

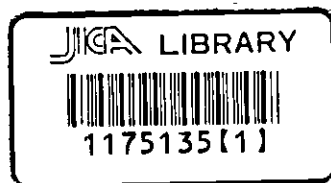
独立行政法人
国際協力機構 (JICA)

レンバ川水力発電実行委員会 (CEL)

エルサルバドル国
トロラ川水力発電計画調査
(エルチャパラル計画)

最終報告書

2004年3月



電源開発株式会社

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序 文

日本国政府は、エルサルバドル国政府の要請に基づき、同国のトロラ川水力発電計画調査を行うことを決定し、国際協力機構がこの調査を実施しました。

当機構は、平成13年5月から平成15年12月までの間、8回にわたり電源開発株式会社の橋本信雄氏を団長とする調査団を現地に派遣しました。

調査団は、エルサルバドル国政府関係者と協議を行うとともに、現地調査を実施し、帰国後の国内作業を経て、ここに本報告書完成の運びとなりました。この報告書が、本計画の推進に寄与するとともに、両国の友好親善の一層の発展に役立つことを願うものです。

終わりに、調査にご協力とご支援をいただいた関係者各位に対し、心から感謝申し上げます。

平成16年3月

独立行政法人国際協力機構
理事 伊 沢 正

平成16年3月

独立行政法人国際協力機構
理事 伊 沢 正 殿

伝 達 状

エルサルバドル国トロラ川水力発電計画調査を終了いたしましたので、ここに最終報告書を提出いたします。

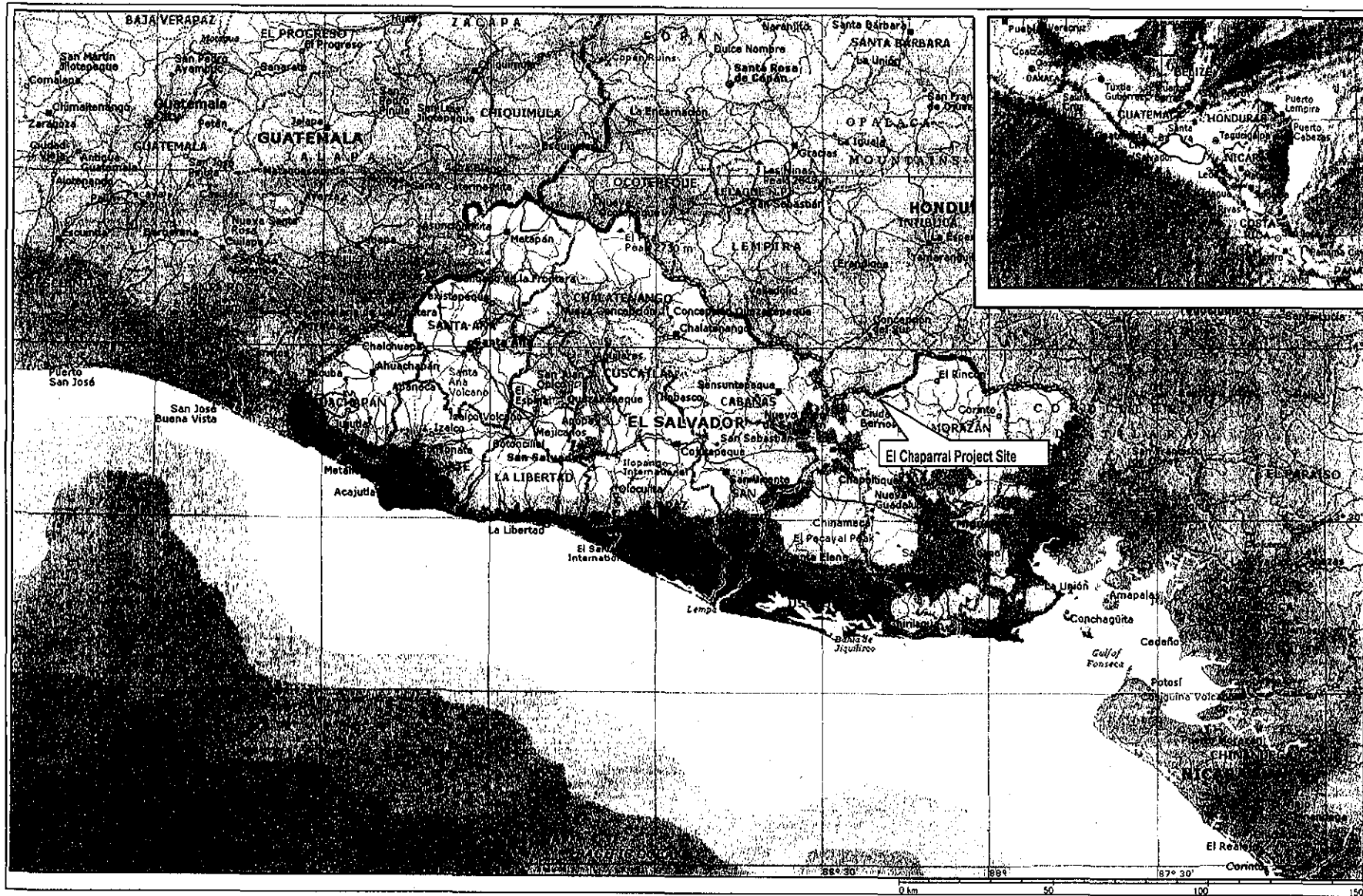
本報告書は、トロラ川水力発電計画について、日本政府関係機関および貴機構の助言を取り込んで計画の策定が行なわれました。

本報告書はエルチャパラル水力発電所（設備出力 657MW、年間発生電力量 233.2 GWh）を建設する計画をまとめております。本計画の完成により、国産水力資源が効果的に使用され、安定したエネルギーの供給および地球温暖化問題に対応することができます。

エルサルバドル国における電源開発の重要性および社会経済開発の必要性に鑑み、エルサルバドル国政府が本計画を最優先で実施するよう希望するものであります。

終わりに、貴機構、外務省、経済産業省各位のご支援、ご指導に心より感謝申し上げます。また、レンパ川水力開発実行委員会（CEL）およびエルサルバドル国政府関係諸機関各位から私どもの調査実施に対して戴きました、ご協力、ご支援に、厚く御礼申し上げます。

トロラ川水力発電計画調査団
団 長 橋 本 信 雄



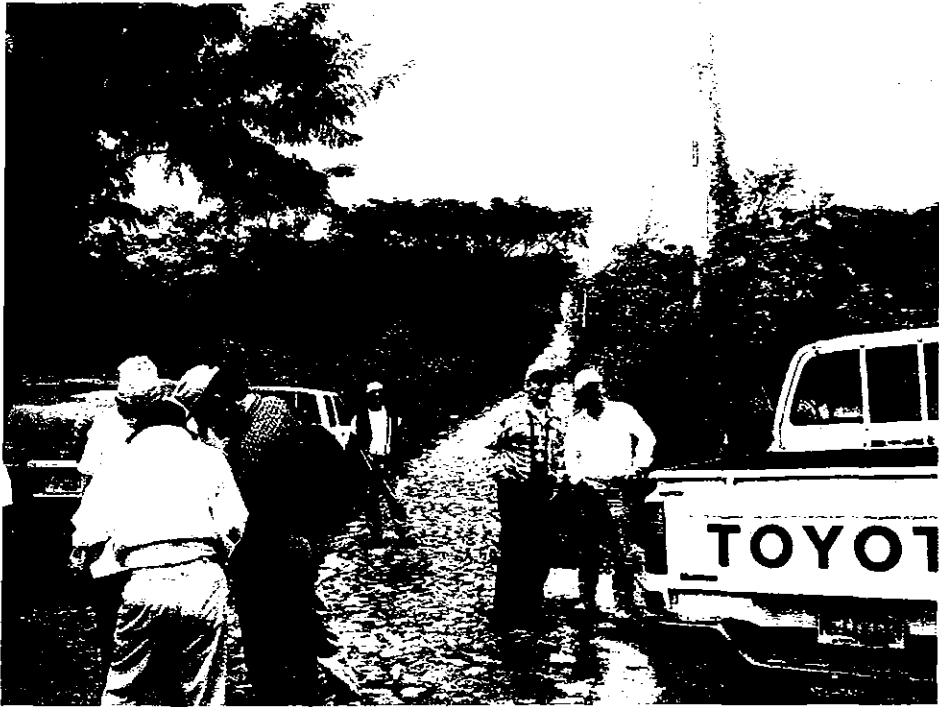
El Salvador Location Map



El Chaparral Dam Site (View from Downstream)



Road Condition (El Trinfo, Turning Point from Pan-American Highway)



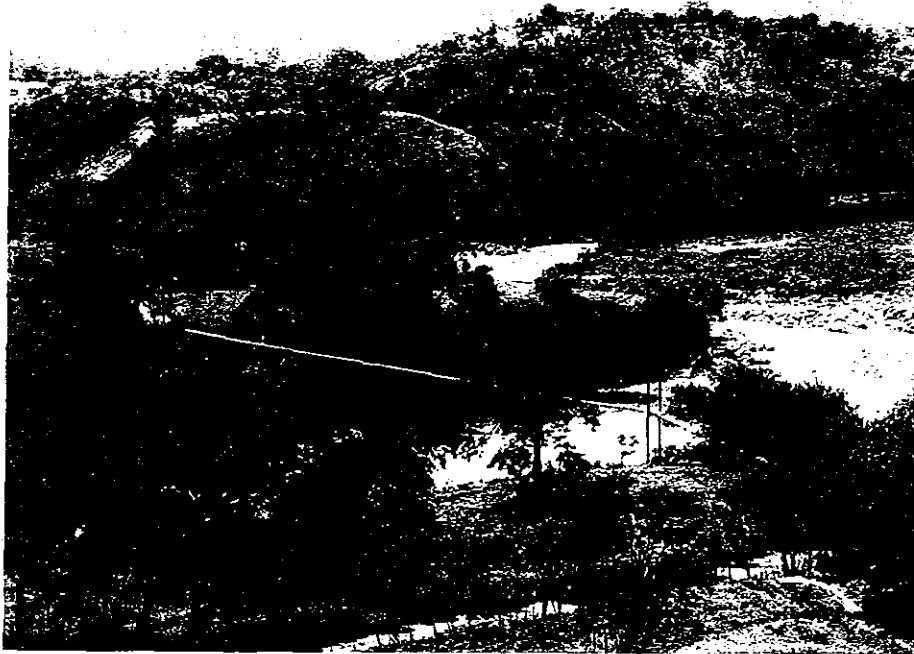
Road Condition (San Luis de La Reina ~ Dam Site)



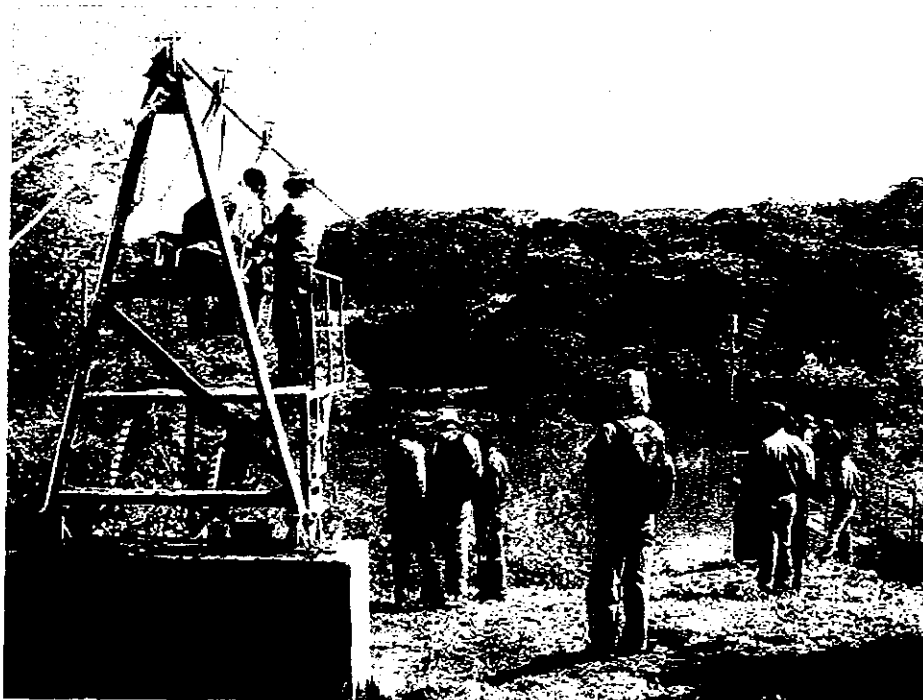
Upstream View from El Chaparral Dam Site



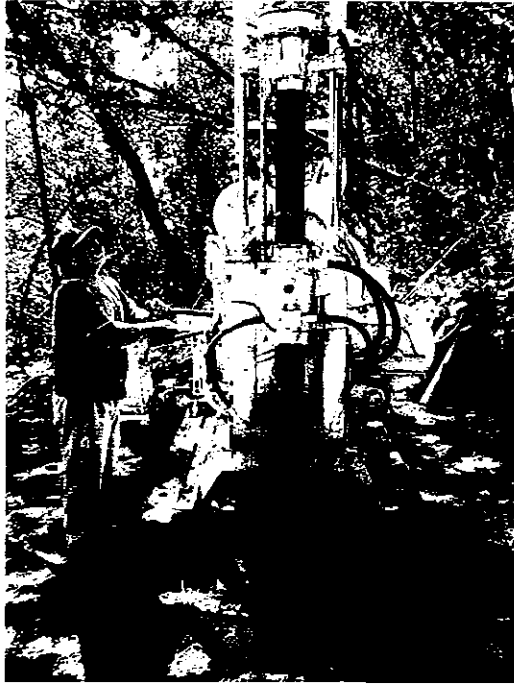
Downstream View from El Chaparral Dam Site



Suspension Bridge in Carolina



Osicala Hydrological Gauging Station



Geological Investigation



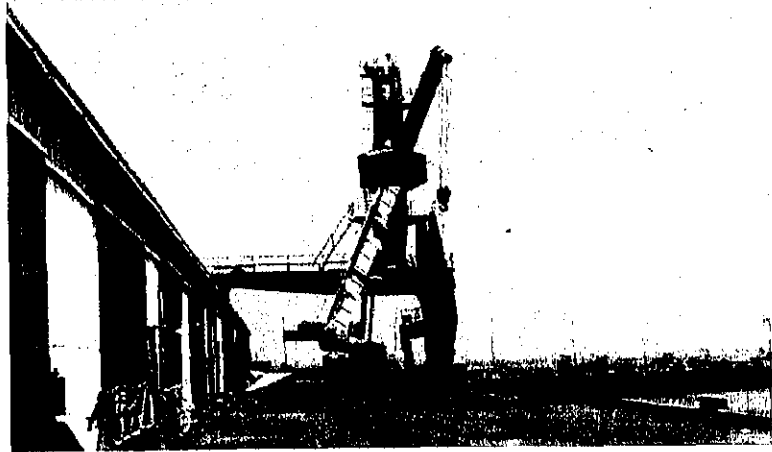
Environmental Investigation



1st Public Hearing (June, 2003)



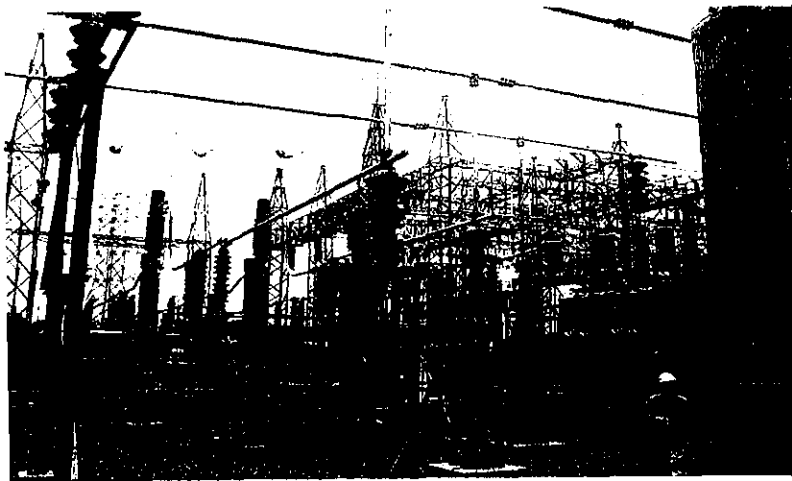
2nd Public Hearing (December, 2003)



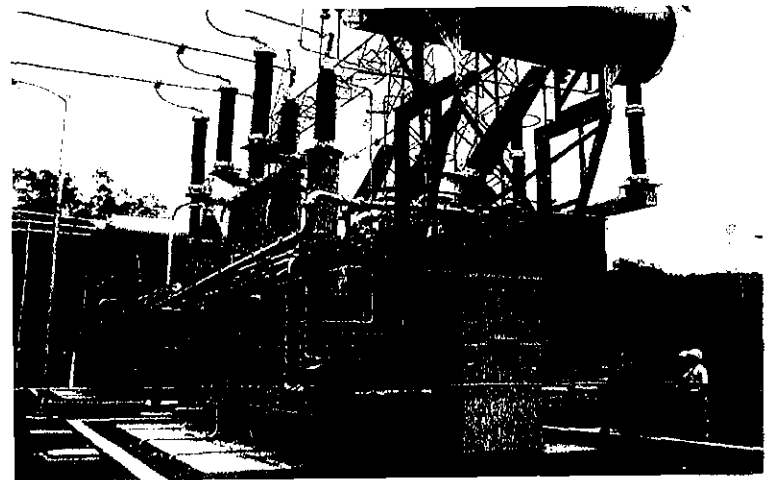
Acajutla Port Facility



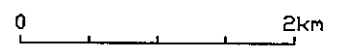
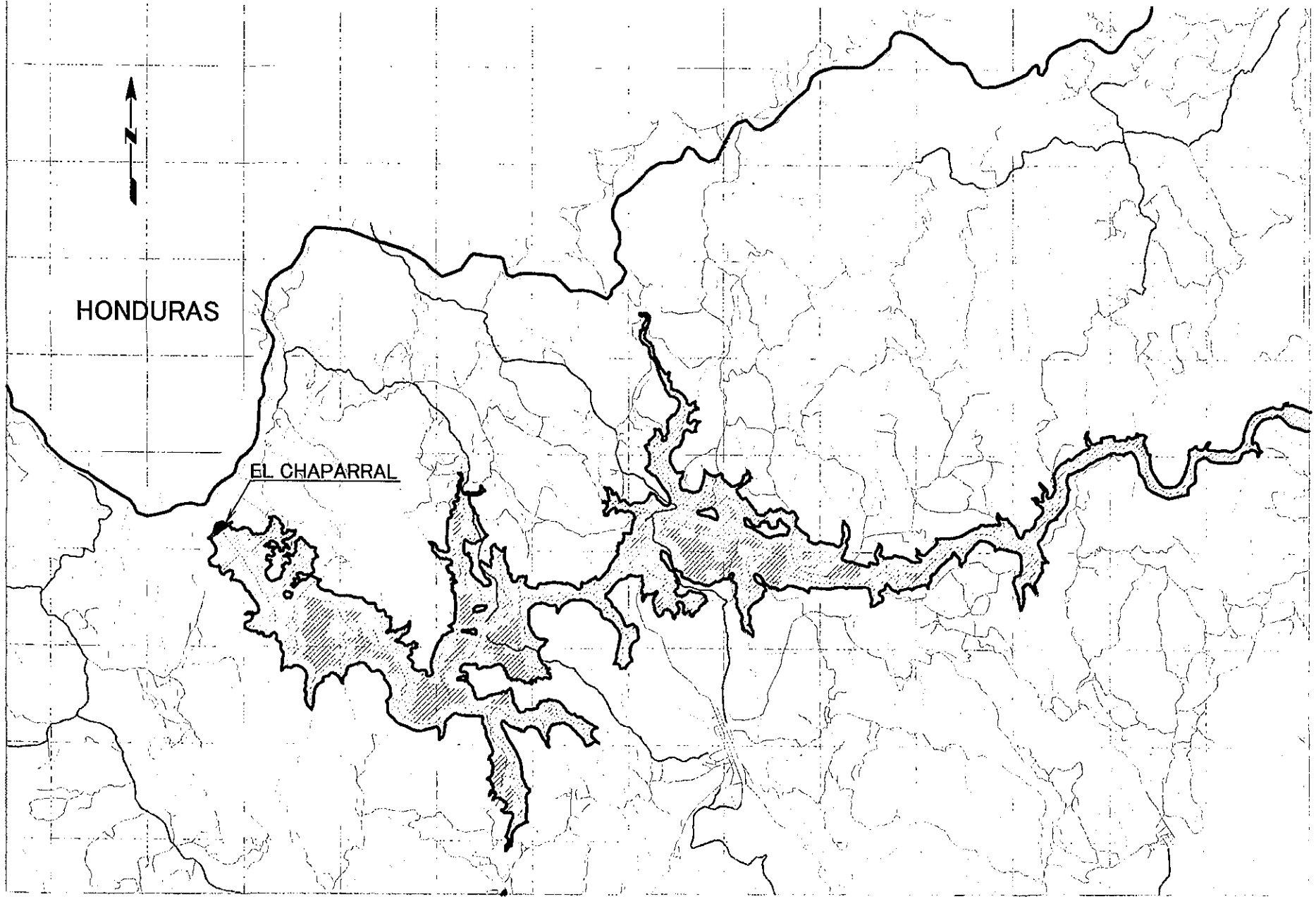
Acajutla Port Facility



15 de Septiembre Sub Station



15 De Septiembre Sub Station



El Chaparral Development Plan

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ABBREVIATION

1. Domestic and Regional Organizations

CIG	Centro de Invertigaciones Geotécicas.
MARN	Ministry of Environment and Natural Resources
COEN	Comité de Emergencia Nacional
CONACYT	Consejo Nacional para la Ciencia y la Tecnología
CONCULTURA	Consejo Nacional para la Culatura y el Arte
CEL	Comisión Ejecutiva Hidroeléctrica del Río Lempa
SIEPAC	Sistema de Interconexión Eléctrica para los Países de América Central
UT	Unidad de Transacciones
SIGET	Superintendencia General de Electricidad y Telecomunicaciones
GESAL	Geotérmica Salvadoreña, S.A. de C.V.
CESSA	Cemento de El Salvador S.A de C.V.
CAESS	Compañía de Alumbrado Eléctrico de San Salvador de S.A de C.V.
CLESA	Compañía de Alumbrado Eléctrico de Santa Ana de S.A de C.V.
DELSUR	Distribuidora Eléctrica del Sur, S.A. de C.V.
DEUSEM	Distribuidora Eléctrica de Usulután, Sociedad de Economía Mixta
ETESAL	Empresa Transmisora de Energía Eléctrica Salvadoreña, S.A
EEO	Empresa Eléctrica de Oriente S.A de C.V
CEAC	Consejo de Electrificación de América Central
ITIC	Instituto Tropical de Investigaciones Científicas
SNET	Servicio Nacional de Estudios Territoriales

2. International and Foreign Organizations

JICA	Japan International Cooperation Agency
BCIE	Central American Bank for Economic Integration (CABEI)
NWS	National Weather Service (USA)
NOAA	National Oceanic and Atmospheric Administration (USA)
USGS	United States Geological Survey
JSCE	Japan Society of Civil Engineers
EPDC	Electric Power Development Co., Ltd.(J-POWER) of Japan
ASTM	American Society for Testing and Materials
ANSI	American National Standards Institute

3. Technical Terms

CA	Catchment area
PMF	Probable maximum flood
PMP	Probable maximum precipitation

HWL	High water level
LWL	Low water level
NWL	Normal water level
IWL	Intake water level
TWL	Tail water level
Hd	Draw down depth
SL	Sedimentation level
EL.m	Elevation (m) above sea level
HPP	Hydropower plant (or project)
GPP	Geothermal power plant
PS or P/S	Power station
GS	Gauging station
S/T or S/S	Substation
T/G	Turbine and generator
L/T	Transmission line
D/L	Distribution line
AC	Alternating current
DC	Direct current
p.f	Power factor
PF	Plant Factor
cct	Circuit
S/Y	Switchyard
GIS	SF6-Gas insulated switch gear
O&M or O/M	Operation and maintenance
E.H.S	Extra high strength
RMS	Root mean square
ROW	Right of way
ACSR	Aluminum cable steel reinforced
RCC	Roller compacted concrete
CRF	Capital recovery factor

4. Environmental Terms

EIA	Environmental impact assessment
AAU	Assigned amount unit
ERU	Emission reduction unit
ET	Emission trading
EsIA	Estudio de impacto ambiental
JI	Joint implementation
RMU	Removal unit

I.E.E	Initial environmental examination
CDM	Clean development mechanism
CER	Certificate of emission reduction
PMA	Environmental Management Program
NMP/100	More probable number in 100ml

5. Economic Terms

GDP	Gross domestic product
B/C	Benefit cost ratio
B-C	Net benefit (Net present value: NPV)
OCC	Opportunity cost of capital
IRR	Internal rate of return
EIRR	Economic internal rate of return
FIRR	Financial internal rate of return
F/C	Foreign currency
L/C	Local currency
CDM	Clean development mechanism
ET	Emission trading
CER	Certified emission reduction
US\$ or \$	US dollar
MUS\$	Million US dollar
USC or c	US cent
SDDP	Stochastic dynamic dual program

6. Others

MC	Contract market
MM	Wholesale market
PM	Power market
MRS	System adjustment market
NGO	Non governmental organization
ODA	Official development aid
F/S	Feasibility study
DD	Definite design
S/W	Scope of work
M/M	Minutes of meeting
IPP	Independent power producer
HDWiz	Hydro design wizard
OFAF	Forced oil, air cooled type
JIS	Japanese Industrial Standards

UNIT

No. Measurement

1 Length

mm	Millimeter
cm	Centimeter
m	Meter
km	Kilometer

2 Area

cm ²	Square centimeter
m ²	Square meter
ha	Hectare
km ²	Square kilometer
MCM	Mil circular mil

3 Volume

cm ³	Cubic centimeter
l	Liter
Kl	Kiloliter
m ³	Cubic meter
MCM	Million cubic meter

4 Weight

g	Gram
kg	Kilogram
ton or t	Metric ton
tC	Carbon ton
gC	Carbon gram
CO ₂ -ton / t- CO ₂	Carbon dioxide ton

5 Time

s / sec	Second
ms	Millisecond
min	Minute
h / hr	Hour
d	Day

No.	Measurement	
	mth	Month
	yr	Year
	gal	Acceleration value
6	Meteorology	
	°C	Degree in centigrade (Celcius)
	K	Degree in Kelvin-grade
	mb	Milibar
7	Electrical Measures	
	V	Volt
	kV	Kilovolt
	A	Ampere
	kA	Kiloampere
	Hz	Hertz (cycle)
	W	Watt
	kW	Kilowatt
	MW	Megawatt
	GW	Gigawatt
	kWh	Kilowatt hour
	MWh	Megawatt hour
	GWh	Gigawatt hour
	kVA	Kilovolt ampere
	MVA	Megavolt ampere
	MVAR/MVar	Megavar
	m-kW	Meter-kilowatt
8	Others	
	Btu	British thermal unit
	rpm / RPM	Revolutions per minute
	%	Percentage (or Percent)
	Lu	Lugeon
	cm ³ /s	Cubic centimeter per second
	m ³ /s	Cubic meter per second
	pH	Hydrogen power