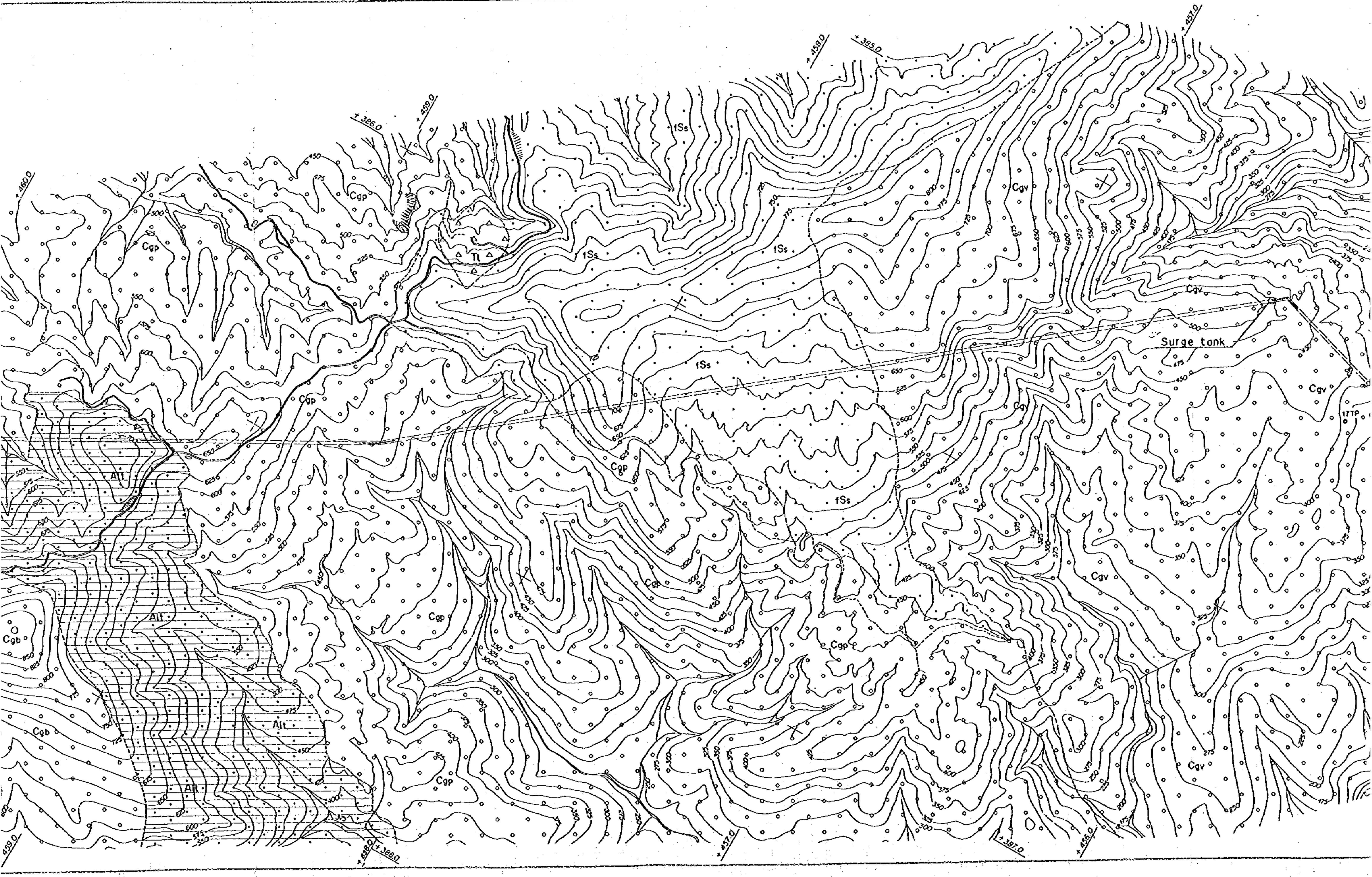
LOS LLANOS HYDROELECTRIC POWER DEVELOPMENT PROJECT

GEOLOGIC SECTION OF DOWN-STREAM DAM SITE

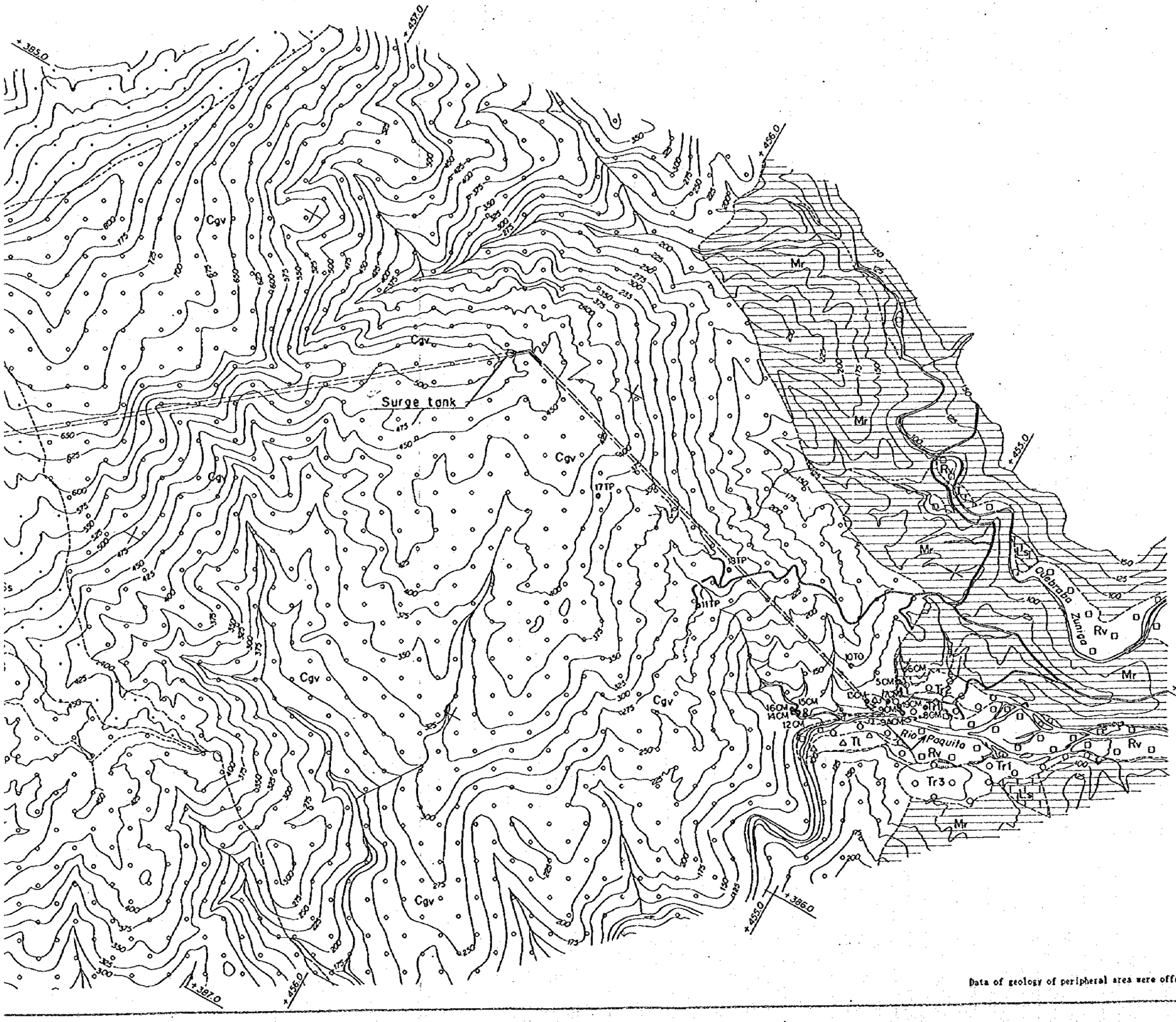
Fig. 7-5 | Date :

5-24


Cgb
Cgp
Alt
mSs
Río Nacaolo
Río Naranjito
+ 389.0
+ 460.0
+ 438.0



+ 460.0
+ 386.0
+ 459.0
+ 458.0
+ 385.0
+ 457.0
Surge tonk
Cgp
Tl
fSs
Cgv
Alt
Cgb
17TP
+ 459.0
+ 638.0
+ 388.0
+ 457.0
+ 387.0
+ 456.0



LEGEND

- Rv — Riverbed Deposits
- Tl — Talus Deposits
- Tr1 — Terrace Deposits (Lower)
- Tr2 — Terrace Deposits (Middle)
- Tr3 — Terrace Deposits (Upper)
- mSs — Sandstone (Medium)
- Cgb — Conglomerate (Boulder)
- Alt — Alternation of Sandstone and Siltstone
- Cgp — Conglomerate (Pebble)
- fSs — Sandstone (Fine)
- Cgv — Conglomerate (Volcanic)
- Mr — Mudstone (Marl)
- Ls — Limestone
- Geologic boundary
- Strike and dip of bedding
- Fault
- Geologic Section

0 — 500m

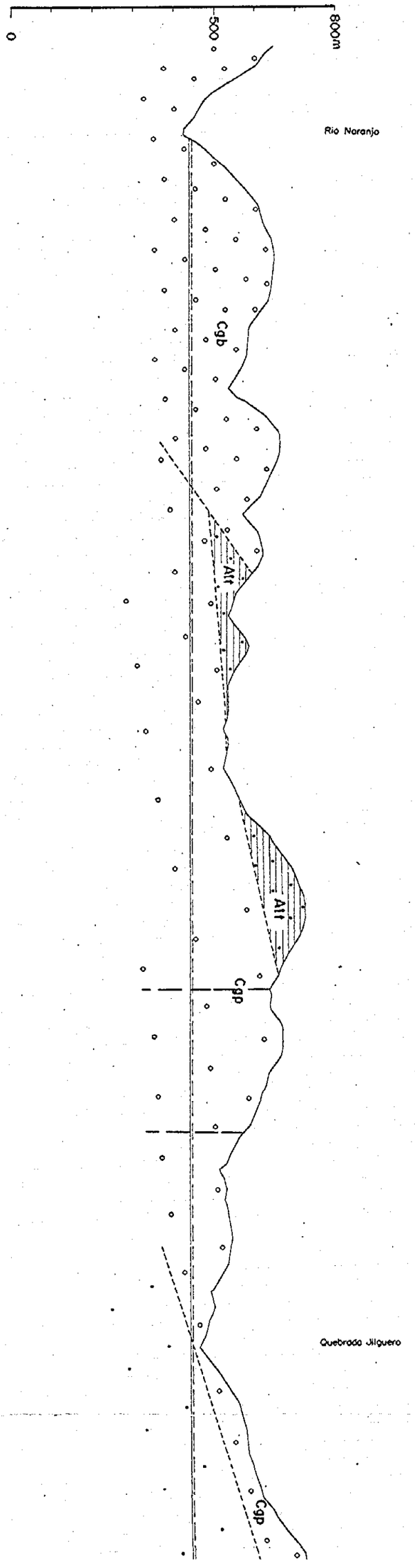
Data of geology of peripheral area were offered by ICE.

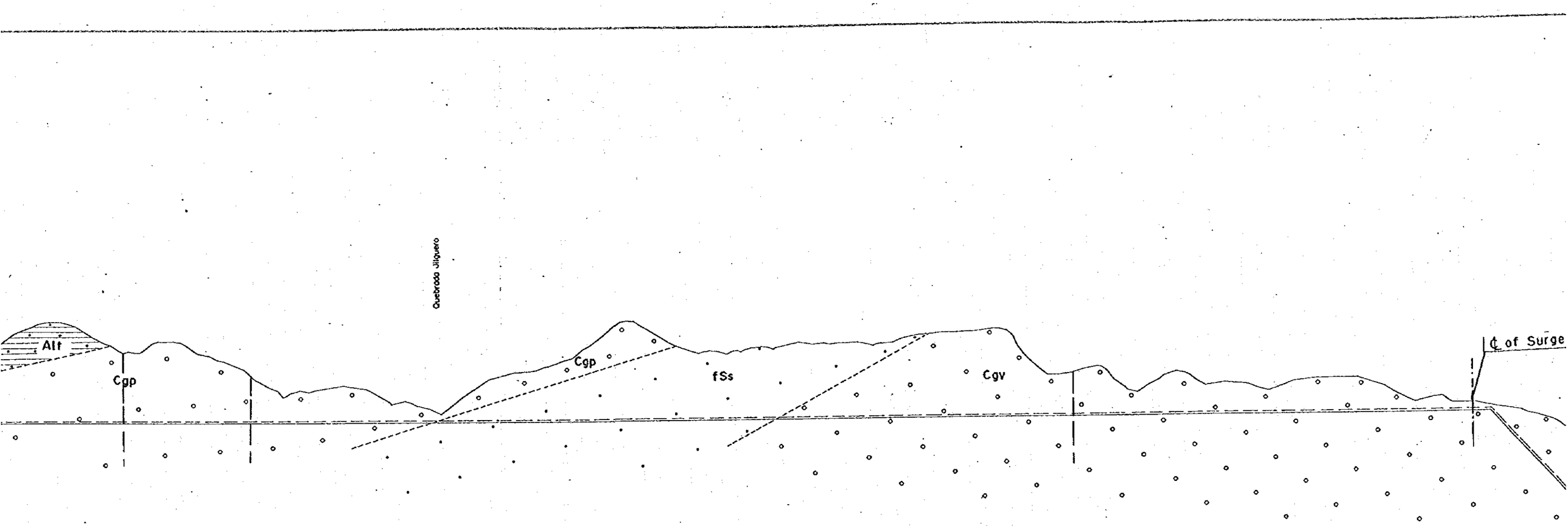
REPUBLIC OF COSTA RICA

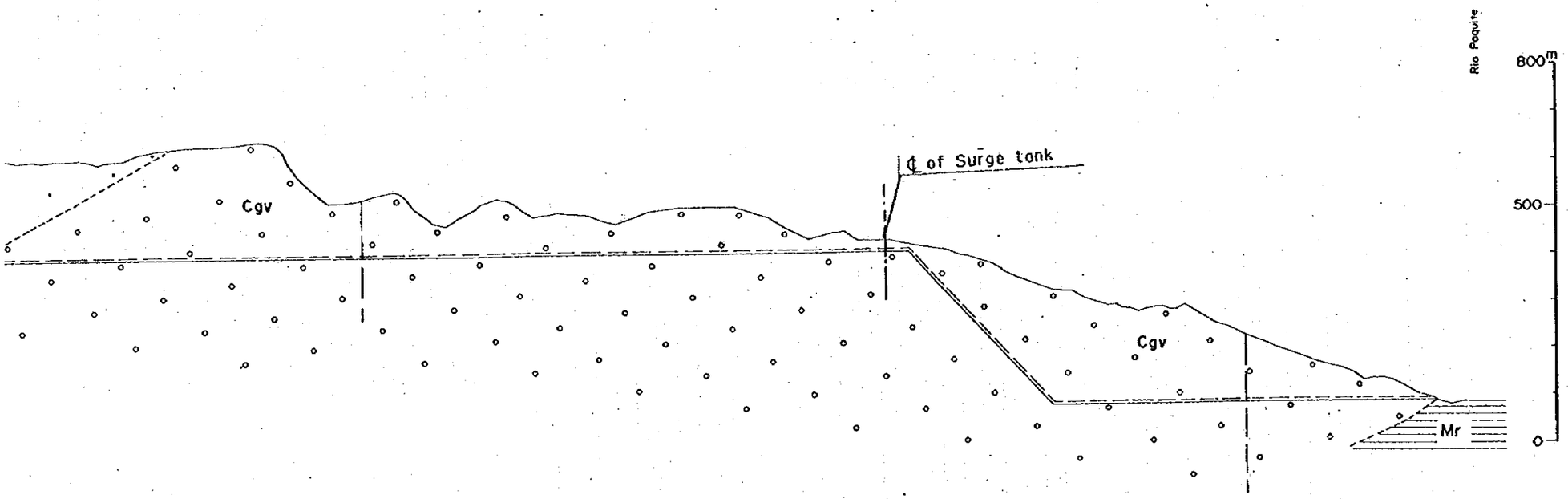
LOS LLANOS HYDROELECTRIC POWER DEVELOPMENT PROJECT

GEOLOGIC PLAN OF WATERWAY ALIGNMENT ROUTE

Fig. 7-8 | Date :


0
500
800m
Rio Naranjo
Cgb
Alt
Alt
Cgp
Cgp
Quebrada Jilguero


Quebrada Jilguero
Alf
Cgp
Cgp
fSs
Cgv
℄ of Surge



LEGEND

- Rv — Riverbed Deposits
- Tl — Talus Deposits
- Trl — Terrace Deposits (Lower)
- Cgb — Conglomerate (Boulder)
- Alt — Alternation of Sandstone and Siltstone
- Cgp — Conglomerate (Pebble)
- fSs — Sandstone (Fine)
- Cgv — Conglomerate (Volcanic)
- Mr — Mudstone (Marl)
- Geologic boundary
- Lineament by aero-photo interpretation

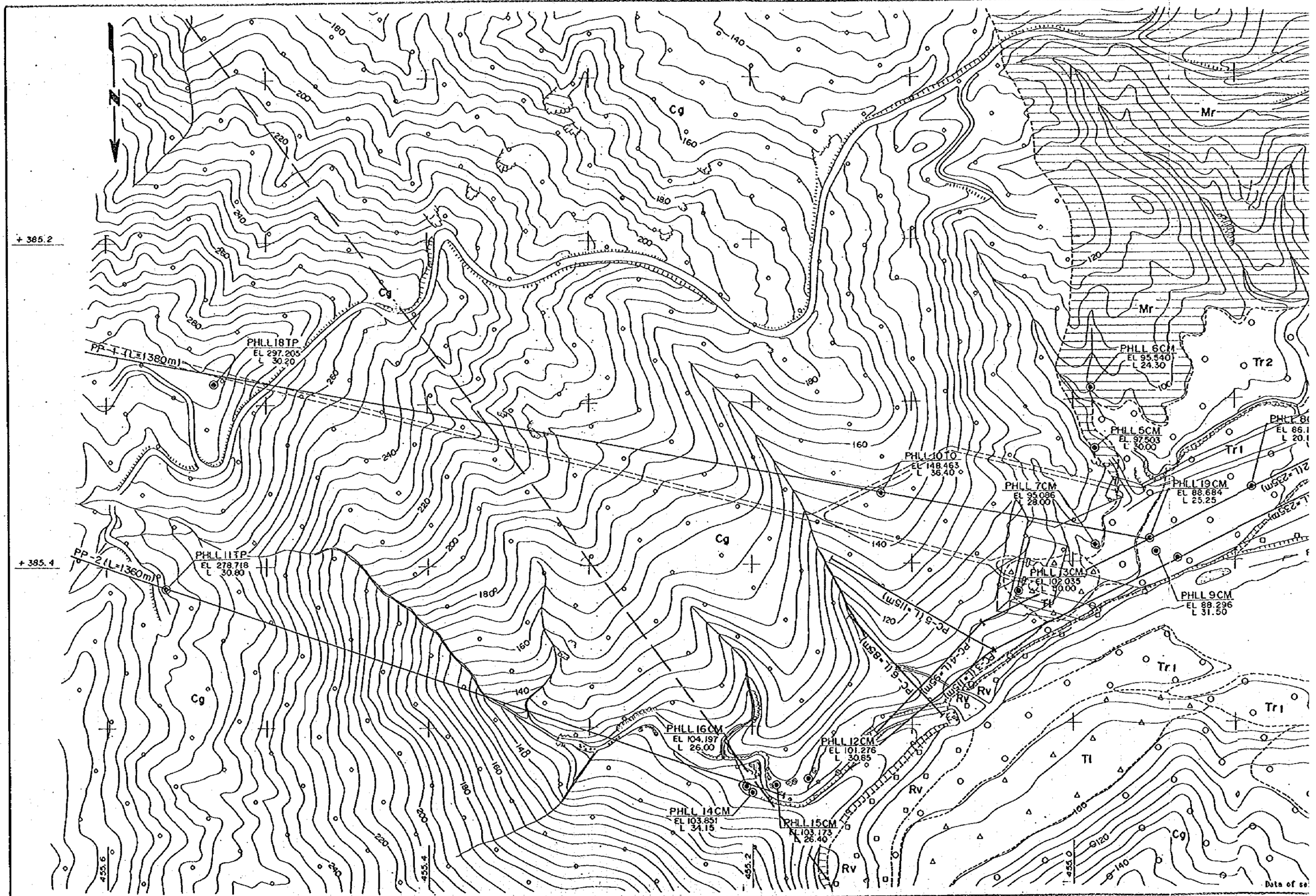
0 500m

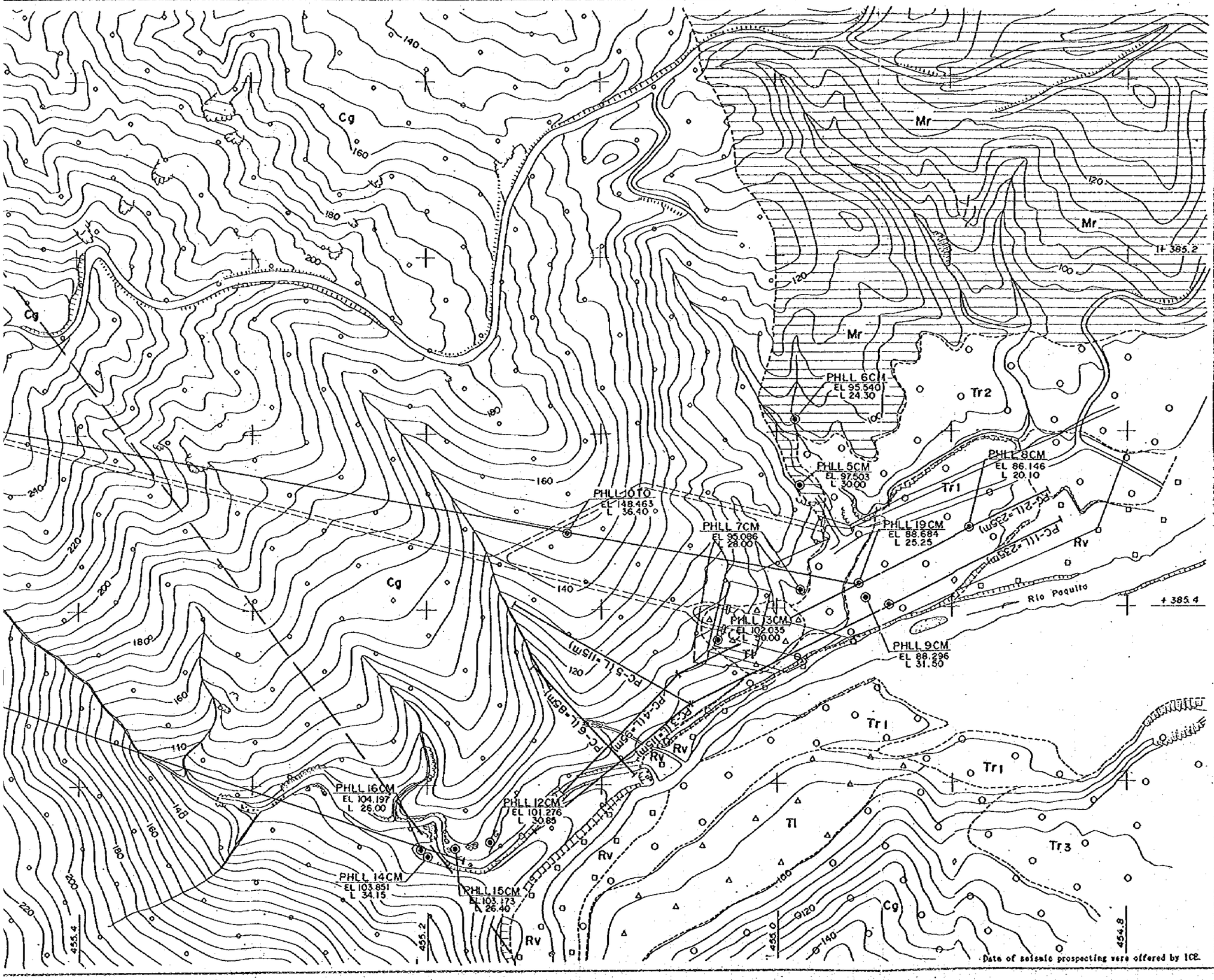
REPUBLIC OF COSTA RICA

LOS LLANOS HYDROELECTRIC POWER DEVELOPMENT PROJECT

GEOLOGIC SECTION
ALONG
HEADRACE TUNNEL ROUTE

Fig. 7-9 | Date:


+ 365.2
+ 385.4
PP-1 (L=1380m)
PP-2 (L=1360m)
PHLL 18TP
EL 297.205
L 30.20
PHLL 11TP
EL 278.718
L 30.80
PHLL 10TO
EL 148.463
L 36.40
PHLL 7CM
EL 95.086
L 28.00
PHLL 6CM
EL 95.540
L 24.30
PHLL 5CM
EL 97.503
L 30.00
PHLL 19CM
EL 88.684
L 25.25
PHLL 13CM
EL 102.035
L 30.00
PHLL 9CM
EL 88.296
L 31.50
PHLL 16CM
EL 104.197
L 26.00
PHLL 12CM
EL 101.276
L 30.85
PHLL 14CM
EL 103.851
L 34.15
PHLL 15CM
EL 103.173
L 26.40
PC-5 (L=115m)
PC-6 (L=85m)
PC-4 (L=95m)
PC-3 (L=115m)
Cg
Mr
Tr1
Tr2
Tl
Rv
455.6
455.4
455.2
455.0
Data of se



LEGEND

- Rv — Riverbed Deposits
- Tl — Talus Deposits
- Tr1 — Terrace Deposits (Lower)
- Tr2 — Terrace Deposits (Middle)
- Tr3 — Terrace Deposits (Upper)
- Cg — Conglomerate
- Mr — Mudstone (Marl)
- Geologic boundary
- Lineament by aero-photo interpretation
- Strike and dip of bedding
- Drillhole
- Seismic Prospecting Traverse
- Geologic Section

Data of seismic prospecting were offered by ICE.

REPUBLIC OF COSTA RICA

LOS LLANOS HYDROELECTRIC POWER DEVELOPMENT PROJECT

GEOLOGIC PLAN OF PENSTOCK ROUTE AND POWER STATION SITE

Fig. 7-10. | Date:

B

E

PHLL 18 TP
EL. 297.205
L. 30.20

REC ROD W H C E

300 m

200

100

0

Cg-a

Cg-b

Cg-c

Cg-d

PHLL 13 CM
EL. 102.035
L. 50.00

REC ROD W H C E

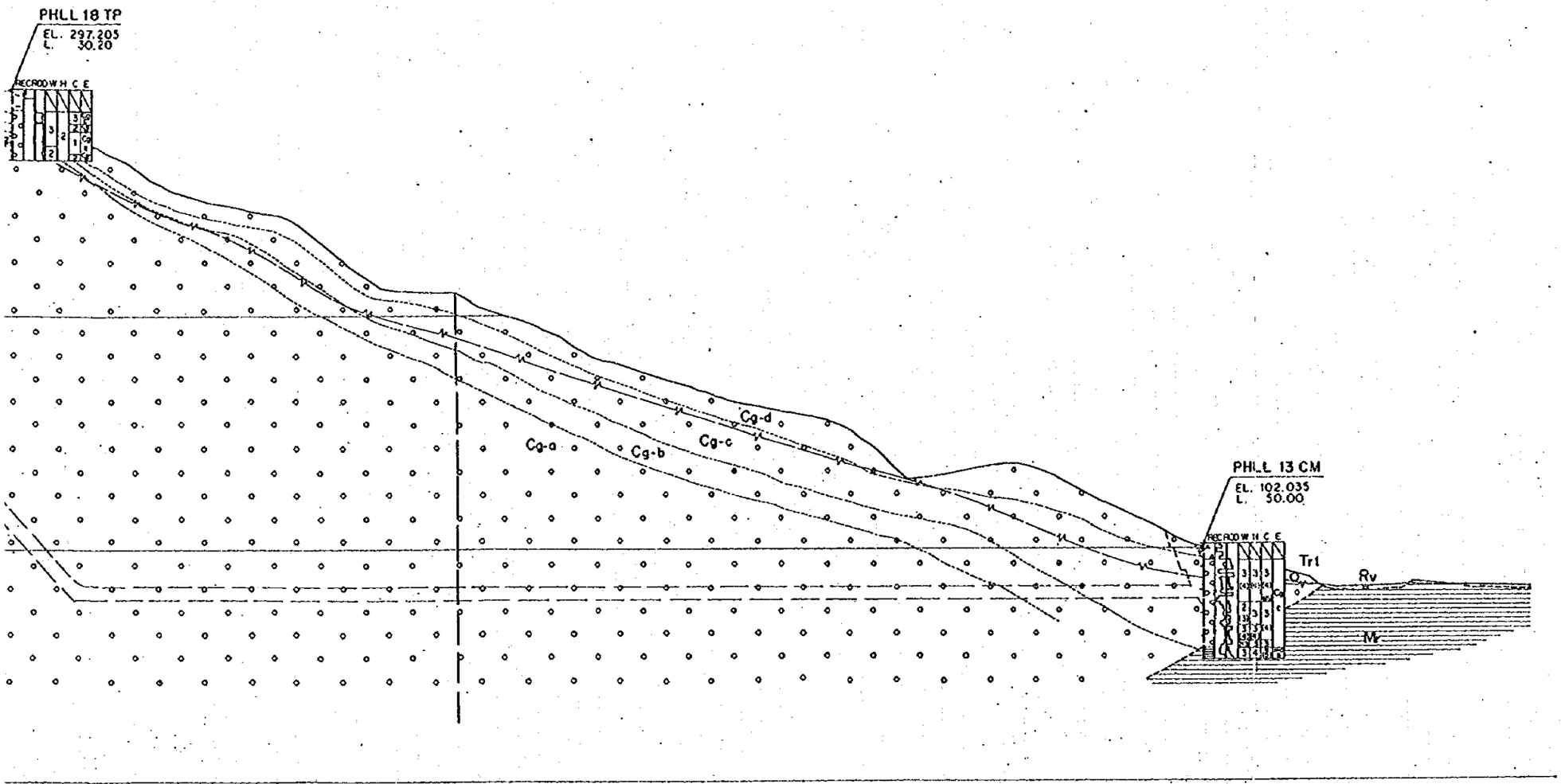
Tr1

Rv

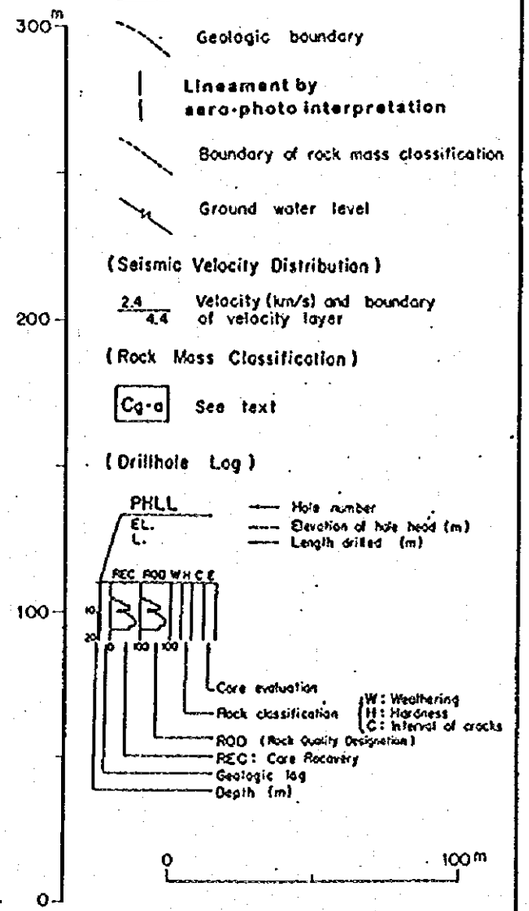
Mr

: Data of drillhole(REC and RQD) were offered by

B-N



B



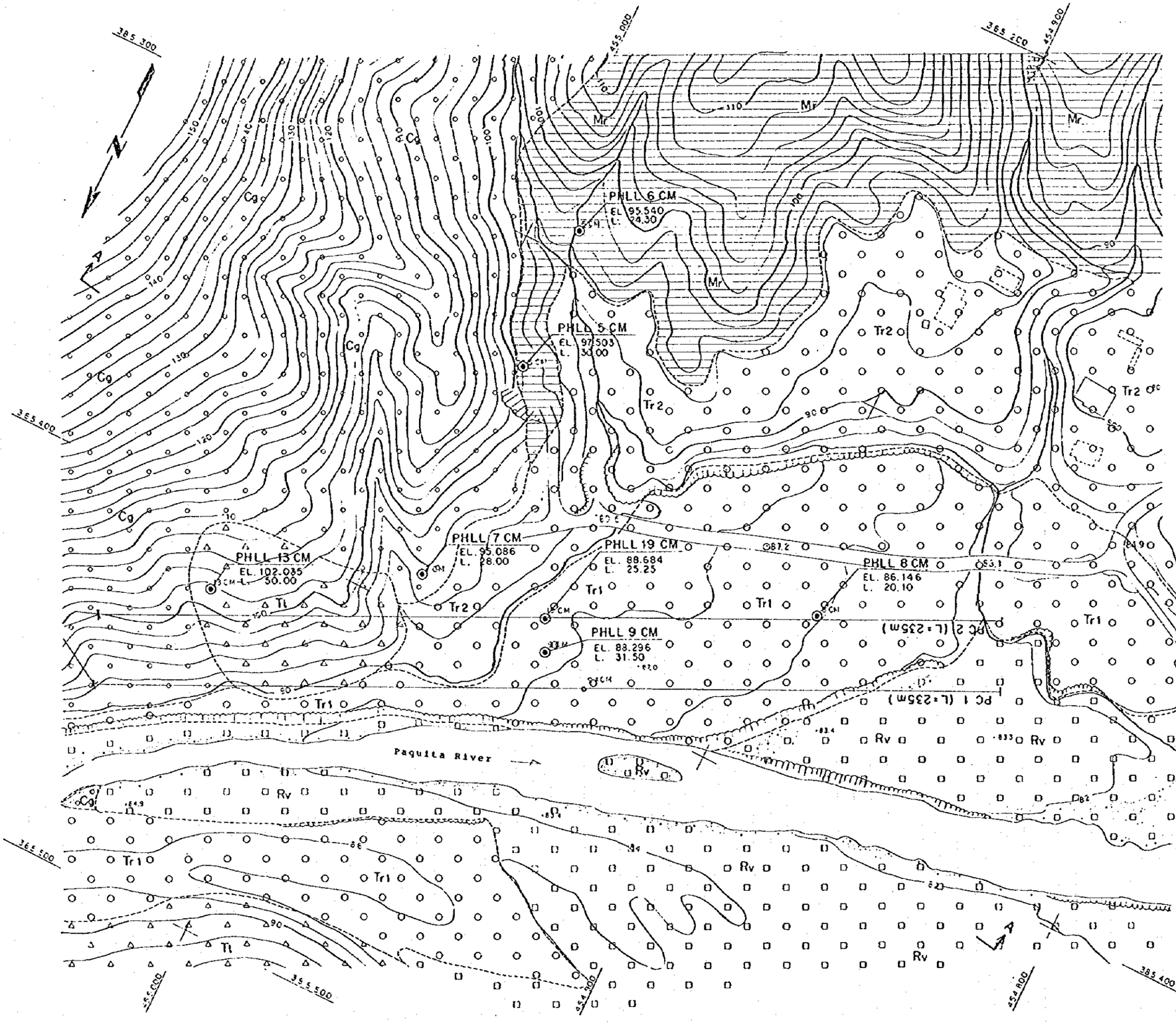
: Data of drillhole(REC and RQD) were offered by ICE.

REPUBLIC OF COSTA RICA

LOS LLANOS HYDROELECTRIC POWER DEVELOPMENT PROJECT

GEOLOGIC SECTION OF PENSTOCK ROUTE (SECTION B - B)

Fig. 7-12 | Date :



LEGEND

- Rv — Riverbed Deposits
- Tl — Talus Deposits
- Tr1 — Terrace Deposits (Lower)
- Tr2 — Terrace Deposits (Middle)
- Cg — Conglomerate
- Mr — Mudstone (Marl)
- Geologic boundary
- Strike and dip of bedding
- Drillhole
- Seismic Prospecting Traverse
- Geologic Section

Data of seissic prospecting were offered by ICE.

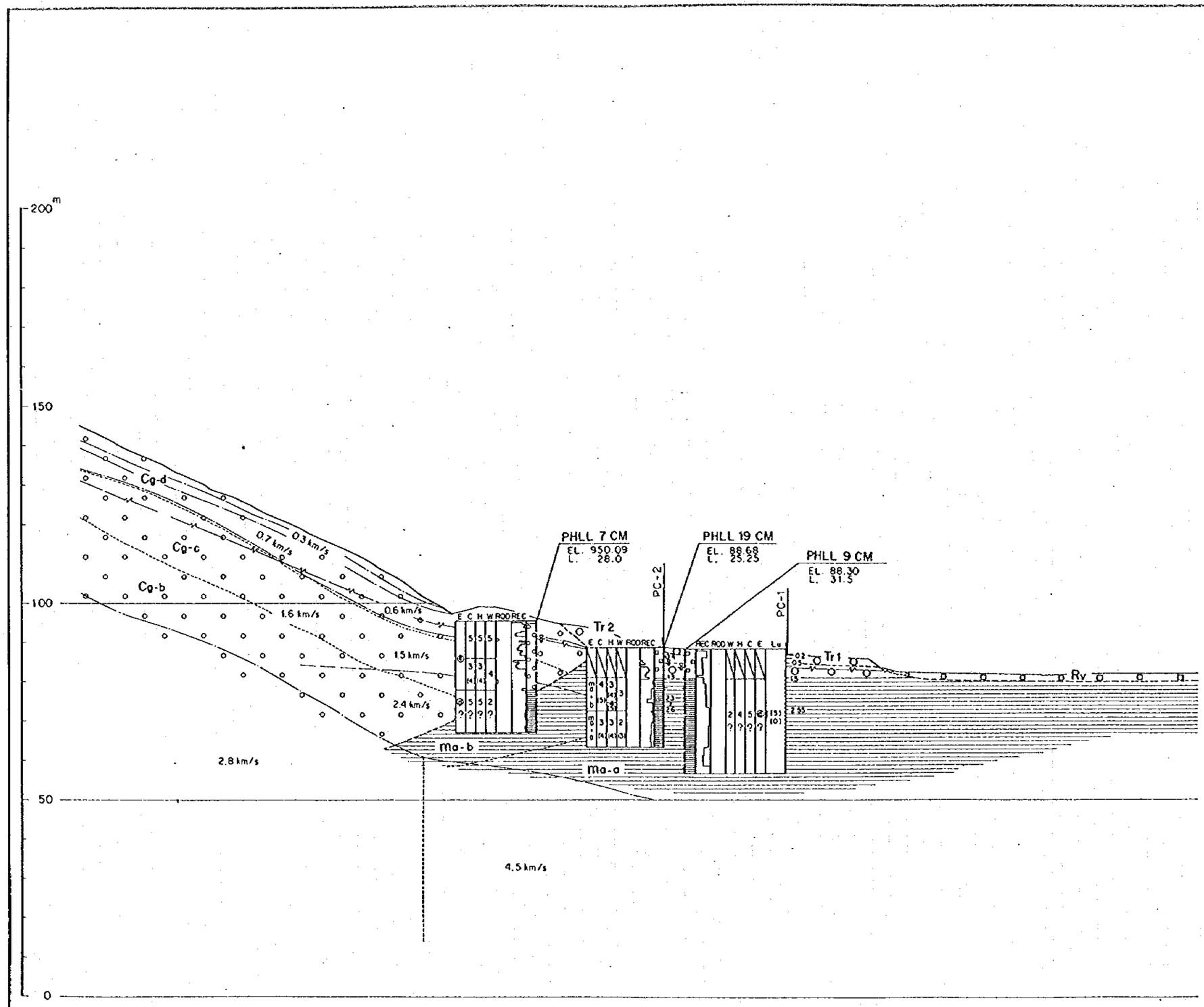
REPUBLIC OF COSTA RICA

LOS LLANOS HYDROELECTRIC POWER DEVELOPMENT PROJECT

GEOLOGIC PLAN OF POWER STATION SITE

Fig. 7-13

Los Llanos Power Plant Site



LEGEND

- Rv — Riverbed Deposits
- Tr1 — Terrace Deposits (Lower)
- Tr2 — Terrace Deposits (Middle)
- Cg — Conglomerate
- Mr — Mudstone (Marl)
- Geologic boundary
- Boundary of rock mass classification
- Ground water level

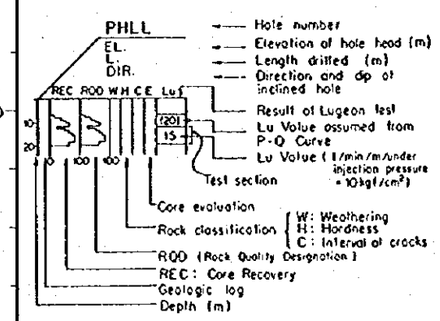
(Seismic Velocity Distribution)

- 2.4 / 4.4 — Velocity (km/s) and boundary of velocity layer

(Rock Mass Classification)

- Ma-a — See text

(Drillhole Log)



0 — 50m

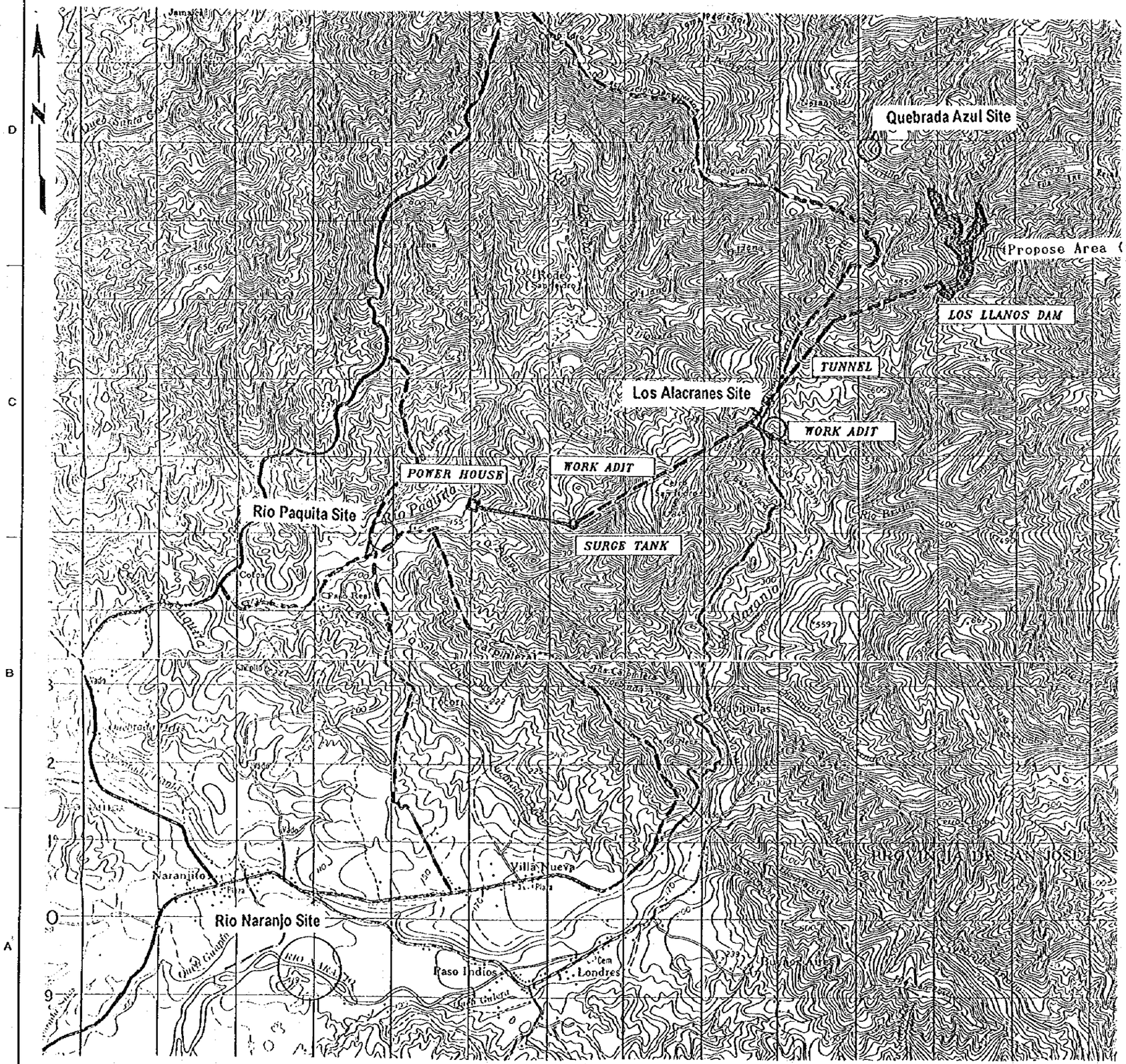
Data of drillhole (REC and RQD) were offered by ICE.

REPUBLIC OF COSTA RICA

LOS LLANOS HYDROELECTRIC POWER DEVELOPMENT PROJECT

GEOLOGIC SECTION OF POWER STATION SITE (section A-A)

Fig. 7-14 | Date :

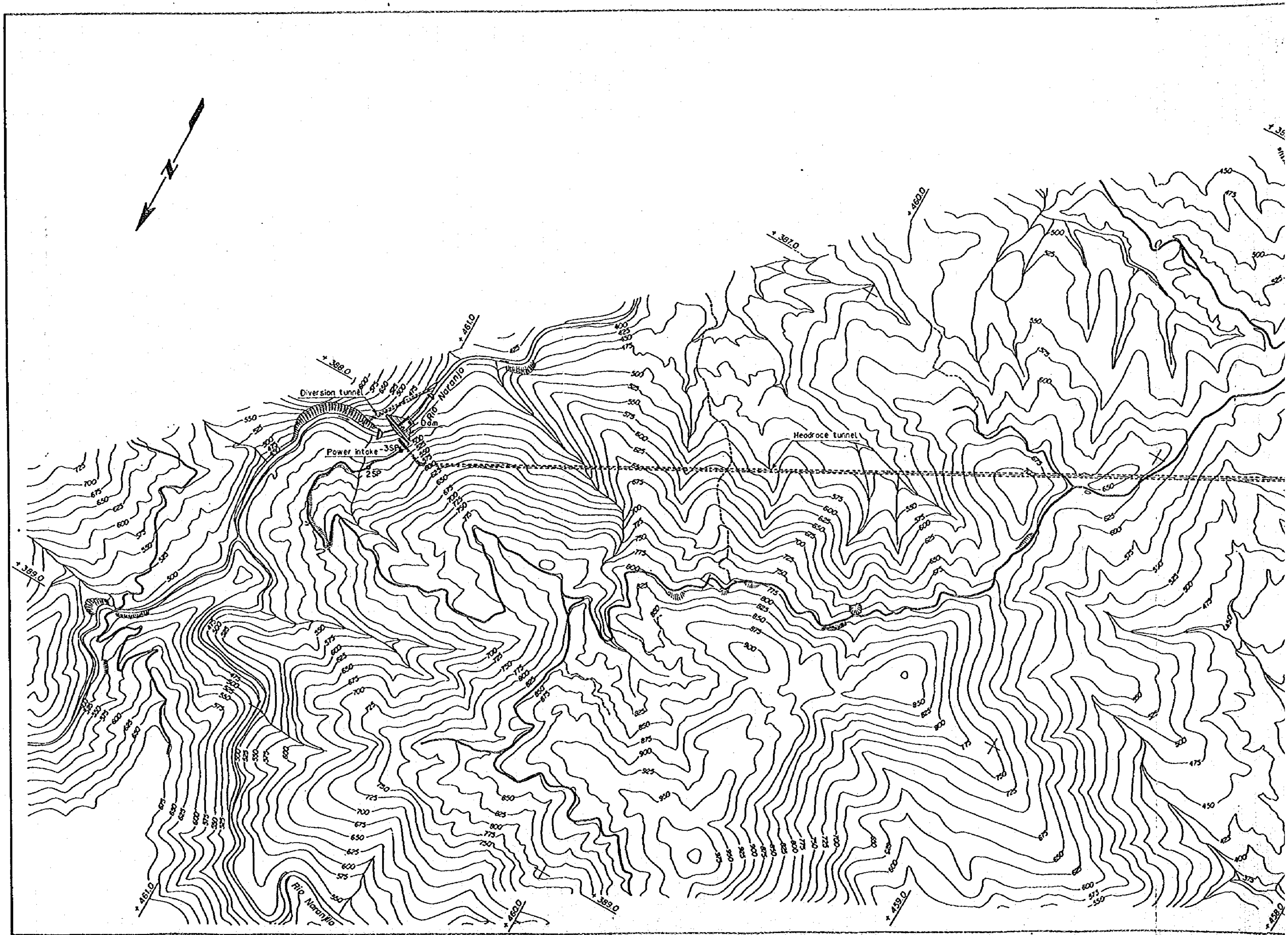


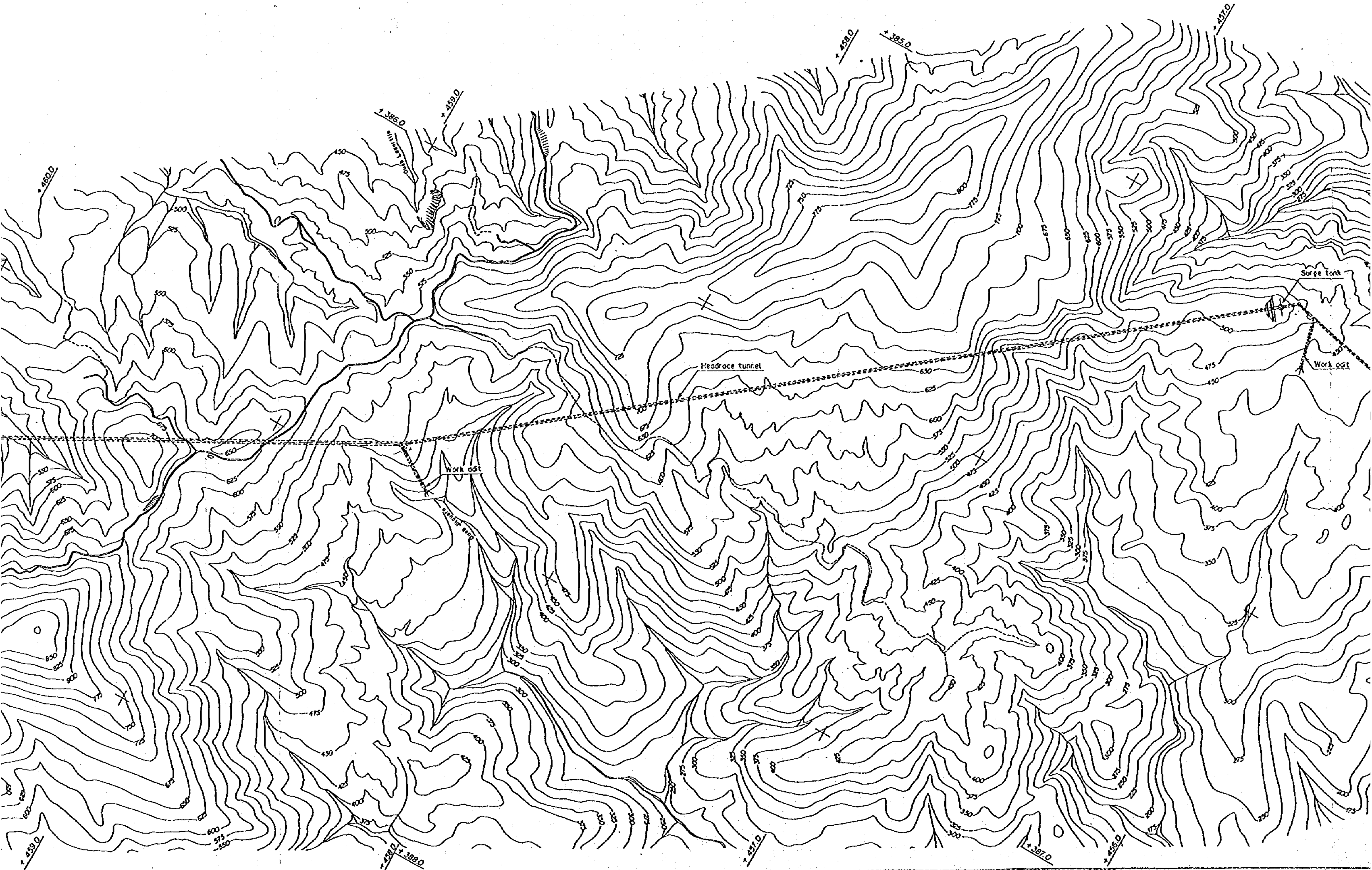
REPUBLIC OF COSTA RICA

LOS LLANOS HYDROELECTRIC POWER DEVELOPMENT PROJECT

Location Map of Riverbed Deposits Sites and Rock Quarry Sites

Fig.7-15 | Dote :


N
Diversion tunnel
Rio Naranjo
Dam
Power intake
Headrace tunnel
Rio Naranjo
+ 389.0
+ 461.0
+ 460.0
+ 387.0
+ 459.0
+ 458.0


Surge tank
Work adit
Headrace tunnel
Work adit
+ 460.0
+ 386.0
+ 459.0
+ 458.0
+ 385.0
+ 457.0
+ 459.0
+ 458.0
+ 388.0
+ 457.0
+ 387.0
+ 456.0

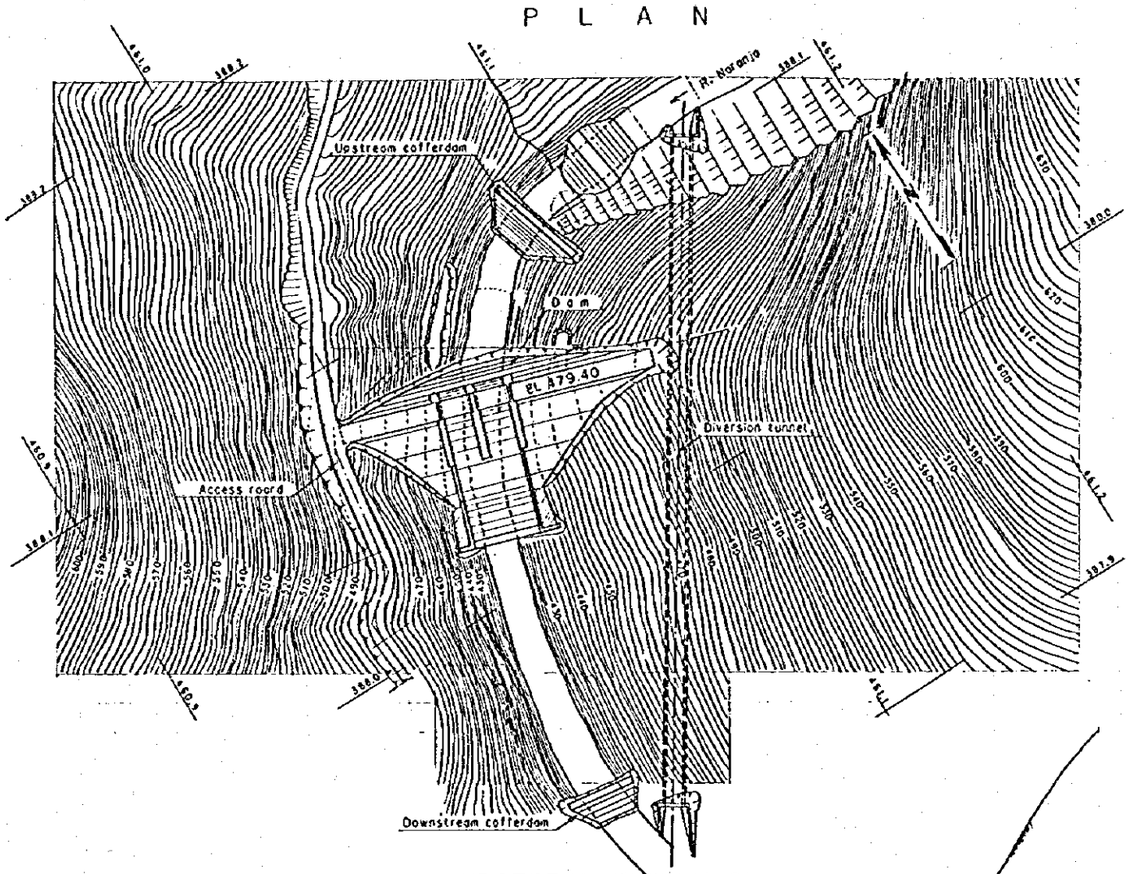
REPUBLIC OF COSTA RICA

LOS LLANOS HYDROELECTRIC POWER DEVELOPMENT PROJECT

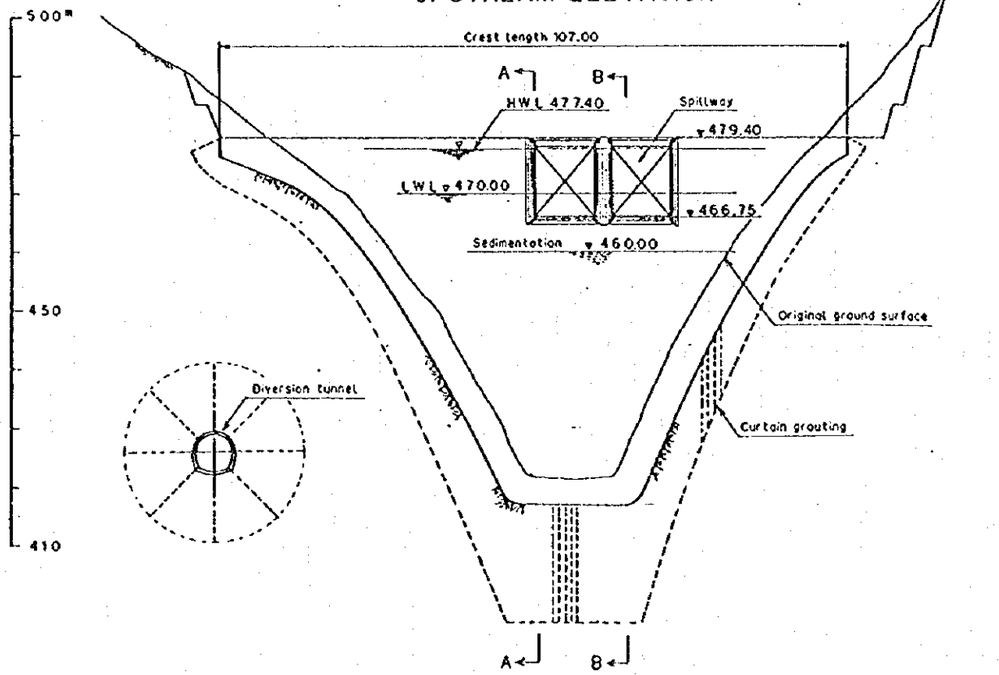
GENERAL PLAN

Fig. 9-13 | Date:

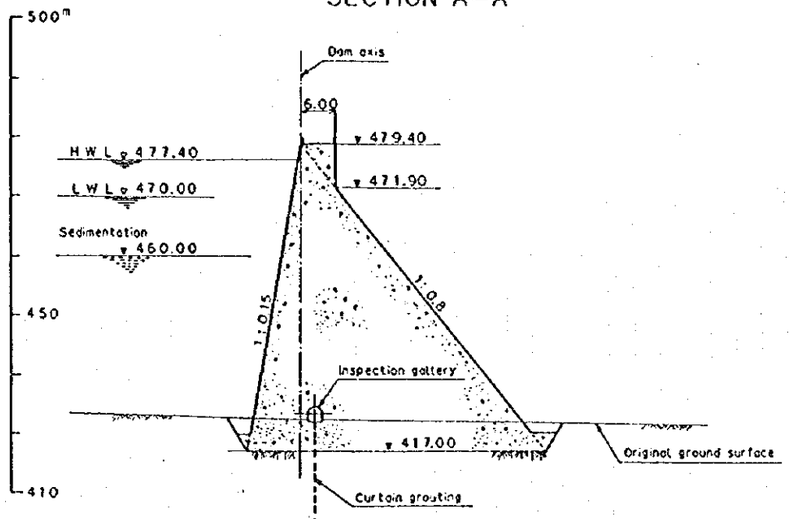
PLAN



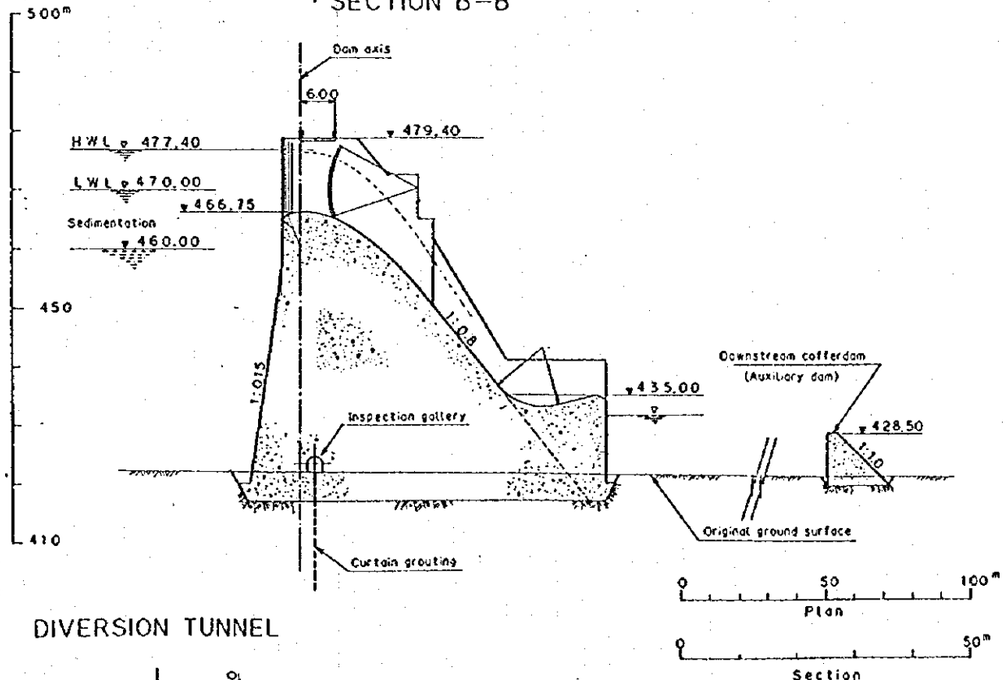
UPSTREAM ELEVATION



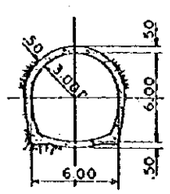
SECTION A–A



SECTION B–B



DIVERSION TUNNEL



REPUBLIC OF COSTA RICA

LOS LLANOS HYDROELECTRIC POWER DEVELOPMENT PROJECT

Los Llanos Dam

Plan and Sections

Fig.9-14

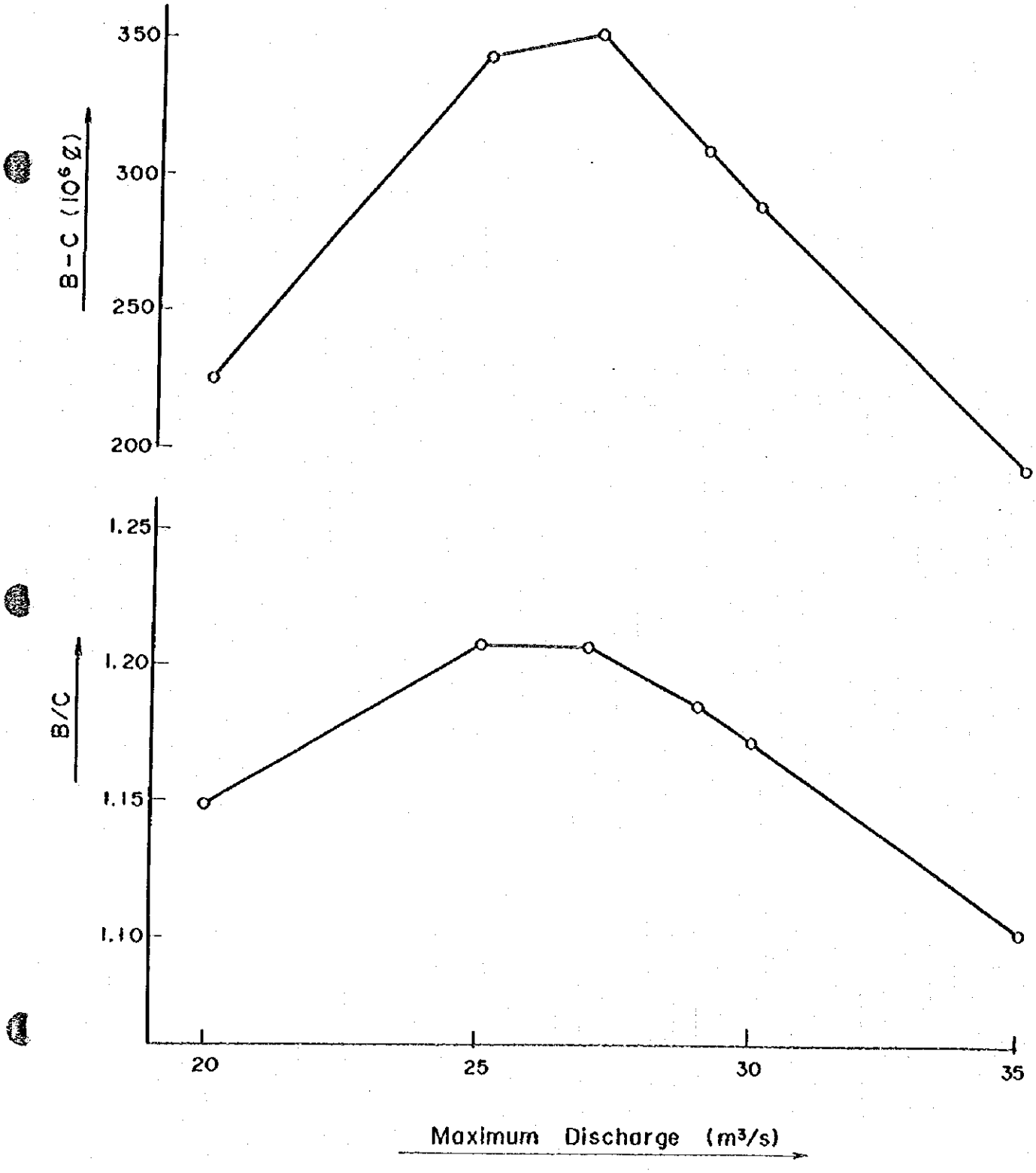


Fig. 9-15 Study on Maximum Discharge

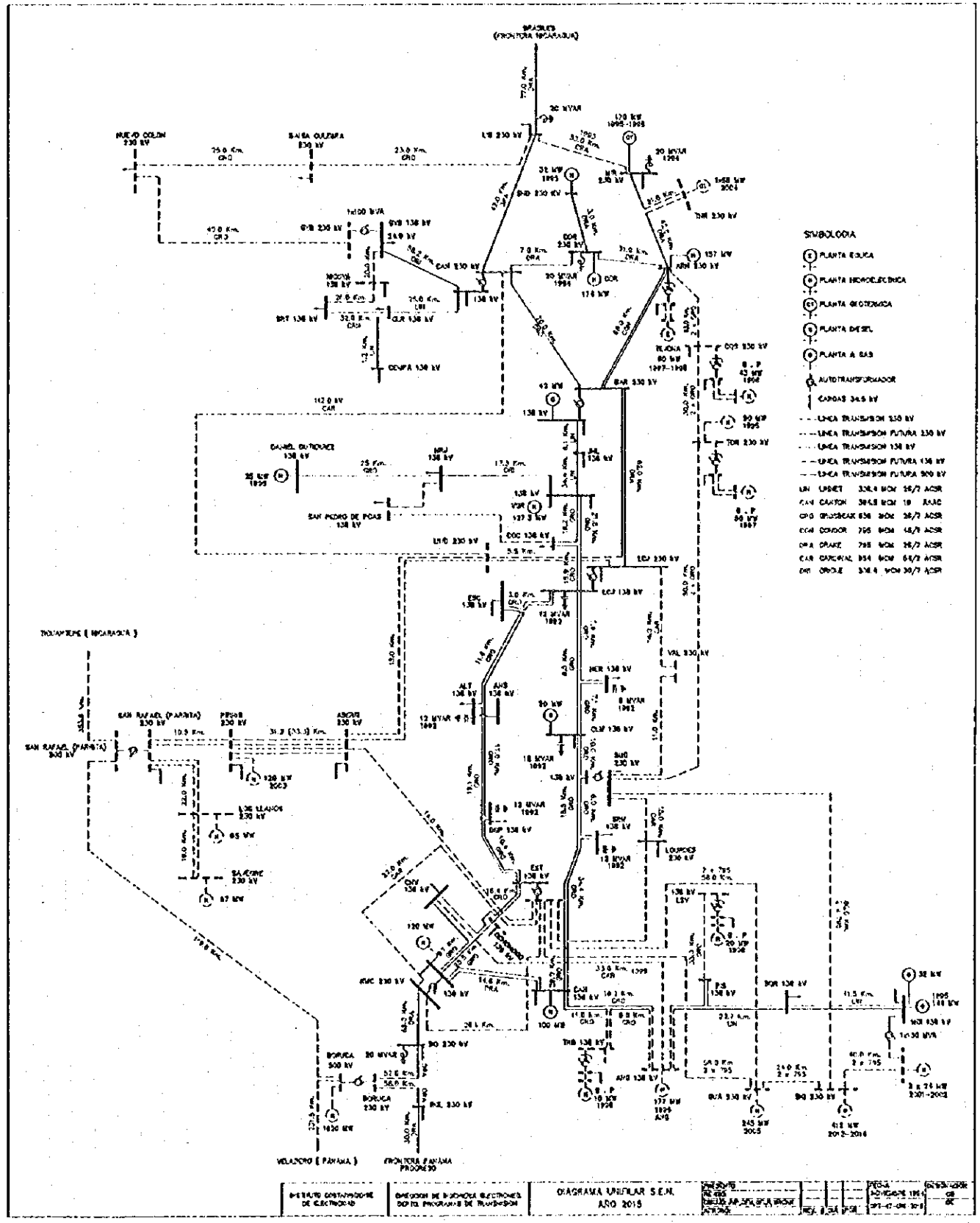
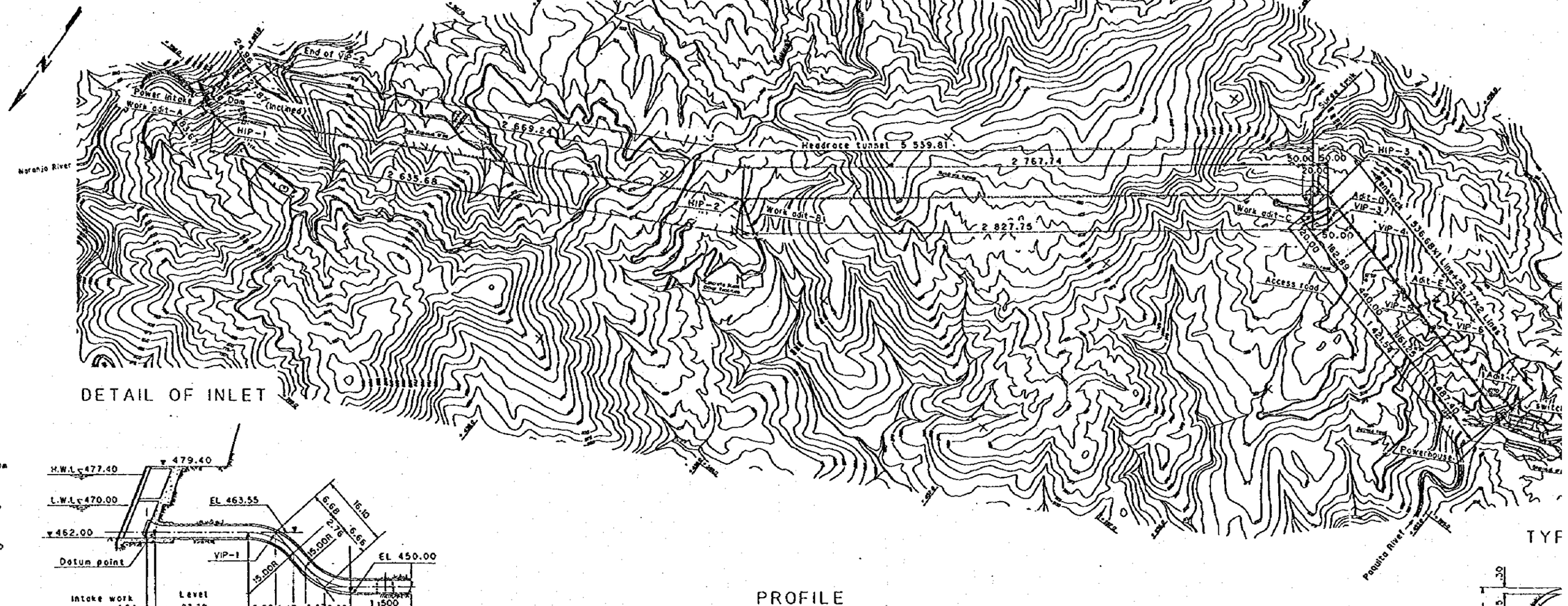


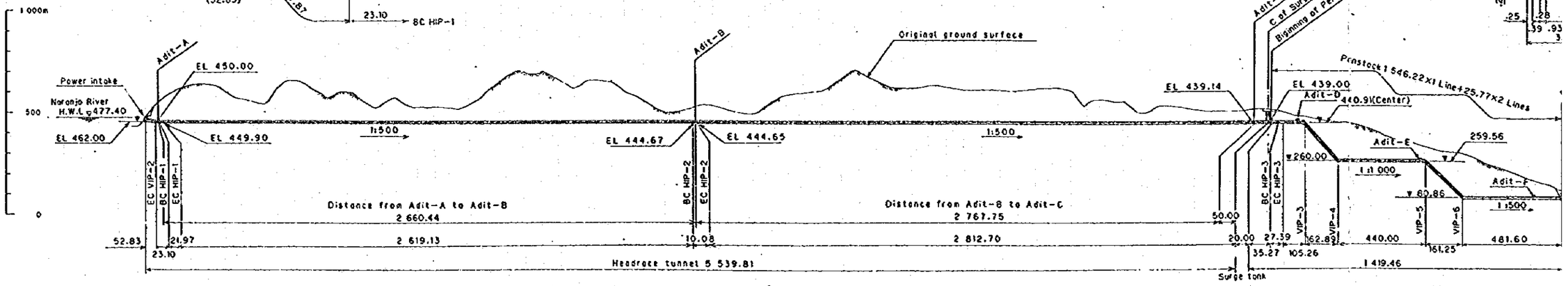
Fig. 10-1 Power Transmission System in Costa Rica

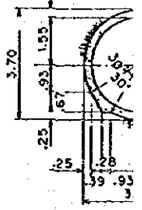
PLAN



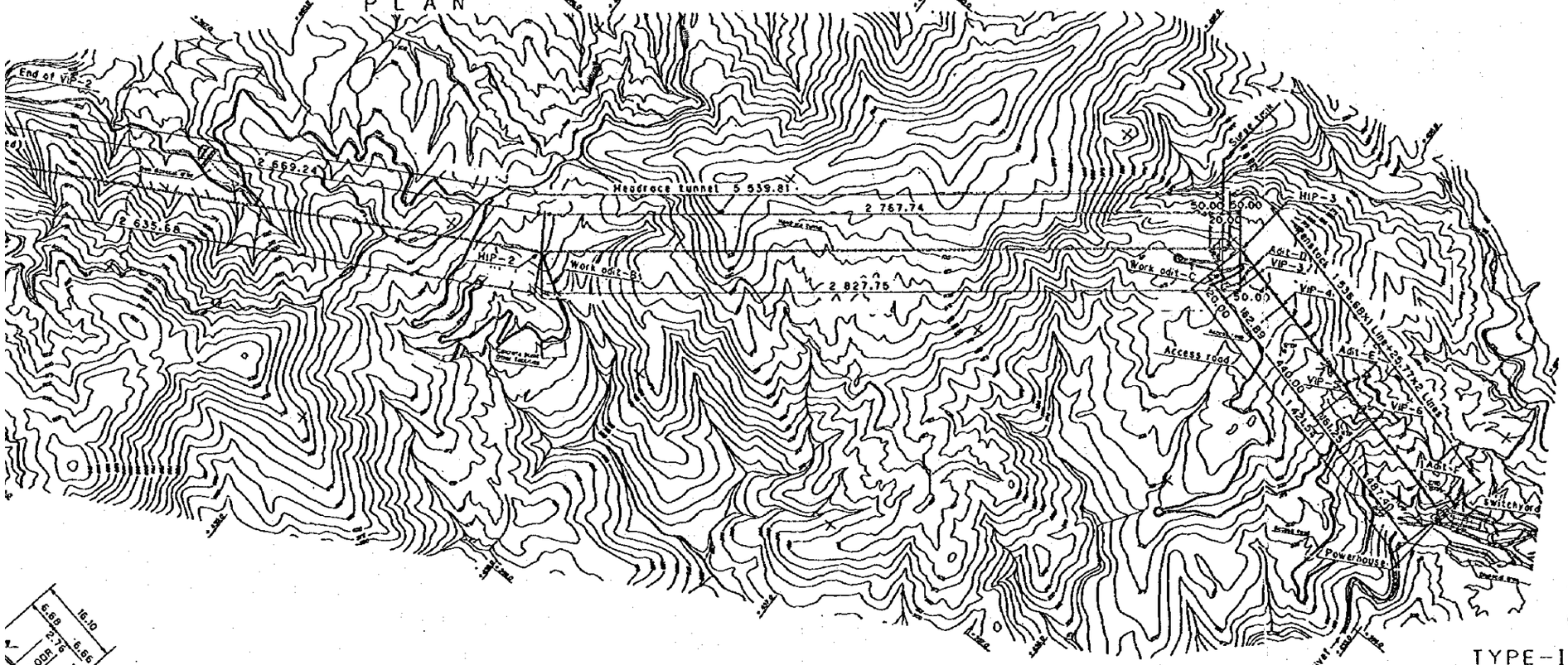
DETAIL OF INLET

PROFILE



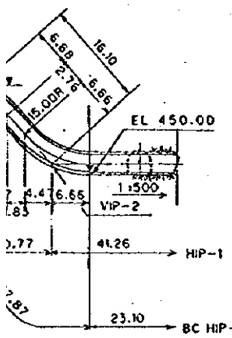


PLAN

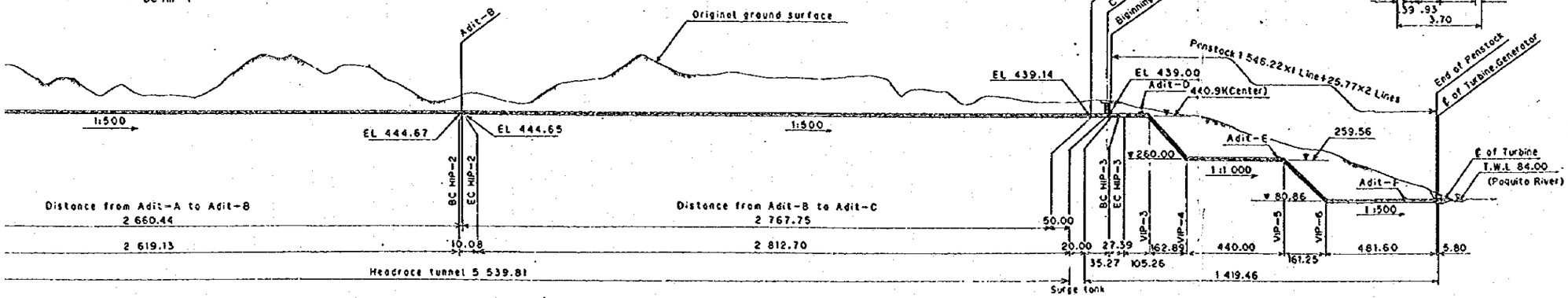


IP	Coordinate X	Coordinate Y	Distance	Note
Intake	-388 101.00	461 014.80		Datum point
HIP-1	388 120.00	460 935.00	82.03	
HIP-2	386 860.00	458 620.00	2 635.68	
Surge tank	385 112.09	456 397.17	2 827.75	C of S.T
HIP-3	385 075.00	456 350.00	60.00	

IP	I.A	R	T.L	C.L
VIP-1	48°00'00"	15.00	6.68	12.57
VIP-2	47°53'07"	15.00	6.66	12.54
HIP-1	41°57'03"	30.00	11.50	21.97
HIP-2	9°37'16"	60.00	5.05	10.08
HIP-3	52°19'01"	30.00	14.74	27.39

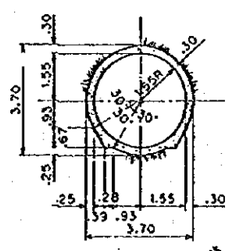


PROFILE

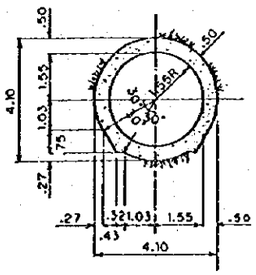


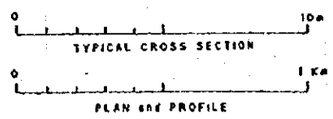
TYPICAL CROSS SECTION
OF HEADRACE TUNNEL

TYPE-I



TYPE-II



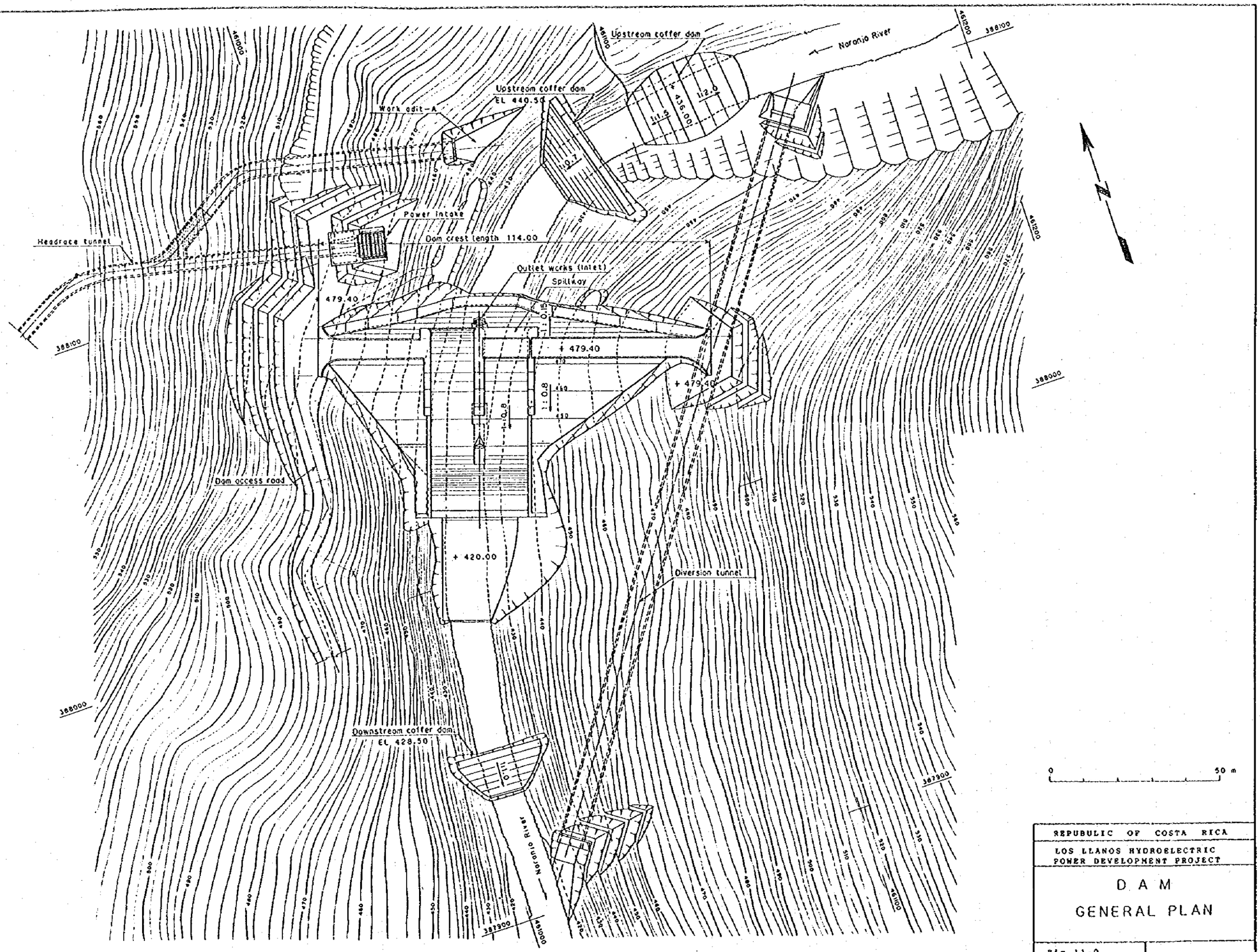


REPUBLIC OF COSTA RICA

LOS LLANOS HYDROELECTRIC POWER DEVELOPMENT PROJECT

GENERAL PLAN
PROFILE AND SECTION

Fig. 11-7



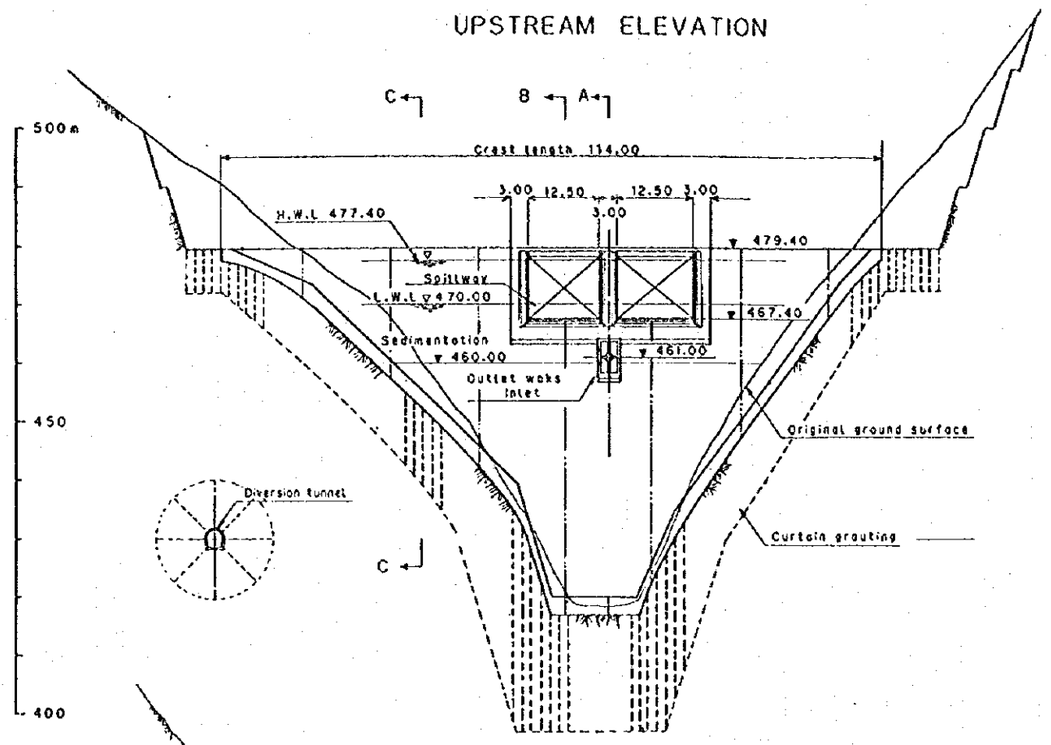
REPUBLIC OF COSTA RICA

LOS LLANOS HYDROELECTRIC POWER DEVELOPMENT PROJECT

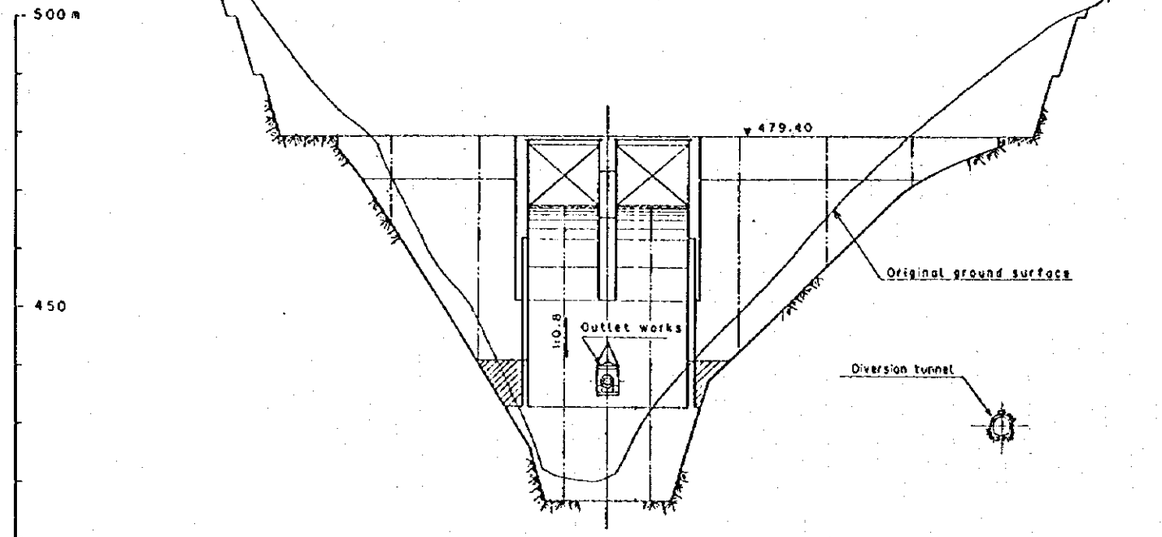
D A M
GENERAL PLAN

Fig. 11-9

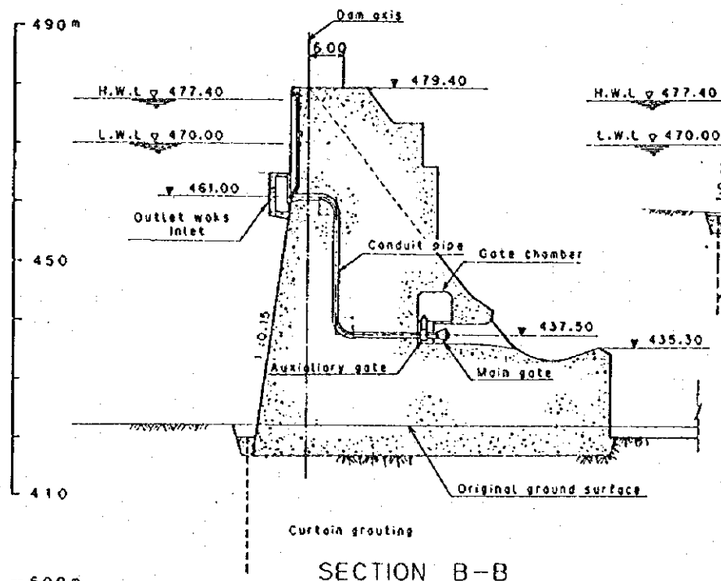
UPSTREAM ELEVATION



DWONSTREAM ELEVATION



SECTION A–A



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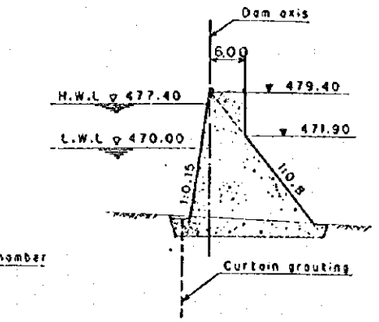

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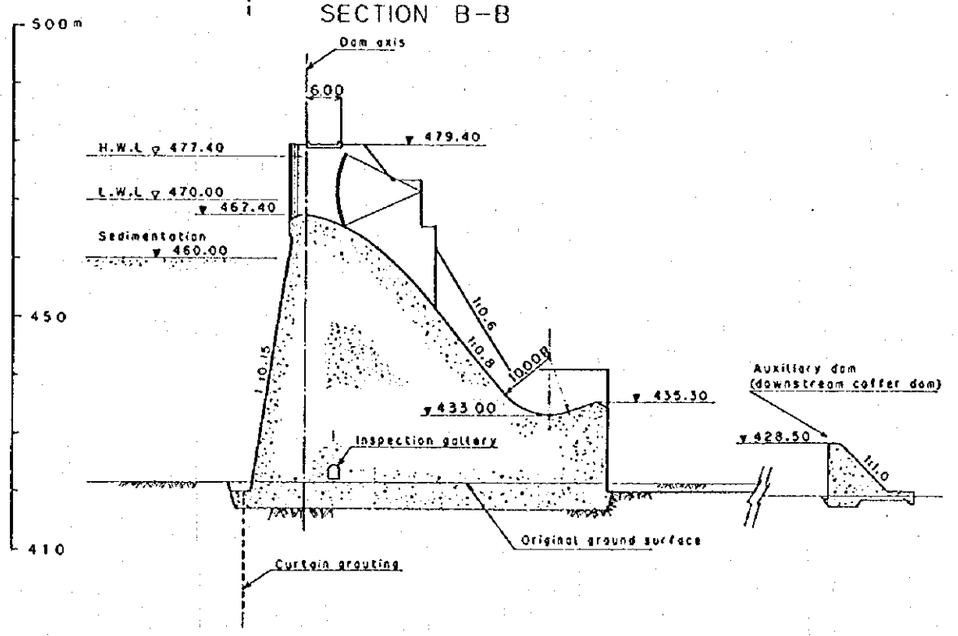

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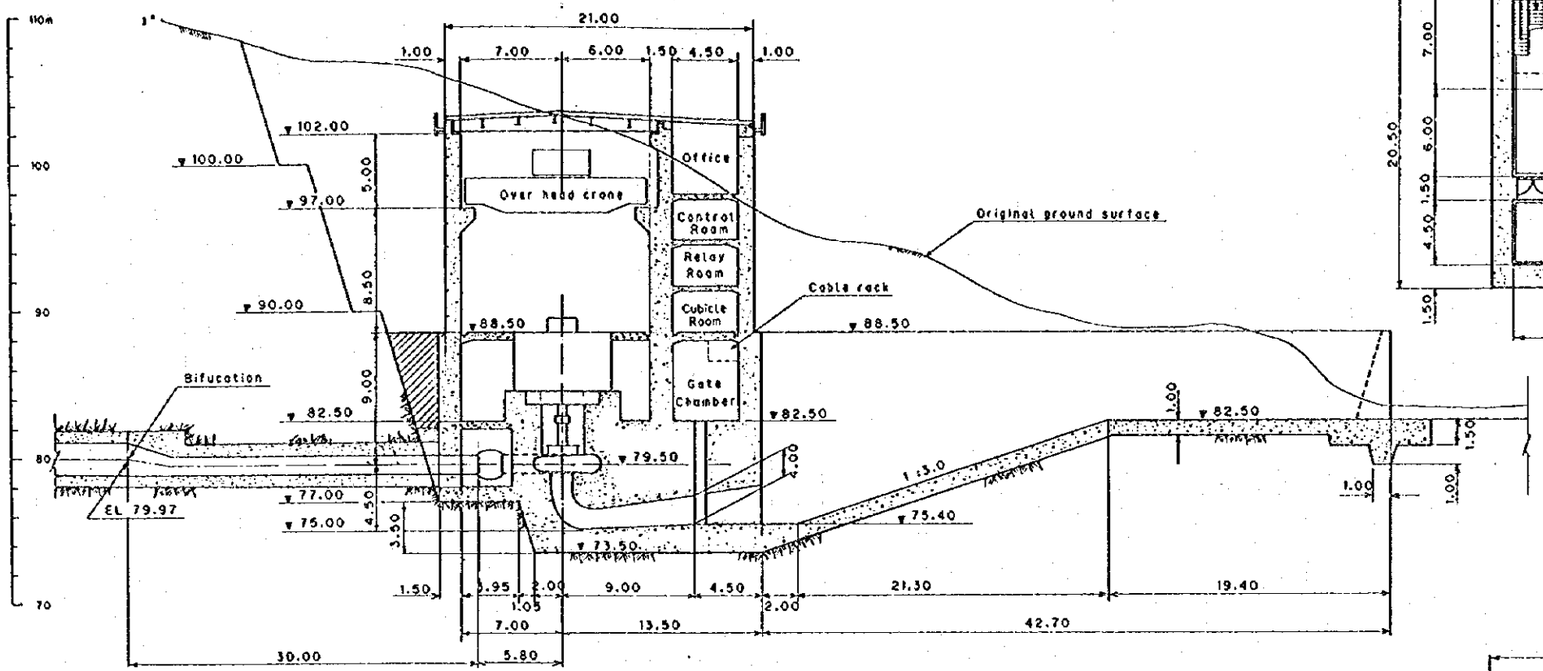
LOS LLANOS HYDROELECTRIC POWER DEVELOPMENT PROJECT

D.A M

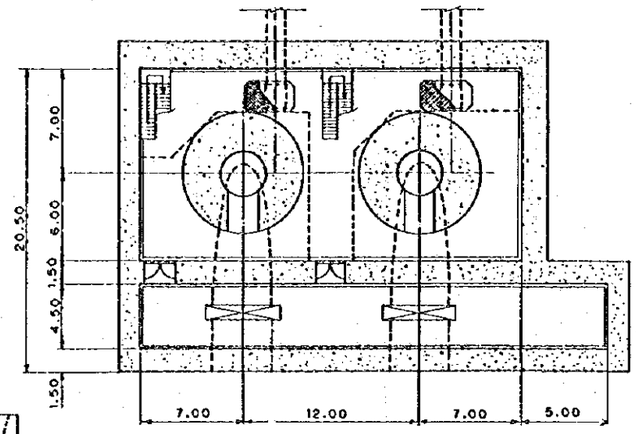
ELEVATION AND SECTION

Fig. 11-10

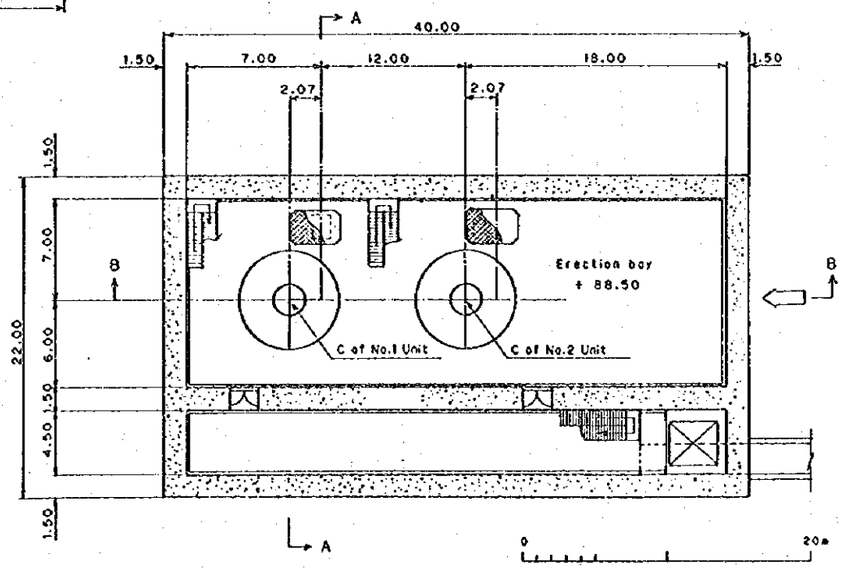
SECTION A–A



PLAN EL 82.50



PLAN EL 88.50



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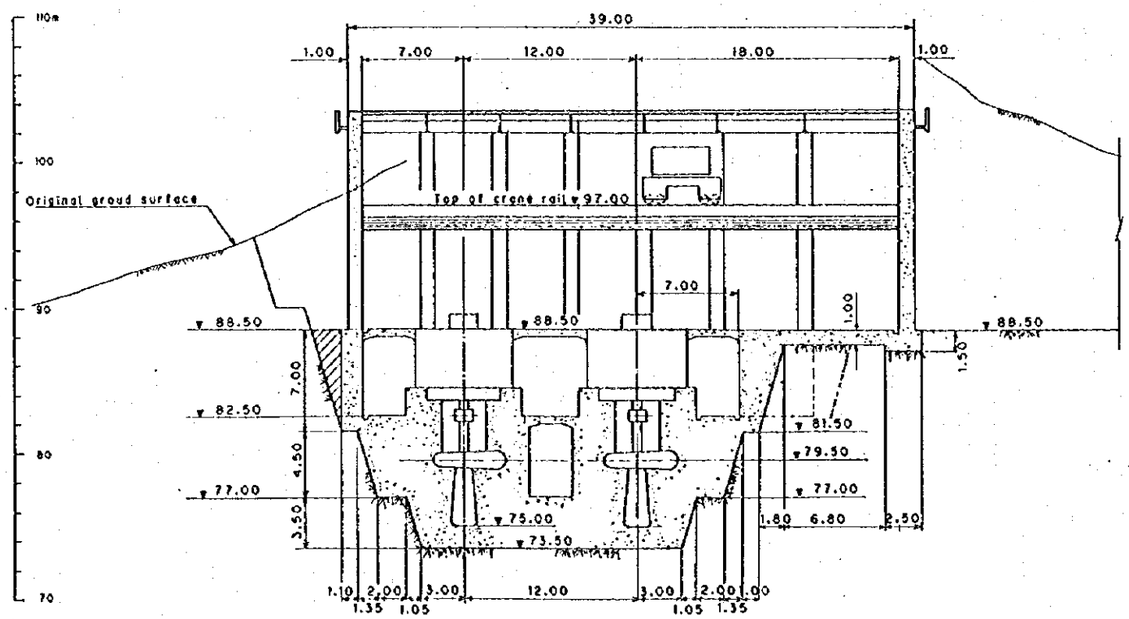

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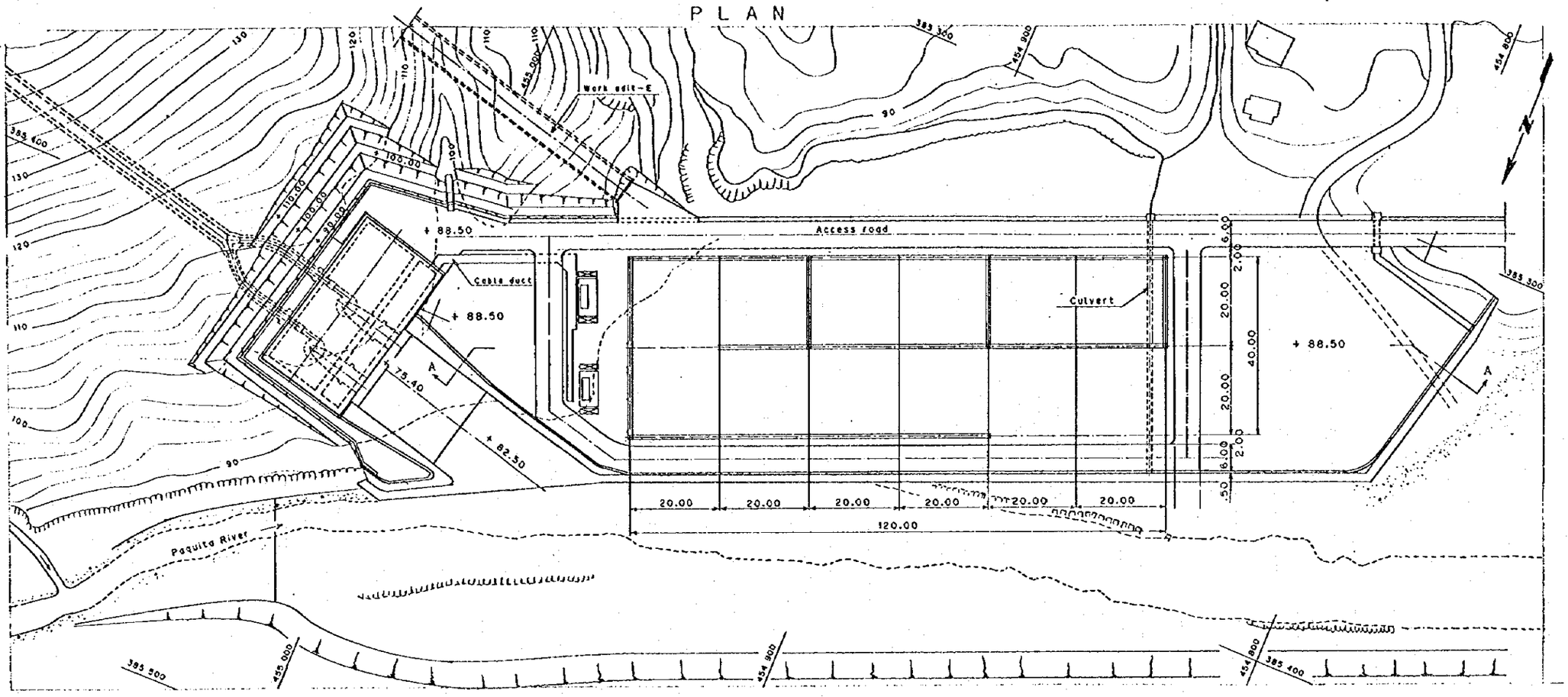
LOS LLANOS HYDROELECTRIC POWER DEVELOPMENT PROJECT

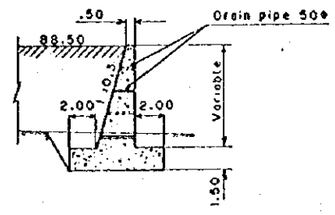
POWER HOUSE PLAN AND SECTION

Fig. 11-16

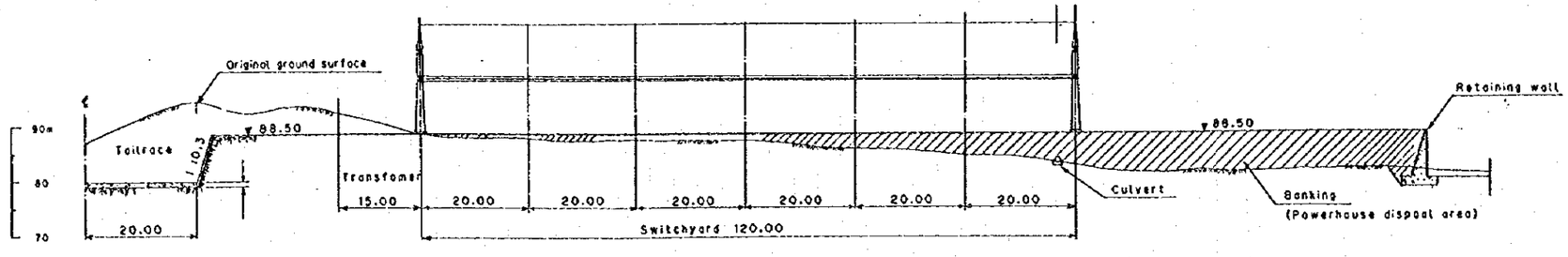
PLAN

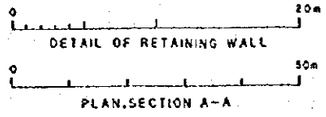


DETAIL OF RETAINING WALL



SECTION A-A





REPUBLIC OF COSTA RICA

LOS LLANOS HYDROELECTRIC POWER DEVELOPMENT PROJECT

SWITCHYARD PLAN AND PROFILE

Fig. 11-17

N-20

Los Llanos Hydroelectric Power Development Project

Fig. 12-3 Construction Schedule

Item	Quantity
Preparatory works and Camp Facilities	
Road Construction	Dam 6.0 Km, Power plant 0.9 Km Headrace tunnel 7.2 Km
Care of River Diversion Tunnel	D = 6.0 m, L = 225 m
Coffer-dam	Upstream h = 20.5 m, Conc. 3,430 m3
	Downstream h = 11.5 m, Conc. 1,200 m3
Dam	Excavation 58,030 m3
Height 62.4m	Concrete 89,200 m3
Crest length 114.0m	Drilling & Grouting 3,100 m
Power Intake	Excavation 9,250 m3
	Concrete 1,000 m3
Headrace Tunnel	D = 3.1 m L = 5,540 m (Maximum length 2,770 m)
Surge Tank	Shaft D = 8.0 m, h = 57.3 m Shaft Ex. 3,640 m3, Conc. 1,100 m3
Penstock	Horizontal tunnel ΣL=1,090 m
Embedded type D=3.1 ~2.2m*1 line	Inclined tunnel ΣL= 508 m,
D=1.25m * 2 lines	After branch ΣL=26 m * 2
Power-house & Switchyard	Excavation 69,500 m3
Outdoor type	Concrete 13,000 m3
Tailrace	Excavation 1,410 m3
	Concrete 2,210 m3
Hydraulic Equipment	Spillway Gate 10m * 12.5m * 2
	Outlet Gate & Coduit
	Intake Gate 4m * 4m * 1
	Draft Gate 2m * 4m * 2
	Penstock D=3.1 ~1.25 m, L=1,560 m
Electromechanical Equipment	No.1 Unit
	No.2 Unit
Switchyard	
Transmission Line	
Telecomunivation