表　2.3　　発電用燃料の消費カロリー

Unit: 10^12 kilocalories

YEAR	OIL	DIESEL	MIXED OIL	GAS	CARBON	TOTAL
1974	42.0	6.5	0.10	15.0	0.60	64.2
1975	45.9	11.9	0.20	21.1	0.50	79.5
1976	54.0	10.7	0.30	17.2	0.60	82.8
1977	60.5	8.3	0.30	16.5	0.60	86.2
1978	77.0	16.5	0.30	21.3		115.1
1979	70.8	11.2	0.30	30.6		112.9
1980	86.7	10.9	0.20	30.1		127.9
1981	90.7	10.5	0.20	25.6	0.04	127.1
1982	97.2	8.0	0.05	28.2	3.00	136.5
1983	110.7	3.0		23.3	6.00	142.9
1984	119.9	3.9		18.7	7.40	149.9
1985	123.2	2.6		19.6	8.90	154.3
1986	131.7	2.1		25.5	14.70	174.0
1987	144.4	3.2		27.5	16.80	191.9
1988	150.7	1.9		25.6	18.40	196.5
1989	159.6	2.9		27.0	18.60	208.1
1990 *1	157.5	3.7		34.3	18.20	213.7

Note : *1 Preliminary numbers
Source : INFORME ANUAL 1990, CFE

表 2.4 送配電線総延長の推移

	Voltage (kV)	Length of Transmission and Distribution Line (km) 1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
CFE	400	5,997	6,035	6,080	6,287	7,610	7,827	7,906	8,380	8,810	9,099
	230	9,581	10,801	10,892	11,515	12,237	13,174	13,380	15,283	16,090	16,417
	161	1,035	1,062	1,066	1,166	920	924	947	949	948	764
	150	875	875	875	868	868	791	774	775	775	774
	138	918	1,056	1,056	1,068	1,068	1,203	1,132	1,168	1,160	1,185
	115	22,172	22,937	23,721	25,474	27,757	27,299	27,034	28,089	29,240	29,827
	85	360	328	328	391	392	385	412	271	244	244
	69	5,190	5,384	5,609	5,114	5,002	4,924	4,842	4,606	4,379	4,236
	44	472	242	242	242	242	160	161	11	11	8
	35	20,345	33,459	34,239	35,347	36,417	39,497	43,437	45,361	46,607	47,393
	23	12,387	14,357	14,796	15,253	15,576	13,034	14,368	15,006	15,637	16,264
	13.8	96,254	125,903	130,063	132,613	136,312	145,110	157,596	157,489	164,175	169,534
	6.6	2,114	1,133	1,133	1,135	1,556	1,355	1,783	1,828	1,863	1,563
	SUBTOTAL	177,700	223,572	230,100	236,473	245,957	255,683	273,772	279,216	289,939	297,308
CLFC	400	225	291	291	291	291	291	291	342	379	379
	230	786	786	786	834	842	842	851	851	888	918
	150	8	8	8	8	8	8	8	8	8	9
	115	0	0	0	0	0	72	72	72	109	109
	85	2,069	2,074	2,274	2,275	2,275	2,068	2,088	2,092	1,905	1,718
	23	7,421	7,688	7,938	8,279	8,717	9,199	9,470	9,691	9,865	10,140
	13.8	0	0	0	0	0	854	861	862	904	904
	6.6	5,225	5,101	5,090	4,997	4,972	4,695	4,679	4,650	4,632	4,721
	SUBTOTAL	15,734	15,948	16,387	16,684	17,105	18,029	18,320	18,568	18,690	18,898
	TOTAL	193,434	239,520	246,487	253,157	263,062	273,712	292,092	297,784	308,629	316,206

Source : INFORME ANUAL 1990, CFE

表 2.5 変電所の変圧器容量の推移

Type of Substation	Capacity of Substation (MVA) 1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Step-up	25,212	26,847	28,407	30,312	30,420	30,420	31,343	33,472	34,322	34,650
Step-down	35,273	41,013	44,901	46,188	47,041	47,273	48,065	57,107	60,367	54,274
CLFC	10,890	11,646	12,278	13,657	14,187	14,301	14,991	15,088	15,278	16,273
Total	71,375	79,506	85,586	90,157	91,648	91,994	94,399	105,667	109,967	105,197

Source : INFORME ANUAL 1990, CFE

表　2.6　　地方電化の推移

Year	Habitants	Rural Centers	Total Length of Distribution Lines (km)	Line Postes
1974	495,976	993	3,236	43,496
1975	988,857	1,976	6,068	87,896
1976	868,188	1,781	5,097	74,461
1977	612,816	1,321	3,342	53,106
1978	584,983	1,207	3,161	48,631
1979	1,209,967	2,137	4,925	92,896
1980	1,150,599	2,324	5,465	96,406
1981	945,330	2,268	6,051	103,588
1982	870,073	1,863	5,656	78,311
1983	855,589	1,848	3,613	67,863
1984	1,096,678	2,258	4,021	92,112
1985	1,481,821	2,926	4,699	99,722
1986	939,112	2,144	3,905	65,626
1987	728,566	1,718	2,917	56,518
1988	1,003,065	2,582	4,662	77,104
1989	1,229,220	2,827	4,330	89,131
1990	1,348,246	3,539	3,562	99,953

Note : In the population centers electrified, rural villages, expanded villages and colonies are taken into account.
Source : INFORME ANUAL 1990, CFE

表　2.7　　売電力量の推移

Unit: GWh

Year	Residentical	Commercial	Industrial	Service	Agriculture	Total
1974	5,509	4,073	17,752	2,453	2,069	32,054
1975	6,056	4,224	19,202	2,619	2,257	34,567
1976	6,706	4,429	21,205	2,891	2,437	37,888
1977	7,362	4,657	23,085	3,160	2,652	41,159
1978	8,269	5,022	25,271	3,296	2,935	45,058
1979	9,210	5,404	27,521	3,437	3,328	49,197
1980	10,038	5,821	28,744	3,667	3,746	52,301
1981	11,211	6,665	31,731	3,932	3,842	57,044
1982	12,511	6,657	33,254	4,220	4,801	61,457
1983	12,979	6,526	34,300	3,888	4,440	62,217
1984	13,411	6,718	37,471	3,894	4,646	66,233
1985	14,285	7,004	40,115	4,131	4,962	70,614
1986	15,079	7,057	40,948	4,332	5,413	74,288
1987	15,712	7,155	44,071	4,506	6,006	79,491
1988	16,825	7,303	46,893	4,456	6,409	83,881
1989	18,813	7,798	50,284	4,426	7,216	90,469
1990	20,389	8,265	52,213	4,549	6,707	94,069

Note : "Commercial" includes services for maize mill factories.
"Service" includes temporary services.
"Total" includes sales in tariff 10 and export.
Source : INFORME ANUAL 1990, CFE

表 2.8 セクター別電力消費者数の推移

Unit : 1,000 Nos.

Year	Residentical	Commercial	Industrial	Service	Agriculture	Total
1974	5,844	945	18	32	18	6,857
1975	6,255	978	20	36	20	7,309
1976	6,618	1,005	22	38	24	7,707
1977	6,978	1,044	24	36	27	8,109
1978	7,168	1,055	24	35	29	8,311
1979	7,626	1,121	27	38	32	8,844
1980	8,143	1,178	30	41	37	9,429
1981	8,730	1,233	33	45	41	10,082
1982	9,331	1,294	36	48	45	10,754
1983	9,923	1,350	39	49	49	11,410
1984	10,434	1,401	41	52	53	11,981
1985	10,959	1,443	43	55	57	12,557
1986	11,568	1,485	45	57	60	13,215
1987	12,134	1,515	47	59	65	13,820
1988	12,707	1,555	50	62	69	14,443
1989	13,313	1,625	53	65	73	15,129
1990	13,952	1,712	56	69	76	15,865

Note : "Commercial" includes services for maize mill factories.
"Service" includes temporary services.
Source : INFORME ANUAL 1990, CFE

表 2.9 セクター別電力消費原単位の推移

Unit : kWh/nos.

Year	Residentical	Commercial	Industrial	Service	Agriculture
1974	79	359	81,255	6,352	9,409
1975	81	360	80,451	6,139	8,905
1976	84	367	80,498	6,361	8,337
1977	88	372	82,033	7,312	8,173
1978	96	397	86,724	7,821	8,372
1979	101	402	85,979	7,504	8,558
1980	103	412	80,318	7,432	8,551
1981	107	451	79,675	7,360	7,823
1982	112	429	76,505	7,368	8,836
1983	109	403	73,255	6,608	7,523
1984	107	400	75,721	6,243	7,278
1985	109	404	77,411	6,269	7,302
1986	109	396	75,216	6,327	7,485
1987	108	394	77,433	6,343	7,711
1988	110	391	78,312	5,999	7,707
1989	118	399	79,947	5,684	8,214
1990	122	402	77,981	5,496	7,326

Note : "Commercial" includes services for maize mill factories.
"Service" includes temporary services.
Source : INFORME ANUAL 1990, CFE

表 2.10　1970年～1990年の電力需要の推移

Year	Required Energy				Sales		GDP		IBF			Population	
	Gross		Net								IBF/GDP		
	(GWh)	(%)	(GWh)	(%)	(GWh)	(%)	($80*10^9)	(%)	($80*10^9)	(%)	(%)	(10^3)	(%)
1970	26,030		25,434		21,758		2,396.1		497.2		20.75	51,176	
1971	28,693	10.2	27,808	9.3	23,705	8.9	2,496.0	4.17	488.7	-1.71	19.58	52,884	3.34
1972	31,805	10.8	30,864	11.0	26,412	11.4	2,707.9	8.49	548.5	12.24	20.25	54,661	3.36
1973	34,781	9.4	33,789	9.5	29,021	9.9	2,934.4	8.37	629.3	14.75	21.45	56,481	3.33
1974	38,407	10.4	37,455	10.8	32,152	10.8	3,115.0	6.15	679.1	7.90	21.80	58,320	3.26
1975	41,228	7.3	40,017	6.8	35,419	10.2	3,289.7	5.61	742.0	9.27	22.55	60,153	3.14
1976	44,927	9.0	43,591	8.9	38,211	7.9	3,429.2	4.24	745.3	0.45	21.73	61,979	3.04
1977	49,010	9.1	47,247	8.4	41,517	8.7	3,547.2	3.44	695.3	-6.71	19.60	63,813	2.96
1978	53,048	8.2	51,067	8.1	45,423	9.4	3,839.9	8.25	800.8	15.17	20.85	65,658	2.89
1979	58,087	9.5	55,608	8.9	49,429	8.8	4,191.4	9.15	962.9	20.25	22.97	67,517	2.83
1980	62,490	7.6	59,937	7.8	52,658	6.5	4,540.3	8.25	1,106.8	14.94	24.38	69,393	2.78
1981	68,213	9.2	65,699	9.6	57,455	9.1	4,901.2	7.95	1,286.4	16.23	26.25	71,284	2.73
1982	73,222	7.3	70,292	7.0	61,479	7.0	4,874.6	-0.54	1,070.4	-16.79	21.96	73,188	2.67
1983	74,843	2.2	71,518	1.7	62,099	1.0	4,617.5	-5.27	767.7	-28.28	16.63	75,107	2.62
1984	79,538	6.3	76,007	6.3	66,333	6.8	4,787.3	3.68	817.0	6.43	17.07	77,043	2.58
1985	85,514	7.5	81,656	7.4	70,652	6.5	4,920.4	2.78	881.2	7.85	17.91	78,996	2.53
1986	89,500	4.7	85,282	4.4	74,331	5.2	4,735.7	-3.75	777.2	-11.80	16.41	80,970	2.50
1987	96,488	7.8	91,846	7.7	79,532	7.0	4,817.7	1.73	775.2	-0.26	16.09	82,966	2.47
1988	102,096	5.8	97,160	5.8	83,925	5.5	4,884.2	1.38	821.6	5.99	16.82	84,976	2.42
1989	110,726	8.5	105,449	8.5	90,665	8.0	5,037.8	3.14	870.4	5.94	17.28	86,993	2.37
1990	115,000	3.9	109,316	3.7	94,285	4.0	5,234.2	3.90	961.8	10.50	18.38	89,012	2.32

Source: DESARROLLO DEL MERCADO ELECTRICO 1986-2000, CFE

表 2.11　1991 年～2000 年の電力需要予測

Year	Required Energy				Sales		GDP		IBF			Population	
	Gross		Net				($80*		($80*		IBF/GDP		
	(GWh)	(%)	(GWh)	(%)	(GWh)	(%)	10^9)	(%)	10^9)	(%)	(%)	(10^3)	(%)
						Medium Scenario							
1991	120,679	4.9	114,844	5.1	98,885	4.9	5,433.1	3.80	1,049.9	9.16	19.32	91,036	2.27
1992	129,673	7.5	123,597	7.6	106,539	7.7	5,740.1	5.65	1,163.6	10.83	20.27	93,070	2.23
1993	139,083	7.3	132,386	7.1	114,190	7.2	6,064.4	5.65	1,274.1	9.50	21.01	95,107	2.19
1994	149,656	7.6	142,249	7.4	122,728	7.5	6,407.0	5.65	1,391.5	9.21	21.72	97,141	2.14
1995	160,354	7.1	152,471	7.2	131,559	7.2	6,727.4	5.00	1,487.1	6.87	22.10	99,165	2.08
1996	171,929	7.2	163,595	7.3	141,154	7.3	7,063.7	5.00	1,577.3	6.07	22.33	101,178	2.03
1997	183,669	6.8	174,746	6.8	150,720	6.8	7,416.9	5.00	1,677.0	6.32	22.61	103,191	1.99
1998	195,790	6.6	186,083	6.5	160,286	6.3	7,787.8	5.00	1,787.9	6.61	22.96	105,193	1.94
1999	210,231	7.4	199,961	7.5	172,380	7.5	8,177.2	5.00	1,901.4	6.35	23.25	107,192	1.90
2000	225,883	7.4	215,209	7.8	185,515	7.6	8,586.0	5.00	2,018.2	6.14	23.51	109,180	1.86
Ave.		7.0		7.0		7.0		5.10		7.70			2.10
						High Scenario							
1991	121,038	5.3	115,186	5.4	99,179	5.2	5,469.7	4.50	1,070.8	11.33	19.58	91,036	2.27
1992	130,343	7.7	124,236	7.9	107,909	8.0	5,797.9	6.00	1,200.5	12.12	20.71	93,070	2.23
1993	140,168	7.5	133,419	7.4	115,081	7.5	6,145.8	6.00	1,325.4	10.40	21.57	95,107	2.19
1994	151,282	7.9	143,795	7.8	124,062	7.8	6,514.5	6.00	1,458.3	10.03	22.39	97,141	2.14
1995	162,779	7.6	154,777	7.6	133,549	7.6	6,872.8	5.50	1,575.9	8.06	22.93	99,165	2.08
1996	175,369	7.7	166,868	7.8	143,978	7.8	7,250.9	5.50	1,690.0	7.24	23.31	101,178	2.03
1997	188,378	7.4	179,226	7.4	154,584	7.4	7,649.7	5.50	1,814.7	7.38	23.72	103,191	1.99
1998	202,076	7.3	192,057	7.2	165,432	7.0	8,070.4	5.50	1,952.2	7.58	24.19	105,193	1.94
1999	218,431	8.1	207,761	8.2	179,104	8.3	8,514.3	5.50	2,093.6	7.24	24.59	107,192	1.90
2000	236,389	8.2	225,219	8.4	194,144	8.4	8,982.5	5.50	2,239.3	6.96	24.93	109,180	1.86
Ave.		7.5		7.5		7.5		5.60		8.80			2.10
						Low Scenario							
1991	120,269	4.6	114,454	4.7	98,549	4.5	5,391.2	3.00	1,026.2	6.70	19.04	91,036	2.27
1992	128,945	7.2	122,903	7.4	105,941	7.5	5,677.0	5.30	1,123.8	9.51	19.80	93,070	2.23
1993	137,937	7.0	131,295	6.8	113,249	6.9	5,977.8	5.30	1,220.9	8.64	20.42	95,107	2.19
1994	147,974	7.3	140,650	7.1	121,349	7.2	6,294.7	5.30	1,323.8	8.43	21.03	97,141	2.14
1995	157,900	6.7	150,137	6.7	129,545	6.8	6,577.9	4.50	1,399.6	5.72	21.28	99,165	2.08
1996	168,515	6.7	160,347	6.8	138,351	6.8	6,873.9	4.50	1,468.7	4.94	21.37	101,178	2.03
1997	179,072	6.3	170,372	6.3	146,948	6.2	7,183.3	4.50	1,546.3	5.28	21.53	103,191	1.99
1998	189,749	6.0	180,342	5.9	155,341	5.7	7,506.5	4.50	1,633.6	5.65	21.76	105,193	1.94
1999	202,463	6.7	192,572	6.8	166,010	6.9	7,844.3	4.50	1,723.0	5.47	21.96	107,192	1.90
2000	216,064	6.7	205,854	6.9	177,451	6.9	8,197.3	4.50	1,814.6	5.32	22.14	109,180	1.86
Ave.		6.5		6.5		6.5		4.60		6.60			2.10

Source: DESARROLLO DEL MERCADO ELECTRICO 1986-2000, CFE

表　2.12　　1993 年における国内幹線システムの月別発電力バランス計画（１／６）

JANUARY

TIME ZONE	E5	E4	E3	E2	E1	DAILY	MONTHLY
DURATION	1	3	11	7	2		
NUCLEAR	591.6	591.6	591.6	591.6	591.6	14,198	440,150
GEOTHERMAL	92.8	92.8	92.8	92.8	92.8	2,227	69,043
COAL FIRED THERMAL	1335.9	1335.9	1335.9	1335.9	1335.9	32,062	993,910
COMBINED CYCLE	1080.6	1080.6	1080.6	1080.3	939.8	25,651	795,172
MAJOR THERMAL IV	685.5	685.5	685.5	685.5	685.5	16,452	510,012
MAJOR THERMAL III	940.3	940.3	940.3	940.3	798.4	22,283	690,785
MAJOR THERMAL II	1697.8	1494.7	1190.7	1147.2	1004.4	29,319	908,883
MAJOR THERMAL I	4037.2	3967.5	3981.7	3467.2	3319.3	90,647	2,810,069
MINOR THERMAL	405.9	339.8	347.3	316.8	256	7,975	247,231
GAS TURBINE	593.5	170.8	0	0	0	1,106	34,283
THERMAL POWER TOTAL	11461.1	10699.5	10246.4	9657.6	9023.7	241,921	7,499,539
MAJOR HYDRO	691.9	520.9	475.9	394.6	164.7	10,581	328,014
MINOR HYDRO	1703.7	1668.2	745.5	134.1	68	15,984	495,489
GRIJALVA HYDRO SYS.	2629.8	1936.1	1571.1	584	0	29,808	924,054
HYDRO POWER TOTAL	5025.4	4125.2	2792.5	1112.7	232.7	56,373	1,747,557
GENERAC. TOTAL	16486.5	14824.7	13038.9	10770.3	9256.4	298,293	9,247,095
% DURATION ANNUALLY	94.16%	84.67%	74.47%	61.51%	52.87%		
MONTHLY	100.00%	89.92%	79.09%	65.33%	56.15%	L.F.=	75.39%

FEBRUARY

TIME ZONE	E5	E4	E3	E2	E1	DAILY	MONTHLY
DURATION	1	3	11	7	2		
NUCLEAR	591.6	591.6	591.6	591.6	591.6	14,198	397,555
GEOTHERMAL	90.5	90.5	90.5	90.5	90.5	2,172	60,816
COAL FIRED THERMAL	1136.7	1136.7	1136.7	1136.7	1136.7	27,281	763,862
COMBINED CYCLE	981	981	981	980.5	963.7	23,506	658,165
MAJOR THERMAL IV	640.7	640.7	640.7	640.7	640.7	15,377	430,550
MAJOR THERMAL III	662.3	662.3	662.3	662.3	650.8	15,872	444,422
MAJOR THERMAL II	1763.1	1744.4	1520.4	1287.5	1243	35,219	986,138
MAJOR THERMAL I	4402.5	4296.1	4250.6	3750.6	3628.5	97,559	2,731,641
MINOR THERMAL	448	369.2	384.8	350.8	310.1	8,864	248,198
GAS TURBINE	585.9	146.8	7.2	0	0	1,106	30,954
THERMAL POWER TOTAL	11302.3	10659.3	10265.8	9491.2	9255.6	241,154	6,752,301
MAJOR HYDRO	933.2	767.2	723.2	644.2	471.4	16,642	465,982
MINOR HYDRO	1675.9	1608.5	761.9	163.4	113.6	16,253	455,092
GRIJALVA HYDRO SYS.	2700.3	1873.5	1558.4	675.9	0	30,195	845,446
HYDRO POWER TOTAL	5309.4	4249.2	3043.5	1483.5	585	63,090	1,766,520
GENERAC. TOTAL	16611.7	14908.5	13309.3	10974.7	9840.6	304,244	8,518,821
% DURATION ANNUALLY	94.88%	85.15%	76.01%	62.68%	56.20%		
MONTHLY	100.00%	89.75%	80.12%	66.07%	59.24%	L.F.=	76.31%

表　2.12　　1993 年における国内幹線システムの月別発電力バランス計画（2／6）

MARCH

TIME ZONE	E5	E4	E3	E2	E1	DAILY	MONTHLY
DURATION	1	3	11	7	2		
NUCLEAR	591.6	591.6	591.6	591.6	591.6	14,198	440,150
GEOTHERMAL	91.3	91.3	91.3	91.3	91.3	2,191	67,927
COAL FIRED THERMAL	1362.4	1362.4	1362.4	1362.4	1362.4	32,698	1,013,626
COMBINED CYCLE	1020.6	1020.6	1020.6	1020.1	1020.1	24,490	759,187
MAJOR THERMAL IV	442.8	442.8	442.8	442.8	442.8	10,627	329,443
MAJOR THERMAL III	922.4	922.4	922.4	922.4	922.4	22,138	686,266
MAJOR THERMAL II	1599.2	1590.4	1573.2	1176.8	1166.2	34,246	1,061,614
MAJOR THERMAL I	4516.3	4432	4405.1	3847.7	3704	100,610	3,118,919
MINOR THERMAL	470.7	409.7	424	392.5	356.7	9,825	304,566
GAS TURBINE	602.8	167.7	0	0	0	1,106	34,283
THERMAL POWER TOTAL	11620.1	11030.9	10833.4	9847.6	9657.5	252,128	7,815,980
MAJOR HYDRO	849.6	717.6	682.6	605.3	448.6	15,645	485,004
MINOR HYDRO	1681.4	1605.4	655	168.2	127.7	15,135	469,197
GRIJALVA HYDRO SYS.	2879.3	2025.2	1665.6	959.6	155	34,304	1,063,415
HYDRO POWER TOTAL	5410.3	4348.2	3003.2	1733.1	731.3	65,084	2,017,616
GENERAC. TOTAL	17030.4	15379.1	13836.6	11580.7	10388.8	317,213	9,833,597
% DURATION ANNUALLY	97.27%	87.84%	79.03%	66.14%	59.33%		
MONTHLY	100.00%	90.30%	81.25%	68.00%	61.00%	L.F.=	77.61%

APRIL

TIME ZONE	E5	E4	E3	E2	E1	DAILY	MONTHLY
DURATION	1	3	11	7	2		
NUCLEAR	591.6	591.6	591.6	591.6	591.6	14,198	425,952
GEOTHERMAL	86.9	86.9	86.9	86.9	86.9	2,086	62,568
COAL FIRED THERMAL	1275.4	1275.4	1275.4	1275.4	1275.4	30,610	918,288
COMBINED CYCLE	1235.9	1235.9	1235.9	1235.3	1235.3	29,656	889,686
MAJOR THERMAL IV	587.4	587.4	587.4	587.4	587.4	14,098	422,928
MAJOR THERMAL III	822.2	822.2	822.2	822.2	822.2	19,733	591,984
MAJOR THERMAL II	1737.9	1730.2	1634.2	1229.1	1209.8	35,928	1,077,840
MAJOR THERMAL I	4302.7	4254.6	4159.5	3638.3	3479.7	95,249	2,857,455
MINOR THERMAL	469.2	468.7	418.6	365.2	302.5	9,641	289,239
GAS TURBINE	559.3	182.2	0	0	0	1,106	33,177
THERMAL POWER TOTAL	11668.5	11235.1	10811.7	9831.4	9590.8	252,304	7,569,117
MAJOR HYDRO	853.8	746.8	698.8	566.6	443.1	15,633	469,002
MINOR HYDRO	1651.7	1548.5	730.8	111.1	57	15,228	456,831
GRIJALVA HYDRO SYS.	3240.5	2324.2	1872.4	1152.8	113.4	39,106	1,173,177
HYDRO POWER TOTAL	5746	4619.5	3302	1830.5	613.5	69,967	2,099,010
GENERAC. TOTAL	17414.5	15854.6	14113.7	11661.9	10204.3	322,271	9,668,127
% DURATION ANNUALLY	99.46%	90.55%	80.61%	66.61%	58.28%		
MONTHLY	100.00%	91.04%	81.05%	66.97%	58.60%	L.F.=	77.11%

表　2.12　　1993 年における国内幹線システムの月別発電力バランス計画（３／６）

MAY

TIME ZONE	E5	E4	E3	E2	E1	DAILY	MONTHLY
DURATION	1	3	11	7	2		
NUCLEAR	591.6	591.6	591.6	591.6	591.6	14,198	440,150
GEOTHERMAL	91.4	91.4	91.4	91.4	91.4	2,194	68,002
COAL FIRED THERMAL	1456.2	1456.2	1456.2	1456.2	1456.2	34,949	1,083,413
COMBINED CYCLE	1042.9	1042.4	1056.7	1038.3	1038.3	25,139	779,294
MAJOR THERMAL IV	501.6	501.6	501.6	501.6	501.6	12,038	373,190
MAJOR THERMAL III	787.9	787.9	787.9	787.9	787.9	18,910	586,198
MAJOR THERMAL II	1949.7	1947.4	1929.9	1403	1387.6	41,617	1,290,127
MAJOR THERMAL I	4446.5	4401.8	4348.5	3976.5	3679.3	100,680	3,121,065
MINOR THERMAL	557.5	510.8	482.4	456.1	415	11,419	353,989
GAS TURBINE	518.8	195.7	0	0	0	1,106	34,283
THERMAL POWER TOTAL	11944.1	11526.8	11246.2	10302.6	9948.9	262,249	8,129,710
MAJOR HYDRO	828.5	734.5	699.5	625.5	447.8	16,001	496,019
MINOR HYDRO	1706.3	1617.9	781.1	159.5	104.1	16,477	510,781
GRIJALVA HYDRO SYS.	3030.2	2276.9	1796.9	1151.1	443.8	38,572	1,195,735
HYDRO POWER TOTAL	5565	4629.3	3277.5	1936.1	995.7	71,050	2,202,535
GENERAC. TOTAL	17509.1	16156.1	14523.7	12238.7	10944.6	333,298	10,332,244
% DURATION ANNUALLY	100.00%	92.27%	82.95%	69.90%	62.51%		
MONTHLY	100.00%	92.27%	82.95%	69.90%	62.51%	L.F.=	79.32%

JUNE

TIME ZONE	E5	E4	E3	E2	E1	DAILY	MONTHLY
DURATION	1	3	11	7	2		
	1	2	3	4	5		
NUCLEAR	591.6	591.6	591.6	591.6	591.6	14,198	425,952
GEOTHERMAL	85.5	85.5	85.5	85.5	85.5	2,052	61,560
COAL FIRED THERMAL	1613.2	1613.2	1613.2	1613.2	1613.2	38,717	1,161,504
COMBINED CYCLE	1094	1094	1094	1093.3	1090.5	26,244	787,323
MAJOR THERMAL IV	605.8	605.8	605.8	605.8	605.8	14,539	436,176
MAJOR THERMAL III	940.3	940.3	940.3	940.3	940.3	22,567	677,016
MAJOR THERMAL II	1563.5	1183.1	1183.1	1183.1	1183.1	28,775	863,244
MAJOR THERMAL I	4822.9	4778.5	4746	4148.2	3998.4	108,399	3,251,958
MINOR THERMAL	460.1	459.9	482.8	430.4	361.9	10,887	326,616
GAS TURBINE	489.2	196.9	2.8	0	0	1,111	33,321
THERMAL POWER TOTAL	12266.1	11548.8	11345.1	10691.4	10470.3	267,489	8,024,670
MAJOR HYDRO	1210.6	1109.6	1073.6	1002.1	818.6	25,001	750,027
MINOR HYDRO	1637.5	1581.1	805.1	218.1	105.3	16,974	509,226
GRIJALVA HYDRO SYS.	2315.5	1895.3	1605	742.8	0	30,856	925,680
HYDRO POWER TOTAL	5163.6	4586	3483.7	1963	923.9	72,831	2,184,933
GENERAC. TOTAL	17429.7	16134.8	14828.8	12654.4	11394.2	340,320	10,209,603
% DURATION ANNUALLY	99.55%	92.15%	84.69%	72.27%	65.08%		
MONTHLY	100.00%	92.57%	85.08%	72.60%	65.37%	L.F.=	81.36%

表　2.12　　1993 年における国内幹線システムの月別発電力バランス計画（4／6）

JULY

TIME ZONE	E5	E4	E3	E2	E1	DAILY	MONTHLY
DURATION	1	3	11	7	2		
NUCLEAR	591.6	591.6	591.6	591.6	591.6	14,198	440,150
GEOTHERMAL	92.7	92.7	92.7	92.7	92.7	2,225	68,969
COAL FIRED THERMAL	1659.4	1659.4	1659.4	1659.4	1659.4	39,826	1,234,594
COMBINED CYCLE	1062.3	1062.3	1062.3	1061.7	882.7	25,132	779,086
MAJOR THERMAL IV	564.2	564.2	564.2	564.2	564.2	13,541	419,765
MAJOR THERMAL III	779.7	779.7	779.7	779.7	605.3	18,364	569,284
MAJOR THERMAL II	1458.4	1345.4	1345.4	1345.4	1239.1	32,190	997,890
MAJOR THERMAL I	4718.7	4595.9	4334.6	4058	3939.5	102,472	3,176,632
MINOR THERMAL	432.9	432.1	461.4	419.2	359.7	10,458	324,210
GAS TURBINE	515.7	198.3	0	0	0	1,111	34,429
THERMAL POWER TOTAL	11875.6	11321.6	10891.3	10571.9	9934.2	259,516	8,045,008
MAJOR HYDRO	1269.4	1114.4	1075.4	992.8	868.8	25,129	779,005
MINOR HYDRO	1716.9	1693.1	968.7	297.9	150.4	19,838	614,978
GRIJALVA HYDRO SYS.	2176.9	1611.2	1391.3	260	0	24,135	748,179
HYDRO POWER TOTAL	5163.2	4418.7	3435.4	1550.7	1019.2	69,102	2,142,162
GENERAC. TOTAL	17038.8	15740.3	14326.7	12122.6	10953.4	328,618	10,187,170
% DURATION ANNUALLY	97.31%	89.90%	81.82%	69.24%	62.56%		
MONTHLY	100.00%	92.38%	84.08%	71.15%	64.29%	L.F.=	80.36%

AUGUST

TIME ZONE	E5	E4	E3	E2	E1	DAILY	MONTHLY
DURATION	1	3	11	7	2		
NUCLEAR	267.2	267.2	267.2	267.2	267.2	6,413	198,797
GEOTHERMAL	88.7	88.7	88.7	88.7	88.7	2,129	65,993
COAL FIRED THERMAL	1516.4	1516.4	1516.4	1516.4	1516.4	36,394	1,128,202
COMBINED CYCLE	1229	1229	1244.2	1228.3	1087.9	29,376	910,659
MAJOR THERMAL IV	685.5	685.5	685.5	685.5	685.5	16,452	510,012
MAJOR THERMAL III	683	683	683	683	543.8	16,114	499,522
MAJOR THERMAL II	1648.5	1351.3	1351.3	1351.3	1351.3	32,728	1,014,580
MAJOR THERMAL I	5210.7	5200.8	4871.5	4438.8	4324.5	114,120	3,537,726
MINOR THERMAL	458.9	458.6	468.4	448.4	386.2	10,898	337,847
GAS TURBINE	545.5	188.3	0	0	0	1,110	34,422
THERMAL POWER TOTAL	12333.4	11668.8	11176.2	10707.6	10251.5	265,734	8,237,760
MAJOR HYDRO	1150.5	1013.5	978.5	900.2	759.2	22,774	706,003
MINOR HYDRO	1711.6	1660.6	911.6	234.6	61.2	18,486	573,054
GRIJALVA HYDRO SYS.	2116.1	1635.4	1394.9	433.4	0	25,400	787,400
HYDRO POWER TOTAL	4978.2	4309.5	3285	1568.2	820.4	66,660	2,066,457
GENERAC. TOTAL	17311.6	15978.3	14461.2	12275.8	11071.9	332,394	10,304,217
% DURATION ANNUALLY	98.87%	91.26%	82.59%	70.11%	63.24%		
MONTHLY	100.00%	92.30%	83.53%	70.91%	63.96%	L.F.=	80.00%

表　2.12　　1993 年における国内幹線システムの月別発電力バランス計画（5／6）

SEPTEMBER

TIME ZONE	E5	E4	E3	E2	E1	DAILY	MONTHLY
DURATION	1	3	11	7	2		
NUCLEAR	39.4	39.4	39.4	39.4	39.4	946	28,368
GEOTHERMAL	91.8	91.8	91.8	91.8	91.8	2,203	68,299
COAL FIRED THERMAL	1416	1416	1416	1416	1416	33,984	1,053,504
COMBINED CYCLE	1242.7	1242.7	1242.7	1242	1125	29,585	917,120
MAJOR THERMAL IV	560.1	560.1	560.1	560.1	560.1	13,442	416,714
MAJOR THERMAL III	932.3	932.3	932.3	932.3	768.3	22,047	683,463
MAJOR THERMAL II	1815.3	1363.1	1363.1	1363.1	1363.1	33,167	1,028,165
MAJOR THERMAL I	5168.1	5146.8	4995.8	4410	4277.3	114,987	3,564,594
MINOR THERMAL	471.1	407.7	429.6	393.3	313.4	9,800	303,791
GAS TURBINE	582.8	175.9	0	0	0	1,111	34,426
THERMAL POWER TOTAL	12319.6	11375.8	11070.8	10448	9954.4	261,271	7,838,118
MAJOR HYDRO	992.4	820.4	778.4	702.5	533.4	18,000	540,009
MINOR HYDRO	1725.1	1708.1	1005	261.4	50	19,834	595,026
GRIJALVA HYDRO SYS.	2433	1954	1354.1	593.8	0	27,347	820,401
HYDRO POWER TOTAL	5150.5	4482.5	3137.5	1557.7	583.4	65,181	1,955,436
GENERAC. TOTAL	17470.1	15858.3	14208.3	12005.7	10537.8	326,452	9,793,554
% DURATION ANNUALLY	99.78%	90.57%	81.15%	68.57%	60.19%		
MONTHLY	100.00%	90.77%	81.33%	68.72%	60.32%	L.F.=	77.86%

OCTOBER

TIME ZONE	E5	E4	E3	E2	E1	DAILY	MONTHLY
DURATION	1	3	11	7	2		
NUCLEAR	591.6	591.6	591.6	591.6	591.6	14,198	440,150
GEOTHERMAL	93.1	93.1	93.1	93.1	93.1	2,234	69,266
COAL FIRED THERMAL	1516.4	1516.4	1516.4	1516.4	1516.4	36,394	1,128,202
COMBINED CYCLE	1248	1248	1248	1247.4	1106.9	29,666	919,634
MAJOR THERMAL IV	604.6	604.6	604.6	604.6	604.6	14,510	449,822
MAJOR THERMAL III	926.3	926.3	926.3	926.3	476	21,331	661,249
MAJOR THERMAL II	1769.4	1353.4	1348.2	1277.4	1053.4	31,708	982,960
MAJOR THERMAL I	4875.4	4725.9	4537.6	4208.7	4131.6	106,691	3,307,415
MINOR THERMAL	396.3	395.4	400.6	358.5	321	9,141	283,359
GAS TURBINE	608.7	167.3	0	0	0	1,111	34,429
THERMAL POWER TOTAL	12629.8	11622	11266.4	10824	9894.6	266,983	8,276,485
MAJOR HYDRO	884.5	720.5	609.5	520.4	400.4	14,194	440,017
MINOR HYDRO	1704.5	1681.5	847.1	255.1	119.2	18,091	560,827
GRIJALVA HYDRO SYS.	2119.8	1766.8	1138	0	0	19,938	618,084
HYDRO POWER TOTAL	4708.8	4168.8	2594.6	775.5	519.6	52,224	1,618,929
GENERAC. TOTAL	17338.6	15790.8	13861	11599.5	10414.2	319,207	9,895,414
% DURATION ANNUALLY	99.03%	90.19%	79.17%	66.25%	59.48%		
MONTHLY	100.00%	91.07%	79.94%	66.90%	60.06%	L.F.=	76.71%

表　2.12　　1993 年における国内幹線システムの月別発電力バランス計画（6／6）

NOVEMBER

TIME ZONE	E5	E4	E3	E2	E1	DAILY	MONTHLY
DURATION	1	3	11	7	2		
NUCLEAR	591.6	591.6	591.6	591.6	591.6	14,198	425,952
GEOTHERMAL	89.4	89.4	89.4	89.4	89.4	2,146	64,368
COAL FIRED THERMAL	1416	1416	1416	1416	1416	33,984	1,019,520
COMBINED CYCLE	1183	1183	1183	1182.4	1065.4	28,153	844,578
MAJOR THERMAL IV	685.5	685.5	685.5	685.5	685.5	16,452	493,560
MAJOR THERMAL III	914.4	900.9	900.9	900.9	900.9	21,635	649,053
MAJOR THERMAL II	1464.3	1397.9	1173.6	1025.8	1017.5	27,783	833,496
MAJOR THERMAL I	4445.2	4386.5	4355.5	3837.4	3697.2	99,771	2,993,142
MINOR THERMAL	427.4	381.7	364	319.7	276.6	8,368	251,028
GAS TURBINE	603	169.2	0	0	0	1,111	33,318
THERMAL POWER TOTAL	11819.8	11201.7	10759.5	10048.7	9740.1	253,601	7,608,015
MAJOR HYDRO	848.3	652.3	530.3	447.3	298.3	12,366	370,986
MINOR HYDRO	1670.1	1642.1	739.9	202.5	82.8	16,318	489,552
GRIJALVA HYDRO SYS.	3072.4	2200.3	1628.5	600.6	0	31,791	953,730
HYDRO POWER TOTAL	5590.8	4494.7	2898.7	1250.4	381.1	60,476	1,814,268
GENERAC. TOTAL	17410.6	15696.4	13658.2	11299.1	10121.2	314,076	9,422,283
% DURATION ANNUALLY	99.44%	89.65%	78.01%	64.53%	57.81%		
MONTHLY	100.00%	90.15%	78.45%	64.90%	58.13%	L.F.=	75.16%

DECEMBER

TIME ZONE	E5	E4	E3	E2	E1	DAILY	MONTHLY
DURATION	1	3	11	7	2		
NUCLEAR	591.6	591.6	591.6	591.6	591.6	14,198	440,150
GEOTHERMAL	93.3	93.3	93.3	93.3	93.3	2,239	69,415
COAL FIRED THERMAL	1659.4	1659.4	1659.4	1659.4	1453.5	39,414	1,221,828
COMBINED CYCLE	1151.2	1151.2	1151.2	1052.7	1010.8	26,659	826,414
MAJOR THERMAL IV	685.5	685.5	685.5	685.5	685.5	16,452	510,012
MAJOR THERMAL III	787.9	787.9	787.9	787.9	412.6	18,159	562,929
MAJOR THERMAL II	1826.8	1371.1	1351.5	1082.7	935.6	30,257	937,958
MAJOR THERMAL I	4628.9	4566.8	4309	4164.5	3836.5	102,553	3,179,137
MINOR THERMAL	485.1	424.9	416.9	366.5	325.3	9,562	296,416
GAS TURBINE	598	169.3	0	0	0	1,106	34,283
THERMAL POWER TOTAL	12507.7	11501	11046.3	10484.1	9344.7	260,598	8,078,541
MAJOR HYDRO	644.7	462.7	356.7	287.9	110.9	8,194	254,002
MINOR HYDRO	1677.8	1648.8	659.2	160.3	86.2	15,170	470,267
GRIJALVA HYDRO SYS.	2214.9	1646.7	1024.1	0	0	18,420	571,023
HYDRO POWER TOTAL	4537.4	3758.2	2040	448.2	197.1	41,784	1,295,292
GENERAC. TOTAL	17045.1	15259.2	13086.3	10932.3	9541.8	302,382	9,373,833
% DURATION ANNUALLY	97.35%	87.15%	74.74%	62.44%	54.50%		
MONTHLY	100.00%	89.52%	76.77%	64.14%	55.98%	L.F.=	73.92%

Source : CFE

表　2.13　　1990 年に運転開始の発電設備

	Project Name	Unit	Capacity (MW)
(A)	Power station entered into operation		
	Boca Pozos Azufres	#9	5
	Laguna Verde	#1	675
	TOTAL		680
(B)	Power Station in Preparation of Tests		
	Guadalupe Victoria	#1	160
	Filipe Carrillo Puerto (Valladolid)	#1	70
	Filipe Carrillo Puerto (Valladolid)	#2	70
	Presidente Juarez (Rasarito 11)	#1	160
	Adolfo Lopez Mateos	#1	350
	Adolfo Lopez Mateos	#2	350
	Boca Pozo Los Humeros	#1	5
	Boca Pozo Los Humeros	#2	5
	Boca Pozo Los Humeros	#3	5
	Boca Pozos Azufres	#8	5
	TOTAL		1,180

Source : INFORME ANUAL 1990, CFE

表　2.14　　1990 年に完成した送電線と変電所

Transmission Lines completed in 1990

Voltage	Length(km)
400 kV lines	67
230 kV lines	829
Lines less than 230 kV	828
Total	1,724

Substation completed in 1990

Voltage	Capacity(MVA)
Of 400 kV	815
Of 230 kV	350
Less than 230 kV	484
Total	1,649

Note : Exclude lines/substations in charge of Subdirection of Production and Distribution.
Source : INFORME ANUAL 1990, CFE

表　2.15　　建設中の発電設備

PROJECT	UNIT *1	CAPACITY (MW)	LOCATION	DATE OF COMPLETION *2
Hydroelectric Power				
Agua Prieta	2	240	Zapopan, Jal.	Oct-91
Comedero	2	110	Cosala, Sin.	Jul-91
Aguamilpa	3	960	Tepic, Nay.	Jun-95
Zimapan	2	280	Zimzpan,Hgo.	Feb-95
Sub-total	9	1590		
Geothermal Power				
Boca Pozo Los Humanos	4	20	Chignautla, Pue.	*4
Boca Pozo Los Azufres	2	10	Zinapecuaro,Mich	Aug-90
Sub-total	6	30		
Oil Fired Thermal Power				
Adolfo Lopez Mateos *3	2	700	Tuxpan, Ver.	Feb-91
Guadalupe Victoria (lerdo)	2	320	Lerdo, Dgo.	May-91
Presidente Juarez (Rosarito II)	2	320	Tijuana, B.C.	Jul-91
San Carlos	2	65	Comondu, B.C.S.	Aug-91
Felipe Carrillo Puerto (Valladolid)	2	75	Valladolid, Yuc.	Sep-91
Petacalco *3	2	700	La Union, Gro.	May-93
Sub-total	12	2180		
Combined Cycle Thermal Power				
Felipe Carrillo Puerto (Valladolid)	3	220	Valladolid, Yuc.	Apr-91
Sub-total	3	220		
Coal Fired Thermal Power				
Carbon II *3	2	700	Nava, Coah.	Oct-92
Sub-total	2	700		
Nuclear Power				
Laguna Verde	1	675	Alto Lucero,Ver.	Jun-94
Sub-total	1	675		
TOTAL	32	5395		

Note : *1 Number of units which conform to total project, except Laguna Verde.
*2 Commercial entry of the latest unit of the project.
*3 1st stage
*4 Subject to delivery from turbo-generator on the part of supplier.
Source : INFORME ANUAL 1990, CFE

表 3.1　マサテペック発電所の総発生電力量

(Unit : MWh)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1962						740	24,790	11,066	32,614	47,440	27,691	21,260	165,601
1963	24,080	13,062	13,142	11,042	16,351	27,831	84,631	64,280	60,881	57,711	53,030	23,060	449,101
1964	28,371	21,311	15,693	14,989	29,361	61,790	71,652	43,341	36,941	68,813	52,033	61,753	506,048
1965	42,181	34,222	23,742	19,736	29,641	30,579	66,979	108,210	54,960	74,363	60,889	41,597	587,099
1966	26,882	17,667	22,183	22,501	31,132	34,658	101,190	69,252	80,912	107,620	81,364	30,552	625,913
1967	26,874	37,488	25,794	25,016	28,812	35,742	39,772	38,328	74,834	101,970	51,190	37,029	522,849
1968	36,079	17,460	23,663	22,900	37,741	44,755	71,912	75,037	81,070	72,354	52,354	39,204	574,529
1969	39,771	34,846	25,460	23,066	20,149	24,637	62,705	82,001	132,450	114,250	70,328	39,492	669,155
1970	35,993	32,486	38,203	26,883	34,470	44,468	66,952	83,621	79,245	99,942	47,251	29,534	619,048
MEAN	32,529	26,068	23,485	20,767	28,457	33,911	65,620	63,904	70,434	82,718	55,126	35,942	524,371
1971	31,060	24,250	24,890	30,190	29,300	38,400	61,810	65,500	59,200	116,190	106,500	44,500	631,790
1972	44,126	33,440	26,109	24,277	27,354	99,088	78,481	111,340	86,168	85,130	57,500	44,900	717,913
1973	32,600	20,730	22,880	24,640	31,280	42,610	101,290	125,790	113,660	88,880	57,760	46,320	708,440
1974	40,000	23,910	27,710	19,070	24,870	77,470	128,510	69,410	96,810	94,710	67,160	53,010	722,640
1975	40,480	30,400	26,810	22,880	25,890	49,470	63,760	64,600	92,990	115,840	48,220	46,080	627,420
1976	60,160	45,070	28,030	28,920	28,610	53,360	104,080	75,920	75,150	75,110	72,150	46,110	692,670
1977	36,774	24,110	40,872	23,036	29,040	35,064	65,338	49,719	50,420	82,212	63,534	32,228	532,347
1978	32,620	26,200	29,780	28,400	19,820	63,210	67,620	101,220	86,190	133,630	76,260	32,870	697,820
1979	36,974	24,730	34,512	31,920	22,496	50,492	57,346	112,120	144,640	76,586	68,014	48,594	708,424
1980	39,708	25,100	38,294	26,907	36,566	30,806	33,326	70,146	83,838	112,300	61,080	40,160	598,231
MEAN	39,450	27,794	29,989	26,024	27,523	53,997	76,156	84,577	88,907	98,059	67,818	43,477	663,770
1981	35,266	32,174	38,290	31,170	34,616	98,104	141,900	88,082	143,300	139,900	73,114	48,886	904,802
1982	44,038	26,108	42,902	28,630	50,836	31,496	53,332	46,218	75,342	107,900	53,330	36,514	596,646
1983	43,310	23,350	28,480	27,360	19,520	16,050	94,640	66,430	78,390	79,880	84,430	41,550	603,390
1984	42,970	29,090	28,880	14,080	45,020	91,820	126,990	86,280	143,730	103,360	53,370	37,130	802,720
1985	37,670	28,650	36,970	25,620	29,760	48,540	74,180	81,050	94,630	125,870	42,340	41,830	667,110
1986	37,500	29,560	32,790	18,290	34,970	80,820	68,950	35,050	45,630	83,330	84,740	40,430	592,060
1987	29,966	21,832	24,888	18,266	21,262	41,430	81,932	97,828	76,700	69,052	35,234	26,270	544,660
1988	26,070	20,148	22,382	36,830	20,844	65,798	65,414	70,572	100,850	56,766	45,056	33,610	564,340
1989	29,756	28,895	29,118	24,166	21,242	28,042	55,240	61,620	132,160	83,012	68,558	46,730	608,539
1990	34,940	29,800	36,340	32,090	37,690	39,270	88,540	91,710	137,430	115,490	70,620	56,920	770,840
MEAN	36,149	26,961	32,104	25,650	31,576	54,137	85,112	72,484	102,816	96,456	61,079	40,987	665,511
MEAN (1962-1990)	36,294	27,003	28,886	24,388	29,237	47,812	75,975	73,991	87,970	92,745	61,555	40,280	621,108

表 3.2　月平均発電水量と月平均貯水池流入量

YEAR		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1976	Qp	19.2	15.4	9.0	9.6	9.1	17.7	33.3	24.4	24.8	24.0	23.9	14.8
	Qi	23.4	16.5	12.6	11.0	11.1	28.4	40.6	27.4	38.6	45.0	25.1	16.1
1977	Qp	11.7	8.5	13.0	7.7	9.3	11.7	21.1	16.1	16.9	26.5	21.2	
	Qi	13.0	11.9	9.7	8.4	9.1	10.8	17.7	16.3	15.8	28.5	18.0	13.2
1978	Qp	10.5	9.4	9.7	9.5	6.5	21.5	21.7	32.6	28.5	42.7	25.3	
	Qi	10.0	8.9	8.9	7.1	6.2	23.6	20.5	30.3	35.3	44.6	24.3	14.4
1979	Qp	11.8	8.7	9.1	10.8	7.3	16.6	18.3	36.1	48.1	24.6	22.6	15.6
	Qi	12.4	11.5	9.6	8.6	9.2	19.4	16.9	36.2	70.3	23.6	24.3	16.7
1980	Qp	12.7	8.9	12.3	8.9	11.7	10.3	10.9	22.8	28.0	36.2	20.4	12.9
	Qi	13.7	11.8	10.5	9.6	9.7	9.9	10.4	21.6	44.0	32.3	19.2	12.6
1981	Qp	11.4	11.4	12.3	10.4	11.2	32.4	45.6	28.4	47.5	45.0	24.3	15.7
	Qi	12.6	14.6	11.6	10.4	10.2	42.9	43.5	58.8	62.0	46.1	25.0	19.4
1982	Qp	13.9	9.2	13.6	9.4	16.3	10.4	17.1		24.9	34.6	17.7	12.1
	Qi	12.1	12.2	11.4	11.9	13.9	11.4	15.1	14.9	32.3	39.2	20.5	14.4
1983	Qp	13.8	8.3	9.1	9.1	6.3	5.3	30.4	21.4	26.0	29.3	27.9	13.2
	Qi	12.2	9.8	8.7	7.5	7.1	8.1	24.0	20.1	34.1	25.4	27.8	16.6
1984	Qp	13.6	9.9	9.2	4.7	14.3	31.3	40.6	27.6	47.5	33.0	17.5	11.8
	Qi	12.4	10.7	8.5	7.0	16.5	29.0	41.8	26.9	121.9	31.9	17.4	13.8
1985	Qp	12.0	10.1	11.8	8.4	9.5	16.1	23.7	25.9	31.4	40.2	14.1	13.3
	Qi	12.1	11.0	11.1	9.6	9.1	15.9	22.7	24.5	31.8	45.4	15.5	15.0
1986	Qp	11.9	10.9	10.4	6.0	11.1	26.7	22.0	11.2	15.1	26.7	28.0	12.9
	Qi	13.3	11.1	9.1	7.9	9.9	25.0	22.2	12.4	13.8	27.3	32.6	12.7
1987	Qp	9.5	7.7	8.0	6.1	7.0	13.7	25.9	31.3	25.4	22.1	11.7	8.4
	Qi	10.2	8.7	8.4	7.2	6.7	12.3	29.3	28.9	25.8	20.3	13.3	9.7
1988	Qp	8.4	6.9	7.1	12.2	6.7	21.8	20.9	22.7	33.5	18.1	14.9	10.7
	Qi	8.2	7.7	6.9	12.6	7.1	20.9	20.8	21.5	48.5	19.3	14.8	13.4
1989	Qp	9.5	10.2	9.4	8.1	6.9	9.3	17.7	19.7	43.7	26.6	22.7	15.2
	Qi	10.0	11.2	8.3	8.6	7.2	10.2	18.3	20.6	82.4	26.5	24.1	18.0
1990	Qp	11.2	10.5	11.6	10.6	12.0	13.0	28.3	29.4	45.3	36.9	23.3	18.2
	Qi	12.5	11.3	10.5	11.6	11.4	12.5	26.8	28.8	48.9	34.4	23.8	19.2

Remarks : Qp : Monthly powerplant discharge
Qi : Monthly reservoir inflow

表 3.3　ソレダッド貯水池の貯水位ー貯水面積ー貯水容量曲線

ELE-VATION (m)	1962 AREA (ha)	1962 VOL. (mcm)	1977 AREA (ha)	1977 VOL. (mcm)	1988 AREA (ha)	1988 VOL. (mcm)	1990 AREA (ha)	1990 VOL. (mcm)	1992 AREA (ha)	1992 VOL. (mcm)
710.0	0.0	0.000								
720.0	2.1	0.274								
730.0	5.8	0.822								
740.0	12.7	2.055								
750.0	22.6	3.973								
760.0	39.5	6.986								
765.0	47.7	9.315								
768.8										
770.0	67.8	12.740	2.4	0.000						
775.0	82.6	17.123	26.6	0.724	3.6	0.000	3.6	0.000		0.000
780.0	99.0	21.233	38.0	2.339	12.2	0.317	10.1	0.342	7.1	0.179
785.0		26.165	55.1	4.667	29.2	1.354	31.2	1.377	16.6	0.771
789.5										
790.0	134.6	31.096	72.0	7.843	66.9	3.759	58.5	3.619	46.5	2.347
795.0		40.000	147.5	13.328	91.7	7.726	78.5	7.044	75.3	5.392
797.5		45.413								8.157
798.4	168.1	47.361								9.152
800.0	173.4	50.000	164.0	21.114	170.4	14.279	167.8	13.212	145.9	10.922
804.5		58.753		28.828		22.305		21.171		18.398
805.0	196.7	59.726	178.8	29.685	186.3	23.197	186.3	22.055	186.4	19.229

Source : Published elevation-area-capacity curves by CFE, above values may differ slightly from actual surveyed data.

表 3.4　貯水池容量の減少

ELEVATION (M)	1962 STORAGE (MCM)	1992 STORAGE (MCM)	LOSS (MCM)
775.0	17.1	0.0	17.1
780.0	21.2	0.2	21.1
785.0	26.2	0.8	25.4
790.0	31.1	2.3	28.7
795.0	40.0	5.4	34.6
797.5	45.4	8.2	37.3
798.4	47.4	9.2	38.2
800.0	50.0	10.9	39.1
804.5	58.8	18.4	40.4
805.0	59.7	19.2	40.5

表 3.5　貯水池堆砂面の縦断標高

1962		1977		1990		1992	
Dist. (m)	Elev. (m)	Dist. (m)	Elev. (m)	Dist. (m)	Elev. (m)	Dist. (m)	Elev. (m)
0	720.5	130	770.0	0	775.0	0	776.2
220	722.2	180	770.0	244	772.0	130	776.6
270	727.0	475	771.5	369	773.4	226	776.6
400	730.0	730	778.0	471	773.4	426	777.2
500	731.0	815	778.0	569	776.4	546	779.9
700	732.7	865	777.0	673	779.3	652	781.2
770	735.0	945	775.5	851	783.9	818	785.8
1,120	740.0	1,135	773.5	963	782.7	898	784.9
1,750	744.5	1,355	773.0	1,060	782.4	1,028	785.5
		1,550	773.0	1,238	783.7	1,228	786.5
		1,735	772.5	1,346	785.0	1,308	787.1
		1,830	773.8	1,493	786.2	1,398	788.4
		2,000	775.0	1,611	787.4	1,468	789.1
		2,125	780.5	1,741	790.0	1,598	793.5
		2,190	783.0	1,867	790.0	1,758	794.1
		2,275	783.0	1,967	791.0	1,890	797.0
		2,340	789.0	2,027	791.8	1,980	797.2
		2,430	789.0	2,097	796.2	2,100	795.9
		2,485	789.5	2,207	796.0	2,160	796.4
		2,545	790.0	2,283	796.5	2,290	798.0
		2,645	790.7	2,513	795.8	2,330	798.1
		2,715	790.4			2,420	796.7
		2,775	790.0			2,530	798.6
		2,995	790.0			2,800	798.2
		3,090	790.5			3,040	798.2
		3,195	791.0			3,220	798.0
		3,345	791.8			3,350	799.7
		4,890	792.5			3,590	800.0
		5,325	794.0			3,690	799.3
						4,480	800.0

表　3.6　　発電取水口付近の貯水池堆砂面

May-90		Jun-92	
Dist. (m)	Elev. (m)	Dist. (m)	Elev. (m)
0	800.5 RB	0	800.0 RB
5	797.5	11	795.0
10	793.2	14	790.0
16	789.4	15	789.0
21	786.9	17	788.0
26	786.9	19	787.0
31	785.4	22	786.0
52	785.0	30	785.0
58	785.0	36	784.0
63	784.9	62	784.0
79	784.5	89	784.0
89	783.7	91	783.0
105	782.3	121	782.0
126	782.0	130	781.0
131	781.4	135	780.0
136	781.0	144	779.0
147	779.5	159	779.0
173	778.1	185	778.0
210	777.4	205	778.0
230	777.0	225	777.0
291	776.0	291	777.0
346	775.5	354	775.0
352	774.5	358	774.0 LB
356	771.9 LB		

表 3.7　既設砂防ダムの堆砂状況

	Name of Check Dam	Drainage Area (Ha)	Year of Constr.	Total Capacity (m3)	Status Year Filled	Annual Sediment Deposition (m3)						
						1980	1981	1982	1984	1985	1986	1987
1	Sta. Ines Morelos	3,325	1979	37,176				4,043				23,147
2	El Durazno	556	1979	14,805				2,831	5,449			6,512
3	Tenanpulco No. 3	1,169	1977-78	25,093	1987			1,202	23,086			25,093
4	Coacal No. 1	694	1977-78	43,889					901	2,441	6,450	15,805
5	Sta. Cruz	2,925	1976	182,501				44,246				
6	Pantijacan	112	1981	6,602	1987				1,146	1,296		6,602
7	Amaxac No. 10	42	1980	17,494	1985			9,976		17,494		
8	Amaxac No. 7	3,475	1976-77	350,394				162,181			220,925	254,474
9	Xalahuit No. 1	238	1978	12,134				1,435	2,821	6,760		
10	XalahuitNo. 2	11	1982	675							281	
11	Sn. Luis No. 1	144	1983	3,444					580			965
12	Apopoza	9	1981	1,750				139	316			
13	Quiquimititan	28	1982	1,773				20	453	936		
14	Sn. Anores Yahuitlalpan	2,181	1979-80	10,631	1981		10,631					
15	La Paz	192	1980	3,500	1985			3,152	3,332	3,500		
16	Pedacillos	355	1980	8,702				969		1,385		
17	Zocavon	23	1981	1,157	1985			421	510	1,157		
18	Nopala	1,917	1980	19,542	1985			3,600	18,942	19,542		
19	Sta. Maria Soltoltepec	1,569	1979	18,277	1981		18,277					
20	Los Plumajes	2,469	1980	35,466	1980	35,466						
21	El Pipian	119	1981	13,665	1985			2,799	9,850	13,665		
22	Atemoloni	365	1983-84	33,023					5,018			7,886
23	Acatla	3,125	1984	20,824	1985				11,547	20,824		
24	Tatempango	3,135	1986	61,629							22,922	32,342
25	Cuchac No. 1	16,883	1987	416,000								30,000
	Total	45,061		1,340,146								

表 3.8　既設砂防ダムへの堆砂量に基づく浸食率の推定

NO.	NAME OF DAM	DRAINAGE AREA (km2)	STORAGE CAPACITY (m3)	SEDIMENT VOLUME (m3)	NO. OF YEARS	CAP-INFL RATIO	TRAP EFFI-CIENCY	EROSION VOLUME (m3)	EROSION RATE (mm/yr.)
1	Sta. Ines Morelos	33.25	37,176	23,147	8	0.010	0.47	49,249	0.185
2	El Durazo	5.56	14,805	5,449	5	0.023	0.62	8,789	0.316
3	Tenanpulco No.3	11.69	25,093	23,086	6	0.020	0.60	38,477	0.549
4	Coacal NO.I	6.94	43,889	15,805	9	0.055	0.67	23,590	0.378
5	Sta. Cruz	29.25	182,501	44,246	6	0.054	0.67	66,039	0.376
6	Pantijacan	1.12	6,602	6,602	6	0.051	0.66	10,003	1.489
7	Amaxac No.10	0.42	17,494	17,494	5	0.362	0.82	21,334	10.159
8	Amaxac No.7	34.75	350,394	254,474	10	0.088	0.72	353,436	1.017
9	Xalahuit No.I	2.38	12,134	6,760	7	0.044	0.65	10,400	0.624
10	Xalahuit No.2	0.11	675	281	4	0.053	0.67	419	0.952
11	Sn. Luis No.I	1.44	3,444	965	4	0.021	0.57	1,693	0.294
12	Apopoza	0.09	1,750	316	3	0.168	0.77	410	1.519
13	Quiquimititan	0.28	1,773	936	3	0.055	0.67	1,397	1.663
14	Sn. AnoresYahuitlalpan	21.81	10,631	10,631	1	0.004	0.35	30,374	1.393
15	La Paz	1.92	3,500	3,152	2	0.015	0.53	5,947	1.549
16	Pedacillos	3.55	8,702	1,385	5	0.020	0.57	2,430	0.137
17	Zocavon	0.23	1,157	1,157	4	0.041	0.65	1,780	1.935
18	Nopala	19.17	19,542	19,542	4	0.008	0.44	44,414	0.579
19	St. Maria Soltoltepec	15.69	18,277	18,277	2	0.007	0.43	42,505	1.355
20	Los Plumajes	24.69	35,466	35,466	1	0.008	0.44	80,605	3.265
21	El Pipian	1.19	13,665	13,665	4	0.067	0.68	20,096	4.222
22	Atemoloni	3.65	33,023	7,886	3	0.079	0.70	11,266	1.029
23	Acatla	31.25	20,824	20,824	1	0.005	0.38	54,800	1.754
24	Tatempango	31.35	61,629	32,342	2	0.016	0.54	59,893	0.955
25	Cuchac NO.I	168.83	416,000	30,000	1	0.014	0.52	57,692	0.342
	Total	450.61	1,340,146	593,888					

表　4.1　　気象観測所リスト

	STATION	LOCATION		OBSERVATION PERIOD	ALTITUDE (EL. m)
		LAT.	LONG.		
1	SAN JUAN ACATENO	19° 52'	97° 22'	1956 - 1991	1,656
2	ATEXCACO	19° 55'	97° 24'	1960 - 1991	1,085
3	LA PAGODA	19° 54'	97° 25'	1960 - 1991	1,560
4	LA SOLEDAD	19° 57'	97° 27'	1954 - 1991	816
5	TEPECAPAN	19° 58'	97° 39'	1979 - 1991	542
6	HUAHUAXTLA	19° 55'	97° 38'	1954 - 1991	1,625
7	TLATLAUQUI	19° 51'	97° 30'	1953 - 1991	2,025
8	GOMEZ PONIENTE	19° 46'	97° 29'	1982 - 1991	2,430
9	ZAUTLA	19° 43'	97° 40'	1954 - 1991	1,940
10	CAPULUAQUE	19° 48'	97° 46'	1954 - 1991	2,200
11	AQUIXTLA	19° 48'	97° 56'	1961 - 1991	2,310
12	IXTACAMAXTITLAN	19° 37'	97° 49'	1954 - 1991	2,175
13	SAN ANTONIO	19° 33'	97° 50'	1954 - 1991	3,140
14	LA GLORIA	19° 37'	97° 59'	1955 - 1991	2,750

表 4.2　月平均雨量

(Unit:mm)

	STATION	OBSERVATION PERIOD	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1	SAN JUAN ACATENO	1956 - 1991	58	44	46	62	113	340	348	356	474	259	140	71	2,311
2	ATEXCACO	1960 - 1991	141	111	110	126	174	475	576	543	624	373	231	162	3,647
3	LA PAGODA	1960 - 1991	100	77	77	93	142	380	371	387	531	316	192	115	2,781
4	LA SOLEDAD	1954 - 1991	87	66	91	103	178	452	610	534	575	344	184	102	3,325
5	TEPECAPAN	1979 - 1991	77	51	58	79	152	284	345	274	509	251	135	84	2,300
6	HUAHUAXTLA	1954 - 1991	69	57	65	67	106	246	199	207	485	282	153	77	2,015
7	TLATLAUQUI	1953 - 1991	38	36	35	41	63	183	137	130	274	182	94	47	1,260
8	GOMEZ PONIENTE	1982 - 1991	22	19	23	34	37	122	104	92	208	112	74	31	878
9	ZAUTLA	1954 - 1991	10	10	12	25	44	101	78	73	115	45	19	10	543
10	CAPULUAQUE	1954 - 1991	18	16	16	34	53	161	126	107	213	107	47	21	920
11	AQUIXTLA	1961 - 1991	11	13	15	27	46	124	104	98	134	73	30	13	688
12	IXTACAMAXTITLAN	1954 - 1991	9	10	16	41	71	104	89	83	96	42	14	8	584
13	SAN ANTONIO	1954 - 1991	16	18	21	60	101	174	155	159	164	81	31	18	998
14	LA GLORIA	1955 - 1991	11	12	16	42	70	148	155	149	126	56	18	10	814

表 4.3　ラ・ソレダッド観測所における時間雨量

Year	Month	Date	Hour	Rain mm	Year	Month	Date	Hour	Rain mm
1990	10	5	19	10	1992	5	16	1	20
			20	24				2	16
			21	16				3	10
			22	14					
					1992	5	28	16	30
1990	10	18	21	1				17	24
			22	0				18	35
			23	7				19	22
			24	5				20	23
		19	1	16				21	7
			2	13				22	8
			3	9				23	24
			4	9					
			5	4	1992	6	16	19	49
			6	8					
					1992	7	23	20	39
1991	8	11	20						
			21	10	1992	8	16	15	2
			22	20				16	6
			23	19				17	10
								18	12
1991	9	24	18	9				19	25
			19	16				20	19
			20	6				21	26
			21	9				22	20
			22	10				23	10
			23	12				24	10
			24	5			17	1	20
								2	13
1991	11	8	9	15				3	5
			10	33				4	2
			11	26					
			12	18					
			13	9					
			14	4					

NOTE : 10 MM RAIN OCCURRED IN 15 MINUTES AND 35 MM RAIN OCCURRED IN ABOUT 30 MINUTES IN SOME CASES.

表 4.4　月平均蒸発量

(Unit:mm)

	STATION	OBSERVATION PERIOD	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1	SAN JUAN ACATENO	1960 - 1991	55	62	87	94	101	80	71	73	68	62	58	54	867
2	ATEXCACO	1960 - 1991	41	45	70	79	93	80	68	69	61	51	45	41	745
3	LA PAGODA	1960 - 1991	64	70	97	103	106	87	78	79	73	69	65	64	953
4	LA SOLEDAD	1955 - 1991	45	54	83	101	117	114	105	111	97	78	53	43	999
5	TEPECAPAN	1979 - 1991	45	53	87	104	117	108	96	99	89	78	56	43	976
6	HUAHUAXTLA	1978 - 1991	71	76	114	124	125	88	69	72	67	71	71	66	1013
7	TLATLAUQUI	1953 - 1991	67	79	124	136	133	96	75	80	68	65	63	60	1045
8	GOMEZ PONIENTE	1982 - 1991	83	87	109	105	138	79	66	63	61	56	71	81	1000
9	ZAUTLA	1979 - 1991	81	88	128	133	141	102	91	82	75	79	75	74	1148
10	CAPULUAQUE	1978 - 1991	72	79	121	130	129	96	82	81	68	69	70	65	1062
11	AQUIXTLA	1978 - 1991	115	128	184	186	184	131	115	121	96	105	108	101	1574
12	IXTACAMAXTITLAN	1979 - 1991	101	113	159	153	149	132	130	129	108	108	98	89	1469
13	SAN ANTONIO	1979 - 1991	103	121	152	150	139	110	100	99	86	99	92	95	1346
14	LA GLORIA	1978 - 1991	107	110	156	142	141	108	99	103	87	99	97	94	1343

表 4.5　月平均気温

(Unit: °C)

	STATION	OBSERVATION PERIOD	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1	SANJUAN ACATENO	1960 - 1991	11.1	11.9	13.5	15.6	17.3	16.8	16.1	16	15.8	14.3	13.1	12.2	14.5
2	ATEXCACO	1960 - 1991	14	15.1	17.6	20.2	22	21.5	20.5	20.7	20.2	18.3	16.8	15	18.5
3	LA PAGODA	1960 - 1991	11.2	12.4	14.6	16.8	18.4	17.7	17.1	17	16.7	15.1	13.8	12.8	15.3
4	LA SOLEDAD	1955 - 1991	14.9	15.8	18.1	21	22.9	23.2	22.2	22.4	22.1	20.2	17.7	15.8	19.7
5	TEPECAPAN	1979 - 1991	15.9	16.9	19.4	21.9	24.2	24.3	23.2	23.5	22.7	21.2	18.3	16.6	20.7
6	HUAHUAXTLA	1978 - 1991	11.9	12.9	15.4	17.4	18.5	18	17	17.3	17.2	15.5	14.3	12.7	15.7
7	TLATLAUQUI	1953 - 1991	12	12.9	15.4	17.2	18	17.1	15.9	16.2	15.9	14.6	13.6	12.6	15.1
8	GOMEZ PONIENTE	1982 - 1991	10.8	11.6	12.8	14.8	15.3	14.1	13.3	13.6	13.2	12	12.2	11.5	12.9
9	ZAUTLA	1979 - 1991	12.8	13.9	16.4	18.3	19	18.2	16.9	17	16.8	15.6	14.4	13.3	16.1
10	CAPULUAQUE	1978 - 1991	11.2	12.7	14.6	16.8	17.8	16.4	14.9	14.9	14.6	13.4	12.8	11.8	14.3
11	AQUIXTLA	1978 - 1991	13.3	14.1	16.9	18.1	18.7	17.8	16.6	16.7	16.9	15.3	14.7	13.9	16.1
12	IXTACAMAXTITLAN	1979 - 1991	13.2	14.1	16.4	18	18.8	18.5	17.7	18	17.4	16.3	14.7	13.8	16.4
13	SAN ANTON10	1979 - 1991	7.2	8.3	10.3	11.2	11.9	10.6	9.2	9.4	9.1	8.7	8.3	7.3	9.3
14	LA GLORIA	1978 - 1991	11.4	12.6	14.2	15.3	15.6	14.3	13.3	13.4	13	12.6	12.5	12	13.3

表 4.6　月平均流量ーブエノスアイレス
（集水面積　1,405 km2）

(Unit: cms)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1963	3.43	3.16	2.38	2.30	2.92	(5.16)	20.34	7.76	11.02	9.58	8.32	4.28	(6.72)
1964	3.33	2.72	2.25	2.12	3.53	7.76	6.62	4.03	4.59	10.45	7.28	7.18	5.15
1965	4.56	2.92	2.37	2.98	3.52	6.37	7.34	16.95	7.99	15.70	7.48	3.02	6.77
1966	2.38	2.63	2.83	2.77	3.66	10.80	15.06	13.29	35.25	19.37	8.68	4.64	10.11
1967	4.16	3.24	2.72	2.90	4.19	4.78	4.06	5.58	26.62	12.33	6.49	4.69	6.81
1968	3.32	3.14	2.30	3.34	4.10	11.78	10.08	7.73	16.17	11.60	4.65	6.42	7.05
1969	4.25	3.02	2.41	2.45	1.95	2.93	7.36	27.91	51.00	15.66	7.39	5.00	10.94
1970	3.61	3.86	2.80	2.48	3.05	7.22	6.45	13.25	16.86	12.65	4.39	2.81	6.62
1971	2.77	2.68	2.93	3.61	2.96	5.47	6.48	8.83	10.67	24.97	23.74	4.98	8.34
1972	3.52	3.06	3.45	2.62	2.93	18.61	12.31	16.01	11.51	9.79	7.02	4.86	7.97
1973	3.25	3.05	2.53	1.48	2.37	6.67	17.32	23.54	18.21	13.94	6.42	6.46	8.77
1974	3.60	2.89	2.40	2.44	2.33	27.06	23.17	7.35	59.59	28.15	11.30	7.35	14.80
1975	5.27	4.45	3.20	2.85	4.48	10.55	12.86	10.68	34.82	36.87	9.02	7.96	11.92
1976	10.03	6.81	4.52	4.17	4.62	13.12	22.59	14.66	21.62	33.14	11.01	6.19	12.71
1977	4.41	3.88	2.93	2.74	3.21	4.55	5.93	5.93	6.30	9.79	6.10	3.91	4.97
1978	2.74	2.37	2.86	1.96	1.76	9.76	6.78	11.59	22.09	24.87	10.65	4.73	8.51
1979	3.93	3.70	2.88	3.62	2.74	8.52	7.03	18.40	51.44	10.67	9.94	5.96	10.74
1980	4.81	3.90	3.33	3.08	3.98	3.62	4.27	11.81	21.41	14.45	7.16	3.53	7.11
1981	3.93	5.56	3.73	3.34	3.91	23.94	22.56	34.48	36.07	25.42	11.20	8.28	15.20
1982	4.68	4.05	3.78	4.01	4.90	3.65	4.26	4.01	15.60	17.66	7.57	4.27	6.54
1983	3.48	2.87	2.57	2.29	2.01	2.46	8.37	7.91	14.46	9.22	12.11	4.71	6.04
1984	3.67	3.03	2.45	2.10	8.34	12.39	23.59	11.20	95.95	15.43	6.39	4.83	15.78
1985	4.09	3.49	3.40	3.25	3.13	6.67	10.16	10.54	14.61	25.84	5.23	5.45	7.99
1986	4.14	3.44	2.82	2.68	3.75	12.54	7.22	3.44	3.95	10.48	14.44	3.59	6.04
1987	3.07	2.76	2.58	2.20	2.12	5.72	14.19	12.07	9.69	8.23	4.45	3.03	5.84
1988	2.89	2.76	2.57	4.46	2.59	8.17	8.20	9.33	30.96	7.67	5.38	4.76	7.48
1989	3.49	3.62	2.88	2.86	2.80	4.85	7.83	10.70	60.27	13.00	9.96	7.67	10.83
1990	4.13	3.74	3.24	3.45	3.60	3.83	11.68	13.96	29.03	14.56	9.18	7.66	9.01
1991	5.58	4.37	3.19	2.46	2.76	8.33	22.22	6.24	12.40	30.42	14.08	6.68	9.89
Ave.	4.02	3.49	2.91	2.86	3.39	8.87	11.60	12.04	25.87	16.96	8.86	5.34	8.85

Note : (　) including missing daily data

表 4.7　月平均流量ーソンタラコ
(集水面積　25 km2)

(Unit: cms)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1963			0.25	0.18	0.21	0.14	1.96	1.57	2.60	1.54	1.41	0.86	(0.89)
1964	0.69	0.43	0.31	0.29	0.25	1.86	2.38	0.95	1.19	2.68	1.41	1.50	1.16
1965	1.19	0.56	0.41	0.59	0.68	1.17	1.82	2.46	1.16	1.96	1.32	0.35	1.14
1966	0.35	0.49	0.49	0.35	0.24	1.95	3.37	1.56	3.37	2.94	1.00	0.53	1.39
1967	0.59	0.59	0.51	0.27	0.43	0.77	0.63	1.05	3.24	2.07	1.32	0.99	1.04
1968	0.60	0.42	0.41	0.45	0.72	1.27	1.68	2.06	2.57	2.08	0.80	1.46	1.21
1969	0.99	0.52	0.40	0.34	0.27	0.26	1.85	4.08	5.96	2.36	1.31	0.76	1.59
1970	0.43	0.65	0.45	0.27	0.54	0.85	2.26	2.55	3.17	2.10	0.86	0.44	1.21
1971	0.37	0.31	0.36	0.82	0.32	0.35	1.46	1.35	1.50	3.81	2.60	0.78	1.17
1972	0.67	0.48	0.68	0.26	0.24	2.39	2.77	2.73	1.83	1.32	1.30	0.88	1.30
1973	0.49	0.43	0.35	0.20	0.72	1.77	2.26	2.66	1.90	2.42	1.07	1.00	1.27
1974	0.44	0.35	0.25	0.21	0.17	3.60	2.03	1.22	4.92	2.72	1.22	0.84	1.50
1975	0.54	0.39	0.20	0.17	0.15	0.29	0.40	1.64	5.35	4.29	0.79	1.07	1.27
1976	1.54	0.59	0.40	0.28	0.24	2.84	2.15	1.20	3.07	3.13	1.42	0.61	1.46
1977	0.42	0.41	0.28	0.18	0.17	0.43	1.57	1.05	0.91	2.88	1.32	0.78	0.87
1978	0.44	0.31	0.36	0.28	0.16	1.80	1.94	3.69	3.08	3.31	1.38	0.53	1.44
1979	0.50	0.49	0.36	0.25	0.46	1.46	0.95	2.82	4.75	1.07	1.54	0.88	1.29
1980	0.58	0.37	0.33	0.26	0.15	0.18	0.20	0.80	5.53	2.48	1.03	0.53	1.04
1981	0.64	0.80	0.53	0.39	0.35	3.92	3.43	5.63	4.35	2.87	(1.45)	1.20	(2.13)
1982	0.50	0.43	0.43	0.41	0.67	0.48	1.22	1.20	3.34	2.97	1.15	0.68	1.12
1983	0.53	0.36	0.25	0.18	0.16	0.20	2.52	1.67	4.92	2.84	2.74	1.75	1.51
1984	0.74	0.59	0.34	0.21	0.88	3.13	4.06	2.49	8.40	1.86	0.57	0.39	1.97
1985	0.28	0.27	0.44	0.29	0.24	0.71	1.38	1.96	2.39	3.78	0.74	0.73	1.10
1986	0.62	0.43	0.24	0.20	0.32	1.80	2.34	0.89	0.99	2.72	2.86	0.45	1.15
1987	0.43	0.33	0.34	0.24	0.20	0.54	2.61	3.04	2.30	1.24	0.69	0.44	1.03
1988	0.21	0.18	0.16	1.06	0.23	2.26	1.92	1.75	3.58	0.93	0.73	0.71	1.14
1989	0.42	0.62	0.29	0.34	0.18	0.25	1.19	1.26	5.77	1.11	1.62	0.79	1.15
1990	0.46	0.45	0.51	0.79	0.78	0.81	2.22	2.28	5.22	2.86	1.65	1.06	1.59
1991	0.81	0.59	0.37	0.22	0.22	0.66	2.71	0.78	1.80	3.43	1.62	0.48	1.14
Ave.	0.59	0.46	0.37	0.34	0.36	1.32	1.98	2.01	3.42	2.47	1.34	0.81	1.29

Note : (　) including missing daily data

表 4.8　月平均流量ー水路トンネルNo.1
(集水面積　370 km2)

(Unit: cms)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1963	4.05	3.65	2.95	2.85	3.63	3.80	5.71	5.49	5.73	6.25	6.25	5.24	4.63
1964	4.82	4.55	4.06	8.72	9.68	7.83	8.83	6.67	7.21	10.55	8.21	8.19	7.44
1965	7.40	6.26	5.29	5.53	5.55	6.80	7.59	10.59	7.38	7.90	8.72	6.29	7.11
1966	5.72	5.55	5.58	4.97	4.58	7.63	12.89	8.93	12.93	15.25	9.53	7.28	8.40
1967	6.84	6.36	5.69	4.65	5.27	6.00	5.88	6.53	12.42	10.57	8.71	6.98	7.16
1968	6.12	5.77	5.12	4.72	5.47	7.06	8.89	9.08	9.69	9.64	7.33	8.38	7.27
1969	7.35	6.26	5.89	5.32	4.79	4.66	8.16	11.73	18.24	15.30	11.42	8.61	8.98
1970	7.61	7.61	6.78	5.42	6.11	7.70	9.06	11.40	13.86	13.23	8.58	6.93	8.69
1971	6.73	6.16	6.16	6.71	5.37	6.08	8.77	8.90	9.03	13.54	14.19	8.67	8.36
1972	7.79	6.97	6.60	5.52	5.75	11.33	12.99	14.01	12.02	11.04	9.90	8.32	9.35
1973	7.07	6.50	5.85	4.64	5.67	7.09	10.05	13.82	12.40	13.48	9.09	8.89	8.71
1974	7.01	6.42	5.52	5.52	4.81	8.72	13.62	9.72	7.55	0.98	11.01	9.60	7.54
1975	8.31	7.61	6.48	5.85	5.70	6.84	7.18	8.49	11.22	18.44	9.51	8.95	8.71
1976	10.22	8.52	7.30	6.27	6.00	9.58	13.72	10.42	10.87	5.64	11.28	8.72	9.05
1977	7.77	7.28	6.25	5.49	5.57	5.48	8.75	8.31	7.69	13.27	9.25	7.78	7.74
1978	6.36	5.90	5.27	4.54	4.08	10.24	9.82	11.34	7.06	13.05	10.88	8.60	8.09
1979	7.44	6.79	5.95	4.44	5.51	7.93	7.92	12.15	9.37	10.75	11.28	8.97	8.21
1980	7.74	7.11	6.46	5.96	5.59	5.92	5.77	8.21	11.55	12.88	10.01	7.97	7.93
1981	7.36	7.41	6.78	6.26	5.73	11.20	14.10	12.99	17.24	14.98	10.94	8.69	10.31
1982	6.45	7.24	6.78	7.06	7.64	6.75	8.35	8.50	10.05	15.57	10.57	8.71	8.64
1983	7.67	6.23	5.65	4.88	4.74	5.25	10.55	8.86	9.78	10.49	10.19	8.36	7.72
1984	7.25	6.45	5.37	4.45	6.54	10.24	10.12	10.73	9.11	12.79	9.82	8.42	8.44
1985	7.49	6.93	6.81	5.74	5.45	7.80	9.68	10.15	12.36	11.96	8.75	8.08	8.43
1986	7.93	6.87	5.76	4.83	5.51	8.91	10.28	7.16	7.93	11.40	12.48	8.25	8.11
1987	6.29	5.30	5.10	4.48	4.21	5.46	9.83	10.65	11.54	9.60	7.43	5.82	7.14
1988	4.88	4.53	4.01	5.79	4.08	8.19	8.72	8.68	10.25	9.76	7.98	7.24	7.01
1989	5.64	6.35	4.80	5.04	4.03	4.89	7.86	7.42	10.42	11.27	11.06	8.76	7.29
1990	7.36	6.70	6.23	6.55	6.21	7.56	10.72	10.21	12.72	14.92	11.33	9.39	9.16
1991	8.98	7.31	6.26	4.63	4.56	6.45	6.65	6.88	9.58	11.23	12.05	8.63	7.77
Ave.	7.02	6.43	5.75	5.41	5.44	7.36	9.40	9.59	10.59	11.58	9.92	8.09	8.05

Note : * including the Atexcaco diversion area and other small tributaries.

表 4.9　月平均流量ーランチョアプルコ
(集水面積　1,204 km2)

(Unit: cms)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1945												3.62	
1946	3.22	3.03	2.71	3.01	3.34	4.93	3.71	3.04	3.94	8.79			
1947											2.80	2.30	
1948	2.29	2.02	1.82	1.91	3.64	5.69	5.39	2.71	7.68	4.02	2.80	1.96	3.49
1949	1.73	1.59	1.58	1.46	2.20	4.67	2.90	3.12	10.20	4.70	2.65	2.25	3.25
1950	2.00	1.91	2.03	2.43	3.01	4.93	3.21	2.89	3.64	3.34	3.28	2.02	2.89
1951	1.54	1.68	1.51	1.23	4.47	6.51	6.27	6.89	6.47	6.78	1.86	1.84	3.92
1952	2.00	1.75	1.41	2.30	3.42	17.12	6.67	6.21	25.15	18.14	8.82	4.14	8.09
1953	3.05	2.43	2.11	2.10	2.11	3.88	4.16	5.45	10.56	10.50	5.30	2.50	4.51
1954*	1.97	1.97	1.64	1.71	2.57	4.95	8.34	4.24	38.72	52.80	8.56	5.14	11.05
1955*	3.90	3.29	2.57	2.21	2.77	3.14	8.07	15.33	52.46	88.18	38.12	4.84	18.74
1956*	4.07	2.91	2.17	1.89	2.40	6.90	8.89	7.42		9.71	5.28	4.04	
1957	3.59	3.79	2.75	3.05	4.92	3.20	3.21	3.30	4.75	3.81	3.07	2.28	3.48
1958	3.10	1.89	1.75	2.00	5.15	4.76	11.58	7.94	20.90	19.27	6.82	3.61	7.40
1959	2.26	1.26	2.08	2.62	2.62	12.36	11.68	10.97	11.70	15.22	5.99	2.81	6.80
1960	2.45	1.90	1.72	1.62	1.90	2.91	3.04	4.06	5.98	2.69	2.32	1.74	2.69
1961	1.56	1.36	1.30	1.14	1.17	4.98	7.10	4.28	5.69	7.18	8.24	2.23	3.85
1962	1.68	1.70	1.58	2.38	1.76	2.73	2.54	2.83	4.29	4.79	1.72	1.46	2.46
1963	1.31	1.22	1.19	1.21	1.82	4.98	14.70	4.46	3.97	4.58	3.79	2.09	3.78
1964	1.77	1.48	1.36	1.35	2.57	4.14	3.23	2.60	2.86	3.31	3.00	2.67	2.53
1965	2.02	1.68	1.50	1.45	2.18	2.89	3.93	11.30	4.44	7.27	3.78	2.03	3.71
1966	1.70	1.52	1.91	2.15	3.14	5.86	6.27	7.87	13.20	8.44	3.94	2.50	4.88
1967	2.51	1.84	1.55	2.17	2.89	2.78	3.01	3.61	12.50	5.83	2.64	2.02	3.61
1968	1.56	1.67	1.28	2.29	2.59	6.13	5.39	4.04	8.08	5.40	2.35	2.53	3.61
1969	2.09	1.71	1.58	1.77	1.35	2.62	4.06	12.60	28.20	6.92	3.66	3.07	5.80
1970	2.75	2.62	2.42	2.27	2.45	5.46	2.96	6.44	8.52	4.54	2.08	1.57	3.67
1971	1.42	1.40	1.40	1.53	2.10	4.31	4.29	6.08	6.72	12.10	7.99	3.60	4.41
1972	2.59	1.99	1.85	2.05	2.40	7.38	4.76	7.31	6.79	5.45	3.66	2.37	4.05
1973	1.73	2.02	1.91	2.05	2.25	5.62	11.00	14.30	12.10	6.49	3.96	3.50	5.58
1974	0.00	2.24	2.45	2.27	1.92	7.86	14.60	5.41	23.80	18.60	6.05	3.94	7.64
1975	3.25	2.77	2.01	1.83	3.45	7.42	9.97	6.24	13.60	11.50	4.13	3.10	5.77
1976	2.70	1.99	1.63	2.51	2.93	5.56	14.40	9.79	12.30	20.30	5.30	4.04	6.95
1977	2.76	2.35	2.04	1.79	2.05	2.63	3.35	3.96	4.30	2.71	2.29	1.69	2.66
1978	1.44	1.35	1.86	1.16	1.10	12.40	13.50	14.80	17.80				
Ave.	2.25	2.01	1.83	1.97	2.65	5.68	6.76	6.61	12.62	12.37	5.36	2.80	4.49**

Note : * Records from 1954 to 1956 are estimated from those at other station.

** Average excluding 1954-1956

表 4.10　ソレダッド貯水池への月平均流量
(総集水面積　1,830 km2)

(Unit: cms)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1963	8.03	6.94	5.58	5.33	6.76	9.10	28.01	14.82	19.35	17.38	15.98	10.38	12.31
1964	8.85	7.70	6.62	11.14	13.46	17.45	17.83	11.65	13.00	23.68	16.90	16.88	13.76
1965	13.15	9.74	8.08	9.10	9.75	14.33	16.75	29.99	16.53	25.56	17.52	9.65	15.01
1966	8.45	8.67	8.90	8.09	8.48	20.39	31.31	23.77	51.55	37.56	19.21	12.45	19.90
1967	11.59	10.20	8.91	7.82	9.89	11.56	10.57	13.17	42.28	24.98	16.51	12.66	15.01
1968	10.04	9.33	7.84	8.51	10.28	20.11	20.66	18.86	28.42	23.32	12.78	16.25	15.53
1969	12.59	9.81	8.70	8.11	7.00	7.85	17.37	43.72	75.19	33.32	20.12	14.37	21.51
1970	11.64	12.12	10.03	8.17	9.69	15.77	17.77	27.20	33.89	27.99	13.83	10.18	16.52
1971	9.87	9.15	9.45	11.14	8.65	11.89	16.71	19.08	21.20	42.31	40.53	14.44	17.87
1972	11.98	10.52	10.73	8.40	8.92	32.33	28.06	32.76	25.36	22.16	18.22	14.06	18.62
1973	10.81	9.98	8.73	6.32	8.76	15.53	29.63	40.01	32.51	29.85	16.58	16.35	18.76
1974	11.05	9.66	8.18	8.17	7.30	39.37	38.82	18.29	72.06	31.85	23.54	17.79	23.84
1975	14.13	12.44	9.88	8.88	10.33	17.67	20.44	20.81	51.38	59.60	19.31	17.98	21.90
1976	21.79	15.93	12.22	10.72	10.85	25.54	38.46	26.27	35.56	41.91	23.71	15.52	23.21
1977	12.60	11.57	9.47	8.41	8.94	10.47	16.26	15.28	14.89	25.94	16.67	12.47	13.58
1978	9.54	8.58	8.49	6.79	6.00	21.80	18.54	26.62	32.23	41.24	22.91	13.86	18.05
1979	11.87	10.98	9.18	8.32	8.71	17.91	15.90	33.38	65.56	22.49	22.75	15.81	20.24
1980	13.13	11.39	10.12	9.29	9.73	9.72	10.24	20.82	38.49	29.81	18.19	12.02	16.08
1981	11.94	13.77	11.03	9.99	9.99	39.05	40.08	53.09	57.65	43.21	23.59	18.17	27.63
1982	11.63	11.72	10.99	11.48	13.20	10.88	13.83	13.70	29.00	36.20	19.29	13.67	16.30
1983	11.69	9.46	8.48	7.35	6.90	7.92	21.45	18.44	29.16	22.56	25.05	14.83	15.27
1984	11.67	10.06	8.15	6.76	15.77	25.77	37.77	24.41	113.45	30.09	16.77	13.65	26.19
1985	11.86	10.68	10.65	9.29	8.82	15.18	21.22	22.65	29.36	41.58	14.72	14.26	17.52
1986	12.69	10.75	8.82	7.70	9.58	23.25	19.83	11.48	12.87	24.60	29.78	12.28	15.30
1987	9.80	8.39	8.03	6.93	6.53	11.72	26.62	25.76	23.52	19.07	12.57	9.28	14.02
1988	7.98	7.47	6.74	11.31	6.90	18.61	18.84	19.76	44.78	18.36	14.09	12.72	15.63
1989	9.55	10.59	7.97	8.24	7.01	9.99	16.88	19.38	76.46	25.39	22.64	17.23	19.28
1990	11.95	10.89	9.97	10.79	10.60	12.20	24.62	26.46	46.97	32.34	22.15	18.12	19.76
1991	15.37	12.26	9.83	7.31	7.55	15.44	31.58	13.90	23.78	45.09	27.75	15.79	18.80
Ave.	11.63	10.37	9.03	8.62	9.18	17.54	22.97	23.64	39.88	31.02	20.13	14.25	18.19

表 4.11 洪水／豪雨の記録 (1/2)

Date	Runoff at Buenos Aires (m3/sec)		Daily Rainfall (mm) Station							
	Daily	Peak	La Soledad	Huahuaxtla	Tlatlauqui	Zautla	Capuluaque	Ixtacamax-titilan	San Antonio	La Gloria
1974										
Sep 19	6.4		4.5	12.0	5.8	18.0	4.0	0.0	0.6	0.0
20	21.4		3.3	4.5	10.5	20.0	2.5	0.0	2.3	0.7
21	418.0	(711.0)	288.7	345.0	255.4	160.0	195.5	104.5	96.0	70.1
22	245.0		37.0	58.0	39.1	39.0	51.0	12.0	20.3	27.1
23	212.0		21.0	20.0	17.2	34.0	26.0	27.0	28.0	28.4
24	143.0		36.4	10.0	13.4	4.0	0.3	1.0	8.5	7.1
25	86.3		2.6	-	0.0	0.0	0.0	1.0	4.9	1.8
1979										
Sep 15	33.2		20.0	20.3	22.5	3.0	7.5	1.0	2.5	0.2
16	58.5		12.5	55.8	38.9	10.0	19.5	1.0	2.6	1.0
17	104.0		11.5	13.8	10.2	10.0	18.8	3.0	2.7	2.1
18	292.0	(413.0)	94.8	141.6	78.2	105.0	143.0	23.0	22.7	19.5
19	216.0		64.5	70.4	37.2	31.5	46.7	4.5	6.5	4.2
20	119.0		13.0	17.2	12.7	4.0	10.0	0.0	3.0	0.5
21	69.1		0.0	-	0.0	0.0	-	1.5	2.3	2.1
1981										
Aug 25	25.2		64.0	40.0	18.3	1.0	12.0	0.0	7.0	2.4
26	106.0		98.0	127.0	72.8	18.0	68.1	5.0	14.0	4.0
27	267.0		153.5	193.0	82.8	29.5	69.0	12.0	15.5	16.0
28	215.0	(451.0)	186.5	96.0	46.1	23.4	53.5	23.5	25.0	33.0
29	116.0		58.7	23.0	23.9	23.5	20.5	24.0	45.5	12.0
30	68.5		-	-	-	0.0	-	0.0	3.0	16.3
31	50.1		0.5	3.0	0.0	-	0.0	4.5	6.2	7.3

表 4.11 洪水／豪雨の記録 (2/2)

Date	Runoff at Buenos Aires (m3/sec)		Daily Rainfall (mm) Station							
	Daily	Peak	La Soledad	Huahuaxtla	Tlatlauqui	Zautla	Capuluaque	Ixtacamax-titilan	San Antonio	La Gloria
1984										
Sep 13	134.0		80.2	120.0	100.0	20.0	54.0	3.9	19.7	12.2
14	119.0		19.7	34.0	9.5	3.0	48.0	14.0	32.4	10.9
15	199.0		28.8	47.0	20.0	9.8	16.0	10.5	22.3	44.6
16	527.0	(655.0)	156.5	220.0	120.0	18.5	81.0	11.5	12.3	12.0
17	497.0		153.0	164.0	80.0	25.0	50.0	3.0	19.0	2.5
18	270.0		103.0	92.0	42.5	13.0	29.0	1.5	14.7	2.3
19	126.0		18.2	36.0	11.0	0.6	11.0	-	3.8	0.3
1988										
Sep 2	32.0		89.0	51.0	20.0	9.4	21.0	4.5	1.7	1.0
3	34.6		40.0	24.0	38.2	10.6	22.5	4.5	16.0	22.0
4	83.1		29.0	58.0	42.3	4.5	20.0	9.0	26.8	3.0
5	373.0	(540.0)	295.0	270.0	123.4	48.0	104.0	56.0	40.3	32.0
6	99.8		12.8	12.0	46.9	8.0	9.0	12.5	5.6	20.0
7	46.1		-	0.0	-	-	0.0	0.0	0.0	0.0
8	29.1		-	0.0	0.0	-	0.0	0.0	0.0	0.0
1989										
Sep 18	96.2		52.0	120.0	27.6	19.8	50.5	14.5	5.3	15.0
19	299.0		67.2	135.0	12.7	37.0	70.0	31.0	20.1	29.8
20	244.0	(404.0)	83.0	170.0	9.5	30.0	13.0	16.5	10.0	23.0
21	115.0		0.6	3.0	7.3	0.3	-	9.5	20.4	29.2
22	110.0		42.5	30.0	-	18.3	40.0	4.5	15.5	10.2
23	264.0		80.0	190.0	-	28.0	63.0	19.0	0.0	10.0
24	119.0		28.0	24.0	0.0	44.0	7.0	0.0	5.0	1.0

表 4.12　年最大洪水ピーク流量

(m3/sec)

Year	Buenos Aires	Rancho Apulco	Sontalaco	Canal Tunnel I
1948		107.7		
1949		123.6		
1950		20.7		
1951		135.4		
1952		249.6		
1953		-		
1954		518.9		
1955		1675.0		
1956		89.2		
1957		39.0		
1958		243.0		
1959		164.3		
1960		95.3		
1961		288.0		
1962		142.0		
1963	134.0	189.0	51.2	14.8
1964	192.0	94.1	26.1	41.9
1965	183.0	94.8	37.9	35.6
1966	440.0	124.0	33.9	31.5
1967	181.0	94.8	21.8	30.5
1968	166.0	112.0	15.2	26.1
1969	282.0	220.0	70.0	27.6
1970	87.7	178.0	33.4	26.7
1971	232.0	90.0	45.4	28.2
1972	148.0	55.9	36.4	27.3
1973	256.0	88.6	22.1	31.3
1974	711.0	135.0	86.5	29.9
1975	249.0	111.0	59.1	32.1
1976	225.0	166.0	78.0	31.3
1977	41.2	112.0	18.9	31.3
1978	225.0		43.7	32.1
1979	413.0		46.4	32.1
1980	183.0		282.0	31.7
1981	451.0		166.0	33.8
1982	221.0		34.8	33.1
1983	152.0		280.0	37.2
1984	655.0		60.3	32.6
1985	245.0		32.2	33.5
1986	196.0		29.3	33.5
1987	128.0		26.3	32.1
1988	540.0		46.3	34.3
1989	404.0		29.0	33.5
1990	175.0		39.4	32.4
1991	184.0			

表　4.13　　ブエノスアイレスにおける洪水ピーク流量と流域平均雨量

Year	Flood Peak	Rainfall (mm)		
	(m3/sec)	1-day	2-day	3-day
1963	134.0	39.9	45.2	46.9
1964	192.0	12.4	19.4	20.7
1965	183.0	32.4	50.7	63.1
1966	440.0	63.6	101.2	122.9
1967	181.0	50.1	64.3	76.9
1968	166.0	19.6	26.5	28.8
1969	282.0	66.3	89.8	97.2
1970	87.7	9.8	26.2	50.4
1971	232.0	27.0	44.8	46.2
1972	148.0	13.4	19.1	23.3
1973	256.0	19.0	34.9	42.5
1974	711.0	155.7	188.5	193.8
1975	249.0	30.7	36.8	44.3
1976	225.0	54.7	68.6	70.8
1977	41.2	4.0	12.4	21.0
1978	225.0	45.0	47.7	52.8
1979	413.0	69.1	76.8	90.4
1980	183.0	49.3	97.8	127.9
1981	451.0	41.1	94.6	129.6
1982	221.0	48.3	77.7	82.9
1983	152.0	9.6	11.4	14.9
1984	655.0	53.5	92.7	117.4
1985	245.0	39.5	47.8	49.0
1986	196.0	39.6	78.5	86.7
1987	128.0	18.6	30.1	30.8
1988	540.0	85.2	103.3	120.7
1989	404.0	46.9	84.3	116.7
1990	175.0	34.9	68.7	70.3
1991	184.0	26.5	45.0	61.7
Correlation Coefficient		0.790	0.808	0.808

表 4.14　ランチョアプルコにおける洪水ピーク流量と流域平均雨量

Year	Flood Peak	Rainfall (mm)		
	(m3/sec)	1-day	2-day	3-day
1955	(1675.0)	113.8	208.8	216.1
1956	(89.2)	16.1	18.0	18.6
1957	39.0	26.2	37.4	46.9
1958	243.0	41.1	63.4	66.7
1959	164.3	16.0	29.3	37.6
1960	95.3	12.1	21.0	30.0
1961	288.0	20.0	24.7	39.4
1962	142.0	27.9	62.1	99.1
1963	189.0	14.6	20.6	22.6
1964	94.1	12.4	19.7	21.0
1965	94.8	14.5	28.6	35.8
1966	124.0	46.1	73.0	91.1
1967	94.8	19.7	25.4	25.4
1968	112.0	31.3	59.2	70.4
1969	220.0	46.0	61.7	66.0
1970	178.0	10.3	27.0	50.0
1971	90.0	17.2	25.0	38.4
1972	55.9	15.2	23.3	27.7
1973	88.6	15.4	26.1	32.9
1974	135.0	129.3	159.2	164.0
1975	111.0	45.1	68.0	90.9
1976	166.0	52.3	66.1	67.3
1977	112.0	18.7	24.5	26.1
Correlation Coefficient		0.142	0.138	0.142

Note : Data with ( ) are excluded from calculation of correlation coefficien since data with ( ) are estimated from other gauging station.

表　4.15　CFEが推定した月平均流砂量（ブエノスアイレス）

RIO APULCO AT BUENOS AIRES (1,000 METERS)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1965			0.34	3.32	125.95	2.71	232.19	491.49	46.24	32.63	0.69	0.24	
66	0.26	0.21	1.34	2.92	3.13	7.08	121.02	115.11	181.28	35.58	1.13	0.41	469.47
67	2.32	2.77	0.36	2.31	29.89	11.03	13.22	25.49	15.34	4.80	1.02	0.25	108.83
68	0.64	3.29	0.18	4.81	3.27	433.09	189.26	25.26	40.79	3.63	1.87		
69	3.76	0.41	0.42	1.46	2.40	29.40	43.96	180.84	38.01	17.84	0.53	0.38	319.41
70	0.33	0.30	0.44	0.39	3.11	2.72	1.52						
71	0.19	0.09	0.13	0.13	9.58	18.80	62.06	152.72	68.65	75.88	1.10	0.17	389.50
72	0.16	0.19	0.59	7.03	1.00	104.69		177.07	125.44	62.22	0.23	0.40	
73	0.14	0.11	0.10	0.06	9.22	525.07	187.46	34.47	71.27	5.17	0.56	0.16	833.79
74	0.75	0.26	0.29	0.21	1.89		519.25	23.43	40.13	4.57	0.65	0.46	
75	0.24			0.19	1.93	141.54	79.52	78.60	44.34	35.27	0.88		
76	0.48		1.15	2.43	1.96	34.26	77.56	126.46	2.55	135.99	0.86		
77		0.18	0.11	0.15	7.47	8.11	82.05	33.06	20.93				
78		0.25	4.30	7.73	0.16	286.56	42.47	8.84	94.50	21.33	0.91		
79		0.20	0.23		0.17	132.84	221.99	250.96	19.96	0.94	1.01		
80		0.20	0.27	0.23	53.67	34.08	14.01	136.06	78.94		1.29		
81		0.34	4.71	1.98	17.58	215.58	119.00	88.78	49.94	56.71	1.53		
82	0.26	0.26	0.61	11.30	21.06	46.38	19.04	21.50	7.09	70.76		0.32	
83													
84	0.26	0.16	0.11	0.64	19.22	109.12	45.50	35.92	245.79	2.19			
85				0.82	0.56	5.17	102.28	56.28	9.10	11.78	0.17		
86		0.07	0.08	1.58	18.71	320.05	36.88				28.44	0.18	
87	0.13	0.09	0.09	0.04	0.27	81.69	133.83	92.10	50.40	1.42	0.22	0.12	360.04
88	0.16	0.10	0.06	1.03	0.14	15.75	48.45	59.34	248.78	1.51	0.31	0.15	375.78
89	0.19	0.16	0.62	0.22	0.82	10.19	111.86	119.93	335.09	23.16	0.48	0.34	603.06
90	0.66	0.50	0.14	0.14	1.54	7.01	68.27	35.49	82.83	11.66	0.50	0.27	209.01
MEAN	0.64	0.48	0.72	2.13	13.39	107.62	107.19	103.01	83.36	29.29	2.11	0.28	

MEAN ANNUAL LOAD BASED ON MONTHLY MEANS = 0.450 MCM

表　4.16　　CFEが推定した月平均流砂量（ソンタラコ）

ARROYO SONTALACO AT SONTALACO (1,000 CUBIC METERS)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1965			0.03	0.04	0.06	0.09	0.17	0.23	0.13	0.21	0.10	0.03	
66	0.04	0.04	0.04	0.03	0.03	0.21	0.37	0.13	0.26	0.33	0.19	0.05	1.72
67	0.14	0.09	0.07	0.03	0.06	0.10	0.07	0.15	0.55	0.48	0.23	0.08	2.05
68	0.05	0.04	0.04	0.04	0.06	0.14	0.16	0.27	0.15	0.15	0.06		
69	0.08	0.05	0.04	0.03	0.02	0.02	0.22	0.31	0.97	0.11	0.06	0.41	2.32
70	0.02	0.09	0.03	0.03	0.07	0.04	0.08						
71	0.01	0.01	0.02	0.03	0.04	0.05	0.05	0.06	0.05	0.14	0.19	0.03	0.68
72	0.04	0.02	0.03	0.01	0.01	0.16		0.15	0.14	0.20	0.11	0.05	
73	0.04	0.09	0.03	0.01	0.51	0.10	0.11	0.21	0.15	0.60	0.05	0.06	1.95
74	0.04	0.06	0.01	0.01	0.01	0.25	0.14	0.06	0.72	0.15	0.05	0.04	1.54
75	0.03			0.01	0.01	0.02	0.02	0.06	0.21	0.22	0.07		
76	0.08		0.02	0.01	0.01	0.31	0.13	0.06	0.21	0.29	0.06		
77		0.02	0.02	0.01	0.01	0.02		0.05	0.05	0.29			
78		0.02	0.02	0.02	0.01	2.99	0.20	0.71	0.25	0.25	0.09	0.03	
79		0.04	0.03		1.69	0.21	0.10	2.04	1.13	0.30	0.15		
80		0.02	0.01		0.01	0.01	0.01	1.08	1.67				
81		0.03	0.02	0.01	0.02	0.80	0.60	20.40	0.77	0.18	0.08		
82	0.02	0.03	0.02	0.03	0.06	0.22	0.10	0.08	0.64	2.48		0.05	
83	0.06	0.02	0.01	0.01	0.01	0.05	0.39	0.16	0.72	0.24			
84	0.10	0.05	0.03	0.01	0.04	0.15	0.19	0.12	3.08	0.15	0.04		
85			0.02	0.03	0.03	0.23	0.70	0.61	0.43	0.26	0.01		
86		0.01	0.01	0.01	0.01	0.04	0.07				0.79		
87	0.02	0.01	0.01	0.01	0.09	0.05	0.23	0.34	0.36	0.07	0.04	0.02	1.25
88	0.01	0.01	0.00	0.04	0.01	0.73	0.11	0.14	1.23	0.08	0.01	0.01	2.38
89	0.02	0.03	0.01	0.02	0.01	0.02	0.91	0.66	1.00	0.05	0.05	0.02	2.80
90	0.02	0.02	0.05		0.04	0.06	0.20	0.43	2.03	0.29	0.03	0.01	
MEAN	0.05	0.04	0.02	0.02	0.11	0.27	0.22	1.19	0.70	0.33	0.12	0.06	

MEAN ANNUAL LOAD BASED ON MONTHLY MEANS = 0.00313 MCM

表 4.17　CFEが推定した月平均流砂量（水路トンネルNo.1）

CANAL TUNNEL NO.1　　(1,000 CUBIC METERS)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
76										0.38	0.70	0.63	
77	0.48		0.45	0.43	0.70	5.99		1.88	2.78	3.52	0.69	0.46	
78		0.38	0.53	0.35	0.29	20.76	1.73	2.25	2.22	3.75	0.98	0.62	
79	0.46	0.44	0.46	1.29	0.62	10.86	4.05	8.04	1.00	2.85	1.04		
80	1.04	0.62	0.38	0.50	4.43	1.32	0.86	4.98	14.01	1.70	0.72	0.51	31.07
81	0.38	0.26	0.86	0.86	0.38	25.12	9.93	6.81	12.00	2.29	2.47	2.07	63.43
82	0.36	0.36	0.42	0.55	1.55	0.71	0.91	1.02	2.26	4.31	0.49	0.46	13.40
83	0.53	0.31	0.26	0.23	0.32	0.72	8.08	21.20	6.66	1.13	1.69	0.58	41.71
84	0.36	0.30	0.27	0.17	1.99	4.70	2.87	1.10	14.48	1.67	0.68		
85			0.51	0.53	1.02	9.19	4.70	1.88	2.08	5.32	0.69	0.85	
86	0.75		0.31	0.36	0.55	6.12	3.15	0.84	1.81	4.94	9.20	0.87	
87	0.67	0.45	0.53	0.41	0.59	2.52	4.43	2.41	1.94	1.10	0.71	0.50	16.26
88	0.47	0.47	0.52	1.00	0.74	2.17	3.89	10.51	10.73	1.35	0.49	0.74	33.08
89	0.49	0.72	1.25	1.13	0.40	4.29	3.45	6.38			2.81	1.07	
90	1.57	0.97	1.28	0.70	8.88	4.94	6.58	6.42	2.95	3.01	1.72	1.94	40.96
MEAN	0.63	0.48	0.57	0.61	1.61	7.10	4.20	5.41	5.76	2.67	1.67	0.87	

MEAN ANNUAL LOAD BASED ON MONTHLY MEANS = 0.0316 MCM

表 4.18　アプルコ川およびソンタラコ川における河床材料の粒度分布

SIEVE No.	SIZE (MM)	RIO APULCO %FINER	ARROYO SONTALACO %FINER
3"	76.2		
2"	50.8		
1"	25.4	92.9	
1/2"	12.7	79.7	93.0
#4	4.76	59.0	78.3
#6	3.35	51.6	71.6
#8	2.36	44.5	63.1
#10	2	38.7	55.2
#20	0.85	28.3	37.1
#40	0.42	14.4	16.0
#50	0.25	9.4	11.2
#100	0.149	2.2	4.1
#200	0.074	0.5	2.0

Notes : Measured by CFE, June 9, 1989

表4.19　1987年に採取された貯水池堆積土砂の特性

HOLE NO.1		HOLE NO.2		HOLE NO. 3		HOLE NO. 4	
SEDIMENT ELEVATION	= 771.53 M	SEDIMENT ELEVATION	= 763.92 M	SEDIMENT ELEVATION	= 768.15 M	SEDIMENT ELEVATION	= 766.09 M
BED ELEVATION	= 734.53 M	BED ELEVATION	= 730.01 M	BED ELEVATION	= 737.05 M	BED ELEVATION	= 735.36 M
ELEVATION (EL. M)	SEDIMENT DEPOSIT	ELEVATION (EL. M)	SEDIMENT DEPOSIT	ELEVATION (EL. M)	SEDIMENT DEPOSIT	ELEVATION (EL. M)	SEDIMENT DEPOSIT
771.53-767.98	CLAYEY SILT	763.92-762.89	SANDY SILT	768.15-767.55	SILT	766.09-756.14	SILT
767.98-758.98	NE SAND	762.89-755.39	SILT	767.55-766.17	SILT	756.14-755.83	SANDY SILT
758.98-754.80	CLAYEY SILT	755.39-753.43	SILT WITH SAND	766.17-764.50	SILT/FINE SAND	755.82-749.66	SILT
754.80-754 55	VERY FINE SAND	753.43-742.21	SANDY SILT	764.59-761.15	CLAYEY SILT	749.66-749.26	SANDY SILT
754.55-752.16	SILTY CLAY	742.21-741.00	SILT WITH SAND	761.15-760.85	SANDY SILT	749.26-739.41	SILT
752.16-752.00	FINE SAND	741.00-740.72	FINE SAND	760.85-760.67	SILT	739.41-738.11	SILTY SAND
752.00-749.65	CLAYEY SILT	740.72-736.00	SILTY SAND	760.67-759.32	FINE SAND	738.11-736.86	SILT
749.68-743.68	SANDY SILT	736.00-735.89	ROCK FRAGMENTS/SAND	759.32-758.20	SILT/FINE SAND	736.86-735.86	SILT/GRAVEL
743.68-741.93	CLAYEY SILT	735.89-733.05	SANDY SILT	758.20-757.70	FINE SAND	735.86-735.36	ROCK FRAGMENTS
741.93-741.00	SANDY SILT	733.05-730.01	ROCK FRAGMENTS	757.70-756.65	SILT		
741.00-740.63	SILTY SAND			756.64-756.58	FINE SAND		
740.63-739.53	CLAYEY SILT			756.58-756.40	SILT		
739.53-737.65	SAND			756.40-755.35	FE SAND/SILT		
737.65-734.53	GRAVELS			755.35-753.54	SANDY SILT		
				753.54-752.70	FINE SAND		
				752.70-752.30	SANDY SILT		
				752.30-749.00	FINE SAND/SILT		
				749.00-748.75	FINE SAND		
				748.75-748.00	SILT		
				748.00-741.12	SANDY SILT		
				741.12-737.60	SAND		
				737.60-737.05	ROCK FRAGMENTS		
PARTICLE SIZE DISTRIBUTION DEPTH EL. 771.53-768.08		PARTICLE SIZE DISTRIBUTION DEPTH EL. 763.56-760.51		PARTICLE SIZE DISTRIBUTION DEPTH EL. 767.55-764.50		PARTICLE SIZE DISTRIBUTION DEPTH EL. 766.09-762.74	
SIZE(MM)	%FINER	SIZE	%FINER	SIZE	%FINER	SIZE	%FINER
1	100.0	1	100.0	1	100.0	1	100.0
0.5	99.9	0.25	99.1	0.25	99.3	0.25	100.0
0.25	99.8	0.5	96.3	0.5	97.9	0.5	99.8
0.177	99.5	0.177	92.7	0.177	96.5	0.177	98.5
0.125	99.1	0.125	90.3	0.125	94.5	0.125	94.5
0.088	99.1	0.088	87.6	0.088	93.1	0.088	91.8
0.074	99.0	0.074	83.7	0.074	92.1	0.074	89.2
0.0625	99.0	0.0625	82.0	0.0625	91.9	0.0625	88.5

表 4.20　貯水池の湖岸で採取された堆積土砂の粒度分布

STZE (MM)	SAMPLE 1	SAMPLE 2	SAMPLE 3	SAMPLE 4	SAMPLE 5
			PERCENT FINER		
76.2					
50.8					
38.1					
25.4					
19.1					
12.7	99.6	99.8	99.7		
9.52	99.4	99.8	99.7		
4.76	98.2	99.2	99.6		
2	96.8	98	99.5	99.4	
0.84	88.3	94.6	98.8	97.6	
0.42	54.9	62.4	83	72.2	
0.25	38.1	29.4	46.2	39.7	
0.149	26.4	12.2	21.3	22.3	99.8
0.074	10.1	6.9	15.4	16.2	97.4
0.054	8.4	5.9	14.1	15.1	75.4
0.021	4.9	4.1	8.7	11.6	45.9
0.0047	2.3	1.1	5.1	2.8	10.9

Note: (1) Samples were taken by the Study Team in September, 1992.
(2) Sample numbering is from upstrem to downstream.

表 4.21 (1/4)

ボーリング孔No.1における貯水池堆砂土砂の粒度分布

Depth from Surface of Reseroivr Bed (m)	Particle Sizes (mm) Percent Finer									
	.0044	.021	.051	.074	.149	.25	.42	.84	2.00	4.76
3.75 - 3.95	29.3	87.0	100.0							
3.95 - 4.20	61.8	96.5	99.8	100.0						
4.75 - 4.95	52.6	92.8	99.8	100.0						
4.95 - 5.15	40.6	82.3	99.3	100.0						
5.35 - 5.80	64.2	95.8	100.0							
5.95 - 6.10	51.4	99.6	100.0							
6.45 - 6.65	18.5	84.5	98.5	100.0						
7.30 - 7.50	69.8	89.5	98.5	100.0						
7.50 - 7.99	66.1	96.6	100.0							
8.70 - 8.85	59.8	95.5	99.4	100.0						
9.45 - 9.90	45.8	90.9	100.0							
10.20 - 10.40	39.4	83.6	100.0							
10.95 - 11.10	89.2	91.4	97.6	100.0						
11.25 - 11.40	52.6	95.3	99.9	100.0						
11.40 - 11.85	66.5	92.4	100.0							
11.85 - 12.22	17.7	48.0	87.7	100.0						
13.35 - 13.80	61.2	94.4	100.0							
13.95 - 14.20	69.8	91.6	99.7	100.0						
14.75 - 14.90	68.1	95.7	98.9	100.0						
15.20 - 15.65	67.8	95.7	100.0							
15.90 - 16.11	41.1	86.5	97.8	100.0						
17.15 - 17.60	66.5	97.2	100.0							
18.12 - 18.31	49.4	96.2	100.0							
18.50 - 18.88	11.8	18.5	19.2	23.9	58.5	83.4	96.3	99.7	99.8	100.0
19.10 - 19.40	58.2	92.8	96.4	100.0						
19.40 - 19.55				42.8	49.3	58.5	74.4	95.8	99.6	100.0
20.63 - 20.77	66.0	100.0								
21.60 - 21.80	82.0	94.0	96.0	100.0						
23.45 - 23.95	38.1	96.1	100.0							
24.77 - 24.95	46.5	81.1	98.4	100.0						
25.40 - 25.46	32.0	41.2	42.0	46.0	55.4	67.7	83.1	97.6	99.7	100.0
26.30 - 26.68	65.0	91.6	94.2	100.0						
27.35 - 27.68	67.0	86.0	93.0	100.0						
28.00 - 28.34	81.9	99.0	99.4	100.0						
29.30 - 29.62	75.5	99.6	100.0							
31.25 - 31.28	17.0	57.8	65.0	67.0	78.9	85.1	91.7	98.4	99.6	100.0
31.28 - 31.63	70.1	99.7	99.9	100.0						
33.20 - 33.60	47.8	85.6	99.6	100.0						
34.20 - 34.70	64.8	94.7	97.2	100.0						
36.05 - 36.43	45.3	76.4	82.0	100.0						
37.10 - 37.42	40.7	66.9	72.6	100.0						
37.61 - 37.81	27.8	57.0	62.4	100.0						
39.05 - 39.15	22.8	40.0	40.3	40.4	59.2	71.2	82.9	95.9	98.9	100.0
39.15 - 39.37	57.3	97.5	98.9	100.0						
40.45 - 40.65	61.5	94.6	96.9	100.0						
41.10 - 41.46	63.8	89.4	93.8	100.0						
43.05 - 43.40	54.3	85.0	88.8	100.0						
43.95 - 44.33	49.8	81.9	83.3	100.0						
45.30 - 45.80	29.6	66.7	87.4	100.0						
46.20 - 46.50	7.9	21.2	32.6	33.1	38.7	45.3	60.3	88.7	97.7	100.0

表 4.21 (2/4)

ボーリング孔No.1における貯水池堆砂土砂の粒度分布

Depth from Surface of Reseroivr Bed (m)	Particle Sizes (mm)									
	.0044	.021	.051	.074	.149	.25	.42	.84	2.00	4.76
	Percent Finer									
1.31 - 1.48	45.5	96.6	99.3	100.0						
2.18 - 2.39	58.4	96.7	100.0							
3.16 - 3.37	54.5	94.9	99.9	100.0						
4.37 - 4.58	78.1	99.2	99.6	100.0						
5.37 - 5.58	42.1	83.6	98.8	100.0						
6.25 - 6.44	46.8	98.7	100.0							
7.44 - 7.63	6.4	17.1	45.5	61.9	95.9	97.6	98.0	98.9	99.5	100.0
7.81 - 8.00	35.5	91.7	100.0							
8.23 - 8.42	30.6	80.7	100.0							
9.48 - 9.65	31.0	81.0	100.0							
10.42 - 10.60	41.5	85.0	100.0							
11.22 - 11.40	13.0	53.0	89.2	100.0						
12.22 - 12.42	63.0	98.9	99.3	100.0						
13.33 - 13.55	46.1	90.8	100.0							
14.47 - 14.64	52.0	97.0	99.3	100.0						
15.26 - 15.45	49.2	87.7	98.9	100.0						
17.70 - 18.00	54.6	90.4	99.5	100.0						
18.65 - 18.83	56.4	95.6	98.0	100.0						
20.82 - 21.00	64.4	96.8	99.4	100.0						
21.60 - 21.80	52.0	96.4	99.2	100.0						
22.20 - 22.40	41.8	94.0	99.1	100.0						
23.60 - 23.80	55.0	98.9	99.4	100.0						
25.20 - 25.40	61.5	97.8	99.6	100.0						
26.40 - 26.60	55.9	923.0	98.4	100.0						
27.50 - 27.77	51.6	89.0	100.0							
29.20 - 29.45	59.3	92.2	99.5	100.0						

表 4.21 (3/4)

ボーリング孔No.1における貯水池堆砂土砂の粒度分布

Depth from Surface of Reseroivr Bed (m)	Particle Sizes (mm)									
	.0044	.021	.051	.074	.149	.25	.42	.84	2.00	4.76
	Percent Finer									
0.06 - 0.80	23.0	77.7	96.9	100.0						
1.60 - 1.80	13.5	56.4	92.4	100.0						
2.40 - 2.60	12.3	51.8	98.3	100.0						
4.83 - 5.00	3.0	8.5	21.2	31.3	70.6	84.7	94.0	98.5	99.1	100.0
5.20 - 5.40	5.0	14.4	32.6	45.1	85.0	91.8	95.3	98.4	99.4	100.0
5.40 - 5.60	22.4	75.4	97.7	100.0						
6.25 - 6.45	16.3	61.0	91.0	100.0						
8.15 - 8.35	24.2	52.0	70.5	100.0						
9.05 - 9.25	21.7	63.8	95.4	100.0						
10.20 - 10.40	16.7	69.0	96.4	100.0						
11.30 - 11.50	17.6	552.0	89.4	100.0						
16.34 - 16.55	6.5	20.2	58.6	73.1	97.2	98.9	99.3	100.0		
17.20 - 17.40	9.9	38.6	85.8	100.0						
19.80 - 20.05	32.7	95.3	99.2	100.0						
20.55 - 20.78	2.9	6.3	17.3	31.9	98.1	96.7	99.0	99.6	100.0	
22.40 - 22.60	9.5	50.8	95.5	100.0						
24.93 - 25.19	1.9	5.3	14.4	20.0	69.8	84.3	93.7	99.5	100.0	
27.19 - 27.40	11.2	32.8	57.5	67.1	97.1	99.1	99.7	100.0		
29.20 - 29.65	47.7	95.3	100.0							
30.98 - 31.17	19.4	69.4	99.7	100.0						
30.80 - 31.00	2.5	6.1	15.1	24.1	80.9	98.4	99.7	99.9	100.0	
34.58 - 34.80	29.5	84.4	99.3	100.0						
35.89 - 36.10	25.9	85.0	99.2	100.0						
37.68 - 37.90	55.0	93.4	98.2	100.0						
39.14 - 39.36	51.1	94.8	98.9	100.0						
40.75 - 41.00	54.3	91.8	99.8	100.0						
41.81 - 42.02	18.1	51.2	97.1	100.0						
44.30 - 44.50	59.4	94.2	98.9	100.0						

表 4.21 (4/4)

ボーリング孔No.1における貯水池堆砂土砂の粒度分布

Depth from Surface of Reseroivr Bed (m)	Particle Sizes (mm) Percent Finer														
	.0044	.021	.051	.074	.149	.25	.42	.84	2.00	4.76	9.52	12.7	19.1	25.4	38.1
1.	3.0	6.0	17.0	33.2	15.4										

PARTICLE SIZE DISTRIBUTION,
RESERVOIR BED MATERIAL AT DRILL HOLE NO. 5

Depth from Surface of Reseroivr Bed (m)	Particle Sizes (mm) Percent Finer														
	.0044	.021	.051	.074	.149	.25	.42	.84	2.00	4.76	9.52	12.7	19.1	25.4	38.1
1.	0.2	0.7	2.5	10.7	25.1	68.7	85.8	92.2	92.6	100.0					
2.	2.0	5.0	12.0	22.0	57.0	77.0	78.0	79.0	100.0						
3.	2.0	5.0	9.0	11.7	23.5	59.8	77.5	96.5	99.1	100.0					
4.				13.5	20.8	38.9	52.9	82.5	94.4	100.0					
5.				33.3	70.3	92.8	94.9	97.7	98.9	100.0					
6.				3.8	9.9	32.3	53.1	76.7	83.6	89.5	95.6	100			
7.				8.8	21.5	38.4	46.1	67.6	78.9	88.7	92.6	97.7	100.0		
8.				2.5	5.5	13.0	17.4	25.7	33.0	59.1	88.4	96.2	100.0		
9.				2.7	4.8	8.6	10.8	20.3	29.0	40.9	49.8	56.5	100.0		
10.				0.3	0.5	0.5	0.5	0.5	0.5	0.5	4.2	20.3	52.0	61.3	100.0
11.				3.3	4.6	5.7	6.4	9.2	13.4	21.9	31.6	57.3	78.8	100.0	
12.				8.6	30.9	68.5	82.0	92.5	95.3	97.6	99.2	100			

表 4.22　貯水池堆砂土砂表層の粒度分布

Sample No.	Depth from Surface of Reservoir Bed (m)	Particle Sizes (mm) .004	.021	.051	.074	.149	.25	.42	.84	2.00	4.76	9.52	12.7	19.1	25.4	38.1	50.8
		Percent Finer															
1.	3.60 - 3.80	45.2	90.0	99.4	100.0												
2.	0.00 - 0.85	46.2	91.9	100.0													
	1.85 - 2.10	34.7	78.0	98.5	100.0												
	2.85 - 4.20	60.9	96.1	100.0													
3.	0.40 - 0.60	52.2	95.6	99.5	100.0												
	2.66 - 2.86	62.0	92.4	97.3	100.0												
4.	1.83 - 2.00	54.3	91.1	99.3	100.0												
	2.60 - 2.80	51.4	93.9	99.2	100.0												
	3.40 - 3.60	57.0	90.5	97.9	100.0												
5.	1.80 - 2.00	1.0	3.0	13.0	28.1	74.9	92.5	96.3	99.6	99.9							
	2.31 - 2.54	14.3	46.8	69.2	71.7	100.0	96.0	99.2	99.6	100.0							
	3.20 - 3.40	37.0	77.3	94.8	100.0												
7.	1.22 - 1.41	66.3	99.0	99.6	100.0												
	2.20 - 2.40	85.9	99.1	99.5	100.0												
	3.20 - 3.40	45.1	95.2	100.0													
8.	0.31 - 0.48	22.8	76.0	97.9	100.0												
	1.64 - 1.80	40.3	88.8	98.0	100.0												
	2.82 -	13.4	51.5	97.0	100.0												
10.	0.65 - 0.83	2.0	4.3	14.9	30.4	83.4	98.9	99.7	100.0								
	1.30 - 1.65				4.8	54.0	89.6	96.0	99.9	100.0							
	3.20 - 3.40				4.8	33.5	88.4	97.8	100.0								
	3.40 - 3.60	14.6	18.7	93.4	100.0												
12.	0.78 - 1.00				3.4	5.2	28.0	52.8	96.4	99.6	100.0						
	1.78 - 2.00				21.2	40.4	61.1	75.4	98.9	100.0							
	2.42 - 2.60	1.0	2.2	5.0	11.9	19.0	32.6	48.1	89.8	96.4	98.1	100.0					
	3.78 - 4.00				31.3	41.7	63.5	75.5	96.4	99.0	99.3	100.0					
13.	3.40 - 3.60	12.0	67.0	100.0													
14.	0.40 - 0.60				2.0	10.0	35.2	58.4	92.6	99.3	100.0						
	2.64 - 2.82				2.7	21.5	59.2	74.6	82.8	84.7	91.7	96.9	100.0				
15.	0.00 - 1.00								0.1	0.3	3.0	10.9	20.7	38.4	66.2	100.0	
	1.00 - 2.00				0.1	0.4	1.7	2.9	8.3	14.0	31.2	38.6	39.4	47.4	54.3	66.0	100.0
	2.00 - 2.45				4.6	7.3	12.4	18.4	45.7	65.0	80.8	92.9	95.9	100.0			
	2.45 - 3.00				1.3	1.9	3.0	3.8	7.0	10.5	21.4	35.1	38.7	51.6	60.5	68.1	100.0

表 4.23　メキシコの人口および国内総生産

Year	Population		Gross Domestic Products		
	Total (millions)	Average Annual Growth Rate (%) (5 yrs interval)	G.D.P. (Current) (billion Pesos)	1985 Prices (billion pesos)	Growth Rate (%)
1965	42.69	-	252.0	16,535	-
1970	50.69	3.49	444.3	23,101	-
1975	60.15	3.48	1,100.1	31,716	-
1980	69.66	2.98	4,276	43,773	-
1985	77.94	2.27	47,392	47,392	
1986	79.57	-	79,191	45,655	Δ3.7
1987	81.20	-	192,802	46,403	1.6
1988	82.84	-	389,259	46,964	1.2
1989	84.49	-	503,668	48,493	3.3
1990	86.15	2.20	678,924	50,622	4.4
1991	87.84	-	852,783	52,451	3.6

Source: UN monthly Bulletin of Statistics, International Financial Statistics Yearbook; 1992.

表 4.24　調査対象地域内の市町村

Number	Municipio	Cabecera Municipal	Elevation (meters)	Area (km2)
Estado de Puebla				
I. Principally in the Rio Apulco Basin				
83	Ixtacamaxtitlan	Ixtacamaxtitlan	2,150	502
200	Xochiapulco	Cinco de Mayo	2,050	57
207	Zacapoaxtla	Zacapoaxtla	1,800	177
212	Zautla	Santiago Zautla	2,000	235
			Total area	971
II. Principally in the Xiuayucan Diversion Area				
17	Atempan	Atempan	1,950	50
186	Tlatlauquitepec	Tlatlauquitepec	1,900	246
204	Yaonahuac	Yoanahuac	1,800	55
211	Zaragoza	Zaragoza	2,300	28
			Total area	379
III. Adjacent Areas				
16	Aquixtla	Aquixtla	2,100	150
43	Cuetzalan del Progreso	Cuetzalan del Progreso	1,000	158
44	Cuyoaco	Cuyoaco	2,500	295
53	Chignahuapan	Chignahuapan	2,320	925
94	Libres	Libres	2,400	305
101	Nauzontla	Nauzontla	1,500	30
105	Ocotepec	Ocotepec	2,400	80
172	Tetela de Ocampo	Tetela de Ocampo	700	418
202	Xochitlan	Xochitlan de V. Suarez	1,000	26
			Total area	2,387
Estado de Tlaxcala				
I. Rio Apulco Basin				
30	Terrente	Terrente	2,400	280
34	Tlaxco	Tlaxco de Mordos	2,330	56
			Total area	336
II. Adjacent Areas				
4	Altzayanc	Villa Altzayance de Hidalgo	2,600	56
31	Tetla	Tetla	2,522	145
			Total area	201

表 4.25 調査対象地域内の人口 (1/2)

Number	Municipio	Population		
		Total	Males	Females
Estado de Puebla				
I. Rio Apulco Basin				
83	Ixtacamaxtitlan	28,405	14,320	14,085
172	Tetela de Ocampo	8,407	4,218	4,189
186	Tlatlauquitepec	4,451	2,305	2,146
200	Xochiapulco	4,086	2,046	2,040
202	Xochitlan de Vicente Suarez	2,242	1,081	1,161
207	Zacapoaxtla	41,855	20,560	21,295
212	Zautla	11,936	5,575	6,361
	Total	101,382	50,105	51,277
II. Xiucayucan Diversion Basin				
17	Atempan	6,897	3,370	3,527
186	Tlatlauquitepec	34,996	17,004	17,992
204	Yaonahuac	4,379	2,159	2,220
211	Zaragoza	10,869	5,287	5,582
212	Zautla	6,188	2,974	3,214
	Total	63,329	30,794	32,535
III. Adjacent Areas				
16	Aquixtla	7,140	3,534	3,606
17	Atempan	5,799	2,902	2,897
43	Cuetzalan del Progreso	35,676	17,641	18,035
44	Cuyoaco	12,410	6,069	6,341
53	Chignahuapan	41,896	21,091	20,805
94	Libres	20,634	10,105	10,529
101	Nauzontla	3,734	1,830	1,904
105	Ocotepec	4,699	2,363	2,336
172	Tetela de Ocampo	16,519	8,091	8,428
186	Tlatlauquitepec	3,000	1,509	1,491
202	Xochitlan	8,223	4,067	4,156
204	Yaonahuac	1,308	677	631
	Total	161,038	79,879	81,159

Source: 1990 Census

表 4.25　調査対象地域内の人口 (2/2)

Number	Municipio	Population		
		Total	Males	Females
Estado de Tlaxcala				
I. Rio Apulco Basin				
30	Terrenate	5,367	2,776	2,591
34	Tlaxco	119	64	55
	Total	5,486	2,840	2,646
II. Adjacent Areas				
4	Altzayanca	11,819	6,055	5,764
30	Terrenate	8,293	4,258	4,035
31	Tetla	15,429	7,654	7,775
34	Tlaxco	26,970	13,385	13,585
	Total	62,511	31,352	31,159
Total, Rio Apulco Basin				
	Puebla	101,382	50,105	51,227
	Tlaxcala	5,486	2,840	2,646
	Total	106,868	52,945	53,873
Total, Xiucayucan Diversion				
	Puebla	63,329	30,794	32,535
	Tlaxcala	-	-	-
	Total	63,329	30,794	32,535
Total, Adjacent Areas				
	Puebla	161,038	79,879	81,159
	Tlaxcala	62,511	31,352	31,159
	Total	223,549	111,231	112,318

表 4.26　調査対象地域内の人口の推移

	Population (person)				Growth Rate (%)		
	1960	1970	1980	1990	1960-70	1970-80	1980-90
I. Estado de Puebla (Whole state)	1,973,837	2,508,226	3,347,685	4,126,101	27.1	33.5	23.3
o (1) Aquixtla	6,407	6,568	6,632	7,140	2.6	0.9	7.7
o• (2) Atempan	6,109	7,991	8,172	12,696	30.8	2.3	55.4
o (3) Cuetzalann del Progreso	22,418	24,501	28,877	35,676	9.3	17.9	23.5
o (4) Cuyoaco	8,637	9,544	11,667	12,410	10.5	22.3	6.4
o (5) *Chignahuapan*	24,733	30,201	33,712	41,896	22.1	11.6	24.3
* (6) Ixtacamaxtitlan	18,084	21,807	26,827	28,405	20.6	23.0	5.9
o (7) Libres	12,394	13,023	17,313	20,634	5.1	32.9	19.2
o (8) Nauzontla	2,744	3,158	3,551	3,734	15.1	12.4	5.2
o (9) Ocotepec	3,505	3,795	4,721	4,699	8.3	24.4	Δ0.5
o* (10) Tetela de Ocampo	18,908	19,967	21,834	24,926	5.6	9.4	14.2
o•* (11) Tlatlauquitepec	24,976	29,113	31,323	42,447	16.6	7.6	35.5
* (12) Xochiapulco	3,462	3,652	3,749	408	5.5	2.7	9.0
o* (13) Xochitlan de Vincente Suarez	7,647	8,042	9,642	10,465	5.2	19.9	8.5
o• (14) Yaonahuac	2,935	3,409	4,163	5,687	16.1	22.1	36.6
* (15) Zacapoaxtla	20,819	26,134	35,456	41,855	25.5	35.7	18.0
• (16) Zaragoza	4,378	6,150	9,070	10,869	40.5	47.5	19.8
•* (17) Zautla	-	14,464	16,834	18,124	-	16.4	7.7
Total	*188156	231,519	273,543	325,749	23.0	18.2	19.1
II. Estado de Tlaxcala (Whole state)	346,699	420,638	556,597	761,277	21.3	32.3	36.8
o (1) Altzayanca	6,726	7,846	9,494	11,819	16.7	21.0	24.5
o* (2) Terrenate	5,983	7,204	9,208	13,660	20.4	27.8	48.3
o (3) Tetla	6,690	7,000	8,491	15,429	4.6	21.3	81.7
o* (4) Tlaxco	16,954	16,405	20,384	27,089	Δ3.2	24.3	32.9
Total	36,353	38,455	47,577	67,997	5.8	23.7	42.9
III. Grand Total							
I. Puebla	188,156	231,519	273,543	325,749	23.0	18.2	19.1
II. Tlaxcala	36,308	38,455	47,577	67,997	5.9	23.7	42.9
G. Total	224,464	269,974	321,120	393,746	20.3	18.9	22.6

Source: INEGI (Instituto Nacional De Estadistica Geografia D Informatica, "PUEBLA: Resultados Definitives Datos Por Localidad, XI Censo General De Poblacion Y Vivienda, 1990),
: Huanchinango, "Region Socioeconomica"

Remarks: * Rio Apulco Basin
• Xiucayucan Division Basin
o Adjacent Area

表 4.27　調査対象地域内の雇用水準（1/2）

Number	Municipio	Males	Employed		In Agriculture	
		No.	No.	%	No.	%
I. Rio Apulco Basin						
	Puebla					
83	Ixtacamaxtidan	14,320	6,673	46.6	5,843	87.6
200	Xochiapulco	2,046	874	42.7	779	89.1
207	Zacapoaxtla	20,560	8,755	42.6	5,791	66.1
212	Zautla	8,549	2,791	32.6	1,686	60.6
	Sub-total	45,475	19,093	42.0	14,039	73.5
	Tlaxcala					
30	Terrente	7,034	3,177	45.2	2,668	84.0
34	Tlaxco					
	Sub-total	7,034	3,177	45.2	2,668	84.0
	Total	52,509	22,270	42.4	16,707	75.0
II. Xiucayucan Diversion Basin						
17	Atempan	6,272	2,662	42.4	2,163	81.2
186	Tlatlauquitepec	20,818	9,211	44.2	6,786	73.7
204	Yaonahuac	2,836	1,197	42.2	882	73.7
211	Zaragoza	5,287	2,111	39.9	845	40.0
	Total	35,213	15,181	43.1	10,676	70.3
III. Puebla State		2,008,531	872,628	43.4	386,298	44.3

表 4.27 調査対象地域内の雇用水準 (2/2)

Number	Manufacture		Construction		Commerce		Community Services	
	No.	%	No.	%	No.	%	No.	%
I. Rio Apulco Basin								
Puebla								
83	147	2.2	272	4.1	106	1.6	45	0.7
200	15	1.7	12	1.4	14	1.6	40	4.6
207	530	6.0	691	7.9	578	6.6	344	3.9
212	520	18.6	151	5.4	244	8.7	47	1.7
Sub-total	1,212	6.3	1,126	5.9	942	4.9	476	2.5
Tlaxcala								
30	142	4.5	176	5.5	48	1.5	13	0.4
Total	1,354	6.1	1,302	5.8	990	4.4	489	2.2
II. Xiucayucan Diversion Basin								
17	100	3.8	108	4.0	78	2.9	80	3.0
186	455	4.9	476	5.2	381	4.1	339	3.7
204	70	5.8	58	4.8	29	2.4	61	5.1
211	243	11.5	127	6.0	253	12.0	265	12.6
Total	868	5.7	769	5.1	741	4.9	745	4.9
III. Puebla State								
	151,256	17.3	65,008	7.4	87,171	10.0	32,083	3.7

表 4.28　プエブラ州の土地所有形態（1988年）

(Unit : ha)

Estado de Puebla*	Total	(Radio)	Group Owned	(Ratio)	Private Owned	(Ratio)	National Property	(Ratio)	Village Owned	(Ratio)	No Data
1. Ixtacamaxtitlan	50,199.13	(100.0)	8,796.16	(17.5)	41,046.97	(81.8)	-		283.76	(0.6)	72.24
2. Tetla de Ocampo	41,813.14	(100.0)	836.03	(2.0)	40,898.05	(97.8)	-		97.06	(0.2)	-
3. Atempan	5,009.84	(100.0)	-		5,009.84	(100.0)	-		-		-
4. Tlatlauquitepec	24,679.92	(100.0)	4,054.13	(16.4)	20,405.09	(82.7)	220.70	(0.9)	-		-
5. Xochiapulco	5,667.74	(100.0)	-		5,667.74	(100.0)	-		-		-
6. Xochitlan de Vincente Suarez	8,401.39	(100.0)	-		8,236.01	(98.0)	-		165.38	(2.0)	-
7. Yaonahuac	5,731.01	(100.0)	-		5,731.01	(100.0)	-		-		-
8. Zacapoaxtla	17,661.01	(100.0)	129.83	(7.0)	16,431.18	(93.0)	-		-		-
9. Zaragoza	3,933.39	(100.0)	2,948.51	(75.0)	984.88	(25.0)	-		-		-
10. Zautla	23,508.03	(100.0)	7,994.10	(34.0)	15,513.93	(66.0)	-		-		-

* Excluded municipalities in adjasent areas

Source: Anuario Estadistico Del Estado De Puebla
Instituto Nacional De Estadistica Geografia E Informatica
Edicion 1990-Pagina 26Y27

表 4.29　アプルコ川流域の気象データ

I. Basin Wide Average

	Annual	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Rainfall (mm)	772	13	13	16	40	68	138	120	114	143	66	26	13
Evaporation (mm)	1,187	90	101	144	144	139	109	99	100	83	90	87	83
Mean Temperature (°C)	13.2	10.8	12.0	14.2	15.7	16.6	15.6	14.4	14.5	14.2	13.3	12.5	11.6

II. Long Term Averages for the Five Individual Stations

Rainfall (mm)

	Annual	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
IXTACAMAXTITLAN	584	9	10	16	41	71	104	89	83	96	42	14	8
ZAUTLA	543	10	10	12	25	44	101	78	73	115	45	19	10
LA GLORIA	814	11	12	16	42	70	148	155	149	126	56	18	10
CAPULUAQUE	920	18	16	16	34	53	161	126	107	213	107	47	21
SAN ANTONIO	998	16	18	21	60	101	174	155	159	164	81	31	18

Evaporation (mm)

	Annual	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
IXTACAMAXTITLAN	1,488	93	106	162	157	150	128	128	133	101	100	98	88
ZAUTLA	1,050	73	81	128	135	140	102	91	82	75	80	75	72
LA GLORIA	1,355	108	112	156	145	140	109	99	103	87	100	98	95
CAPULUAQUE	1,052	70	80	117	130	127	94	78	82	70	68	70	63
SAN ANTONIO	1,373	105	125	158	154	140	112	101	99	84	102	95	96

Mean Temperature (°C)

	Annual	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
IXTACAMAXTITLAN	16	13	14	16	18	19	19	18	18	17	16	15	14
ZAUTLA	16	13	14	16	18	19	18	17	17	17	16	14	13
LA GLORIA	12	11	12	13	14	16	14	13	13	13	13	13	12
CAPULUAQUE	13	11	13	15	17	18	16	15	15	15	13	13	12
SAN ANTONIO	9.3	7.2	8.3	10.3	11.2	11.9	10.6	9.2	9.4	9.1	8.7	8.3	7.3

III. Station La Soledad

	Annual	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Rainfall (mm)	3,325	87	66	91	103	178	452	610	534	575	344	184	102
Evaporation (mm)	1,003	45	53	81	102	118	114	104	112	97	78	53	43
Mean Temperature (°C)	16.9	14.5	14.9	17.0	21.0	22.9	23.2	22.2	21.7	21.4	19.6	17.2	15.4

表 4.30　プエブラ州の土地利用

I. Principally in the Rio Apulco Basin (Area in Hectares)

Land Use	Ixtacamaxtitlan		Xochiapulco		Zacapoaxtla		Zautla		Total	
	Ha.	%	Ha.	%	Ha.	%	Ha.	%	Ha.	%
(1) Agricola de Temporal	33,419	66.5	3,928	69.3	15,485	87.7	10,367	44.1	63,199	65.1
(2) Agricola Nomada	3,804	7.6					564	2.4	4,368	4.5
(3) Agricola Bajo Riego					180	1.0	-	-	180	0.2
(4) Pecuario Semi Intensivo	12,496	24.9	1,644	29.0	1,789	10.1	12,239	52.1	28,168	29.0
(5) Pecuario Extensivo	480	1.0							480	0.5
(6) Urbano	-	-	96	1.7	212	1.2	338	1.4	646	0.7
(7) *No Disponible*										
Total	50,199	100	5,668	100	17,666	100	23,508	100	97,041	100

II. Principally in the Xiucayucan Diversion Basin

Land Use	Ixtacamaxtitlan		Xochiapulco		Zacapoaxtla		Zautla		Total	
	Ha.	%	Ha.	%	Ha.	%	Ha.	%	Ha.	%
(1) Agricola de Temporal	4,933	98.5	19,284	78.1	5,513	96.2	2,720	69.2	32,450	82.4
(2) Agricola Nomada										
(3) Agricola Bajo Riego	-	-	154	0.6	-	-	480	12.2	634	1.6
(4) Pecuario Semi Intensivo	-	-	4,707	19.1	85	1.5	545	13.8	5,337	13.6
(5) Pecuario Extensivo										
(6) Urbano	77	1.5	314	1.3	133	2.3	188	4.8	712	1.8
(7) No Disponible	-	-	221	0.9					221	0.6
Total	5,010	100	24,680	100	5,731	100	3,933	100	39,354	100

Notes: Land use
(1) Rain-feed agriculture
(2) Shifting agriculture
(3) Irrigated agriculture
(4) Semi-intensive pasturage
(5) Extensive pasturage
(6) no use

表 5.1　貯水池運転水位の変化による年間発生電力量の計算結果

H-V APPLIED	HWL (EL. m)	MOL (EL. m)	EFFECTIVE STORAGE (MCM)	ANNUAL ENERGY (GWh)
1992	804.5	797.5	10.2	629.2
1988	804.5	797.5	11.3	630.0
1977	804.5	797.5	11.6	630.0
1962	804.5	797.5	13.3	631.2
1992	804.5	795.0	12.5	629.1
1988	804.5	795.0	14.6	630.3
1977	804.5	795.0	15.5	630.5
1962	804.5	795.0	18.8	632.3
1992	804.5	790.0	16.1	626.3
1988	804.5	790.0	18.5	627.9
1977	804.5	790.0	21.0	629.3
1962	804.5	790.0	27.7	632.0
1992	804.5	785.0	17.6	622.4
1988	804.5	785.0	21.0	624.2
1977	804.5	785.0	24.2	625.6
1962	804.5	785.0	32.6	628.7
1992	804.5	780.0	18.2	617.7
1988	804.5	780.0	22.0	619.7
1977	804.5	780.0	26.5	621.4
1962	804.5	780.0	37.5	625.0
1992	804.5	775.0	18.4	612.8
1988	804.5	775.0	22.3	614.8
1977	804.5	775.0	28.1	616.7
1962	804.5	775.0	41.6	620.8

表 5.2　転流排砂の年間可能日数

(Unit : MCM)

		Q (CMS)*							
		30	40	50	60	70	80	90	100
YEAR	1963	3.68	0.27	0.00	0.00	0.00	0.00	0.00	0.00
	1964	0.95	0.09	0.00	0.00	0.00	0.00	0.00	0.00
	1965	3.91	1.65	0.78	0.00	0.00	0.00	0.00	0.00
	1966	29.94	25.05	22.29	20.09	18.38	16.64	14.90	13.19
	1967	10.48	6.24	4.69	3.81	2.95	2.10	1.22	0.36
	1968	1.66	0.07	0.00	0.00	0.00	0.00	0.00	0.00
	1969	34.18	21.22	12.80	7.66	4.35	1.84	0.29	0.00
	1970	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1971	14.91	10.25	6.79	3.71	1.43	0.00	0.00	0.00
	1972	3.52	1.43	0.03	0.00	0.00	0.00	0.00	0.00
	1973	5.92	1.70	0.00	0.00	0.00	0.00	0.00	0.00
	1974	98.53	82.72	70.24	59.05	50.93	44.01	38.10	33.15
	1975	23.42	14.41	9.29	5.84	3.53	2.44	1.58	0.70
	1976	20.18	11.09	6.81	4.42	2.95	2.09	1.23	0.35
	1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1978	9.60	5.47	3.73	2.44	1.58	0.73	0.00	0.00
	1979	41.61	33.49	28.49	24.16	19.85	16.41	14.54	12.80
	1980	9.78	6.18	4.46	2.72	1.35	0.47	0.00	0.00
	1981	59.21	43.57	34.44	28.37	22.89	18.56	15.65	13.05
	1982	6.72	3.58	1.89	1.04	0.18	0.00	0.00	0.00
	1983	2.30	0.84	0.00	0.00	0.00	0.00	0.00	0.00
	1984	98.61	84.34	72.43	64.36	58.29	52.90	49.14	45.70
	1985	6.73	3.79	1.58	0.00	0.00	0.00	0.00	0.00
	1986	4.40	2.68	1.19	0.31	0.00	0.00	0.00	0.00
	1987	0.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1988	23.02	20.42	17.83	15.81	14.62	13.74	12.88	12.03
	1989	53.33	46.03	39.74	33.70	28.28	24.55	21.95	19.36
	1990	9.18	3.98	0.00	0.00	0.00	0.00	0.00	0.00
	1991	14.65	7.80	4.26	1.85	0.11	0.00	0.00	0.00
TOTAL		591.95	438.36	343.75	279.33	231.68	196.46	171.50	150.70
AVE.		20.41	15.12	11.85	9.63	7.99	6.77	5.91	5.20

NOTE : * Excess runoff exceeding 'Q' is assumed to be used for sediment diversion

表　5.3　　転流排砂の年間利用水量

		Q (CMS)*							
		30	40	50	60	70	80	90	100
YEAR	1963	7	2	0	0	0	0	0	0
	1964	1	1	0	0	0	0	0	0
	1965	4	2	1	0	0	0	0	0
	1966	7	4	3	2	2	2	2	2
	1967	6	3	1	1	1	1	1	1
	1968	3	1	0	0	0	0	0	0
	1969	18	12	6	5	3	2	1	0
	1970	1	0	0	0	0	0	0	0
	1971	7	4	4	3	2	1	0	0
	1972	5	2	1	0	0	0	0	0
	1973	7	4	0	0	0	0	0	0
	1974	21	15	14	11	9	7	6	4
	1975	12	8	4	4	2	1	1	1
	1976	16	7	3	2	1	1	1	1
	1977	0	0	0	0	0	0	0	0
	1978	7	2	2	1	1	1	0	0
	1979	12	8	5	5	5	3	2	2
	1980	6	2	2	2	1	1	0	0
	1981	22	15	7	7	6	4	3	3
	1982	4	3	1	1	1	0	0	0
	1983	2	1	0	0	0	0	0	0
	1984	20	15	12	8	7	5	4	4
	1985	4	3	2	0	0	0	0	0
	1986	2	2	1	1	0	0	0	0
	1987	3	0	0	0	0	0	0	0
	1988	3	3	3	2	1	1	1	1
	1989	10	8	7	7	6	3	3	3
	1990	7	6	0	0	0	0	0	0
	1991	11	6	4	2	2	0	0	0
TOTAL		228	139	83	64	50	33	25	22
AVE.		7.86	4.79	2.86	2.21	1.72	1.14	0.86	0.76

NOTE : * Excess runoff exceeding 'Q' is assumed to be used for sediment diversion

表 5.4　洪水吐土砂排出の年間可能日数

(Unit: MCM)

		Q (CMS)*								
		30	40	50	55.2	60	70	80	90	100
YEAR	1963	25.04	13.56	6.88	4.29	2.93	1.43	0.56	0.00	0.00
	1964	21.18	13.70	9.38	7.53	5.94	4.33	3.46	2.60	1.74
	1965	31.82	16.95	11.03	9.12	7.87	5.28	3.76	2.89	2.03
	1966	126.15	90.49	69.89	63.05	57.82	49.67	44.46	40.28	37.06
	1967	49.09	35.55	27.59	24.45	21.54	16.14	11.75	8.86	7.62
	1968	25.03	9.19	2.90	1.33	0.89	0.03	0.00	0.00	0.00
	1969	183.86	138.85	110.04	98.32	88.70	70.51	54.07	41.06	30.73
	1970	40.40	19.15	8.40	5.00	3.16	0.51	0.00	0.00	0.00
	1971	89.19	64.55	49.07	42.94	38.73	31.45	26.24	22.03	18.57
	1972	61.59	31.29	17.29	12.28	9.02	4.92	2.33	0.48	0.00
	1973	83.16	43.73	21.45	15.42	11.47	6.48	4.63	2.90	1.17
	1974	233.06	194.98	169.16	158.38	149.60	133.98	119.99	107.15	96.48
	1975	145.84	116.21	95.72	86.79	79.04	66.69	56.83	47.33	37.82
	1976	121.51	76.27	49.37	40.17	33.53	23.76	17.90	13.64	10.19
	1977	9.04	5.09	2.45	1.55	0.72	0.00	0.00	0.00	0.00
	1978	87.05	55.76	35.60	29.52	24.55	17.23	12.18	8.12	5.50
	1979	137.24	106.78	83.98	74.59	67.55	56.63	49.59	43.54	37.83
	1980	56.38	42.27	33.99	30.84	28.34	24.02	20.10	16.64	13.60
	1981	262.55	197.34	158.85	144.10	132.38	111.74	94.20	79.35	68.54
	1982	49.81	36.43	27.78	24.41	22.20	18.74	15.29	11.83	8.38
	1983	29.51	17.43	11.80	9.79	8.13	5.75	4.03	2.56	1.69
	1984	266.10	222.53	192.33	181.44	172.39	155.79	142.40	129.85	119.49
	1985	63.38	40.07	28.86	25.23	22.33	17.65	14.13	11.54	8.95
	1986	35.93	25.81	20.22	17.53	15.09	11.53	8.39	5.80	3.94
	1987	27.04	14.70	7.75	4.90	2.61	0.13	0.00	0.00	0.00
	1988	64.78	52.55	46.39	43.37	40.94	37.49	34.03	31.08	28.48
	1989	132.12	111.16	98.29	93.26	88.69	79.60	72.06	66.01	59.97
	1990	79.92	47.53	32.81	28.00	24.27	16.71	9.80	3.95	1.56
	1991	89.22	56.61	36.04	29.04	24.21	16.56	11.94	8.48	5.26
	TOTAL	2626.99	1896.53	1465.31	1306.64	1184.64	984.75	834.12	707.97	606.60
	AVE.	90.59	65.40	50.53	45.06	40.85	33.96	28.76	24.41	20.92

NOTE : * Excess runoff exceeding 'Q' is assumed to be used for sediment flushing through spillwa

表 5.5　洪水吐土砂排出の年間利用水量

		Q (CMS)*								
		30	40	50	55.2	60	70	80	90	100
YEAR	1963	18	10	6	5	2	1	1	0	0
	1964	12	5	5	4	3	1	1	1	1
	1965	25	11	5	3	3	3	1	1	1
	1966	58	30	17	14	12	7	5	4	3
	1967	21	13	7	7	7	6	4	2	1
	1968	28	11	6	2	1	1	0	0	0
	1969	70	39	27	25	22	21	16	13	11
	1970	33	16	8	6	4	2	0	0	0
	1971	37	20	15	11	9	7	5	4	4
	1972	52	25	12	9	6	3	3	2	0
	1973	57	32	16	11	8	3	2	2	2
	1974	55	39	24	24	20	17	16	14	11
	1975	46	28	20	19	18	14	11	11	11
	1976	69	40	23	17	16	8	5	4	4
	1977	6	4	2	2	2	0	0	0	0
	1978	47	29	14	12	12	6	5	4	2
	1979	42	32	23	19	16	10	7	7	6
	1980	22	12	7	7	5	5	4	4	3
	1981	104	55	36	30	27	22	19	15	10
	1982	21	12	8	7	4	4	4	4	4
	1983	24	9	5	4	4	2	2	1	1
	1984	66	42	27	22	21	17	15	12	12
	1985	37	18	10	7	7	5	3	3	3
	1986	19	7	6	6	5	4	3	3	2
	1987	20	9	7	6	5	1	0	0	0
	1988	21	8	7	6	4	4	4	3	3
	1989	36	17	14	11	11	10	7	7	7
	1990	53	22	14	9	9	8	8	5	2
	1991	50	28	20	13	10	7	4	4	3
	TOTAL	1149	623	391	318	273	199	155	130	107
	AVE.	39.62	21.48	13.48	10.97	9.41	6.86	5.34	4.48	3.69

NOTE : * Excess runoff exceeding 'Q' is assumed to be used for sediment flushing through spillway.

表　6.1　　ソレダッド貯水池の捕捉率

	Total storage (x 10^6 m3)	Capacity – Inflow ratio	Trap efficiency
(1) Reservoir volume at EL. 804.5 m in 1962	58.753	0.103	0.73
(2) Reservoir volume at EL. 804.5 m in 1977	28.828	0.050	0.66
(3) Reservoir volume at EL. 804.5 m in 1988	22.305	0.039	0.63
(4) Reservoir volume at EL. 804.5 m in 1990	21.171	0.037	0.62
(5) Reservoir volume at EL. 804.5 m in 1992	18.398	0.032	0.61

Notes: (1) Mean annual inflow: 572.694 x 10^6 m3
(2) The mean trap efficiency over 30-year period (1962 - 1992) is assumed to be about 0.65.

表　6.2　　発電所１号基からの放流水の月平均土砂濃度

YEAR/MONTH	SIZES >0.062mm (mg/l)	SIZES <0.062mm (mg/l)
1989 JAN	26	17
FEB	33	35
MAR	33	32
APR	26	25
MAY	25	21
JUN	32	27
JUL	154	32
AUG	257	31
SEP	133	5
OCT	14	3
NOV	9	4
DEC	16	0
1990 JAN	12	12
FEB	16	23
MAR	19	20
APR	20	23
MAY	25	28
JUN	90	54
JUL	231	161
AUG	114	81
SEP	28	89
OCT	19	57
NOV	27	35

表 6.3　1992年の貯水池堆砂面横断標高（1/2）

SECTION NO. / DISTANCE FROM DAM SITE

#91 /250m		#89 /450m		#87 /670m		#82 /920m		#80 /1050m		/1270m (NEW SECTION)		#67 /1500m		/1630m (NEW SECTION)		#61 /1820m		#60 /1950m	
DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)
0	805.0 R	0	805.0 R	0	805.0 R	0	805.0 R	0	805.0 R	0	805.0 R	0	805.0 R	0	805.0 R	0	805.0 R	0	805.0 R
30	800.0	12	800.0	10	800.0	2	800.0	14	800.0	9	800.0	2	800.0	10	800.0	10	800.0	7	800.0
39	795.0	140	800.0	142	795.0	4	795.0	24	795.0	32	795.0	6	795.0	16	795.0	26	795.0	22	797.0
55	790.0	165	795.0	153	790.0	16	790.0	38	790.0	74	790.0	160	790.0	280	791.0	64	796.5	144	797.2
74	785.0	178	790.0	166	785.0	26	787.2	68	785.9	162	786.8	264	790.0	452	792.5	110	796.1	153	795.0
82	780.0	190	785.0	240	781.2	60	785.4	124	785.5	276	786.9	288	795.0	530	791.5	176	795.3	173	795.0
150	776.7	201	780.0	274	785.0	168	785.2	182	785.5	400	787.0	318	800.0	580	791.9	232	795.3	188	796.0
176	780.0	232	777.2	344	790.0	280	785.0	306	790.0	456	790.0	322	805.0 L	586	793.0	254	794.5	206	797.4
189	785.0	342	780.0	364	795.0	304	784.9	314	795.0	464	795.0			598	794.0	282	794.1	254	797.0
211	790.0	428	785.0	375	800.0	346	787.1	324	800.0	470	800.0			602	795.0	322	792.9	320	797.2
214	795.0	442	790.0	412	805.0 L	352	790.0	336	805.0 L	492	805.0 L			608	800.0	344	792.6	358	796.3
224	800.0	456	795.0			356	795.0							611	805.0 L	434	792.7	368	798.6
252	805.0 L	468	800.0			364	800.0									436	793.6	378	800.0
		482	805.0 L			394	805.0 L									444	795.0	387	805.0 L
																458	800.0		
																466	805.0 L		

表 6.3　1992年の貯水池堆砂面横断標高 (2/2)

SECTION NO. / DISTANCE FROM DAM SITE

#59 /2040m		#56 /2130m		#54 /2250m		#51 /2410m		#45 /2760m		/3010m (INTERPOLATED)		#32 /3200m		#26 /3510m		#21 /3790m		/3900m (INTERPOLATED)	
DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)
0	805.0 R	0	805.0 R	0	805.0 R	0	805.0 R	0	805.0 R	0	805.0 R	0	805.0 R	0	805.0 R	0	805.0 R	0	805.0 R
13	800.0	12	800.0	12	800.0	6	800.0	10	800.0	12	800.0	27	800.0	33	800.0	8	803.2	200	800.0
21	798.5	68	798.0	80	798.0	24	798.1	14	799.0	16	799.0	31	797.2	96	799.0	15	800.2	236	799.0
64	796.1	72	796.7	96	797.9	160	798.1	107	799.3	23	798.1	68	797.9	152	800.0	52	800.0	312	800.0
90	797.2	100	795.8	104	794.2	187	797.9	113	798.7	192	798.0	82	800.7	186	805.0 L	77	798.7	388	805.0 L
165	797.5	122	795.6	128	796.0	225	796.3	119	797.5	350	798.6	161	800.0			115	800.0		
181	795.2	126	797.8	220	796.8	230	798.3	186	797.2	516	799.0	180	805.0 L			150	805.0 L		
204	797.2	175	798.0	234	798.4	256	781.1	203	797.2	546	800.0								
276	796.6	224	798.0	302	798.4	261	800.0	238	800.0	550	805.0 L								
330	797.3	256	797.3	308	795.4	271	805.0 L	240	805.0 L										
346	800.0	278	798.1	324	795.7														
362	805.0 L	282	800.0	334	798.5														
		300	805.0 L	342	797.5														
				348	800.0														
				358	805.0 L														

SECTION NO. / DISTANCE FROM DAM SITE

#13 /4180m		#11 /4570m		/4660m (INTERPOLATED)		#8 /4700m		#7 /4860m		#5 /5210m		#2 /5710m	
DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)	DIST. (M)	ELEV. (M)
0	805.0 R	0	805.0 R	0	805.0 R	0	805.0 R	0	805.0 R	0	805.0 R	0	805.0 R
5	803.8	6	801.3	87	801.3	22	800.0	4	802.4	10	802.0	14	800.0
20	800.0	30	800.0	228	800.0	48	800.0	21	800.0	40	800.0	32	799.0
82	800.0	74	800.0	310	800.0	62	805.0 L	41	800.0	58	800.0	47	800.0
90	805.0 L	82	803.3	328	805.0 L			55	801.4	66	805.0 L	52	801.0
		88	805.0 L					60	805.0 L			55	805.0 L

表 7.1　概略工事費　既存発電取水口の放流施設への転用＋発電取水口の新設
(代替案C+F)

NEW INTAKE STRUCTURE & NEW LOW LEVEL OUTLET		PRELIMINARY COST ESTIMATE (*)					
No.	Description	Units	Quant.	Unit Price (N) Peso	Cost (N) Peso	Unit Price (U.S. $)	Cost (U.S. $)
	NEW INTAKE STRUCTURE						
1	Cofferdam (cells)	sq.m.	2,500	1,500	3,750,000	500	1,250,000
2	Excavation (Rock)	cu.m.	3,000	63	188,700	21	62,900
3	Concrete	cu.m.	3,500	760	2,660,000	253	886,667
4	Gates (4.5m x 4.5m)	ea.	2	1,500,000	3,000,000	500,000	1,000,000
5	Trashracks (8m x 12m)	ea.	1	1,500,000	1,500,000	500,000	500,000
	POWER TUNNEL(D=4m,L=100m.)						
6	Excavation (Rock)	cu.m.	2,000	74	148,000	25	49,333
7	Tunnel Concrete + Plug	cu.m.	1,200	760	912,000	253	304,000
8	Shotcrete	cu.m.	160	380	60,800	127	20,267
9	Rockbolts	m.	540	88	47,466	29	15,822
	L.L.OUTLET TUNNEL(D=4m,L=215m						
10	Excavation (Rock)	cu.m.	4,300	74	318,200	25	106,067
11	Concrete	cu.m.	1,520	760	1,155,200	253	385,067
12	Shotcrete	cu.m.	300	380	114,000	127	38,000
13	Rockbolts	m.	1,100	88	96,690	29	32,230
	L.L. OUTLET STRUCTURE						
14	Excavation (Rock)	cu.m.	2,000	63	125,800	21	41,933
15	Concrete	cu.m.	1,000	760	760,000	253	253,333
16	Hollow Jet Valve (D=1.7m.)	ea.	1	1,500,000	1,500,000	500,000	500,000
17	Electrical, Controls, etc	ea.	1	2,250,000	2,250,000	750,000	750,000
18	Yard, Misc. Strucrures	ea.	1	3,000,000	3,000,000	1,000,000	1,000,000
19	Mobilization, Unwatering, etc	ea.	1	3,000,000	3,000,000	1,000,000	1,000,000
	Subtotal:				24,586,856		8,195,619
	Contigency @ 30%				7,376,057		2,458,686
	TOTAL:				31,962,913		10,654,304

(*) Based partially on Unit Cost Prices for Civil Works Provided by CFE, Dec. 1992 ($US = 3 New Peso)

表 7.2　概略工事費　沈砂池の新設（代替案G）

SETTLING BASIN (30m x 110m)		PRELIMINARY COST ESTIMATE (*)					
No.	Description	Units	Quant.	Unit Price (N) Peso	Cost (N) Peso	Unit Price (U.S. $)	Cost (U.S. $)
	SETTLING BASIN						
1	Cofferdam (cells)	sq.m.	9,000	1,500	13,500,000	500	4,500,000
2	Excavation (Rock)	cu.m.	51,000	63	3,207,900	21	1,069,300
3	Concrete	cu.m.	11,000	760	8,360,000	253	2,786,667
4	Gates (4.5m x 4.5m)	ea.	3	1,500,000	4,500,000	500,000	1,500,000
	SLUICE SHAFT(D=4m,L=70m.)						
5	Excavation (Rock)	cu.m.	1,380	280	386,400	93	128,800
6	Concrete	cu.m.	500	760	380,000	253	126,667
7	Shotcrete	cu.m.	100	380	38,000	127	12,667
8	Rockbolts	m.	950	88	83,505	29	27,835
	SLUICE TUNNEL(D=4m,L=278m.)						
9	Excavation (Rock)	cu.m.	5,500	74	407,000	25	135,667
10	Concrete	cu.m.	2,000	760	1,520,000	253	506,667
11	Shotcrete	cu.m.	400	380	152,000	127	50,667
12	Rockbolts	m.	1,500	88	131,850	29	43,950
	POWER TUNNEL(D=4m,L=185m.)						
13	Excavation (Rock)	cu.m.	3,700	74	273,800	25	91,267
14	Tunnel Concrete + Plug	cu.m.	1,600	760	1,216,000	253	405,333
15	Shotcrete	cu.m.	300	380	114,000	127	38,000
16	Rockbolts	m.	1,000	88	87,900	29	29,300
	D/S RIVER OUTLET						
17	Excavation (Rock)	cu.m.	15,000	63	943,500	21	314,500
18	Concrete	cu.m.	1,500	760	1,140,000	253	380,000
19	Hollow Jet Valve (D=1.7m.)	ea.	1	1,500,000	1,500,000	500,000	500,000
20	Electrical, Controls, etc	ea.	1	3,750,000	3,750,000	1,250,000	1,250,000
21	Yard, Misc. Strucrures	ea.	1	3,000,000	3,000,000	1,000,000	1,000,000
22	Mobilization, Unwatering, etc	ea.	1	4,500,000	4,500,000	1,500,000	1,500,000
	Subtotal:				49,191,855		16,397,285
	Contigency @ 30%				14,757,557		4,919,186
	TOTAL:				63,949,412		21,316,471

(*) Based partially on Unit Cost Prices for Civil Works Provided by CFE, Dec. 1992 ($US = 3 New Peso)

表 7.3　概略工事費　砂防ダム／サイトB（代替案I）

CHECK DAM SITE B - ALTERNATIVE I (DAM CREST ELEVATION 1425) (H=40+15=55m, W=278m, V=194,000cu.m.)		PRELIMINARY COST ESTIMATE (*)					
No.	Description	Units	Quant.	Unit Price (N) Peso	Cost (N) Peso	Unit Price (U.S. $)	Cost (U.S. $)
	CHECK DAM SITE B						
1	Cofferdam (cells)	sq.m.	1,500	1,500	2,250,000	500	750,000
2	Excavation (Rock)	cu.m.	6,000	63	377,400	21	125,800
3	Excavation (Common)	cu.m.	120,000	25	3,000,000	8	1,000,000
4	Concrete - RCC	cu.m.	194,000	69	13,386,000	23	4,462,000
5	Concrete Regular	cu.m.	1,500	760	1,140,000	253	380,000
6	Foundation Treatment	ea.	1	2,250,000	2,250,000	750,000	750,000
7	Yard, Misc. Strucrures	ea.	1	750,000	750,000	250,000	250,000
8	Mobilization, Unwatering, etc	ea.	1	2,250,000	2,250,000	750,000	750,000
	Subtotal:				25,403,400		8,467,800
	Contigency @ 30%				7,621,020		2,540,340
	TOTAL:				33,024,420		11,008,140

(*) Based partially on Unit Cost Prices for Civil Works Provided by CFE, Dec. 1992 ($US = 3 New Peso)

表 7.4　概略工事費　転流排砂トンネル（代替案J）

SAND CONVEYANCE TUNNEL WITH DIVERSION DAM - ALTERNATIVE J (Assume Diversion Dam equals 1/3 the Size/Quantities of Check Dam -Site B)		PRELIMINARY COST ESTIMATE (*)					
No.	Description	Units	Quant.	Unit Price (N) Peso	Cost (N) Peso	Unit Price (U.S. $)	Cost (U.S. $)
	DIVERSION DAM - ALTERNATIVE J						
1	Cofferdam (cells)	sq.m.	500	1,500	750,000	500	250,000
2	Excavation (Rock)	cu.m.	2,000	63	125,800	21	41,933
3	Excavation (Common)	cu.m.	40,000	25	1,000,000	8	333,333
4	Concrete - RCC	cu.m.	65,000	69	4,485,000	23	1,495,000
5	Concrete Regular	cu.m.	500	760	380,000	253	126,667
6	Foundation Treatment	ea.	1	750,000	750,000	250,000	250,000
	SAND CONV.TUNNEL (D=4m,L=4Km)						
7	Excavation (Rock)	cu.m.	72,000	63	4,528,800	21	1,509,600
8	Concrete (T=.3m)	cu.m.	16,000	760	12,160,000	253	4,053,333
9	Shotcrete	cu.m.	6,000	380	2,280,000	127	760,000
10	Rockbolts	m.	22,000	88	1,931,600	29	643,867
11	Yard, Intake, Misc. Strucrure	ea.	1	4,500,000	4,500,000	1,500,000	1,500,000
12	Gates, Mechanical, Electrical	ea.	1	3,000,000	3,000,000	1,000,000	1,000,000
13	Mobilization, Unwatering, etc	ea.	1	4,500,000	4,500,000	1,500,000	1,500,000
	Subtotal:				40,391,200		13,463,733
	Contigency @ 30%				12,117,360		4,039,120
	TOTAL:				52,508,560		17,502,853

(*) Based partially on Unit Cost Prices for Civil Works Provided by CFE, Dec. 1992 ($US = 3 New Peso)

表 7.5　　新取水口および新設トンネルの諸元

INTAKE STRUCTURE

Type	Vertical Reinforced Concrete
Invert Elev. - m	785
Top Elev. - m	806.5
Hydraulic Design Capacity - cms	55.2
Intake Gate	
Type	Fixed-Wheel Gate
Number	1
Size - m	4.0 x 4.0
Trashrack Size - m	7.0(w) x 8.5(h)
Velocity Thru Gross Area - mps	1.0
Bulkhead Size - m	4.0(w) x 6.0(h)
Gate Control House	
Dimensions - m	7.0(l) x 6.0(w) x 5.0(h)

TUNNEL

Type	Pressure, Circular Concrete-lined
Diameter (I.D.) - m	4.0
Length[1] - m	114.0

OPERATING REQUIREMENTS

Minimum water submergence above tunnel crown - m	5.0
Minimum Reservoir Water Surface El. for Power Operation - m	794.0

[1] To the existing power tunnel connection

表 7.6　　既存発電取水口を放流施設に転換する計画

INTAKE STRUCTURE	
Type	Use Existing Structure/Rehab Existing Gate and Replace Trashrack
TUNNEL	
Type	Pressure, Circular Concrete-Lined
Diameter (I.D.) - m	4.0
Length[1] - m	290
Steel Lining	
Thickness - mm	13
Length - m	48
OUTLET STRUCTURE	
Type	Hydraulic-Controlled Fixed-Cone Valve
Fixed-Cone Valve	
Number	1
Size - m	2.4
Hydraulic Capacity - cms	15 to 70
Design Head - m	57
Guard Valve	
Type	Butterfly Valve
Size - m	3.5

[1] From the connection with the existing tunnel.

表 7.7　アブルコ川砂防ダム関連データ

RESERVOIR	
Normal Max. Water Surface Elev. - m	1489
Available Storage Capacity - mcm	17.6
Surface Area - hectares	68.0
Design Life - years	15
DAM	
Type	Roller-Compacted Concrete
Crest Elev. - m	1494
Crest Length - m	294
Upstream Slope	Vertical
Downstream Slope	0.8H : 1V
Maximum Height above Riverbed - m	34
RCC Dam Volume - cm	138,000
SPILLWAY	
Type	Free Overflow in Central Portion of Dam with Stilling Basin
Crest Elev. - m	1489
Crest Length - m	100
Design Flood (1,000 - yr) - cms	1,306
Maximum Flood Level of Design Flood	1492.3
Stilling Basin	
Floor Elev. - m	1455
Length - m	35
Guide Wall Elev. - m	1466
Design Tailwater Elev. - m	1463
DIVERSION OF RIVER DURING CONSTRUCTION	
Method	Two Stages using Fill Cofferdams and Low Level Outlet thru Base of Partially Constructed Dam
Design Flood (5 - yr) - cms	343
First Stage	Diversion thru Left Bank of River Section
Cofferdam	
Crest Elev. - m	1464
Length - m	340
Second Stage	Diversion thru Low Level Outlet
Cofferdam	
Crest Elev. - m	1467
Length - m	90
Intake Structure for River Diversion/Reservoir Bottom Outlet	
Invert Elev. - m	1459.5
Outlet Elv. - m	1459.0
Size - m	5.5 x 5.5
Length - m	29.5
Gate Type	Fixed Wheel
Gate Size - m	5.5 x 5.5
River Diversion Intake	
Invert Elv. - m	1459.5
Closure	Concrete stoplogs
High Level Intake	
Invert Elv. - m	1487.0
Opening Size (s sides) - m	5.5 (w) x 4.0 (h)

表 8.1　新取水口および放流施設の建設費(1/2)

Item No.	Description	Unit	Quantity	Unit Price ($N)	Cost ($N)	Cost Summary ($N)
A	NEW POWER INTAKE					
	Unwatering During Construction					
	Circular Cell Cofferdam					
	Steel Sheet Piles	SQM	2,500	1,500.00	3,750,000	
	Fill For Cells	CM	16,000	16.00	256,000	
	Unwatering	LS	1	600,000.00	600,000	
	Intake Structure					
	Excavation (Rock)	CM	5,900	63.00	371,700	
	Concrete					
	Structure	CM	2,230	760.00	1,694,800	
	Gate House	CM	50	760.00	38,000	
	Retaining Walls	CM	780	760.00	592,800	
	Access Road Surface	CM	70	380.00	26,600	
	Fill	CM	16,300	28.00	456,400	
	Intake Gate (4m x 4m)	EA	1	900,000.00	900,000	
	Bulkhead (4mx6m)	EA	1	400,000.00	400,000	
	Trashrack (7m x 8.5m)	EA	1	750,000.00	750,000	
	Electrical, Controls, Misc.	LS	1	1,350,000.00	1,350,000	
						11,186,300
B	NEW POWER TUNNEL SEGMENT (I.D. = 4.0m, L = 114m)					
	Excavation (Rock)	CM	2,240	74.00	165,760	
	Rockbolts	M	910	88.00	80,080	
	Shotcrete	CM	180	380.00	68,400	
	Concrete Lining	CM	810	760.00	615,600	
	Concrete Plug for Existing Tu	CM	450	760.00	342,000	
						1,271,840
C	INTAKE FOR LOW LEVEL OUTLET (Rehab of Existing Intake)					
	Rehab Existing Gate	LS	1	600,000.00	600,000	
	Replace Trashrack	LS	1	750,000.00	750,000	
						1,350,000

表 8.1　新取水口および放流施設の建設費(2/2)

Item No.	Description	Unit	Quantity	Unit Price ($N)	Cost ($N)	Cost Summary ($N)
D	LOW LEVEL OUTLET TUNNEL (I.D. = 4.0m, L = 290m)					
	Excavation (Rock)	CM	5,700	74.00	421,800	
	Rockbolts	M	2,300	88.00	202,400	
	Shotcrete	CM	450	380.00	171,000	
	Concrete Lining	CM	2,050	760.00	1,558,000	
	Steel Lining (t=13mm, L=48m)	KG	60,100	7.64	459,164	
						2,812,364
E	L.L.O. OUTLET STRUCTURE					
	Excavation (Rock)	CM	5,100	63.00	321,300	
	Concrete	CM	340	760.00	258,400	
	Hollow Jet Valve (D=2.1m)	EA	1	1,650,000.00	1,650,000	
	Butterfly Valve (D=2.7m)	EA	1	1,560,000.00	1,560,000	
	Electrical, Controls, Misc. Eq	LS	1	900,000.00	900,000	
						4,689,700
F	D/S CHANNEL IMPROVEMENTS FROM NEW OUTLET TO SPILLWAY					
	Clear & Grub Existing Riverbed	SQM	10,000	1.50	15,000	
	Removal of Loose Rock near Spillway Impact Area	CM	4800	28.00	134,400	
						149,400
G	MOBILIZATION & CONSTRUCTION ACCESS (Incl. Acces Shaft)	LS	1	3,000,000.00	3,000,000	
						3,000,000
	Subtotal Direct Costs					24,459,604
	Contingencies (25%)					6,114,901
	TOTAL CONSTRUCTION COST					30,574,505 ($N)
						10,191,502 ($US)
	Engineering & Administration (15%)					4,586,176 ($N)
	TOTAL COSTS					35,160,681 ($N)
						11,720,227 ($US)

表 8.2　新設砂防ダムの建設費

Item No.	Description	Unit	Quantity	Unit Price ($N)	Cost ($N)	Cost Summary ($N)
A	RIVER DIVERSION DURING CONSTRUCTION (2Stages)					
	Fill Cofferdams					
	First Stage	CM	33,000	16	528,000	
	Second Stage	CM	10,000	16	160,000	
	Diversion Outlet (Thru First Stage Dam Construction)					
	Concrete	CM	2,800	760	2,128,000	
	Channel Excavation	CM	6,000	25	150,000	
	Bulkhead gate	LS	1	1,050,000	1,050,000	
	Stoplog (Diversion)	LS	1	750,000	750,000	
	Stoplog (Tower)	LS	1	900,000	900,000	
						5,666,000
B	DAM					
	Excavation (Rock)	CM	27,200	63	1,713,600	
	Excavation (Common)	CM	126,886	25	3,172,150	
	Roller-Compacted Concrete	CM	138,325	105	14,524,125	
	Concrete - Walls	CM	1,850	760	1,406,000	
	Concrete - Basin Slab	CM	8,100	380	3,078,000	
	Foundation Treatment	LS	1	2,250,000	2,250,000	
						26,143,875
C	MOBILIZATION, CONSTRUCTION ACCESS, ROAD RELOCATION, ETC.	LS	1	2,250,000	2,250,000	
						2,250,000
	Sub Total Direct Costs					34,059,875
	Contigencies (20%)...(*)					6,811,975
	TOTAL CONSTRUCTION COST					40,871,850($N)
						13,623,950($US)
	Engineering & Administration (15%)					6,130,778($N)
	TOTAL COSTS					47,002,628($N)

Note: (*) Use 20% contigency since two preliminary estimates were obtained from specialized US contractors.

15,667,543($US)

表 9.1　発電所の建設費および運転・燃料費

(Price at mid 1991)

Power Plant	Capacity (MW)	Unit Construction Cost								Energy Generation Cost							
		Direct Cost		Direct and Indirect Cost		Capitalized as of Operation Start 12%		Capitalized as of Operation Start 14%		Investment		Fuel		O & M		Total	
		(x mil Peso/kW)	Index	(x mil Peso/kW)	Index	(x mil Peso/kW)	Index	(x mil Peso/kW)	Index	(Peso/kWh)	Index	(Peso/kWh)	Index	(Peso/kWh)	Index	(Peso/kWh)	Index
Conventional thermal	2 x 350	1.663	100	1.812	100	2.561	100	2.708	100	53.21	100	109.01	100	2.69	100	164.91	100
	2 x 160	2.025	122	2.207	122	3.086	120	3.258	120	64.12	121	118.89	109	4.48	167	187.49	114
	2 x 84	2.380	143	2.594	143	3.596	140	3.791	140	74.71	140	126.37	116	6.80	253	207.88	162
	2 x 37.5	2.915	175	3.177	175	4.249	166	4.451	164	88.28	166	137.12	126	11.61	432	237.01	144
Gas turbine	1 x 30	0.942	57	0.989	55	1.217	48	1.258	46	147.05	276	132.53	122	20.41	759	299.99	182
Gas turbine/diesel	1 x 30	0.969	58	1.018	56	1.253	49	1.295	48	151.36	284	247.99	227	20.41	759	419.76	255
Combined cycle (gas)	1 x 250	1.825	110	2.025	112	2.804	109	2.956	109	68.31	128	93.78	86	14.85	552	176.94	107
Combined cycle (diesel)	1 x 250	1.859	112	2.063	114	2.857	112	3.012	111	69.59	131	165.41	152	14.85	552	249.85	152
Diesel	2 x 32.5	4.268	257	4.482	247	5.516	215	5.702	211	122.15	230	86.97	80	11.72	436	220.66	134
Coal-fired thermal (*)	2 x 350	2.406	145	2.673	148	4.017	157	4.291	158	84.62	159	60.48	55	5.30	197	150.40	91
- do - without desulfurator	2 x 350	2.526	152	2.807	155	4.218	165	4.506	166	88.86	167	47.72	44	4.83	180	141.41	86
- do - with desulfurator	2 x 350	3.003	181	3.337	184	4.840	189	5.144	190	107.06	201	50.11	46	17.52	651	174.69	106
Medium nuclear plant (USA)	2 x 1000	6.513	392	7.157	395	15.028	587	17.035	629	306.33	576	17.50	16	23.66	880	347.49	211
Improved nuclear plant (USA)	2 x 1000	4.043	243	4.443	245	7.185	281	7.776	287	146.45	275	17.50	16	23.66	880	187.61	114
Medium nuclear plant (France)	2 x 1000	3.310	199	3.637	201	5.881	230	6.365	235	119.88	225	17.50	16	15.30	569	152.68	93
Geothermal																	
Cerro Prieto	1 x 20	2.095	126	2.520	139	2.992	117	3.074	114	53.43	100	65.51	60	14.34	533	133.28	81
Los Azufres	1 x 20	2.095	126	2.520	139	2.992	117	3.074	114	53.43	100	73.32	67	14.34	533	141.09	86
Hydropower																	
Aguamilpa	3 x 320	1.863	112	2.068	114	3.186	124	3.416	126	155.35	292	4.46	4	1.29	48	161.10	98
Agua Prieta	2 x 120	1.911	115	2.121	117	3.083	120	3.273	121	181.97	342	12.74	12	4.44	165	199.15	121
La Amistad	2 x 33	1.859	112	2.063	114	2.832	111	2.978	110	122.12	230	8.92	8	11.46	426	142.50	86
Bacurato	2 x 46	2.652	159	2.944	162	4.041	158	4.249	157	150.58	283	8.92	8	7.48	278	166.98	101
Caracol	3 x 198	3.108	187	3.450	190	5.804	227	6.325	234	248.57	467	4.46	4	2.00	74	255.03	155
Comedero	2 x 55	2.022	122	2.245	124	3.081	120	3.240	120	121.82	229	8.92	8	6.40	238	137.14	83
Chicoasén	5 x 300	3.109	187	3.451	190	5.329	208	5.723	211	154.66	291	4.46	4	0.88	33	160.00	97
Penitas	4 x 105	3.929	236	4.361	241	6.976	272	7.533	278	165.47	311	4.46	4	2.48	92	172.41	105
Zirr Apán	2 x 140	4.137	249	4.592	253	6.913	270	7.387	273	161.81	304	6.37	6	1.83	68	170.01	103

Source: CFE　　Note : (*) coal-fired plant used for economic evaluation.

表 9.2　経済分析キャッシュフロー
（石炭火力発電所の燃料費節約を考慮した場合）

(Unit : million US$)

	Year	Cost			Benefit				Net Benefit
		Capital Cost	O&M Cost	Total Cost	Capital Cost	O&M Cost	Fuel Cost	Total Cost	(B-C)
1	1995	9.42		9.42					-9.42
2	1996	9.42		9.42					-9.42
3	1997	9.42	2.40	11.82					-11.82
4	1998		2.55	2.55					-2.55
5	1999		2.55	2.55					-2.55
6	2000		2.55	2.55		1.13	12.98	14.11	11.56
7	2001		2.55	2.55		1.13	12.98	14.11	11.56
8	2002		2.55	2.55		1.13	12.98	14.11	11.56
9	2003		2.55	2.55		1.13	12.98	14.11	11.56
10	2004		2.55	2.55		1.13	12.98	14.11	11.56
11	2005		2.55	2.55		1.13	12.98	14.11	11.56
12	2006		2.55	2.55		1.13	12.98	14.11	11.56
13	2007		2.55	2.55		1.13	12.98	14.11	11.56
14	2008		2.55	2.55		1.13	12.98	14.11	11.56
15	2009		2.55	2.55		1.13	12.98	14.11	11.56
16	2010		2.55	2.55		1.13	12.98	14.11	11.56
17	2011		2.55	2.55		1.13	12.98	14.11	11.56
18	2012		2.55	2.55		1.13	12.98	14.11	11.56

EIRR = 18.27%

Notes : (1) Total construction cost is US$ 28.25 x 10^6.
(2) During the construction, power stop is inevitable due to plug concrete in the power tunnel. Loss of energy is valued at US$ 2.40 x 10^6.
(3) O&M cost for hydropower is assumed at 2% of capital cost plus existing cost of US$ 2.0 x 10^6.
(4) O&M cost for coal-fired thermal plant is assumed at US$ 0.00176 / kWh x 1.15.
(5) Fuel cost is assumed at US$ 0.0202 / kWh x 1.15.
(6) Energy output is assumed at 90% of the past average output of 621GWh due to use of water for sluicing sediment load.

表 9.3　経済分析キャッシュフロー
（石炭火力発電所の設置、運転を考慮した場合）

(Unit : million US$)

	Year	Cost			Benefit				Net Benefit
		Capital Cost	O&M Cost	Total Cost	Capital Cost	O&M Cost	Fuel Cost	Total Cost	(B-C)
1	1995	9.42		9.42					-9.42
2	1996	9.42		9.42					-9.42
3	1997	9.42	2.40	11.82	74.33			74.33	62.51
4	1998		2.55	2.55	74.33			74.33	71.78
5	1999		2.55	2.55	74.33			74.33	71.78
6	2000		2.55	2.55		1.13	12.98	14.11	11.56
7	2001		2.55	2.55		1.13	12.98	14.11	11.56
8	2002		2.55	2.55		1.13	12.98	14.11	11.56
9	2003		2.55	2.55		1.13	12.98	14.11	11.56
10	2004		2.55	2.55		1.13	12.98	14.11	11.56
11	2005		2.55	2.55		1.13	12.98	14.11	11.56
12	2006		2.55	2.55		1.13	12.98	14.11	11.56
13	2007		2.55	2.55		1.13	12.98	14.11	11.56
14	2008		2.55	2.55		1.13	12.98	14.11	11.56
15	2009		2.55	2.55		1.13	12.98	14.11	11.56
16	2010		2.55	2.55		1.13	12.98	14.11	11.56
17	2011		2.55	2.55		1.13	12.98	14.11	11.56
18	2012		2.55	2.55		1.13	12.98	14.11	11.56

EIRR = 177.33%

Notes : (1) Peak capacity for 5 hours with 90% dependable flow :
220,000 x [7.57 x (24 / 5) / 55.2] = 144,800 kW
220,000 kW : installed capacity
7.57 m3/s : 90% dependable flow
55.2 m3/s : max. plant discharge
(2) Unit construction cost of coal-fired thermal plant is US$ 1,339 / kW in 1991.
(3) Capital cost of new thermal plant is:
144,800 kW x US$ 1,339 / kW x 1.15 = US$ 222,970

表 9.4　　財務的内部収益率のキャッシュフロー

(Unit : million US$)

	Year	Cost			Revenue	Balance
		Capital Cost	O&M Cost	Total Cost		
1	1995	10.25		10.25		-10.25
2	1996	10.25		10.25		-10.25
3	1997	10.25	2.40	12.65		-12.65
4	1998		3.05	3.05		-3.05
5	1999		3.05	3.05		-3.05
6	2000		3.05	3.05	12.58	9.53
7	2001		3.05	3.05	12.58	9.53
8	2002		3.05	3.05	12.58	9.53
9	2003		3.05	3.05	12.58	9.53
10	2004		3.05	3.05	12.58	9.53
11	2005		3.05	3.05	12.58	9.53
12	2006		3.05	3.05	12.58	9.53
13	2007		3.05	3.05	12.58	9.53
14	2008		3.05	3.05	12.58	9.53
15	2009		3.05	3.05	12.58	9.53
16	2010		3.05	3.05	12.58	9.53
17	2011		3.05	3.05	12.58	9.53
18	2012		3.05	3.05	12.58	9.53

IRR = 14.05%

Notes : (1) Assuming that the existing dredger be repaired at US$ 2.5 million.
(2) Revenue is assumed as follows.

Total energy generated	:	621 x 10^6 kWh
Loss by flushing	:	10 %
Loss by station use and by transmission	:	10 %
Revenue attributable to generating side	:	50 %

621 x 10^6 kWh x 0.9 x 0.9 x US$ 0.05/kWh x 0.5 = 12.575 x 10^6 kWh

表 9.5　　ローン返済のキャッシュフロー

(Unit : million US$)

	Year	Cost				Revenue	Balance	Accumulation balance
		Capital Cost	O&M Cost	Interest	Repayment of principal			
1	1995	10.25		0.256			-0.256	-0.256
2	1996	10.25		0.769			-0.769	-1.025
3	1997	10.25	2.40	1.281			-3.681	-4.706
4	1998		3.05	1.538			-4.588	-9.294
5	1999		3.05	1.538			-4.588	-13.881
6	2000		3.05	1.384	3.075	12.58	5.071	-8.810
7	2001		3.05	1.230	3.075	12.58	5.225	-3.585
8	2002		3.05	1.076	3.075	12.58	5.379	1.794
9	2003		3.05	0.923	3.075	12.58	5.533	7.326
10	2004		3.05	0.769	3.075	12.58	5.686	13.013
11	2005		3.05	0.615	3.075	12.58	5.840	18.853
12	2006		3.05	0.461	3.075	12.58	5.994	24.846
13	2007		3.05	0.308	3.075	12.58	6.148	30.994
14	2008		3.05	0.154	3.075	12.58	6.301	37.295
15	2009		3.05	0	3.075	12.58	6.455	43.750
16	2010		3.05			12.58	9.530	53.280
17	2011		3.05			12.58	9.530	62.810
18	2012		3.05			12.58	9.530	72.340
Total		30.75	48.15	12.300	30.750	163.54	72.340	

Notes : (1) Loan with an interest rate of 5% for a repayment period of 15 years including 5 year grace period.
(2) Principal is repaid uniformly over 10 years.

表 10.1　　ソレダッド貯水池及び発電所放水路における濁度

(A) Soledad Reservoir　　Measured on Oct. 6 '92

Water depth (m)	Measurring Points R1 (ppm)	R2 (ppm)	R3 (ppm)	R4 (ppm)	R5 (ppm)	R12 (ppm)
0	-	-	-	-	-	-
2	48.4	33.8	53.2	43.2	77.5	39.2
4	62.2	31.4	53.2	49.1	94.4	31.5
6	62.2	42.7	53.2	57.6	95.2	25.3
8	58.2	53.4	54.1	49.7	96.3	25.3
10	54.9	52.6	48.1	53.0	76.7	32.2
12	54.9	50.3	48.4	45.9	95.7	37.2
14	54.9	50.2	48.4	45.9	90.4	49.8
16		48.4				50.6
18						51.8
20						
Water temperature (°C)	16.9~17.6	17.0~18.1	17.0~17.6	16.9~17.7	16.9~17.9	16.5~18.2

(B) Tailrace　　Measured on Oct. 6 '92

Water depth (m)	Measurring Points P1 (ppm)	P2 (ppm)	P3 (ppm)	P4 (ppm)
0 ~ 2	57.8~63.9	8.0	-	13.6~15.1
Water temperature (°C)	17.1~17.6	20.2~20.3	-	21.8

Notes:　Power plant on Oct. 6, '92 was fully operated.

表 10.2　　濁度測定結果

(A) Soledad Reservoir
Date : September 23, 1993
Reservoir Water Level : EL. 803.57 m (13.00) to EL. 803.54 m (14.00)

Depth (m)	(1) Near Power Intake Temperature (°C)	(1) Near Power Intake Turbidity (ppm)	(2) Center of Dam Temperature (°C)	(2) Center of Dam Turbidity (ppm)	(3) Right Side of Dam Temperature (°C)	(3) Right Side of Dam Turbidity (ppm)
0 - 2	20.5	65.9	20.5	66.2	20.5	66.3
2 - 4	20.2	65.3	20.2	66.3	20.2	66.2
4 - 6	20.0	67.4	19.9	68.4	19.8	67.1
6 - 8	19.8	71.8	19.9	72.4	19.8	71.8
8 - 10	19.8	71.6	19.8	69.9	19.7	72.5
10 - 12	19.8	74.5	19.8	72.4	19.7	73.2
12 - 14			19.8	73.3		
14 - 16			19.8	73.6		
16 - 18			19.7	73.4		
18 - 20			19.7	73.9		

Notes : Values are the average for 10 seconds.

(B) Mazatepec Powerstation
Date : September 23, 1993, 11:00 to 11:30

Depth (m)	(1) Just upstream of tailrace Temperature (°C)	(1) Just upstream of tailrace Turbidity (ppm)	(2) Just downstream of tailrace Temperature (°C)	(2) Just downstream of tailrace Turbidity (ppm)
0 - 2	21.3	20 ~ 24	20.0	76.4 ~ 81.1

Notes : Values are the average for 10 seconds.
Power plant was operated fully on Sept. 23 and the power discharge was approximately 55 m3/s.

(C) Downstream Section of Apulco/Tecolutla River
Date : September 24, 1993, 11:00 to 14:00

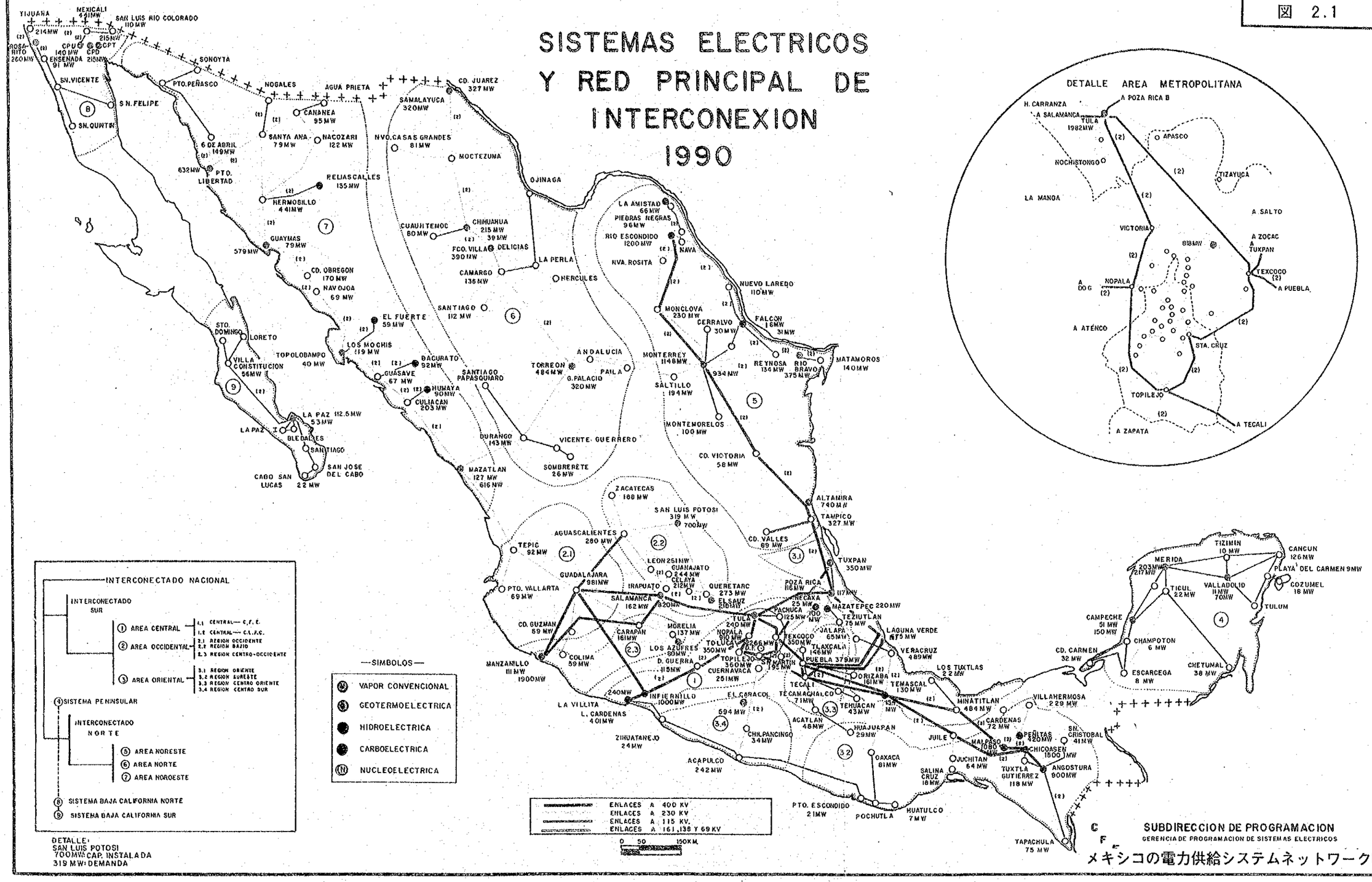
Depth (m)	(1) Necaxa River near junction Temperature (°C)	(1) Necaxa River near junction Turbidity (ppm)	(2) El. Espinal Temperature (°C)	(2) El. Espinal Turbidity (ppm)	(3) El. Remolino Temperature (°C)	(3) El. Remolino Turbidity (ppm)	(4) Bridge at Gutierrez Zamora Temperature (°C)	(4) Bridge at Gutierrez Zamora Turbidity (ppm)
0 - 2	24.7	165 ~ 174	24.8	221 ~ 233	24.4	283 ~ 305	24.2	335 ~ 356

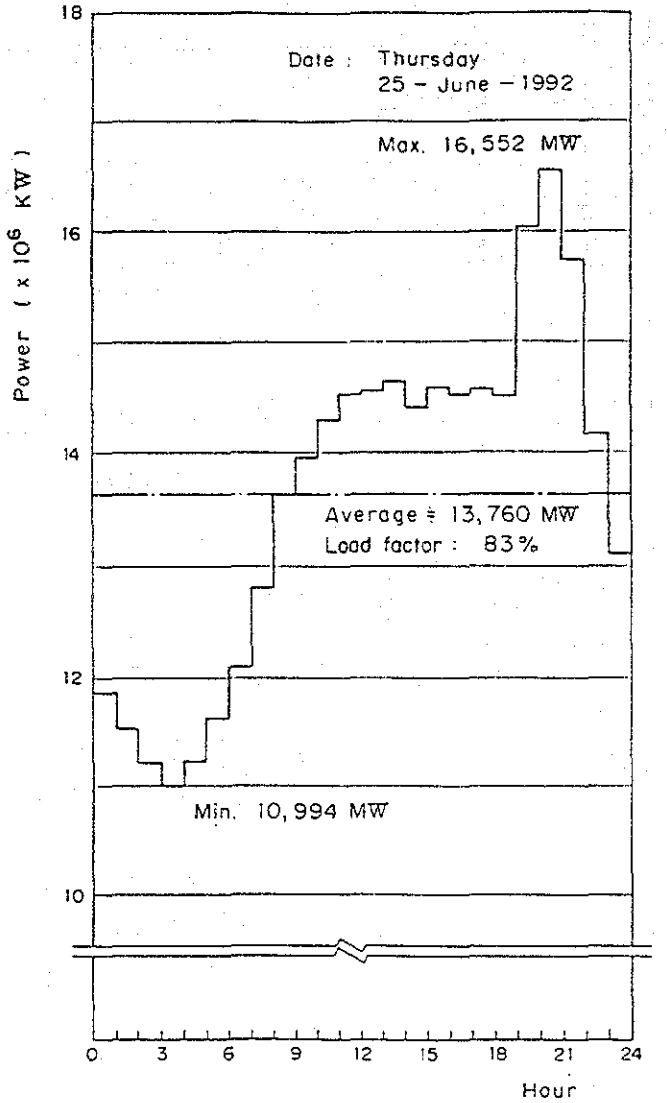
Note : Locations (1) approx. 40 km from Mazatepec and 75 km from the estuary
(2) approx. 68 km from the estuary
(3) approx. 40 km from the estuary
(4) approx. 13 km from the estuary

付　図

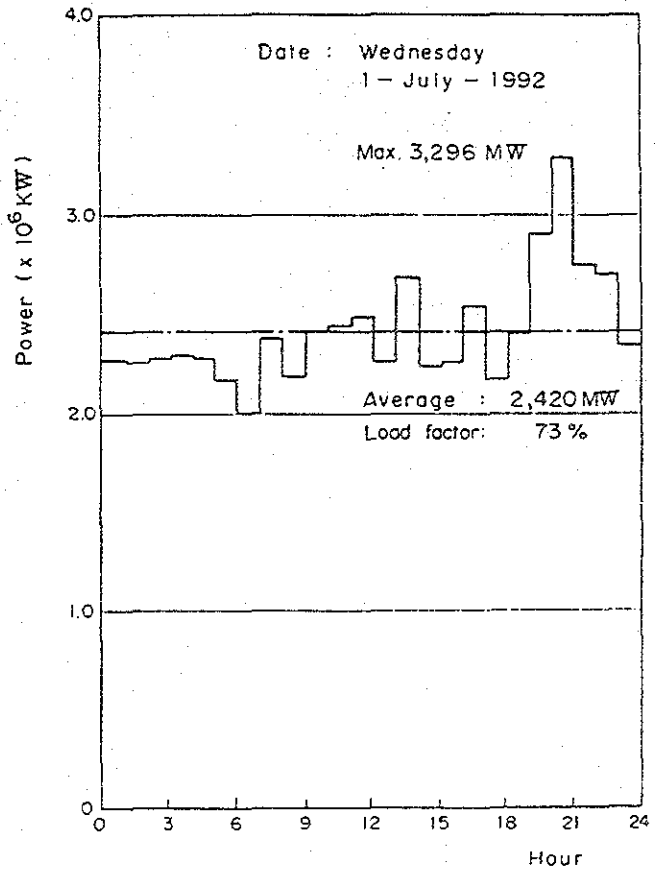
図 2.1

SISTEMAS ELECTRICOS Y RED PRINCIPAL DE INTERCONEXION 1990





DAILY LOAD CURVE OF NATIONAL INTERCONNECTED SYSTEM (Excl. BAJA CALIFORNIA)

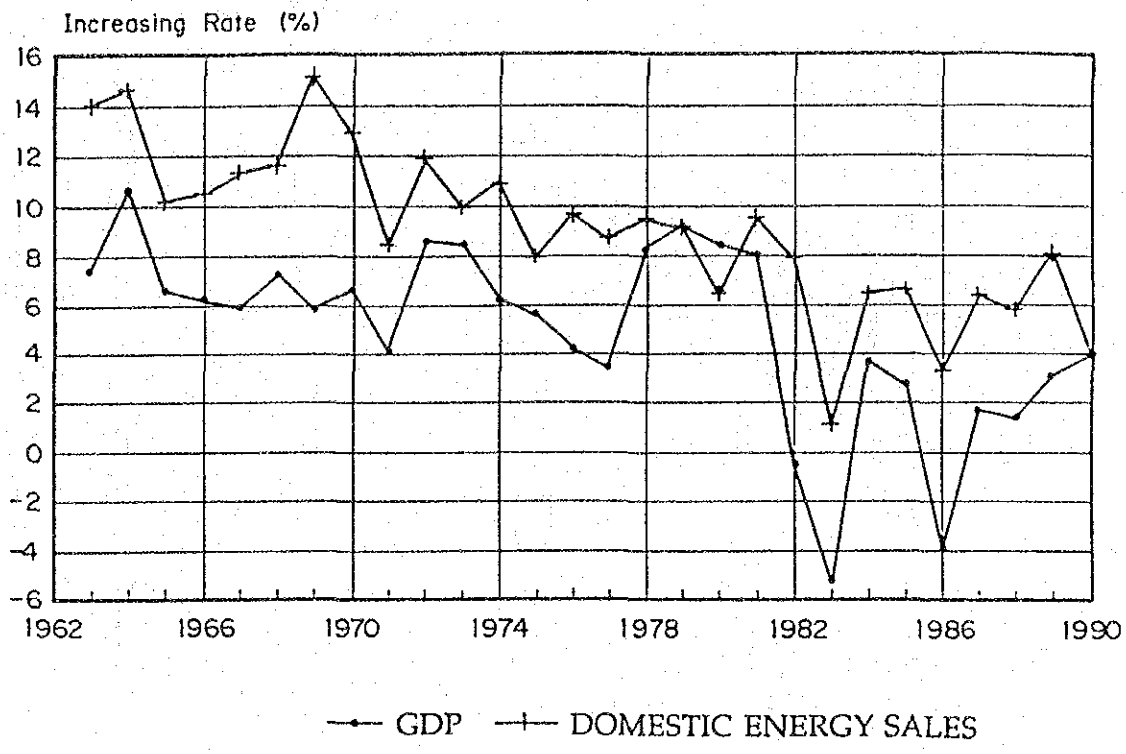


DAILY LOAD CURVE OF ORIENTAL AREA

国内幹線システムと東部地区の日負荷曲線

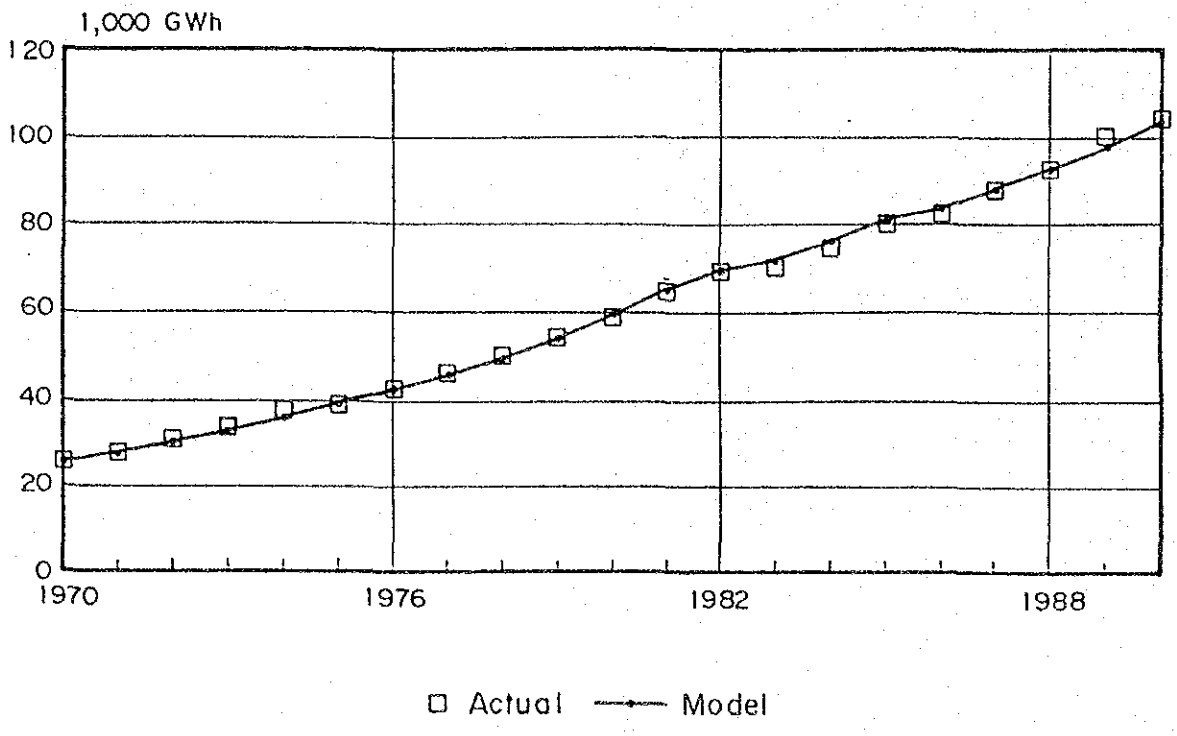
図 2.2

図 2.3



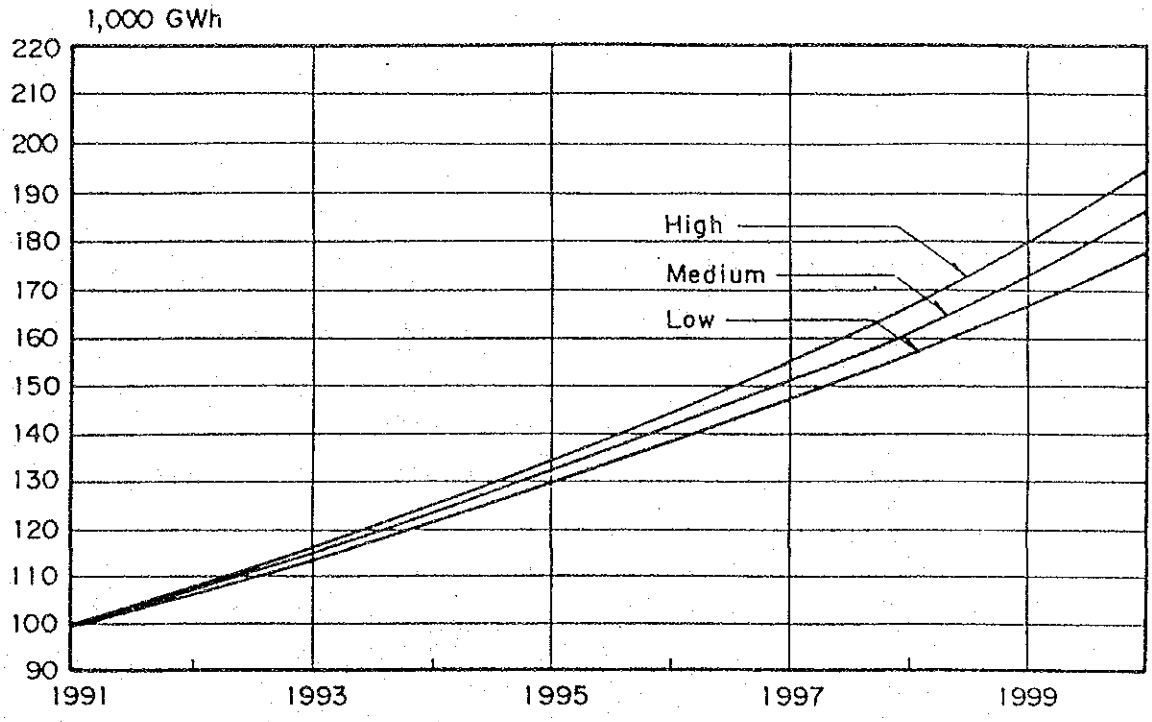
国内売電力量と国内総生産の増加率の推移

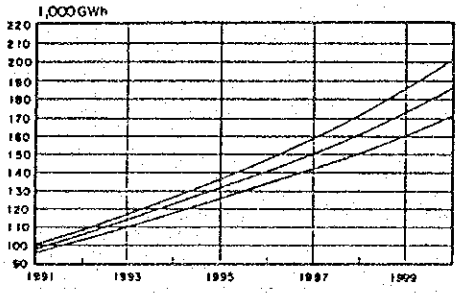
図 2.4



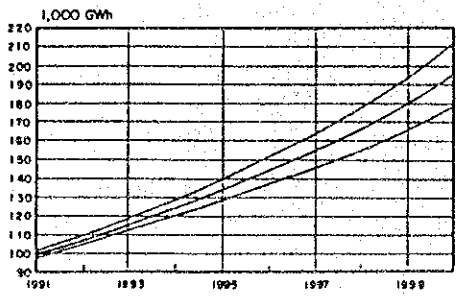
計量経済モデルの電力需要実績による検証

図 2.5

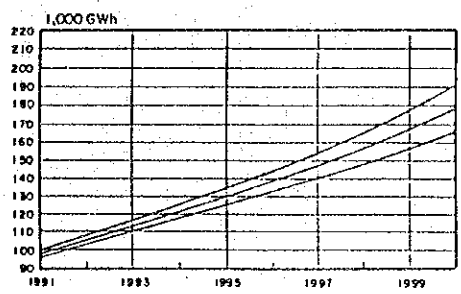




MEDIUM SCENARIO WITH 80% RELIABILITY



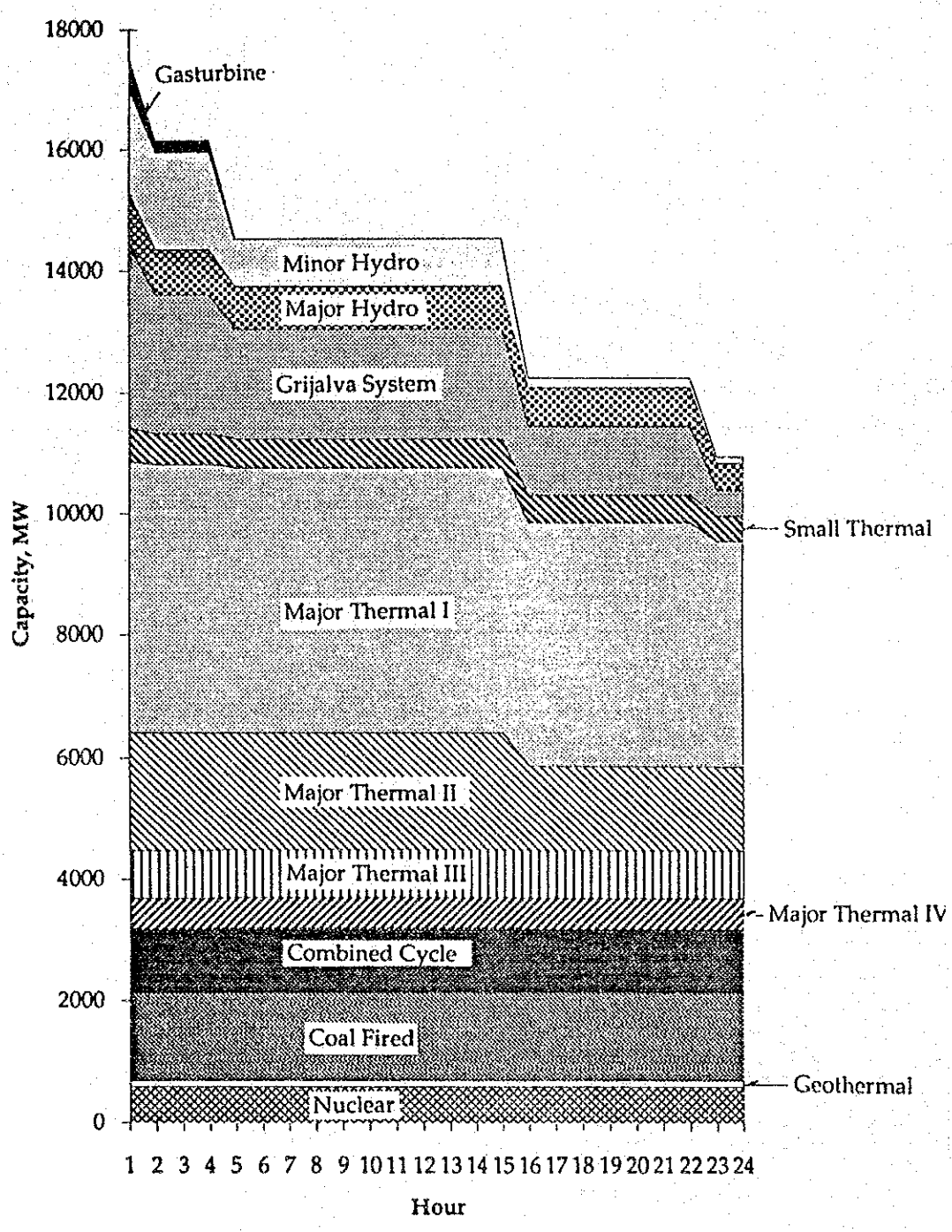
HIGH SCENARIO WITH 80% RELIABILITY



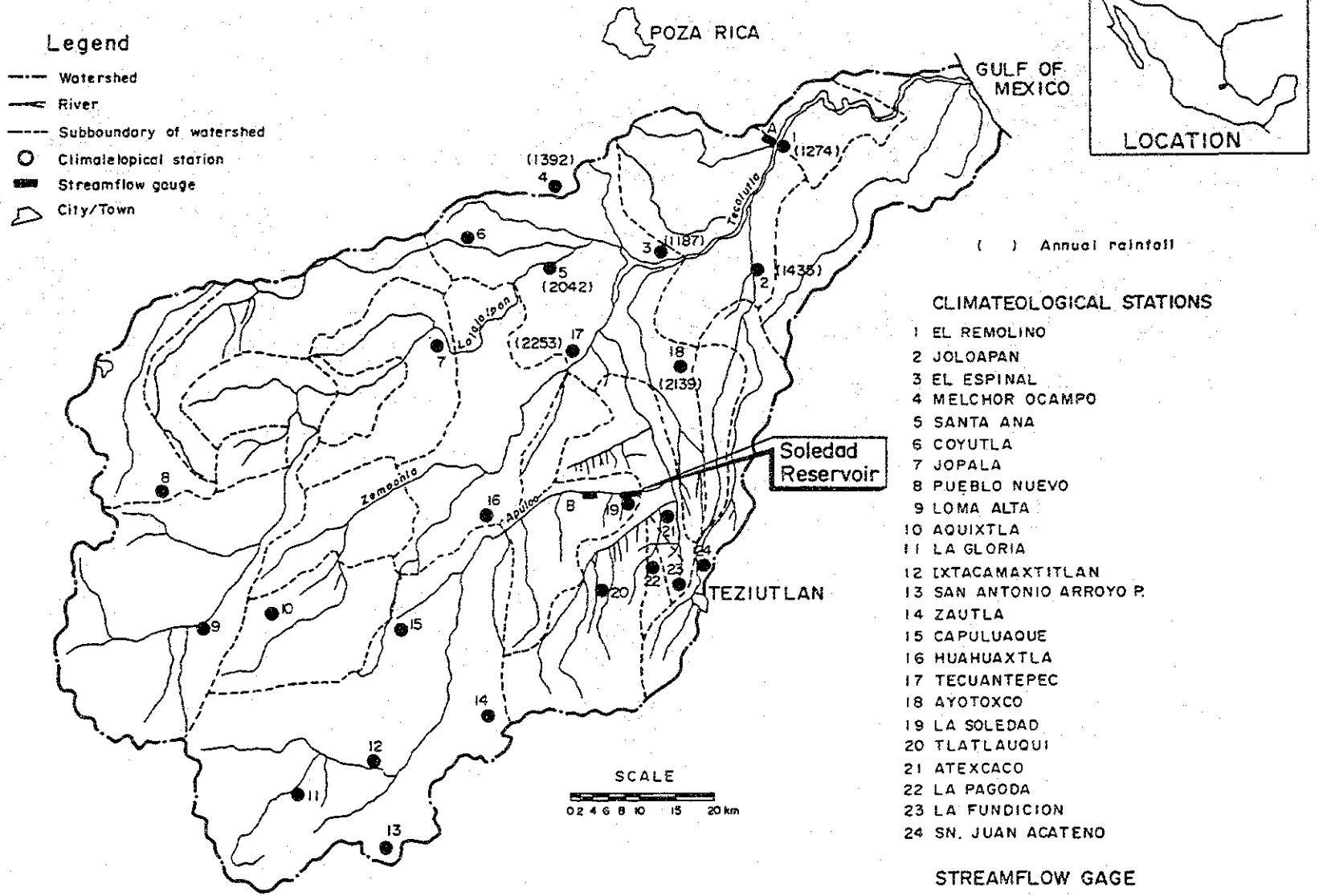
LOW SCENARIO WITH 80% RELIABILITY

経済予測に基づく売電力量の予測

図 2.6



1993年5月の計画日負荷継続曲線



調査対象地域位置図

F-6

3.1 図