

TABLE 8.4.1 MWSS WATER TARIFF SCHEDULE

Customer Type/ Consumption volume	Up to 12/31/91	Effectivity Date				
		1992 Jan 16	Feb 16	Mar 16	Apr 16	May 16
RESIDENTIAL A						
First 10 cu.m.	P18.50/conn.	P20.50	P22.50	P24.50	P26.50	P28.00
Next 10 cu.m.	2.45/cu.m.	2.65	2.85	3.05	3.25	3.40
Next 10 cu.m.	3.20/cu.m.	3.40	3.60	3.80	4.00	4.15
Next 10 cu.m.	4.25/cu.m.	4.45	4.65	4.85	5.05	5.20
Next 10 cu.m.	5.05/cu.m.	5.25	5.45	5.65	5.85	6.05
Next 10 cu.m.	5.60/cu.m.	5.80	6.00	6.20	6.40	6.55
Next 20 cu.m.	6.30/cu.m.	6.50	6.70	6.90	7.10	7.25
Next 20 cu.m.	6.95/cu.m.	7.15	7.35	7.55	7.75	7.90
Over 100 cu.m.	7.50/cu.m.	7.70	7.90	8.10	8.30	8.45
RESIDENTIAL B						
First 10 cu.m.	P24.00/conn.	P26.00	P28.00	P30.00	P32.00	P33.50
Next 10 cu.m.	3.15/cu.m.	3.35	3.55	3.75	3.95	4.10
Next 10 cu.m.	3.70/cu.m.	3.90	4.10	4.30	4.50	4.65
Next 10 cu.m.	4.45/cu.m.	4.65	4.85	5.05	5.25	5.40
Next 10 cu.m.	5.15/cu.m.	5.35	5.55	5.75	5.95	6.10
Next 10 cu.m.	5.70/cu.m.	5.90	6.10	6.30	6.50	6.65
Next 20 cu.m.	6.50/cu.m.	6.70	6.90	7.10	7.30	7.45
Next 20 cu.m.	7.05/cu.m.	7.25	7.45	7.65	7.85	8.00
Over 100 cu.m.	7.60/cu.m.	7.80	8.00	8.20	8.40	8.60
COMMERCIAL						
First 25 cu.m.	P202.50/conn.	P207.50	P212.50	P217.50	P222.50	P226.25
Next 975 cu.m.	8.18/cu.m.	8.30	8.50	8.70	8.90	9.05
Over 1000 cu.m.	8.55/cu.m.	8.75	8.95	9.15	9.35	9.50
INDUSTRIAL						
First 25 cu.m.	P222.50/conn.	P227.50	P232.50	P237.50	P242.50	P246.25
Next 975 cu.m.	8.90/cu.m.	9.10	9.30	9.50	9.70	9.85
Over 1000 cu.m.	10.60/cu.m.	10.80	11.00	11.20	11.40	11.55
OVER-ALL AVERAGE TARIFF						
	P5.48/cu.m.	5.68	5.88	6.08	6.28	6.43

Reference : Board Resolution No. 250-91
 Prepared By: The Corporate Planning Group
 Date : January 17, 1992

TABLE 8.4.2 PROJECT COST FINANCING

(unit: P1000)

COMPONENTS	TOTAL COST	LOAN	GOV'T EQUITY	INTERNAL CASH G.
CONSTRUCTION WORKS				
1. Existing Well Rehabilitation	4,838	4,838	0	0
2. New Well Construction	13,317	13,317	0	0
3. Elevated Water Tanks	23,448	23,448	0	0
4. Transmission Pipeline	58,343	58,343	0	0
5. Booster Pumping Station No.1	42,223	42,223	0	0
6. Booster Pumping Station No.2	49,201	49,201	0	0
7. Communication Wiring	5,383	5,383	0	0
8. Distribution Reservoir	14,308	14,308	0	0
9. Distribution Main	65,355	65,355	0	0
10. Inner Network	23,761	0	23,761	0
11. Fire Hydrant	3,461	0	3,461	0
12. Service Connection	58,570	0	0	58,570
LAND ACQUISITION				
1. New Well Construction	350	0	350	0
2. Elevated Water Tanks	2,400	0	2,400	0
3. Surface Water Dist. Fac.	9,585	0	9,585	0
ENGINEERING SERVICES (D/D, 8%)				
1. Existing Well Rehabilitation	387	0	387	0
2. New Well Construction	2,941	0	2,941	0
3. Surface Water Dist. Fac.	25,648	0	25,648	0
ENGINEERING SERVICES (C/S, 4%)				
1. Existing Well Rehabilitation	194	0	194	0
2. New Well Construction	1,471	0	1,471	0
3. Surface Water Dist. Fac.	12,824	0	12,824	0
CONTINGENCIES				
1. Physical Contingency	41,801	27,642	14,159	0
2. Price Contingency	203,020	133,362	69,658	0
3. Taxes	73,837	0	73,837	0
4. IDC	66,304	0	0	66,304
TOTAL	802,970	437,420	240,676	124,874
%	100.00%	54.48%	29.97%	15.55%

TABLE 8.4.3 ESTIMATED PROJECT COST AND FINANCING

COMPONENTS	TOTAL COST	1992			1993			1994			1995			1996		
		FOREX	LOCAL	TOTAL	FOREX	LOCAL	TOTAL	FOREX	LOCAL	TOTAL	FOREX	LOCAL	TOTAL	FOREX	LOCAL	TOTAL
		P	F	P	P	F	P	P	F	P	P	F	P	P	F	P
((PROJECT COST))																
1. Materials	1,552	0	0	0	466	1,086	1,552	0	0	0	0	0	0	0	0	0
Rehab.	26,407	0	0	0	4,150	9,684	13,834	3,772	8,801	12,573	0	0	0	0	0	0
New Well	93,844	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Surface W.	121,802	0	0	0	4,616	10,770	15,385	3,772	8,801	12,573	0	0	0	0	0	
Materials Sub Total																
2. Labor	141	0	0	0	141	141	141	0	0	0	0	0	0	0	0	0
Skilled	1,461	0	0	0	751	710	710	710	710	710	0	0	0	0	0	0
New Well	27,788	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Surface W.	29,390	0	0	0	892	892	892	0	710	710	0	0	0	0	2,422	2,422
Skilled Labor Sub Total																
Unskilled	422	0	0	0	422	422	422	0	0	0	0	0	0	0	0	0
Rehab.	3,212	0	0	0	1,668	1,668	1,668	0	1,544	1,544	0	0	0	0	0	0
New Well	20,640	0	0	0	0	0	0	0	0	0	0	0	0	0	2,220	2,220
Surface W.	24,293	0	0	0	2,089	2,089	2,089	0	1,544	1,544	0	0	0	0	2,220	2,220
Unskilled L. Sub Total																
3. Equipment	2,724	0	0	0	2,315	409	2,724	0	0	0	0	0	0	0	0	0
Rehab.	5,685	0	0	0	2,208	972	3,081	1,803	801	2,604	0	0	0	0	0	0
New Well	179,325	0	0	0	0	0	0	0	0	0	0	0	0	0	4,173	5,923
Surface W.	186,733	0	0	0	4,524	1,281	5,805	1,803	801	2,604	0	0	0	0	4,173	5,923
Equipment Sub Total																
SUB TOTAL-A (1+2+3)	362,208	0	0	0	9,439	15,032	24,471	5,575	11,956	17,431	0	0	0	0	9,954	20,993
4. Land Acquisition	12,335	0	2,750	2,750	0	0	0	0	0	0	0	0	0	0	0	0
Rehab.	387	62	248	310	15	62	77	0	0	0	0	0	0	0	0	0
New Well	2,941	471	1,892	2,363	118	471	589	0	0	0	0	0	0	0	0	0
Surface W.	25,648	0	0	0	0	0	0	0	0	0	0	10,259	10,259	20,519	2,565	5,130
5. Eng'g Serv. (C/S)	194	0	0	0	39	155	194	0	0	0	0	0	0	0	0	0
Rehab.	1,471	0	0	0	168	672	840	125	504	630	0	0	0	0	0	0
New Well	12,824	0	0	0	0	0	0	0	0	0	0	0	0	0	641	641
Surface W.	55,900	533	4,880	5,413	340	1,360	1,700	125	504	630	10,259	10,844	30,104	3,206	3,206	6,412
SUB TOTAL-B (4+5+6)																
6. Physical Contingency	41,801	53	498	541	948	1,639	2,587	570	1,236	1,806	1,026	1,994	3,010	1,316	2,420	3,736
7. Price Contingency	203,020	21	488	509	774	3,442	4,216	712	4,091	4,803	1,743	9,210	10,952	2,651	14,065	16,916
8. Taxes	73,837	0	488	488	0	3,612	3,612	0	2,109	2,109	0	1,984	1,984	0	4,203	4,203
SUB TOTAL-C (6+7+8)	319,657	75	1,464	1,539	1,721	8,694	10,415	1,282	7,436	8,718	2,769	13,179	15,947	4,167	20,688	24,855
GRAND TOTAL (A+B+C)	736,865	607	8,344	8,951	11,201	25,685	36,286	6,893	19,797	26,780	13,028	33,023	48,051	17,328	44,866	62,214
ADB: IDC	66,304	0	0	0	0	0	0	0	1,939	1,939	0	0	0	0	0	0
PROJECT COST TOTAL	802,969	607	8,344	8,951	11,201	25,685	36,286	6,822	19,797	28,719	13,028	33,023	48,051	17,328	44,866	62,214
((FINANCING))																
1. Government Equity	240,675				6,951	5,795	5,795		2,985	2,985			46,051			13,814
2. Inter'l Cash Generation	124,874				0	0	0		1,939	1,939			0		0	0
3. Foreign Loan	437,420				0	30,491	30,491		23,795	23,795			0		48,400	48,400
FINANCING TOTAL	802,969				6,951	36,286	36,286		28,719	28,719			46,051		62,214	62,214

TABLE 3.4.3. ESTIMATED PROJECT COST AND FINANCING (cont'd)

COMPONENTS	1997			1998			1999			2000		
	TOTAL COST	FOREX P	LOCAL P	TOTAL COST	FOREX P	LOCAL P	TOTAL COST	FOREX P	LOCAL P	TOTAL COST	FOREX P	LOCAL P
((PROJECT COST))												
1. Materials												
Rehab.	1,552	0	0	0	0	0	0	0	0	0	0	0
New Well	26,407	0	0	0	0	0	0	0	0	0	0	0
Surface W.	93,844	21,564	26,448	48,012	4,431	7,080	11,511	4,373	6,553	10,925	2,905	4,280
Materials Sub Total	121,802	21,564	26,448	48,012	4,431	7,080	11,511	4,373	6,553	10,925	2,905	4,280
2. Labor												
Skilled												
Rehab.	141	0	0	0	0	0	0	0	0	0	0	0
New Well	1,461	0	0	0	0	0	0	0	0	0	0	0
Surface W.	27,788	0	15,763	15,763	0	3,802	3,802	0	3,509	3,509	0	2,291
Skilled Labor Sub Total	29,390	0	15,763	15,763	0	3,802	3,802	0	3,509	3,509	0	2,291
Unskilled												
Rehab.	422	0	0	0	0	0	0	0	0	0	0	0
New Well	3,212	0	0	0	0	0	0	0	0	0	0	0
Surface W.	20,649	0	10,057	10,057	0	3,542	3,542	0	2,957	2,957	0	1,874
Unskilled L. Sub Total	24,283	0	10,057	10,057	0	3,542	3,542	0	2,957	2,957	0	1,874
3. Equipment												
Rehab.	2,724	0	0	0	0	0	0	0	0	0	0	0
New Well	5,685	0	0	0	0	0	0	0	0	0	0	0
Surface W.	178,325	73,322	24,515	97,807	20,527	8,890	29,417	16,353	8,671	25,024	10,207	5,744
Equipment Sub Total	186,733	73,322	24,515	97,807	20,527	8,890	29,417	16,353	8,671	25,024	10,207	5,744
SUB TOTAL-A (1+2+3)	362,208	94,887	76,762	171,669	24,958	23,315	48,273	20,726	21,669	42,416	12,112	14,189
4. Land Acquisition	12,335	0	0	0	0	0	0	0	0	0	0	0
5. Eng'g Serv. (D/P) Rehab.	397	0	0	0	0	0	0	0	0	0	0	0
New Well	2,941	0	0	0	0	0	0	0	0	0	0	0
Surface W.	25,648	0	0	0	0	0	0	0	0	0	0	0
6. Eng'g Serv. (C/S) Rehab.	194	0	0	0	0	0	0	0	0	0	0	0
New Well	1,491	0	0	0	0	0	0	0	0	0	0	0
Surface W.	12,824	3,206	3,206	6,412	385	1,530	1,924	385	1,530	1,924	256	1,026
SUB TOTAL-B (4+5+6)	55,800	3,206	3,206	6,412	385	1,530	1,924	385	1,530	1,924	256	1,026
6. Physical Contingency	41,801	9,809	7,999	17,608	2,534	2,485	5,020	2,111	2,323	4,434	1,337	1,521
7. Price Contingency	203,020	26,026	56,610	62,636	8,007	20,385	28,992	7,781	23,040	30,821	5,659	17,516
8. Taxes	73,837	0	36,902	36,902	0	10,405	10,405	0	8,655	8,655	0	5,478
SUB TOTAL-C (6+7+8)	318,657	35,835	101,511	137,346	10,541	33,875	44,416	9,892	34,018	43,910	6,996	24,516
GRAND TOTAL (A+B+C)	736,665	133,928	161,499	315,427	35,863	58,729	94,612	31,003	57,246	86,249	20,355	39,730
ADD: IDC	66,304	0	3,078	3,078	16,193	16,193	16,193	29,381	29,381	29,381	22,712	0
PROJECT COST TOTAL	802,969	137,928	164,577	318,505	54,076	58,729	112,805	51,384	57,246	108,630	43,077	39,730
((FINANCING))												
1. Government Equity	240,675			63,139			39,695			36,961		25,285
2. Inter'l Cash Generation	124,874			17,721			30,682			35,024		31,698
3. Foreign Loan	437,420			237,646			34,418			36,646		26,024
FINANCING TOTAL	802,969			318,505			112,805			108,630		82,807

TABLE 8.4.4 OPERATION AND MAINTENANCE COST

(in Thousand Pesos)

ITEMS	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
A. SALARIES															
Add'l No. of Employees (Adm.)	0	0	0	0	0	17	40	57	67	67	67	67	67	67	67
Unit Salary (P/month) Adm.	4.162	4.245	4.320	4.416	4.505	4.595	4.697	4.780	4.876	4.973	5.073	5.174	5.278	5.383	5.491
Add'l No. of Employees (Empl.)	0	0	8	8	9	8	18	18	18	18	18	18	18	18	18
Unit Salary (P/month) Empl.	5.202	5.306	5.412	5.520	5.631	5.743	5.858	5.975	6.095	6.217	6.341	6.468	6.597	6.729	6.864
Constant Price Index Factor (L)	1.210	1.331	1.464	1.611	1.739	1.878	2.029	2.191	2.366	2.556	2.760	2.981	3.219	3.477	3.755
Total Personnel Cost per Year	0	0	63	71	78	233	594	833	1,033	1,138	1,253	1,381	1,521	1,675	1,845
B. ELECTRICITY															
Add'l Power Charge for Well Pump	0	0	854	1,099	1,975	2,859	3,745	4,480	4,480	4,480	4,480	4,480	4,480	4,480	4,480
Power Charge for B.P.S. #1	0	0	0	0	0	0	0	181	860	1,393	1,926	2,459	2,992	3,525	3,951
Power Charge for B.P.S. #2	0	0	0	0	0	0	0	254	1,358	2,046	2,833	3,621	4,409	5,197	5,827
Constant Price Index Factor (F)	1.082	1.125	1.170	1.217	1.265	1.316	1.369	1.423	1.480	1.539	1.601	1.665	1.732	1.801	1.873
Total Electricity Cost per Year	0	0	999	1,325	2,499	3,762	5,125	6,996	9,766	12,190	14,782	17,563	20,573	23,774	26,705
C. CHEMICALS															
Add'l Water Distribution (m3/day)	0	0	937	1,873	3,442	5,009	6,578	8,145	9,714	10,945	12,177	13,409	14,640	15,871	16,857
Chlorine Consumption (kg/year)	0	0	171	342	628	914	1,200	1,486	1,773	1,997	2,222	2,447	2,672	2,896	3,076
Chemicals Cost P25-S/HR	0	0	4	9	16	23	31	38	45	51	57	62	68	74	78
Constant Price Index Factor (F)	1.082	1.125	1.170	1.217	1.265	1.316	1.369	1.423	1.480	1.539	1.601	1.665	1.732	1.801	1.873
Total Chemicals Cost per Year	0	0	5	11	20	31	42	54	67	78	91	104	118	133	147
D. MAINTENANCE															
Total Maintenance Cost	0	0	205	383	383	622	4,040	4,426	4,766	4,984	4,984	9,822	4,984	4,984	4,984
Constant Price Index Factor (F&L)	1.146	1.228	1.317	1.414	1.502	1.597	1.699	1.807	1.923	2.048	2.181	2.323	2.476	2.639	2.814
Total Maintenance Cost per Year	0	0	270	551	575	993	6,863	7,999	9,166	10,205	10,868	22,817	12,338	13,153	14,025
E. WATER FROM CDS															
Transmitted Water Volume (m3/day)	0	0	0	0	0	0	0	265	1,834	3,065	4,297	5,528	6,760	7,991	8,977
Annual Production Cost P2.21/m3	0	0	0	0	0	0	0	214	1,479	2,473	3,466	4,459	5,453	6,446	7,241
Constant Price Index Factor (L)	1.210	1.331	1.464	1.611	1.739	1.878	2.029	2.191	2.366	2.556	2.760	2.981	3.219	3.477	3.755
Total Water Cost per Year	0	0	0	0	0	0	0	468	3,501	6,319	9,567	13,293	17,554	22,412	27,191
TOTAL OPERATION AND MAINTENANCE COST	0	0	1,337	1,946	3,173	5,020	12,624	16,349	23,533	29,931	36,571	55,177	52,104	61,147	69,914

(L): Local Cost, (F): Foreign Cost, (F&L): Foreign 50% + Local 50%

TABLE 8.4.4 OPERATION AND MAINTENANCE COST (cont'd)

(In Thousand Pesos)

ITEMS	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
A. SALARIES															
Add'l No. of Employees (Adm.)	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67
Unit Salary (P/month) Adm.	5,601	5,713	5,827	5,944	6,063	6,184	6,308	6,434	6,562	6,694	6,828	6,964	7,103	7,245	7,390
Add'l No. of Employees (Engr.)	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Unit Salary (P/month) Engr.	7,001	7,141	7,284	7,430	7,578	7,730	7,884	8,042	8,203	8,367	8,534	8,705	8,879	9,057	9,238
Constant Price Index Factor (I)	4.056	4.380	4.730	5.109	5.518	5.959	6.436	6.950	7.507	8.107	8.756	9.456	10.213	11.030	11.912
Total Personnel Cost per Year	2,033	2,240	2,467	2,718	2,994	3,298	3,633	4,002	4,409	4,857	5,350	5,894	6,493	7,152	7,879
B. ELECTRICITY															
Add'l Power Charge for Well Pump	4,450	4,480	4,480	4,480	4,480	4,480	4,480	4,480	4,480	4,480	4,480	4,480	4,480	4,480	4,480
Power Charge for B.P.S. #1	4,378	4,804	5,231	5,658	5,658	5,658	5,658	5,658	5,658	5,658	5,658	5,658	5,658	5,658	5,658
Power Charge for B.P.S. #2	6,458	7,089	7,719	8,350	8,350	8,350	8,350	8,350	8,350	8,350	8,350	8,350	8,350	8,350	8,350
Constant Price Index Factor (F)	1.948	2.026	2.107	2.191	2.279	2.370	2.465	2.563	2.666	2.772	2.883	2.999	3.119	3.243	3.373
Total Electricity Cost per Year	29,633	33,168	36,722	40,506	42,128	45,813	45,566	47,388	49,284	51,255	53,305	55,438	57,655	59,961	62,360
C. CHEMICALS															
Add'l Water Distribution (m ³ /day)	17,843	18,828	19,814	20,800	20,800	20,800	20,800	20,800	20,800	20,800	20,800	20,800	20,800	20,800	20,800
Chlorine Consumption (kg/year)	3,256	3,436	3,616	3,796	3,796	3,796	3,796	3,796	3,796	3,796	3,796	3,796	3,796	3,796	3,796
Chemicals Cost P25.5/kg	53	86	92	97	97	97	97	97	97	97	97	97	97	97	97
Constant Price Index Factor (F)	1.948	2.026	2.107	2.191	2.279	2.370	2.465	2.563	2.666	2.772	2.883	2.999	3.119	3.243	3.373
Total Chemicals Cost per Year	162	178	194	212	221	229	239	249	258	268	279	290	302	314	327
D. MAINTENANCE															
Total Maintenance Cost	4,984	4,984	4,984	4,984	4,984	4,984	4,984	4,984	4,984	4,984	4,984	4,984	4,984	4,984	4,984
Constant Price Index Factor (F&I)	3.002	3.203	3.419	3.650	3.898	4.164	4.450	4.757	5.086	5.440	5.819	6.227	6.666	7.136	7.643
Total Maintenance Cost per Year	14,961	15,963	17,038	18,191	19,428	20,755	23,708	23,708	25,350	27,112	29,004	31,037	33,221	35,568	38,090
E. WATER FROM CDS															
Transmitted Water Volume (m ³ /day)	9,963	10,948	11,934	12,920	12,920	12,920	12,920	12,920	12,920	12,920	12,920	12,920	12,920	12,920	12,920
Annual Production Cost P2.21/m ³	8,036	8,632	9,227	9,822	10,417	10,422	10,422	10,422	10,422	10,422	10,422	10,422	10,422	10,422	10,422
Constant Price Index Factor (I)	4.056	4.380	4.730	5.109	5.518	5.959	6.436	6.950	7.507	8.107	8.756	9.456	10.213	11.030	11.912
Total Water Cost per Year	32,553	38,682	45,538	53,244	57,503	62,103	67,072	72,437	78,232	84,491	91,250	98,550	106,434	114,949	124,145
TOTAL OPERATION AND MAINTENANCE COST															
	79,580	90,230	101,960	114,573	122,274	130,199	160,219	147,784	157,533	167,983	179,169	191,209	204,105	217,945	232,801

(I): Local Cost, (F): Foreign Cost, (F&I): Foreign 50% + Local 50%

TABLE 8.4.5 PROJECTED REVENUE

(In Thousand Pesos)

YEAR	ADD'L WATER PROD. VOLUME (MCM)	RATIO OF SOLD WATER (%)	ADD'L SOLD WATER VOLUME (MCM)	LEAKED WATER RECOVERY VOLUME (MCM)	AVERAGE WATER TARIFF (P/m3)	ADD'L WATER SALES REVENUE (1000P)	BILL COLL'N EFF. (%)	PROVISION FOR BAD DEBTS (1000P)	ACC'TS RECEIV- ABLES (1000P)	CASH RECEIPTS FROM OPER'N (1000P)
							80.00%	4.00%	16.00%	
1992	0.00	55.0%	0.00	0.00	6.43	0	0	0	0	0
1993	0.00	60.0%	0.00	0.00	7.07	0	0	0	0	0
1994	0.34	65.0%	0.22	0.64	7.78	6,743	80.00%	270	1,079	5,394
1995	0.68	70.0%	0.48	0.82	8.56	11,143	81.77%	446	1,783	9,993
1996	1.26	70.0%	0.88	0.82	9.24	15,740	82.03%	630	2,518	14,375
1997	1.83	70.0%	1.28	0.82	9.98	20,996	82.14%	840	3,359	19,315
1998	2.40	70.0%	1.68	0.82	10.78	26,997	82.21%	1,080	4,320	24,957
1999	2.97	70.0%	2.08	0.82	11.64	33,819	82.27%	1,353	5,411	31,375
2000	3.55	70.0%	2.48	0.82	12.57	41,565	82.30%	1,663	6,650	38,663
2001	4.00	71.0%	2.84	0.86	13.58	50,192	82.34%	2,008	8,031	46,804
2002	4.44	72.0%	3.20	0.90	14.67	60,065	82.36%	2,403	9,610	56,083
2003	4.89	73.0%	3.57	0.93	15.84	71,339	82.37%	2,854	11,414	66,682
2004	5.34	74.0%	3.95	0.97	17.11	84,186	82.39%	3,367	13,470	78,763
2005	5.79	75.0%	4.34	1.00	18.48	98,798	82.40%	3,952	15,808	92,509
2006	6.15	75.0%	4.61	1.00	19.95	112,087	82.47%	4,483	17,934	105,478
2007	6.51	75.0%	4.88	1.00	21.55	126,870	82.48%	5,075	20,299	119,430
2008	6.87	75.0%	5.15	1.00	23.28	143,301	82.48%	5,732	22,928	134,940
2009	7.23	75.0%	5.42	1.00	25.14	161,549	82.49%	6,462	25,848	152,167
2010	7.59	75.0%	5.69	1.00	27.15	181,799	82.49%	7,272	29,088	171,287
2011	7.59	75.0%	5.69	1.00	29.32	196,343	82.58%	7,854	31,415	186,162
2012	7.59	75.0%	5.69	1.00	31.67	212,051	82.58%	8,482	33,928	201,055
2013	7.59	75.0%	5.69	1.00	34.20	229,015	82.58%	9,161	36,642	217,140
2014	7.59	75.0%	5.69	1.00	36.94	247,336	82.58%	9,893	39,574	234,511
2015	7.59	75.0%	5.69	1.00	39.89	267,123	82.58%	10,685	42,740	253,272
2016	7.59	75.0%	5.69	1.00	43.08	288,492	82.58%	11,540	46,159	273,534
2017	7.59	75.0%	5.69	1.00	46.53	311,572	82.58%	12,463	49,851	295,416
2018	7.59	75.0%	5.69	1.00	50.25	336,498	82.58%	13,460	53,840	319,050
2019	7.59	75.0%	5.69	1.00	54.27	363,417	82.58%	14,537	58,147	344,574
2020	7.59	75.0%	5.69	1.00	58.61	392,491	82.58%	15,700	62,799	372,139
2021	7.59	75.0%	5.69	1.00	63.30	423,890	82.58%	16,956	67,822	401,911

TABLE 8.4.6 FINANCIAL INTERNAL RATE OF RETURN
(Groundwater and Surface Water)

YEAR	CASH RECEIPTS FROM OPER'N (1000P)	CASH EXPENSES FOR O & M (1000P)	INVESTMENT IN PROJECT (1000P)	FINANCIAL NET BENEFIT FLOW (1000P)
1992	0	0	6,951	(6,951)
1993	0	0	36,286	(36,286)
1994	5,394	1,337	28,719	(24,662)
1995	9,993	1,948	46,051	(38,006)
1996	14,375	3,173	62,214	(51,012)
1997	19,315	5,020	318,505	(304,210)
1998	24,957	12,624	112,805	(100,472)
1999	31,375	16,349	108,630	(93,604)
2000	38,663	23,533	82,807	(67,677)
2001	46,804	29,931	0	16,873
2002	56,083	36,571	0	19,512
2003	66,682	55,177	0	11,505
2004	78,763	52,104	0	26,659
2005	92,509	61,147	0	31,362
2006	105,478	69,914	0	35,564
2007	119,430	79,580	0	39,850
2008	134,940	90,230	0	44,710
2009	152,167	101,960	0	50,207
2010	171,287	114,873	0	56,414
2011	186,162	122,274	0	63,888
2012	201,055	130,199	0	70,856
2013	217,140	160,219	0	56,921
2014	234,511	147,784	0	86,727
2015	253,272	157,533	0	95,739
2016	273,534	167,983	0	105,551
2017	295,416	179,189	0	116,227
2018	319,050	191,209	0	127,841
2019	344,574	204,105	0	140,469
2020	372,139	217,945	0	154,194
2021	401,911	232,801	0	169,110
NPV at 3.47% WACC				100,120
FIRR				4.46%

TABLE 8.4.7 ESTIMATED PROJECT COST AND FINANCING (GROUNDWATER COMPONENT ONLY)

(unit: P1000)

COMPONENTS	1992			1993			1994			1995			1996		
	TOTAL COST	FOREX P	LOCAL P	TOTAL COST	FOREX P	LOCAL P	TOTAL COST	FOREX P	LOCAL P	TOTAL COST	FOREX P	LOCAL P	TOTAL COST	FOREX P	LOCAL P
((PROJECT COST))															
1. Materials															
Rehab.	1,552	0	0	466	1,086	1,552	0	0	0	0	0	0	0	0	0
New Well	26,407	0	0	4,150	9,684	13,834	3,772	8,801	12,573	0	0	0	0	0	0
Surface W.	28,315	0	0	2,371	3,916	6,217	3,545	5,668	9,209	3,498	5,242	8,740	2,324	3,424	5,749
Materials Sub Total	57,874	0	0	6,887	14,616	21,603	7,317	14,465	21,782	3,498	5,242	8,740	2,324	3,424	5,749
2. Labor															
Skilled															
Rehab.	141	0	0	0	141	141	0	0	0	0	0	0	0	0	0
New Well	1,461	0	0	0	751	751	0	710	710	0	0	0	0	0	0
Surface W.	9,749	0	0	0	2,067	2,067	0	3,042	3,042	0	2,808	2,808	0	1,833	1,833
Skilled Labor Sub Total	11,351	0	0	0	2,959	2,959	0	3,752	3,752	0	2,808	2,808	0	1,833	1,833
Unskilled															
Rehab.	422	0	0	0	422	422	0	0	0	0	0	0	0	0	0
New Well	9,212	0	0	0	1,668	1,668	0	1,544	1,544	0	0	0	0	0	0
Surface W.	8,666	0	0	0	1,967	1,967	0	2,834	2,834	0	2,365	2,365	0	1,499	1,499
Unskilled L. Sub Total	12,299	0	0	0	4,057	4,057	0	4,378	4,378	0	2,365	2,365	0	1,499	1,499
3. Equipment															
Rehab.	2,724	0	0	2,315	409	2,724	0	0	0	0	0	0	0	0	0
New Well	5,685	0	0	2,208	872	3,061	1,803	801	2,604	0	0	0	0	0	0
Surface W.	72,588	0	0	11,504	4,771	16,275	16,421	7,112	23,534	13,083	6,937	20,019	8,165	4,595	12,761
Equipment Sub Total	80,997	0	0	16,028	6,052	22,080	18,224	7,913	26,137	13,063	6,937	20,019	8,165	4,595	12,761
SUB TOTAL-A (1+2+3)	162,521	0	0	23,015	27,683	50,698	25,541	30,568	56,049	16,591	17,352	33,932	10,490	11,351	21,841
4. Land Acquisition	2,750	0	2,750	0	0	0	0	0	0	0	0	0	0	0	0
5. Eng'g Serv. (D/B) Rehab.	387	62	248	310	15	62	77	0	0	0	0	0	0	0	0
New Well	2,941	471	1,662	2,353	118	471	588	0	0	0	0	0	0	0	0
Surface W.	9,670	1,518	6,191	7,739	387	1,548	1,935	0	0	0	0	0	0	0	0
6. Eng'g Serv. (C/S) Rehab.	194	0	0	0	39	155	194	0	0	0	0	0	0	0	0
New Well	1,471	0	0	168	672	840	126	504	630	0	0	0	0	0	0
Surface W.	4,837	0	0	531	531	1,061	309	1,236	1,545	271	1,086	1,357	175	689	874
SUB TOTAL-B (4+5+6)	22,252	2,080	11,071	13,151	1,257	3,438	4,695	435	1,740	2,175	271	1,086	1,357	175	689
6. Physical Contingency	18,477	208	1,107	1,315	2,427	3,112	5,539	2,598	3,225	5,822	1,685	1,844	3,529	1,066	1,205
7. Price Contingency	44,359	83	1,107	1,190	1,991	5,535	8,516	3,243	10,674	13,918	2,863	6,557	11,419	2,310	7,004
8. Taxes	32,340	0	1,107	1,107	0	9,520	9,520	0	10,433	10,433	0	6,909	6,909	0	4,370
SUB TOTAL-C (6+7+8)	95,175	291	3,321	3,613	4,408	19,168	23,576	5,841	24,332	30,173	4,546	17,310	21,958	3,377	12,579
GRAND TOTAL (A+B+C)	279,946	2,372	14,392	16,764	23,680	50,289	78,969	31,817	56,580	88,398	21,400	35,747	57,147	14,041	24,623
ADD: IDC	11,389	0	0	0	0	0	0	3,129	0	3,129	0	3,106	0	5,164	0
PROJECT COST TOTAL	291,347	2,372	14,392	16,764	23,680	50,289	78,969	34,946	56,580	91,527	24,506	35,747	60,253	19,205	24,623
((FINANCING))															
1. Government Equity	74,682			16,764		16,054		18,082		18,082		13,070		8,712	
2. Inter'l Cash Generation	58,255			0		11,714		19,529		19,529		14,820		12,192	
3. Foreign Loan	158,410			0		49,201		53,816		53,816		32,363		22,920	
FINANCING TOTAL	291,347			16,764		78,969		91,527		91,527		60,253		43,834	

TABLE 8.4.3 OPERATION AND MAINTENANCE COST (Groundwater only)

ITEMS	(In Thousand Pesos)														
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
A. SALARIES															
Add'l No. of Employees (Adm.)	0	17	25	32	40	40	40	40	40	40	40	40	40	40	40
Unit Salary (P/month) Adm.	4,152	4,245	4,330	4,416	4,505	4,595	4,687	4,780	4,876	4,973	5,073	5,174	5,278	5,383	5,491
Add'l No. of Employees (Eng.)	0	0	8	8	8	8	8	8	8	8	8	8	8	8	8
Unit Salary (P/month) Eng.	5,202	5,306	5,412	5,520	5,631	5,743	5,858	5,975	6,095	6,217	6,341	6,468	6,597	6,729	6,864
Constant Price Index Factor (I)	1,210	1,331	1,464	1,611	1,739	1,878	2,029	2,191	2,366	2,556	2,760	2,981	3,219	3,477	3,755
Total Personnel Cost per Year	0	96	222	299	392	432	475	524	577	636	700	771	850	936	1,031
B. ELECTRICITY															
Add'l Power Charge for Well Pump	0	0	854	1,089	1,975	2,859	3,745	4,480	4,480	4,480	4,480	4,480	4,480	4,480	4,480
Power Charge for B.P.S. #1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Charge for B.P.S. #1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Constant Price Index Factor (F)	1,082	1,125	1,170	1,217	1,265	1,316	1,369	1,423	1,480	1,539	1,601	1,665	1,732	1,801	1,873
Total Electricity Cost per Year	0	0	999	1,325	2,499	3,762	5,125	6,376	6,631	6,896	7,172	7,459	7,757	8,058	8,390
C. CHEMICALS															
Add'l Water Production (m3/day)	0	0	937	1,873	3,442	5,009	6,578	7,880	7,880	7,880	7,880	7,880	7,880	7,880	7,880
Chlorine Consumption (kg/year)	0	0	171	342	628	914	1,200	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438
Chemicals Cost P25, S/kg	0	0	4	9	16	23	31	37	37	37	37	37	37	37	37
Constant Price Index Factor (F)	1,082	1,125	1,170	1,217	1,265	1,316	1,369	1,423	1,480	1,539	1,601	1,665	1,732	1,801	1,873
Total Chemicals Cost per Year	0	0	5	11	20	31	42	52	54	56	59	61	64	66	69
D. MAINTENANCE															
Total Maintenance Cost	0	0	536	1,023	1,295	1,470	1,470	1,470	1,470	1,470	1,470	1,470	1,470	1,470	1,470
Constant Price Index Factor (P&I)	1,146	1,228	1,317	1,414	1,502	1,597	1,699	1,807	1,923	2,048	2,181	2,323	2,476	2,639	2,814
Total Maintenance Cost per Year	0	0	706	1,446	1,946	2,348	2,497	2,657	2,827	3,010	3,205	3,404	3,609	3,829	4,137
TOTAL OPERATION AND MAINTENANCE COST	0	96	1,932	3,080	4,856	6,573	8,139	9,608	10,089	10,598	11,196	12,945	12,310	12,949	13,627

(I): Local Cost, (F): Foreign Cost, (P&I): Foreign 50% + Local 50%

TABLE 8.4.8 OPERATION AND MAINTENANCE COST (Groundwater only) (cont'd)

(in Thousand Pesos)

ITEMS	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
A. SALARIES															
Add'l No. of Employees (Adm.)	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Unit Salary (P/month) Adm.	5,601	5,713	5,927	5,944	6,063	6,184	6,308	6,434	6,562	6,694	6,828	6,964	7,103	7,245	7,390
Add'l No. of Employees (Eng.)	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Unit Salary (P/month) Eng.	7,001	7,141	7,284	7,430	7,578	7,730	7,884	8,042	8,203	8,367	8,534	8,705	8,879	9,057	9,238
Constant Price Index Factor (L)	4,056	4,380	4,730	5,109	5,518	5,959	6,436	6,950	7,507	8,107	8,756	9,456	10,213	11,030	11,912
Total Personnel Cost per Year	1,136	1,251	1,378	1,518	1,673	1,842	2,030	2,236	2,463	2,713	2,989	3,293	3,627	3,995	4,402
B. ELECTRICITY															
Add'l Power Charge for Well Pump	4,480	4,480	4,480	4,480	4,480	4,480	4,480	4,480	4,480	4,480	4,480	4,480	4,480	4,480	4,480
Power Charge for B.P.S. #1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Charge for B.P.S. #1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Constant Price Index Factor (F)	1,948	2,026	2,107	2,191	2,279	2,370	2,465	2,563	2,665	2,772	2,883	2,999	3,119	3,243	3,373
Total Electricity Cost per Year	8,726	9,075	9,438	9,816	10,208	10,616	11,041	11,483	11,942	12,420	12,917	13,433	13,971	14,529	15,111
C. CHEMICALS															
Add'l Water Production (m3/day)	7,880	7,880	7,880	7,880	7,880	7,880	7,880	7,880	7,880	7,880	7,880	7,880	7,880	7,880	7,880
Chlorine Consumption (kg/year)	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438
Chemicals Cost P25.5/kg	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37
Constant Price Index Factor (F)	1,948	2,026	2,107	2,191	2,279	2,370	2,465	2,563	2,665	2,772	2,883	2,999	3,119	3,243	3,373
Total Chemicals Cost per Year	71	74	77	80	84	87	90	94	98	102	106	110	114	119	124
D. MAINTENANCE															
Total Maintenance Cost	1,470	1,470	1,470	1,470	1,470	1,470	1,470	1,470	1,470	1,470	1,470	1,470	1,470	1,470	1,470
Constant Price Index Factor (FAL)	3,002	3,203	3,419	3,650	3,898	4,164	4,450	4,757	5,086	5,440	5,819	6,227	6,666	7,136	7,643
Total Maintenance Cost per Year	4,413	4,706	5,025	5,365	5,730	6,122	6,593	7,147	7,796	8,555	9,454	10,511	11,758	13,215	14,912
TOTAL OPERATION AND MAINTENANCE COST	14,346	15,109	15,919	16,780	17,695	18,666	19,693	20,805	21,980	23,231	24,566	25,990	27,511	29,135	30,870

(L): Local Cost, (F): Foreign Cost, (FAL): Foreign 50% + Local 50%

TABLE 8.4.9 PROJECTED REVENUE
(Groundwater only)

YEAR	ADD'L WATER PROD. VOLUME (MCM)	RATIO OF SOLD WATER (%)	ADD'L SOLD WATER VOLUME (MCM)	LEAKED WATER RECOVERY VOLUME (MCM)	AVERAGE WATER TARIFF (P/m3)	ADD'L WATER SALES REVENUE (1000P)	BILL COLL'N EFF. (%)	PROVISION FOR BAD DEBTS (1000P)	ACC'TS RECEIVABLES (1000P)	CASH RECEIPTS FROM OPER'N (1000P)
							80.00%	4.00%	16.00%	
1992	0.00	55.0%	0.00	0.00	6.43	0	0	0	0	0
1993	0.00	60.0%	0.00	0.47	7.07	3,292	80.00%	132	527	2,634
1994	0.34	65.0%	0.22	0.64	7.78	6,743	81.45%	270	1,079	5,921
1995	0.68	70.0%	0.48	0.82	8.56	11,143	81.77%	446	1,783	9,993
1996	1.26	70.0%	0.88	0.82	9.24	15,740	82.03%	630	2,518	14,375
1997	1.83	70.0%	1.28	0.82	9.98	20,996	82.14%	840	3,359	19,315
1998	2.40	70.0%	1.68	0.82	10.78	26,997	82.21%	1,080	4,320	24,957
1999	2.88	70.0%	2.01	0.82	11.64	33,030	82.31%	1,321	5,285	30,744
2000	2.88	70.0%	2.01	0.82	12.57	35,673	82.58%	1,427	5,708	33,823
2001	2.88	71.0%	2.04	0.86	13.58	39,403	82.53%	1,576	6,305	37,230
2002	2.88	72.0%	2.07	0.90	14.67	43,503	82.53%	1,740	6,960	41,107
2003	2.88	73.0%	2.10	0.93	15.84	48,006	82.53%	1,920	7,681	45,365
2004	2.88	74.0%	2.13	0.97	17.11	52,951	82.53%	2,118	8,472	50,042
2005	2.88	75.0%	2.16	1.00	18.48	58,389	82.53%	2,335	9,341	55,176
2006	2.88	75.0%	2.16	1.00	19.95	63,050	82.58%	2,522	10,088	59,781
2007	2.88	75.0%	2.16	1.00	21.55	68,094	82.58%	2,724	10,895	64,563
2008	2.88	75.0%	2.16	1.00	23.28	73,542	82.58%	2,942	11,767	69,728
2009	2.88	75.0%	2.16	1.00	25.14	79,425	82.58%	3,177	12,708	75,307
2010	2.88	75.0%	2.16	1.00	27.15	85,779	82.58%	3,431	13,725	81,331
2011	2.88	75.0%	2.16	1.00	29.32	92,641	82.58%	3,706	14,823	87,838
2012	2.88	75.0%	2.16	1.00	31.67	100,053	82.58%	4,002	16,008	94,865
2013	2.88	75.0%	2.16	1.00	34.20	108,057	82.58%	4,322	17,289	102,454
2014	2.88	75.0%	2.16	1.00	36.94	116,702	82.58%	4,668	18,672	110,650
2015	2.88	75.0%	2.16	1.00	39.89	126,038	82.58%	5,042	20,166	119,502
2016	2.88	75.0%	2.16	1.00	43.08	136,121	82.58%	5,445	21,779	129,063
2017	2.88	75.0%	2.16	1.00	46.53	147,010	82.58%	5,880	23,522	139,388
2018	2.88	75.0%	2.16	1.00	50.25	158,771	82.58%	6,351	25,403	150,539
2019	2.88	75.0%	2.16	1.00	54.27	171,473	82.58%	6,859	27,436	162,582
2020	2.88	75.0%	2.16	1.00	58.61	185,191	82.58%	7,408	29,631	175,588
2021	2.88	75.0%	2.16	1.00	63.30	200,006	82.58%	8,000	32,001	189,635

TABLE 8.4.10 FINANCIAL INTERNAL RATE OF RETURN
(Groundwater only)

YEAR	CASH RECEIPTS FROM OPER'N (1000P)	CASH EXPENSES FOR OPER'N (1000P)	INVESTMENT IN PROJECT (1000P)	FINANCIAL NET BENEFIT FLOW (1000P)
1992	0	0	16,764	(16,764)
1993	2,634	96	78,969	(76,431)
1994	5,921	1,932	91,527	(87,538)
1995	9,993	3,080	60,253	(53,340)
1996	14,375	4,856	43,834	(34,315)
1997	19,315	6,573	0	12,742
1998	24,957	8,139	0	16,818
1999	30,744	9,608	0	21,136
2000	33,823	10,089	0	23,734
2001	37,230	10,598	0	26,632
2002	41,107	11,136	0	29,971
2003	45,365	22,945	0	22,420
2004	50,042	12,310	0	37,732
2005	55,176	12,949	0	42,227
2006	59,781	13,627	0	46,154
2007	64,563	14,346	0	50,217
2008	69,728	15,109	0	54,619
2009	75,307	15,919	0	59,388
2010	81,331	16,780	0	64,551
2011	87,838	17,695	0	70,143
2012	94,865	18,668	0	76,197
2013	102,454	41,233	0	61,221
2014	110,650	20,805	0	89,845
2015	119,502	21,980	0	97,522
2016	129,063	23,231	0	105,832
2017	139,388	24,566	0	114,822
2018	150,539	25,990	0	124,549
2019	162,582	27,511	0	135,071
2020	175,588	29,135	0	146,453
2021	189,635	30,870	0	158,765
NPV at 3.46% WACC				565,807
FIRR				11.43%

NOTE: To reduce the NRW, distribution network replacement and construction was assumed to be implemented with an amount of 80% of initial proposed project from 1993.

TABLE 8.4.11 INCREASE IN CONSUMER SATISFACTION

YEAR	ADD'L WATER PROD. VOLUME (MCM)	RATIO OF SOLD WATER WATER (%)	ADD'L SOLD WATER VOLUME (MCM)	LEAKED WATER RECOVERY VOLUME (MCM)	AVERAGE WATER TARIFF (P/m3)	ECONOMIC VALUE PER CU.M (P/m3)	ECONOMIC WATER REVENUE (P1,000)
1992	0.00	55.0%	0.00	0.00	6.43	7.72	0
1993	0.00	60.0%	0.00	0.00	6.43	7.72	0
1994	0.34	65.0%	0.22	0.64	6.43	7.72	6,687
1995	0.68	70.0%	0.48	0.82	6.43	7.72	10,046
1996	1.26	70.0%	0.88	0.82	6.43	7.72	13,140
1997	1.83	70.0%	1.28	0.82	6.43	7.72	16,229
1998	2.40	70.0%	1.68	0.82	6.43	7.72	19,322
1999	2.97	70.0%	2.08	0.82	6.43	7.72	22,411
2000	3.55	70.0%	2.48	0.82	6.43	7.72	25,504
2001	4.00	71.0%	2.84	0.86	6.43	7.72	28,517
2002	4.44	72.0%	3.20	0.90	6.43	7.72	31,598
2003	4.89	73.0%	3.57	0.93	6.43	7.72	34,749
2004	5.34	74.0%	3.95	0.97	6.43	7.72	37,969
2005	5.79	75.0%	4.34	1.00	6.43	7.72	41,259
2006	6.15	75.0%	4.61	1.00	6.43	7.72	43,341
2007	6.51	75.0%	4.88	1.00	6.43	7.72	45,423
2008	6.87	75.0%	5.15	1.00	6.43	7.72	47,506
2009	7.23	75.0%	5.42	1.00	6.43	7.72	49,588
2010	7.59	75.0%	5.69	1.00	6.43	7.72	51,670
2011	7.59	75.0%	5.69	1.00	6.43	7.72	51,670
2012	7.59	75.0%	5.69	1.00	6.43	7.72	51,670
2013	7.59	75.0%	5.69	1.00	6.43	7.72	51,670
2014	7.59	75.0%	5.69	1.00	6.43	7.72	51,670
2015	7.59	75.0%	5.69	1.00	6.43	7.72	51,670
2016	7.59	75.0%	5.69	1.00	6.43	7.72	51,670
2017	7.59	75.0%	5.69	1.00	6.43	7.72	51,670
2018	7.59	75.0%	5.69	1.00	6.43	7.72	51,670
2019	7.59	75.0%	5.69	1.00	6.43	7.72	51,670
2020	7.59	75.0%	5.69	1.00	6.43	7.72	51,670
2021	7.59	75.0%	5.69	1.00	6.43	7.72	51,670
TOTAL INCREASE IN CONSUMER SATISFACTION							1,093,329

* Economic value per cu.m was assumed to be 1.2 times of the price.

TABLE 8.4.12 MEDICAL EXPENSE FOR A WATER-BORNE DISEASE

ITEMS	EAST AVENUE MEDICAL CENTE	ST. LUKE'S MEDICAL CENTE	LUNG CENTER OF THE PHIL.
LABORATORY TEST			
CBC	P70.00	P110.00	P95.00
Stool Examination for Amoebiasis	35.00	70.00	60.00
Sensitibity to Antibiotics	150.00	200.00	170.00
Culture of Amoebiasis Organism	150.00	240.00	170.00
Widal Test	120.00	210.00	160.00
Blood Culture	200.00	430.00	200.00
Electrolyte Determination	120.00	210.00	180.00
Proctosigmoidscopy	100.00	500.00	350.00
SUB-TOTAL	P945.00	P1,970.00	P1,385.00
HOSPITALIZATION			
Three (3) days confinement	@P65/day= P195.00	@P150/day= P450.00	@P100/day= P300.00
Antibiotics @P60/day for 30 days	420.00	420.00	420.00
Dextrose 4 lit. @P80/bottle	320.00	320.00	320.00
Rehydration medicine @P6.00/day	180.00	180.00	180.00
Vitamins for revitalizing body @P4.20/day for 30 days	126.00	126.00	126.00
Doctors fee average of 3 visits	195.00	450.00	300.00
SUB-TOTAL	P1,436.00	P1,946.00	P1,646.00
FOLLOW-UP (CHECK-UP)			
Stool Examination	P35.00	P70.00	P60.00
Second Culture of Amoebiasis Organism	150.00	240.00	170.00
Doctors Fee	-	100.00	100.00
Follow-up Medicines	65.00	65.00	65.00
SUB-TOTAL	P250.00	P475.00	P405.00
GRAND TOTAL	P2,631.00	P4,391.00	P3,436.00
AVERAGE OF THE THREE HOSPITALS	P3,486.00	SAY P3,500.00	

SOURCE: F/S, RPNSIP

TABLE 8.4.13 HEALTH BENEFIT

YEAR	1/ ADD'L SERVED POP'N	COST OF TIME LOSS DUE TO ILLNESS (P1,000)	LOSS DUE TO PREMATURE DEATH (P1,000)	COST OF MEDICAL EXPENSES (P1,000)	TOTAL ECONOMIC LOSS (P1,000)	ECON. LOSS REDUCTION BY PROJECT 20% (P1,000)
1992	0	0	0	0	0	0
1993	0	0	0	0	0	0
1994	4,714	6	64	57	127	25
1995	9,427	12	129	114	255	51
1996	16,429	21	224	198	444	89
1997	22,962	30	313	277	620	124
1998	29,208	38	399	353	789	158
1999	35,247	46	481	426	952	190
2000	41,151	54	561	497	1,112	222
2001	44,329	58	605	535	1,198	240
2002	47,508	62	648	574	1,284	257
2003	50,686	66	692	612	1,370	274
2004	53,865	70	735	650	1,456	291
2005	57,043	74	778	689	1,541	308
2006	58,814	77	802	710	1,589	318
2007	60,586	79	827	732	1,637	327
2008	62,357	81	851	753	1,685	337
2009	64,129	84	875	774	1,733	347
2010	65,900	86	899	796	1,781	356
2011	65,900	86	899	796	1,781	356
2012	65,900	86	899	796	1,781	356
2013	65,900	86	899	796	1,781	356
2014	65,900	86	899	796	1,781	356
2015	65,900	86	899	796	1,781	356
2016	65,900	86	899	796	1,781	356
2017	65,900	86	899	796	1,781	356
2018	65,900	86	899	796	1,781	356
2019	65,900	86	899	796	1,781	356
2020	65,900	86	899	796	1,781	356
2021	65,900	86	899	796	1,781	356
TOTAL HEALTH BENEFIT						7,832

1/ (Total served pop'n)*(Augmented water share in total production)

TABLE 8.4.14 WEIGHTED AVERAGE REPLACEMENT COST OF DWELLING UNIT

TYPE OF DWELLING UNIT	VALUE (P1000)	NO. IN RIZAL	% TO TOTAL	RVSD % FOR ANTIPOLO	WEIGHTED COST
A. Galvanized Iron/Aluminium/ Tile/Concrete/Brick Stone	1,200	9,865	9.90%	10.00%	120,000
B. Wood/Plywood	350	37,601	37.74%	40.00%	140,000
C. Mixed A & B	600	34,549	34.67%	36.00%	216,000
D. Bamboo/Sawali/Cogon/Nipa	150	12,814	12.86%	10.00%	15,000
E. Others	18	4,814	4.83%	4.00%	720
TOTAL		99,643	100.00%	100.00%	491,720
				say	500,000

(Source: F/S, RPWSIP)

Assumed Value of Replacement Cost by Dwelling Unit Type:

Type of Dwelling Unit	Unit Cost (P/m ²)	Avg. Area (m ²)	Total (P1000)
A. Galvanized Iron/Aluminium/ Tile/Concrete/Brick Stone	6,000	200	1,200
B. Wood/Plywood	3,500	100	350
C. Mixed A & B	4,000	150	600
D. Bamboo/Sawali/Cogon/Nipa	2,500	60	150
E. Others	1,000	18	18

TABLE 8.4.15 FIRE DAMAGE REDUCTION

YEAR	1/ ADD'L SERVED POP'N	NUMBER OF HOUSINGS	TOTAL VALUE P500,000 EACH (P1000)	0.75% OVERALL REDUCTION IN FIRE DAMAGE	RATIO OF PROTECTION	NET REDUCTION IN FIRE DAMAGE (P1000)
1992	0	0	0	0	20%	0
1993	0	0	0	0	20%	0
1994	4,714	673	323,246	2,424	20%	485
1995	9,427	1,347	673,357	5,050	20%	1,010
1996	16,429	2,347	1,173,500	8,801	20%	1,760
1997	22,962	3,280	1,640,143	12,301	20%	2,460
1998	29,208	4,173	2,086,286	15,647	20%	3,129
1999	35,247	5,035	2,517,643	18,882	20%	3,776
2000	41,151	5,879	2,939,357	22,045	20%	4,409
2001	44,329	6,333	3,166,386	23,748	20%	4,750
2002	47,508	6,787	3,393,414	25,451	20%	5,090
2003	50,686	7,241	3,620,443	27,153	20%	5,431
2004	53,865	7,695	3,847,471	28,856	20%	5,771
2005	57,043	8,149	4,074,500	30,559	20%	6,112
2006	58,814	8,402	4,201,029	31,508	20%	6,302
2007	60,586	8,655	4,327,557	32,457	20%	6,491
2008	62,357	8,908	4,454,086	33,406	20%	6,681
2009	64,129	9,161	4,580,614	34,355	20%	6,871
2010	65,900	9,414	4,707,143	35,304	20%	7,061
2011	65,900	9,414	4,707,143	35,304	20%	7,061
2012	65,900	9,414	4,707,143	35,304	20%	7,061
2013	65,900	9,414	4,707,143	35,304	20%	7,061
2014	65,900	9,414	4,707,143	35,304	20%	7,061
2015	65,900	9,414	4,707,143	35,304	20%	7,061
2016	65,900	9,414	4,707,143	35,304	20%	7,061
2017	65,900	9,414	4,707,143	35,304	20%	7,061
2018	65,900	9,414	4,707,143	35,304	20%	7,061
2019	65,900	9,414	4,707,143	35,304	20%	7,061
2020	65,900	9,414	4,707,143	35,304	20%	7,061
2021	65,900	9,414	4,707,143	35,304	20%	7,061
TOTAL FIRE DAMAGE REDUCTION						155,257

1/ (Total served pop'n)*(Augmented water share in total production)

TABLE 8.4.16 INCREASE IN LAND VALUE

YEAR	SERVICE AREA (HA)	RATIO OF BENEFIT AREA (%)	BENEFIT AREA (HA)	BENEFIT INCREASE OF AREA (HA)	NET BENEFIT AREA INCREASE (HA)	LAND PRICE (P/m ²)	INCREASE IN LAND VALUE (%)	INCREASE IN LAND VALUE (P,000)
1992	420	0.0%	0.00	0.00	0.00	800	5.00%	0
1993	420	0.0%	0.00	0.00	0.00	800	5.00%	0
1994	420	50.0%	210.00	210.00	126.00	800	5.00%	50,400
1995	420	100.0%	420.00	210.00	126.00	800	5.00%	50,400
1996	420	100.0%	420.00	0.00	0.00	600	25.00%	0
1997	511	100.0%	511.25	91.25	54.75	600	25.00%	82,125
1998	603	100.0%	602.50	91.25	54.75	600	25.00%	82,125
1999	694	100.0%	693.75	91.25	54.75	600	25.00%	82,125
2000	785	100.0%	785.00	91.25	54.75	600	25.00%	82,125
TOTAL INCREASE IN LAND VALUE								429,300

TABLE 8.4.17 CONVERSION OF FINANCIAL PROJECT COSTS TO ECONOMIC COSTS

COMPONENTS	1992		1993		1994		1995		1996					
	SUB-TOTAL	FOREX P	LOCAL P	FOREX P	LOCAL P	FOREX P	LOCAL P	FOREX P	LOCAL P	TOTAL COST				
1. Materials	47,002	0	0	5,539	10,770	16,308	4,526	8,801	13,328	0	0	6,938	10,427	17,365
2. Labor														
Skilled Labor	4,024	0	0	0	892	892	0	710	710	0	0	0	2,422	2,422
Unskilled Labor	2,926	0	0	0	1,045	1,045	0	772	772	0	0	0	1,110	1,110
3. Equipment	20,605	0	0	5,429	1,281	6,710	2,163	801	2,964	0	0	0	5,007	10,930
4. Land Acquisition	12,335	0	2,750	0	0	0	0	0	0	0	9,585	9,585	0	0
5. Eng'g Serv. (D/D) Rehab.	31,675	639	2,130	160	533	692	0	0	0	12,311	10,259	22,571	3,078	2,565
6. Eng'g Serv. (C/S) Rehab.	3,141	0	0	248	827	1,075	151	504	655	0	0	0	769	641
6. Physical Contingency	12,463	64	488	1,138	1,639	2,777	684	1,236	1,920	1,231	1,984	3,216	1,579	2,420
ECONOMIC PROJECT COST	134,172	703	5,368	6,071	12,513	16,986	29,499	7,525	12,825	20,350	13,542	21,829	35,371	17,372
25,509	42,880													

COMPONENTS	1997		1998		1999		2000							
	SUB-TOTAL	FOREX P	LOCAL P	FOREX P	LOCAL P	FOREX P	LOCAL P	FOREX P	LOCAL P	TOTAL COST				
1. Materials Sub Total	84,289	25,877	26,448	52,325	5,318	7,080	12,397	5,247	6,553	11,800	3,486	4,280	7,767	131,291
2. Labor														
Skilled Labor Sub Total	25,365	0	15,763	15,763	0	3,802	3,802	0	3,509	3,509	0	2,291	2,291	29,390
Unskilled L. Sub Total	9,215	0	5,028	5,028	0	1,771	1,771	0	1,478	1,478	0	937	937	12,141
3. Equipment Sub Total	192,311	87,987	24,515	112,501	24,632	8,890	33,522	19,624	8,671	28,295	12,248	5,744	17,992	212,915
4. Land Acquisition	0	0	0	0	0	0	0	0	0	0	0	0	0	12,335
5. Eng'g Serv. (D/D) Rehab.	0	0	0	0	0	0	0	0	0	0	0	0	0	31,675
6. Eng'g Serv. (C/S) Rehab.	12,388	3,847	3,206	7,053	462	1,539	2,001	462	1,539	2,001	308	1,026	1,324	15,530
6. Physical Contingency	33,278	11,771	7,999	19,770	3,041	2,485	5,526	2,533	2,323	4,856	1,604	1,521	3,126	45,742
ECONOMIC PROJECT COST	356,846	129,482	82,959	212,441	33,452	25,568	59,020	27,866	24,073	51,939	17,647	15,799	33,446	491,018

TABLE 8-4.18 ECONOMIC REPLACEMENT COST

COMPONENTS	2008			2009			2010			2011		
	SUBTOTAL COST	FOREX P	LOCAL P	TOTAL COST	FOREX P	LOCAL P	TOTAL COST	FOREX P	LOCAL P	TOTAL COST	FOREX P	LOCAL P
<<ECONOMIC COSTS>>												
Rehab. of Existing Wells *	0	0	0	0	0	0	0	0	0	0	0	0
New Wells Construction	5,189	2,120	698	2,818	1,731	641	2,372	0	0	0	0	0
Surface Water Facilities	8,744	0	0	0	0	0	0	0	0	4,006	4,738	8,744
Total	13,934	2,120	698	2,818	1,731	641	2,372	0	0	4,006	4,738	8,744

COMPONENTS	2012			2013			2014			2015		
	TOTAL COST	FOREX P	LOCAL P	TOTAL COST	FOREX P	LOCAL P	TOTAL COST	FOREX P	LOCAL P	TOTAL COST	FOREX P	LOCAL P
<<ECONOMIC COSTS>>												
Rehab. of Existing Wells *	0	0	0	0	0	0	0	0	0	0	0	0
New Wells Construction	5,189	0	0	0	0	0	0	0	0	0	0	0
Surface Water Facilities	162,593	70,389	19,612	90,001	19,706	7,112	26,818	15,699	6,937	22,636	9,799	4,595
Total	167,783	70,389	19,612	90,001	19,706	7,112	26,818	15,699	6,937	22,636	9,799	4,595

* Costs for Rehab. of Existing Wells are counted as O & M Cost.

TABLE 8.4.19 ECONOMIC OPERATION AND MAINTENANCE COST

YEAR	DE-ESCALATED FINANCIAL O & M COST				CONVERTED ECONOMIC O & M COST				TOTAL ECONOMIC O & M COST (P1000)		
	SALARIES (L) (P1000)	ELEC'Y (F) (P1000)	CHEMICALS (F) (P1000)	MAINT. (F & L) (P1000)	WATER (L) (P1000)	SALARIES (L) (P1000)	ELEC'Y (F) (P1000)	CHEMICALS (F) (P1000)		MAINT. (F & L) (P1000)	WATER (L) (P1000)
1992	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0
1994	40	854	4	205	0	29	1,025	5	220	0	1,278
1995	40	1,089	9	383	0	29	1,307	11	412	0	1,758
1996	40	1,975	16	383	0	29	2,370	19	412	0	2,829
1997	108	2,859	23	622	0	77	3,431	28	669	0	4,204
1998	250	3,745	31	4,040	0	178	4,494	37	4,343	0	9,052
1999	318	4,915	38	4,426	214	227	5,898	46	4,758	203	11,131
2000	358	6,598	45	4,766	1,479	255	7,918	54	5,123	1,405	14,755
2001	358	7,918	51	4,984	2,473	255	9,502	61	5,358	2,349	17,523
2002	358	9,239	57	4,984	3,466	255	11,087	68	5,358	3,293	20,061
2003	358	10,560	62	9,822	4,459	255	12,672	74	10,559	4,236	27,796
2004	358	11,880	68	4,984	5,453	255	14,256	82	5,358	5,180	25,131
2005	358	13,201	74	4,984	6,446	255	15,841	89	5,358	6,124	27,667
2006	358	14,258	78	4,984	7,241	255	17,110	94	5,358	6,879	29,695
2007	358	15,315	83	4,984	8,036	255	18,378	100	5,358	7,634	31,725
2008	358	16,373	88	4,984	8,832	255	19,648	106	5,358	8,390	33,756
2009	358	17,430	92	4,984	9,627	255	20,916	110	5,358	9,146	35,785
2010	358	18,487	97	4,984	10,422	255	22,184	116	5,358	9,901	37,815
2011	358	18,487	97	4,984	10,422	255	22,184	116	5,358	9,901	37,815
2012	358	18,487	97	4,984	10,422	255	22,184	116	5,358	9,901	37,815
2013	358	18,487	97	9,822	10,422	255	22,184	116	10,559	9,901	43,015
2014	358	18,487	97	4,984	10,422	255	22,184	116	5,358	9,901	37,815
	(do)	(do)	(do)	(do)	(do)	(do)	(do)	(do)	(do)	(do)	(do)
2021	358	18,487	97	4,984	10,422	255	22,184	116	5,358	9,901	37,815
TOTAL	8,672	360,053	1,983	129,165	182,790	6,179	432,064	2,380	138,852	173,651	753,125

TABLE 8.4.20 SUMMARY OF ECONOMIC COST

YEAR	ECONOMIC PROJECT COST (P1000)	ECONOMIC REPLACEMENT COST (P1000)	ECONOMIC O & M COST (P1000)	TOTAL ECONOMIC COST (P1000)
1992	6,071	0	0	6,071
1993	29,499	0	1,278	30,777
1994	20,350	0	1,758	22,108
1995	35,371	0	2,829	38,200
1996	42,880	0	4,204	47,084
1997	212,441	0	9,052	221,493
1998	59,020	0	11,131	70,151
1999	51,939	0	14,755	66,694
2000	33,446	0	17,525	50,971
2001	0	0	20,061	20,061
2002	0	0	27,796	27,796
2003	0	0	25,131	25,131
2004	0	0	27,667	27,667
2005	0	0	29,695	29,695
2006	0	0	31,725	31,725
2007	0	0	33,756	33,756
2008	0	2,818	35,785	38,603
2009	0	2,372	37,815	40,187
2010	0	0	37,815	37,815
2011	0	8,744	37,815	46,559
2012	0	90,001	43,015	133,016
2013	0	26,818	37,815	64,633
2014	0	22,636	37,815	60,451
2015	0	14,394	37,815	52,209
2016	0	0	37,815	37,815
2017	0	0	37,815	37,815
2018	0	0	37,815	37,815
2019	0	0	37,815	37,815
2020	0	0	37,815	37,815
2021	0	0	37,815	37,815
	491,017	167,783	790,939	1,449,739

TABLE 8.4.21 ECONOMIC INTERNAL RATE OF RETURN

YEAR	ECONOMIC BENEFITS							TOTAL ECONOMIC COSTS (PI, 000)	ECONOMIC NET BENEFITS (PI, 000)
	WATER REVENUE (PI, 000)	HEALTH BENEFITS (PI, 000)	FIRE PROTECTION (PI, 000)	LAND-VALUE INCREASE (PI, 000)	ECONOMIC BENEFITS (PI, 000)	TOTAL ECONOMIC BENEFITS (PI, 000)	TOTAL ECONOMIC COSTS (PI, 000)		
1992	0	0	0	0	0	0	6,071	(6,071)	
1993	0	0	0	0	0	0	30,777	(30,777)	
1994	6,687	25	485	50,400	57,597	57,597	22,108	35,489	
1995	10,046	51	1,010	50,400	61,507	61,507	38,200	23,307	
1996	13,140	89	1,760	0	14,989	14,989	47,084	(32,095)	
1997	16,229	124	2,460	82,125	100,938	100,938	221,493	(120,555)	
1998	19,322	158	3,129	82,125	104,734	104,734	70,151	34,583	
1999	22,411	190	3,776	82,125	108,503	108,503	66,694	41,809	
2000	25,504	222	4,409	82,125	112,261	112,261	50,971	61,290	
2001	28,517	240	4,750	0	33,506	33,506	20,061	13,445	
2002	31,598	257	5,090	0	36,945	36,945	27,796	9,149	
2003	34,749	274	5,431	0	40,454	40,454	25,131	15,323	
2004	37,969	291	5,771	0	44,031	44,031	27,667	16,365	
2005	41,259	308	6,112	0	47,679	47,679	29,695	17,984	
2006	43,341	318	6,302	0	49,960	49,960	31,725	18,236	
2007	45,423	327	6,491	0	52,242	52,242	33,756	18,486	
2008	47,506	337	6,681	0	54,524	54,524	38,603	15,921	
2009	49,588	347	6,871	0	56,805	56,805	40,187	16,619	
2010	51,670	356	7,061	0	59,087	59,087	37,815	21,272	
2011	51,670	356	7,061	0	59,087	59,087	46,559	12,528	
2012	51,670	356	7,061	0	59,087	59,087	133,016	(73,930)	
2013	51,670	356	7,061	0	59,087	59,087	64,633	(5,546)	
2014	51,670	356	7,061	0	59,087	59,087	60,451	(1,364)	
2015	51,670	356	7,061	0	59,087	59,087	52,209	6,878	
2016	51,670	356	7,061	0	59,087	59,087	37,815	21,272	
2017	51,670	356	7,061	0	59,087	59,087	37,815	21,272	
2018	51,670	356	7,061	0	59,087	59,087	37,815	21,272	
2019	51,670	356	7,061	0	59,087	59,087	37,815	21,272	
2020	51,670	356	7,061	0	59,087	59,087	37,815	21,272	
2021	51,670	356	7,061	0	59,087	59,087	37,815	21,272	
NPV at 15.00%									
								5,592	
EIRR									
								17.19%	

TABLE 8.4.22 INCREASE IN CONSUMER SATISFACTION
(Groundwater only)

YEAR	ADD'L WATER PROD. VOLUME (MCM)	RATIO OF SOLD WATER (%)	ADD'L SOLD WATER VOLUME (MCM)	LEAKED WATER RECOVERY VOLUME (MCM)	AVERAGE WATER TARIFF (P/m3)	ECONOMIC VALUE PER CU.M (P/m3)	ECONOMIC WATER REVENUE (P1,000)
1992	0.00	55.0%	0.00	0.00	6.43	7.72	0
1993	0.00	60.0%	0.00	0.47	6.43	7.72	3,591
1994	0.34	65.0%	0.22	0.64	6.43	7.72	6,687
1995	0.68	70.0%	0.48	0.82	6.43	7.72	10,046
1996	1.26	70.0%	0.88	0.82	6.43	7.72	13,140
1997	1.83	70.0%	1.28	0.82	6.43	7.72	16,229
1998	2.40	70.0%	1.68	0.82	6.43	7.72	19,322
1999	2.88	70.0%	2.01	0.82	6.43	7.72	21,889
2000	2.88	70.0%	2.01	0.82	6.43	7.72	21,889
2001	2.88	71.0%	2.04	0.86	6.43	7.72	22,387
2002	2.88	72.0%	2.07	0.90	6.43	7.72	22,885
2003	2.88	73.0%	2.10	0.93	6.43	7.72	23,383
2004	2.88	74.0%	2.13	0.97	6.43	7.72	23,882
2005	2.88	75.0%	2.16	1.00	6.43	7.72	24,380
2006	2.88	75.0%	2.16	1.00	6.43	7.72	24,380
2007	2.88	75.0%	2.16	1.00	6.43	7.72	24,380
2008	2.88	75.0%	2.16	1.00	6.43	7.72	24,380
2009	2.88	75.0%	2.16	1.00	6.43	7.72	24,380
2010	2.88	75.0%	2.16	1.00	6.43	7.72	24,380
2011	2.88	75.0%	2.16	1.00	6.43	7.72	24,380
2012	2.88	75.0%	2.16	1.00	6.43	7.72	24,380
2013	2.88	75.0%	2.16	1.00	6.43	7.72	24,380
2014	2.88	75.0%	2.16	1.00	6.43	7.72	24,380
2015	2.88	75.0%	2.16	1.00	6.43	7.72	24,380
2016	2.88	75.0%	2.16	1.00	6.43	7.72	24,380
2017	2.88	75.0%	2.16	1.00	6.43	7.72	24,380
2018	2.88	75.0%	2.16	1.00	6.43	7.72	24,380
2019	2.88	75.0%	2.16	1.00	6.43	7.72	24,380
2020	2.88	75.0%	2.16	1.00	6.43	7.72	24,380
2021	2.88	75.0%	2.16	1.00	6.43	7.72	24,380

* Economic value per cu.m was assumed to be 1.2 times of the price.

TABLE 8.4.23 HEALTH BENEFIT
(groundwater only)

YEAR	1/ ADD'L SERVED POP'N	COST OF TIME LOSS DUE TO ILLNESS (P1,000)	LOSS DUE TO PREMATURE DEATH (P1,000)	COST OF MEDICAL EXPENSES (P1,000)	TOTAL ECONOMIC LOSS (P1,000)	ECO'C LOSS REDUCTION BY PROJECT 20% (P1,000)
1992	0	0	0	0	0	0
1993	0	0	0	0	0	0
1994	4,714	6	64	57	127	25
1995	9,427	12	129	114	255	51
1996	16,429	21	224	198	444	89
1997	22,962	30	313	277	620	124
1998	29,208	38	399	353	789	158
1999	34,100	44	465	412	921	184
2000	34,100	44	465	412	921	184
2001	34,100	44	465	412	921	184
2002	34,100	44	465	412	921	184
2003	34,100	44	465	412	921	184
2004	34,100	44	465	412	921	184
2005	34,100	44	465	412	921	184
2006	34,100	44	465	412	921	184
2007	34,100	44	465	412	921	184
2008	34,100	44	465	412	921	184
2009	34,100	44	465	412	921	184
2010	34,100	44	465	412	921	184
2011	34,100	44	465	412	921	184
2012	34,100	44	465	412	921	184
2013	34,100	44	465	412	921	184
2014	34,100	44	465	412	921	184
2015	34,100	44	465	412	921	184
2016	34,100	44	465	412	921	184
2017	34,100	44	465	412	921	184
2018	34,100	44	465	412	921	184
2019	34,100	44	465	412	921	184
2020	34,100	44	465	412	921	184
2021	34,100	44	465	412	921	184
TOTAL HEALTH BENEFIT						4,686

1/ (Total served pop'n)*(Augmented water share in total production)

TABLE 8.4.24 FIRE DAMAGE REDUCTION
(groundwater only)

YEAR	1/ ADD'L SERVED POP'N	NUMBER OF HOUSINGS	TOTAL VALUE P500,000 EACH (P1000)	0.75% OVERALL REDUCTION IN FIRE DAMAGE	RATIO OF PROTECTION	NET REDUCTION IN FIRE DAMAGE (P1000)
1992	0	0	0	0	20%	0
1993	0	0	0	0	20%	0
1994	4,714	673	323,211	2,424	20%	485
1995	9,427	1,347	673,357	5,050	20%	1,010
1996	16,429	2,347	1,173,500	8,801	20%	1,760
1997	22,962	3,280	1,640,143	12,301	20%	2,460
1998	29,208	4,173	2,086,286	15,647	20%	3,129
1999	34,100	4,871	2,435,714	18,268	20%	3,654
2000	34,100	4,871	2,435,714	18,268	20%	3,654
2001	34,100	4,871	2,435,714	18,268	20%	3,654
2002	34,100	4,871	2,435,714	18,268	20%	3,654
2003	34,100	4,871	2,435,714	18,268	20%	3,654
2004	34,100	4,871	2,435,714	18,268	20%	3,654
2005	34,100	4,871	2,435,714	18,268	20%	3,654
2006	34,100	4,871	2,435,714	18,268	20%	3,654
2007	34,100	4,871	2,435,714	18,268	20%	3,654
2008	34,100	4,871	2,435,714	18,268	20%	3,654
2009	34,100	4,871	2,435,714	18,268	20%	3,654
2010	34,100	4,871	2,435,714	18,268	20%	3,654
2011	34,100	4,871	2,435,714	18,268	20%	3,654
2012	34,100	4,871	2,435,714	18,268	20%	3,654
2013	34,100	4,871	2,435,714	18,268	20%	3,654
2014	34,100	4,871	2,435,714	18,268	20%	3,654
2015	34,100	4,871	2,435,714	18,268	20%	3,654
2016	34,100	4,871	2,435,714	18,268	20%	3,654
2017	34,100	4,871	2,435,714	18,268	20%	3,654
2018	34,100	4,871	2,435,714	18,268	20%	3,654
2019	34,100	4,871	2,435,714	18,268	20%	3,654
2020	34,100	4,871	2,435,714	18,268	20%	3,654
2021	34,100	4,871	2,435,714	18,268	20%	3,654
TOTAL FIRE DAMAGE REDUCTION						92,877

1/ (Total served pop'n)*(Augmented water share in total production)

TABLE 8.4.25 INCREASE IN LAND VALUE

YEAR	SERVICE AREA (HA)	RATIO OF BENEFIT AREA (%)	BENEFIT AREA (HA)	INCREASE OF BENEFIT AREA (HA)	NET BENEFIT AREA INCREASE (HA)	LAND PRICE (P/m ²)	INCREASE IN LAND VALUE (%)	INCREASE IN LAND VALUE (P1,000)
1992	420	0.0%	0.00	0.00	0.00	800	5.00%	0
1993	420	0.0%	0.00	0.00	0.00	800	5.00%	0
1994	420	50.0%	210.00	210.00	126.00	800	5.00%	50,400
1995	420	100.0%	420.00	210.00	126.00	800	5.00%	50,400
1996	420	100.0%	420.00	0.00	0.00	600	10.00%	0
1997	472	100.0%	472.00	52.00	31.20	600	10.00%	18,720
1998	524	100.0%	524.00	52.00	31.20	600	10.00%	18,720
1999	576	100.0%	576.00	52.00	31.20	600	10.00%	18,720
2000	628	100.0%	628.00	52.00	31.20	600	10.00%	18,720
TOTAL INCREASE IN LAND VALUE								175,680

TABLE 8.4.26 CONVERSION OF FINANCIAL PROJECT COSTS TO ECONOMIC COSTS
(GROUNDWATER ONLY)

COMPONENTS	TOTAL COST	1992		1993		1994		1995		1996					
		FOREX P	LOCAL P	FOREX P	LOCAL P	FOREX P	LOCAL P	FOREX P	LOCAL P	FOREX P	LOCAL P				
1. Materials	61,899	0	0	8,384	14,616	23,000	8,780	14,465	23,246	4,198	5,242	9,440	2,789	3,424	6,214
2. Labor															
Skilled Labor	11,351	0	0	0	2,959	2,959	0	3,752	3,752	0	2,808	2,808	0	1,833	1,833
Unskilled Labor	6,150	0	0	0	2,028	2,028	0	2,189	2,189	0	1,183	1,183	0	749	749
3. Equipment	92,097	0	0	19,233	6,052	25,285	21,869	7,913	29,782	15,699	6,937	22,636	9,798	4,595	14,394
4. Land Acquisition	2,750	0	2,750	0	0	2,750	0	0	0	0	0	0	0	0	0
5. Eng'g Serv. (D/D)	19,522	2,496	8,321	10,817	624	2,080	2,704	0	0	0	0	0	0	0	0
6. Eng'g Serv. (C/S)	6,825	0	0	885	1,358	2,242	522	1,740	2,262	326	1,086	1,412	210	699	909
7. Physical Contingency	20,074	250	1,107	1,357	2,913	6,025	3,117	3,225	6,342	2,022	1,844	3,866	1,280	1,205	2,485
ECONOMIC PROJECT COST	214,667	2,746	12,178	14,924	32,039	32,205	34,289	33,284	67,573	22,245	19,098	41,344	14,077	12,505	26,583

TABLE 8.4.27 ECONOMIC REPLACEMENT COST (Groundwater only)

(Unit: P1000)

COMPONENTS	2008			2009			2010			2011		
	FOREX P	LOCAL P	TOTAL COST	FOREX P	LOCAL P	TOTAL COST	FOREX P	LOCAL P	TOTAL COST	FOREX P	LOCAL P	TOTAL COST
<<ECONOMIC COST>>												
Rehab. of Existing Wells *	0	0	0	0	0	0	0	0	0	0	0	0
New Wells Construction	5,457	2,120	835	2,958	1,731	769	2,500	0	0	0	0	0
Surface Water Facilities	69,685	11,044	4,580	15,624	15,764	6,828	22,592	12,559	6,659	19,219	7,839	4,411
Total	75,142	13,164	5,418	18,581	17,495	7,597	25,092	12,559	6,659	19,219	7,839	4,411

* Costs for Rehab. of Existing Wells are counted as O & M Cost

TABLE 8.4.28 ECONOMIC OPERATION AND MAINTENANCE COST (GROUNDWATER ONLY)

YEAR	DE-ESCALATED FINANCIAL O & M COST			CONVERTED ECONOMIC O & M COST			TOTAL ECONOMIC O & M COST (P1000)
	SALARIES (L) (P1000)	ELEC'Y (F) (P1000)	CHEMICALS (F) (P1000)	MAINT. (F&L) (P1000)	SALARIES (L) (P1000)	ELEC'Y (F) (P1000)	
1992	0	0	0	0	0	0	0
1993	68	0	0	0	48	0	48
1994	140	854	4	536	100	1,025	576
1995	168	1,089	9	1,023	120	1,307	1,100
1996	200	1,975	16	1,295	143	2,370	1,392
1997	200	2,859	23	1,470	143	3,431	1,580
1998	200	3,745	31	1,470	143	4,494	1,580
1999	200	4,480	37	1,470	143	5,376	1,580
2000	200	4,480	37	1,470	143	5,376	1,580
2001	200	4,480	37	1,470	143	5,376	1,580
2002	200	4,480	37	1,470	143	5,376	1,580
2003	200	4,480	37	1,470	143	5,376	1,580
2004	200	4,480	37	6,308	143	5,376	6,781
2005	200	4,480	37	1,470	143	5,376	1,580
2006	200	4,480	37	1,470	143	5,376	1,580
2007	200	4,480	37	1,470	143	5,376	1,580
2008	200	4,480	37	1,470	143	5,376	1,580
2009	200	4,480	37	1,470	143	5,376	1,580
2010	200	4,480	37	1,470	143	5,376	1,580
2011	200	4,480	37	1,470	143	5,376	1,580
2012	200	4,480	37	1,470	143	5,376	1,580
2013	200	4,480	37	6,308	143	5,376	6,781
2014	200	4,480	37	1,470	143	5,376	1,580
	(do)	(do)	(do)	(do)	(do)	(do)	(do)
2021	200	4,480	37	1,470	143	5,376	1,580
TOTAL	5,576	113,562	934	49,272	3,973	136,274	1,121
							52,968
							194,336

TABLE 8.4.29 SUMMARY OF ECONOMIC COST
(GROUNDWATER ONLY)

YEAR	ECONOMIC PROJECT COST (P1000)	ECONOMIC REPLACEMENT COST (P1000)	ECONOMIC O & M COST (P1000)	TOTAL ECONOMIC COST (P1000)
1992	14,924	0	48	14,972
1993	64,244	0	1,706	65,950
1994	67,573	0	2,538	70,111
1995	41,344	0	3,924	45,268
1996	26,583	0	5,181	31,764
1997	0	0	6,254	6,254
1998	0	0	7,143	7,143
1999	0	0	7,143	7,143
2000	0	0	7,143	7,143
2001	0	0	7,143	7,143
2002	0	0	12,344	12,344
2003	0	0	7,143	7,143
2004	0	0	7,143	7,143
2005	0	0	7,143	7,143
2006	0	0	7,143	7,143
2007	0	0	7,143	7,143
2008	0	18,581	7,143	25,724
2009	0	25,092	7,143	32,235
2010	0	19,219	7,143	26,362
2011	0	12,250	7,143	19,393
2012	0	0	12,344	12,344
2013	0	0	7,143	7,143
2014	0	0	7,143	7,143
2015	0	0	7,143	7,143
2016	0	0	7,143	7,143
2017	0	0	7,143	7,143
2018	0	0	7,143	7,143
2019	0	0	7,143	7,143
2020	0	0	7,143	7,143
2021	0	0	7,143	7,143
	214,668	75,142	201,479	491,289

TABLE 8.4.30 ECONOMIC INTERNAL RATE OF RETURN
(GROUNDWATER ONLY)

YEAR	ECONOMIC BENEFITS					TOTAL ECONOMIC BENEFITS (P1,000)	TOTAL ECONOMIC COSTS (P1,000)	ECONOMIC NET BENEFITS (1000P)
	WATER REVENUE (P1,000)	HEALTH BENEFITS (P1,000)	FIRE PROTECTION (P1,000)	LAND VALUE INCREASE (P1,000)				
1992	0	0	0	0	0	0	14,972	(14,972)
1993	3,591	0	0	0	3,591	3,591	65,950	(62,359)
1994	6,687	25	485	50,400	57,597	57,597	70,111	(12,513)
1995	10,046	51	1,010	50,400	61,507	61,507	45,268	16,240
1996	13,140	89	1,760	0	14,989	14,989	31,764	(16,775)
1997	16,229	124	2,460	18,720	37,533	37,533	6,254	31,280
1998	19,322	158	3,129	18,720	41,329	41,329	7,143	34,186
1999	21,889	184	3,654	18,720	44,447	44,447	7,143	37,304
2000	21,889	184	3,654	18,720	44,447	44,447	7,143	37,304
2001	22,387	184	3,654	0	26,225	26,225	7,143	19,082
2002	22,885	184	3,654	0	26,723	26,723	12,344	14,379
2003	23,383	184	3,654	0	27,221	27,221	7,143	20,078
2004	23,882	184	3,654	0	27,719	27,719	7,143	20,577
2005	24,380	184	3,654	0	28,218	28,218	7,143	21,075
2006	24,380	184	3,654	0	28,218	28,218	7,143	21,075
2007	24,380	184	3,654	0	28,218	28,218	7,143	21,075
2008	24,380	184	3,654	0	28,218	28,218	25,724	2,494
2009	24,380	184	3,654	0	28,218	28,218	32,235	(4,017)
2010	24,380	184	3,654	0	28,218	28,218	26,362	1,856
2011	24,380	184	3,654	0	28,218	28,218	19,393	8,825
2012	24,380	184	3,654	0	28,218	28,218	12,344	15,874
2013	24,380	184	3,654	0	28,218	28,218	7,143	21,075
2014	24,380	184	3,654	0	28,218	28,218	7,143	21,075
2015	24,380	184	3,654	0	28,218	28,218	7,143	21,075
2016	24,380	184	3,654	0	28,218	28,218	7,143	21,075
2017	24,380	184	3,654	0	28,218	28,218	7,143	21,075
2018	24,380	184	3,654	0	28,218	28,218	7,143	21,075
2019	24,380	184	3,654	0	28,218	28,218	7,143	21,075
2020	24,380	184	3,654	0	28,218	28,218	7,143	21,075
2021	24,380	184	3,654	0	28,218	28,218	7,143	21,075
NPV at 15.00%								11,207
EIRR								17.20%

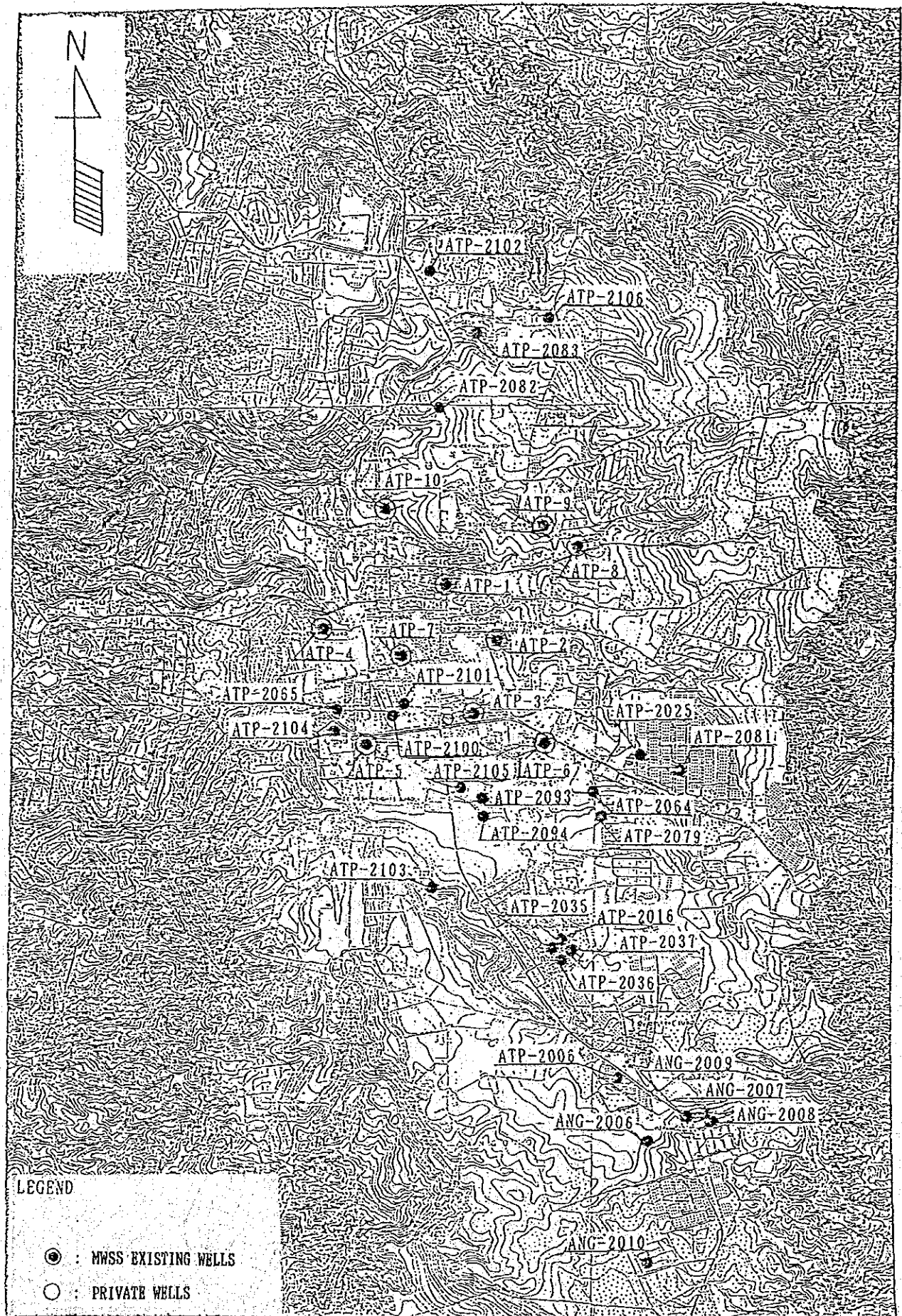


FIGURE 8.2.1 LOCATION MAP OF MWSS EXISTING WELLS AND PRIVATE WELLS IN ANTIPOLO AREA

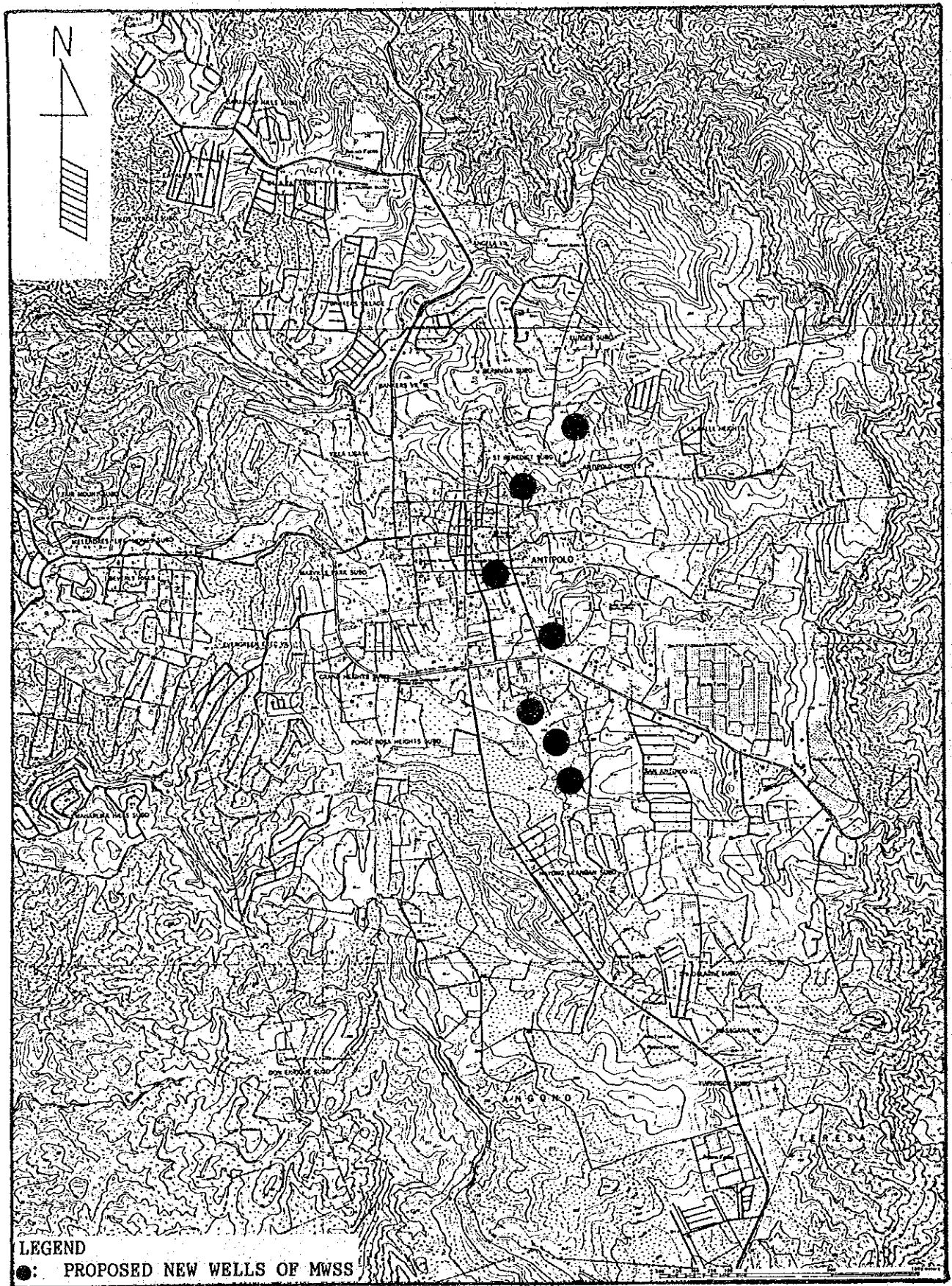
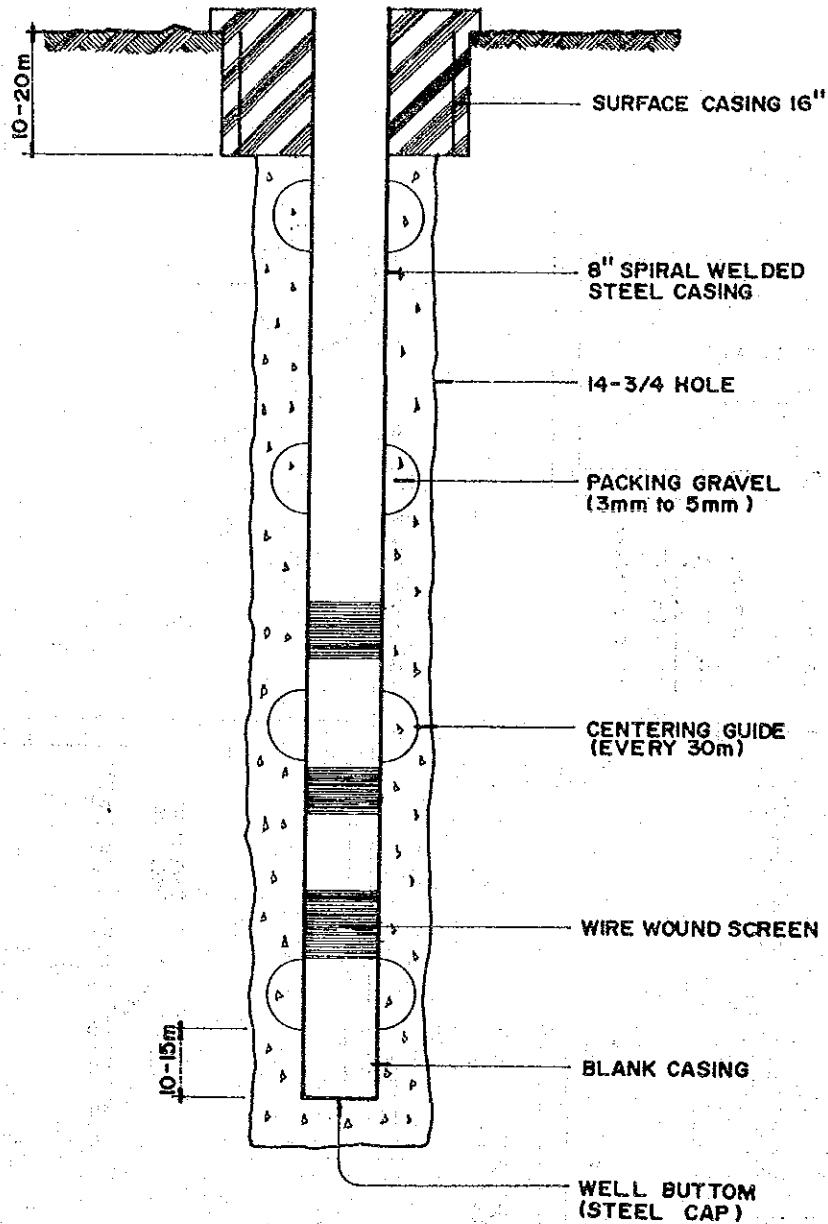


FIGURE 8.2.2 LOCATION MAP OF PLANNED NEW WELLS



RECOMMENDED WELL DEPTH: THICKNESS OF AQUIFER LAYER + (20m
 SCREEN LENGTH: LESS THAN 20% OF WELL DEPTH
 DISCHARGE - DRAWDOWN RELATIONSHIP/WELL: 800m / DAY IN DRAWDOWN OF 21m

FIGURE 8.2.3 STANDARD WELL DESIGN

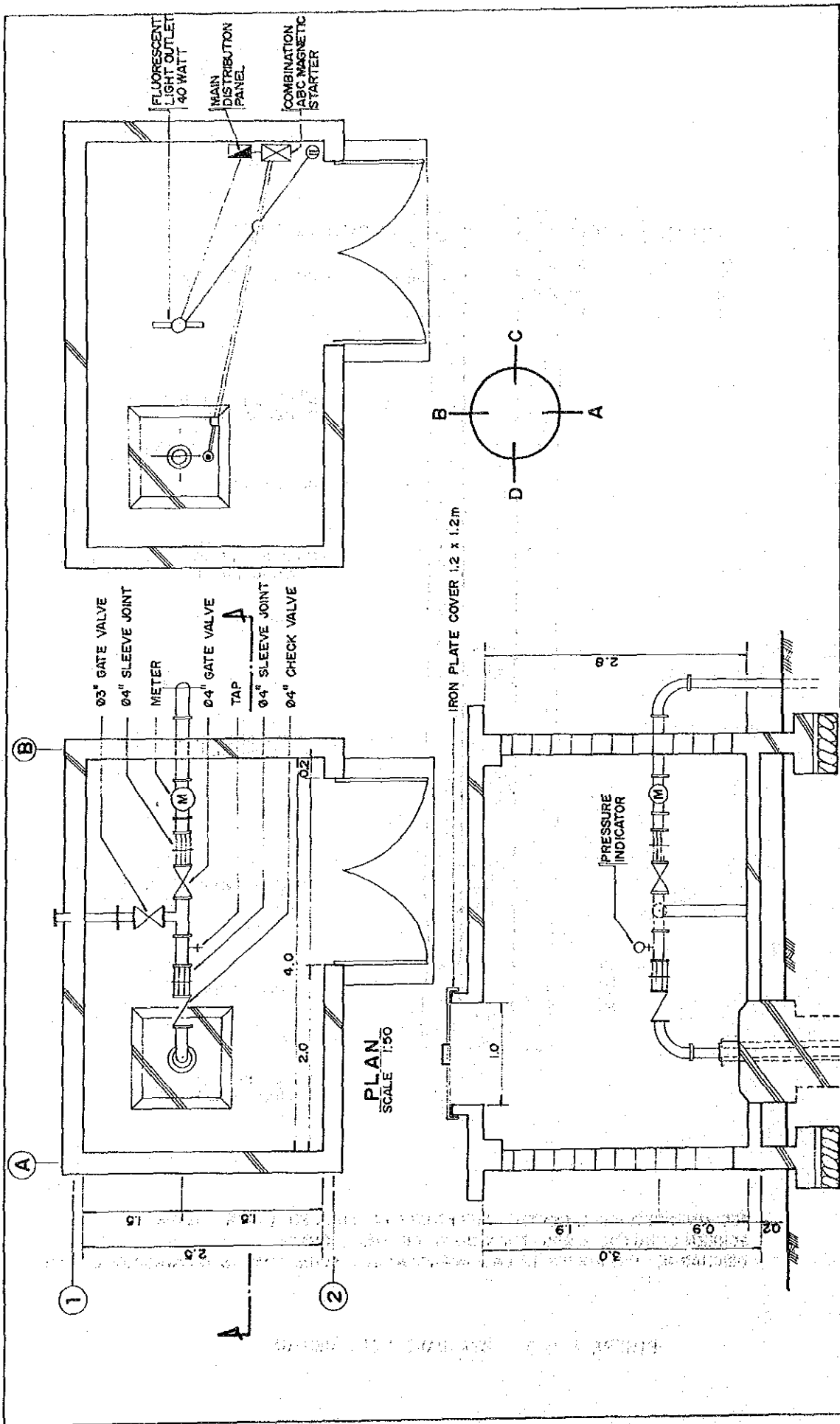
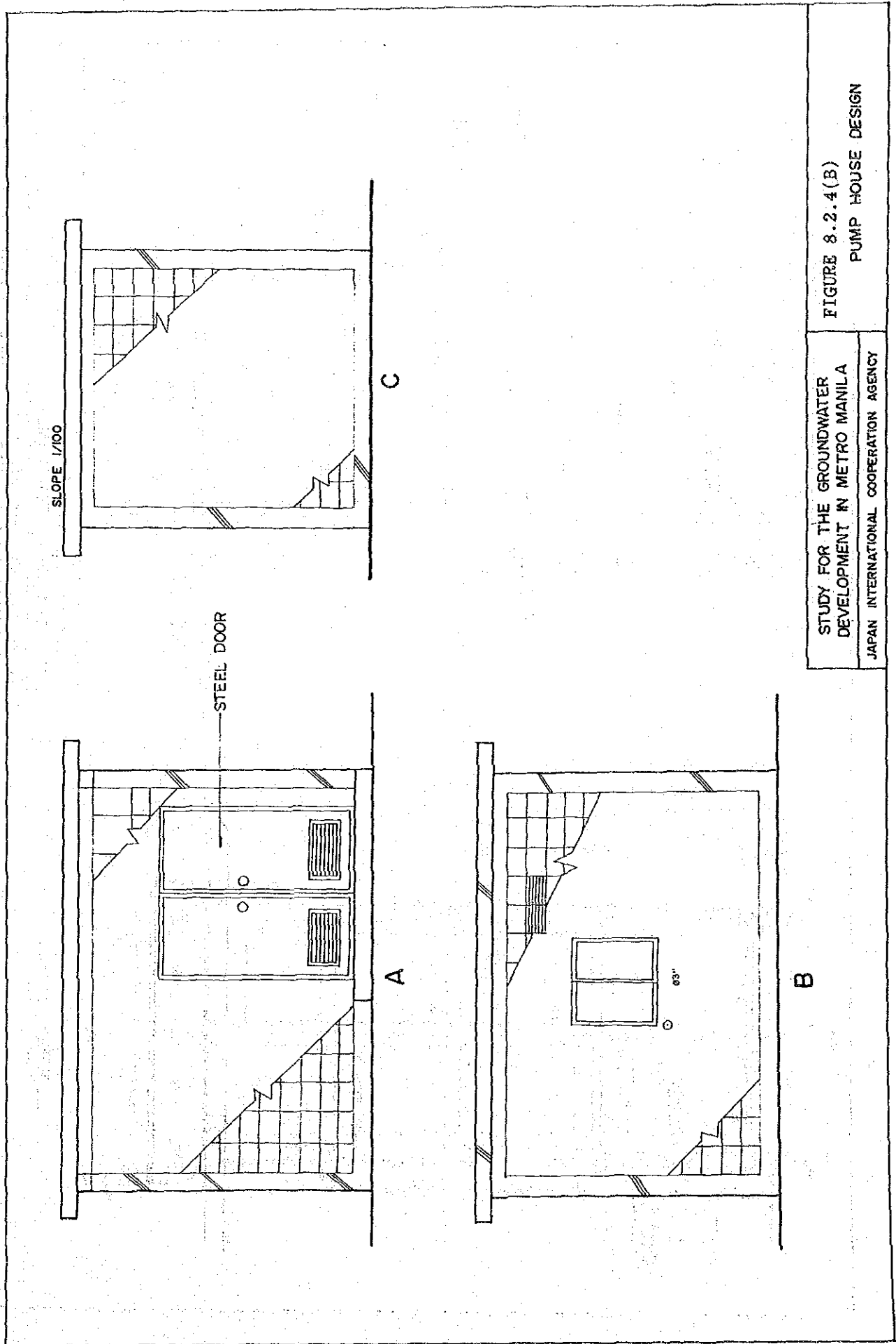


FIGURE 8.2.4(A)
 PUMP HOUSE DESIGN

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 DEVELOPMENT IN METRO MANILA
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FIGURE 8.2.4(B)
 PUMP HOUSE DESIGN

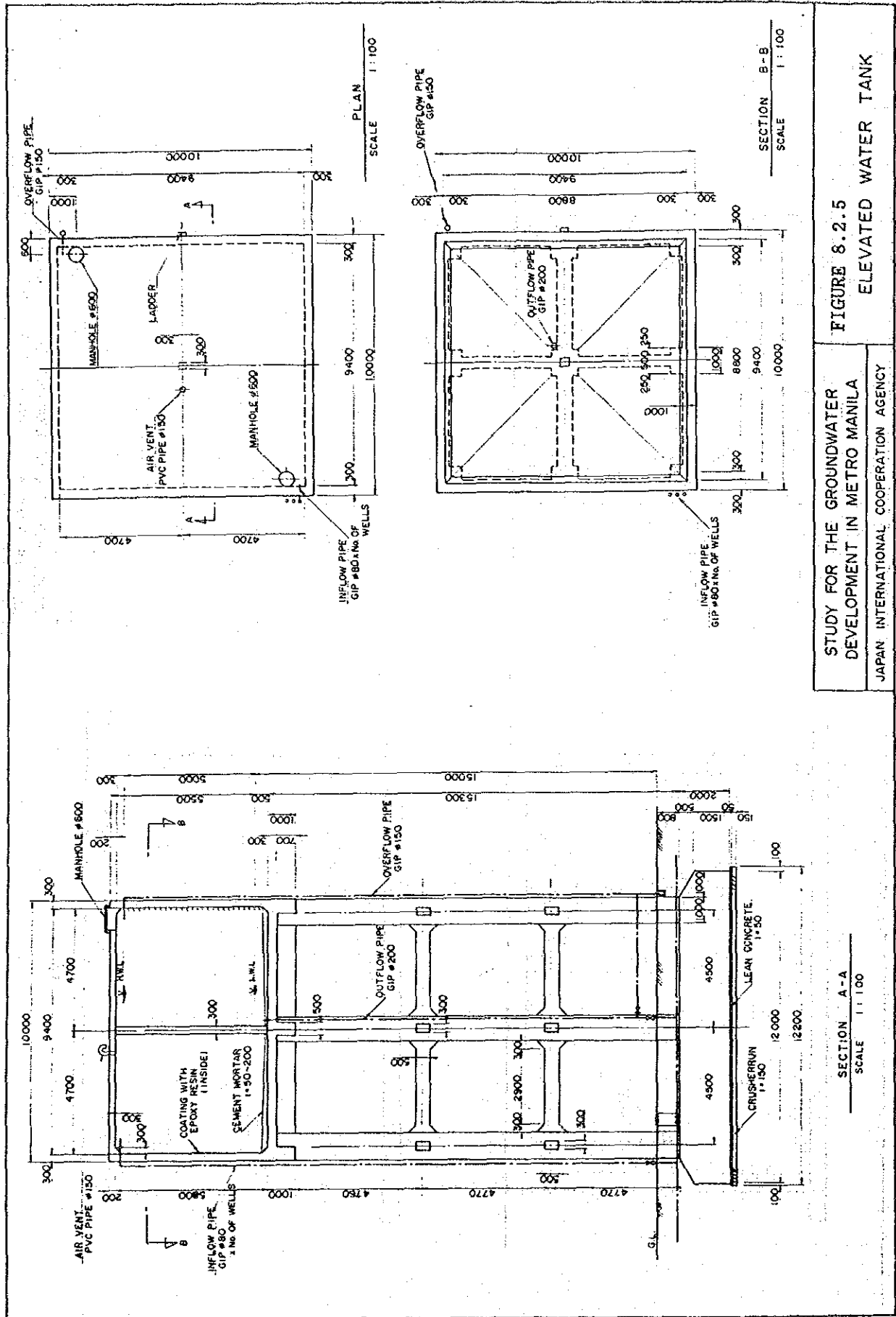


FIGURE 8.2.6 IMPLEMENTATION SCHEDULE FOR FUTURE PROJECT

Items	1 Year							2 Year						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
1. Preparation														
1) Recheck of Project Plan		[] (review of Project)												
2) Arrangement for Land Use		[]												
3) Preparation for Bidding		[]	[] (tender document, bidding, advertisement, etc.)											
2. Bidding			[] (bidding, evaluation)											
3. Contract			[] (award, signing)											
4. Construction Work (well drilling, pumping station)				[] (No.1)	[] (No.2)	[] (No.3)	[] (No.4)	[] (No.5)	[] (No.6)	[] (No.7)				

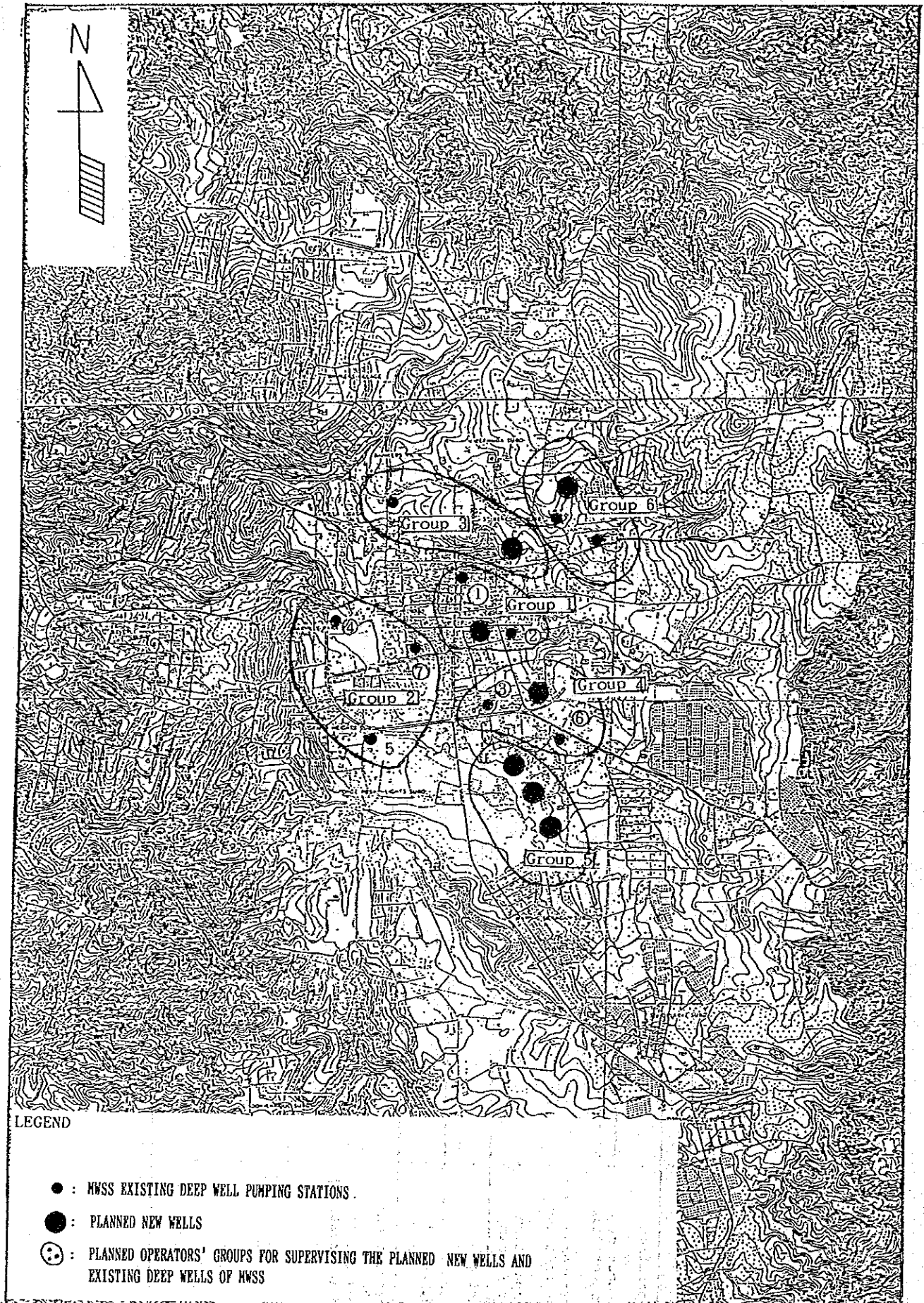


FIGURE 8.2.7 GROUPING OF OPERATORS FOR SUPERVISING THE PLANNED NEW WELLS

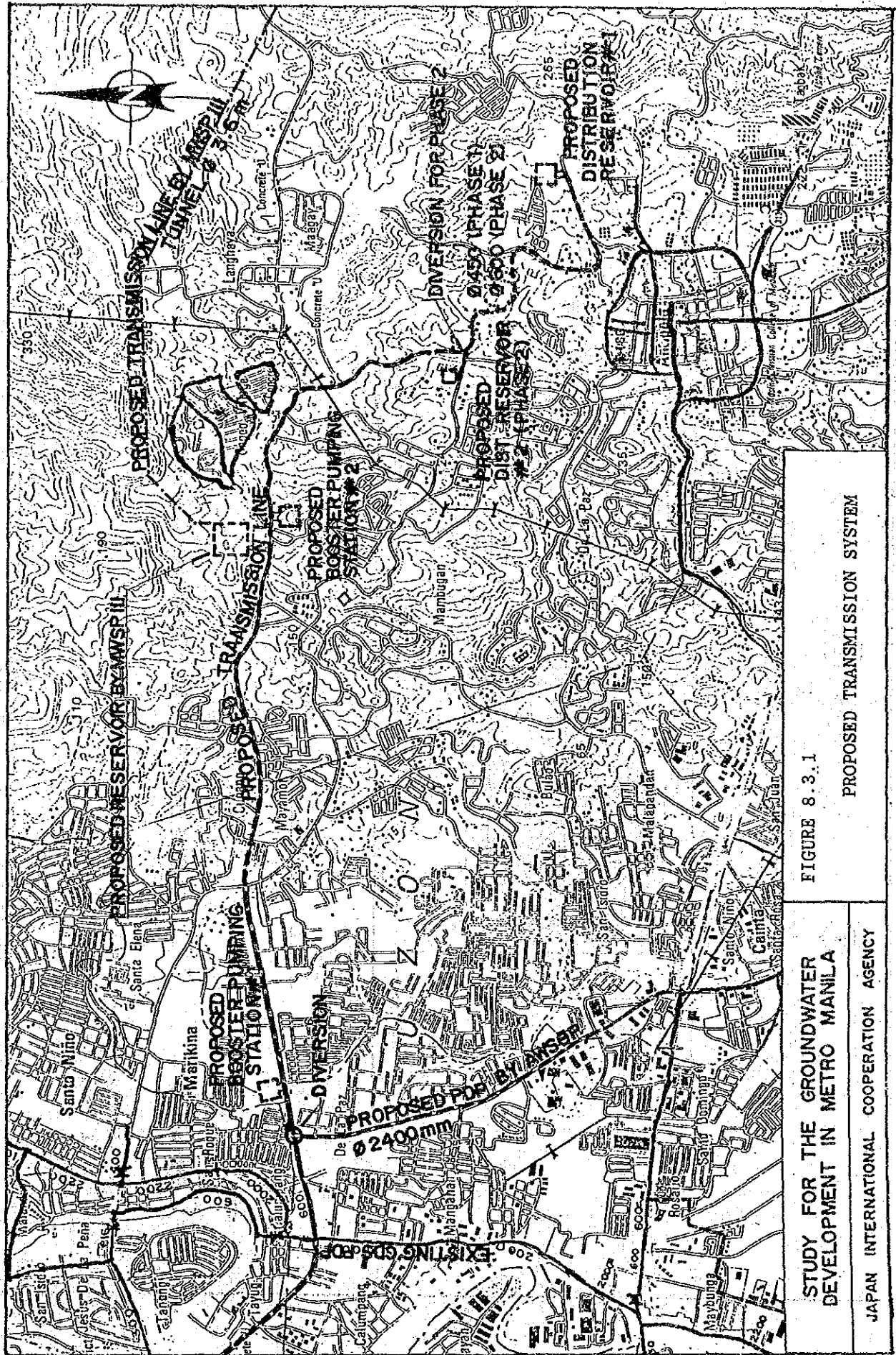


FIGURE 8.3.1

PROPOSED TRANSMISSION SYSTEM

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JAPAN INTERNATIONAL COOPERATION AGENCY

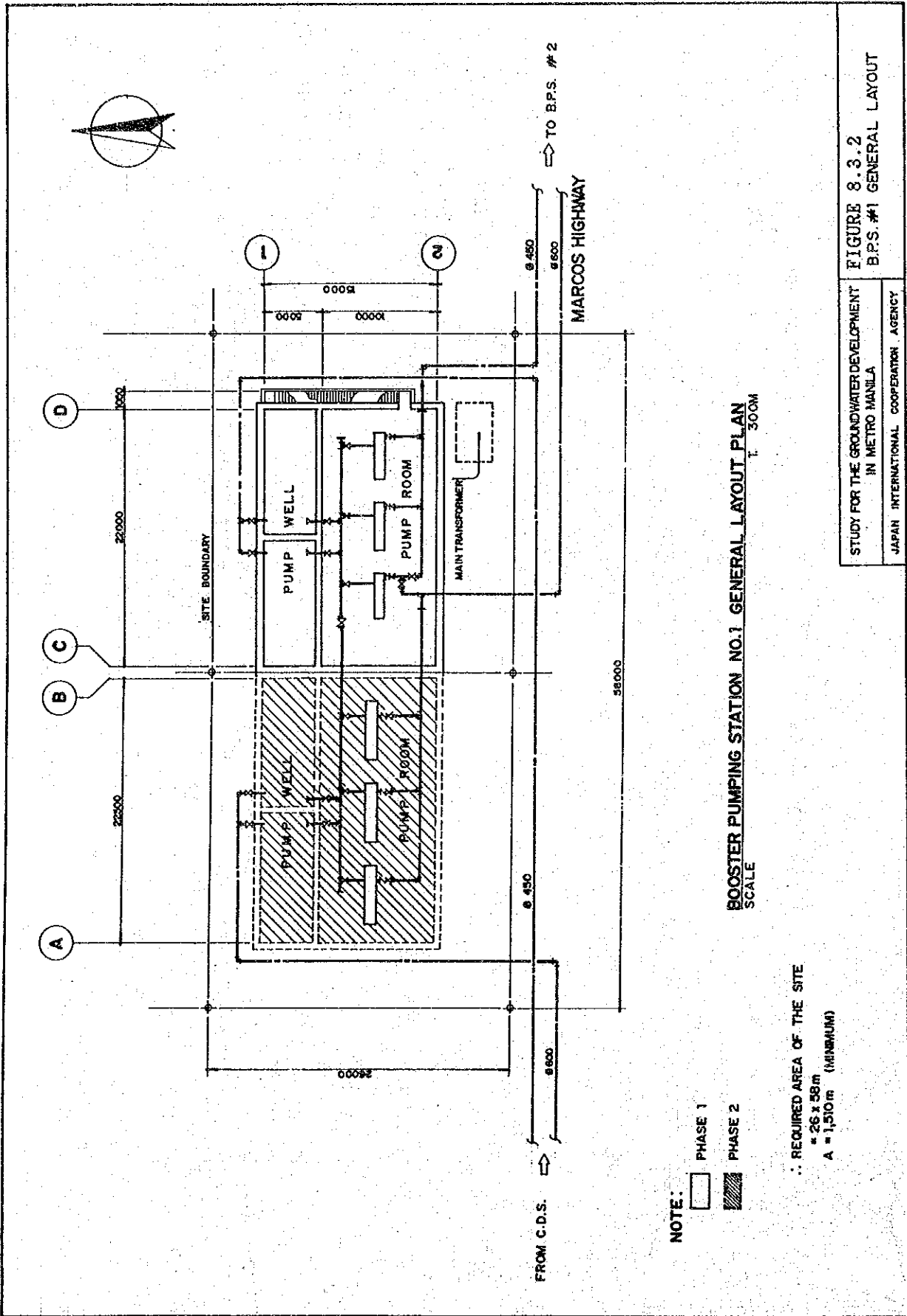
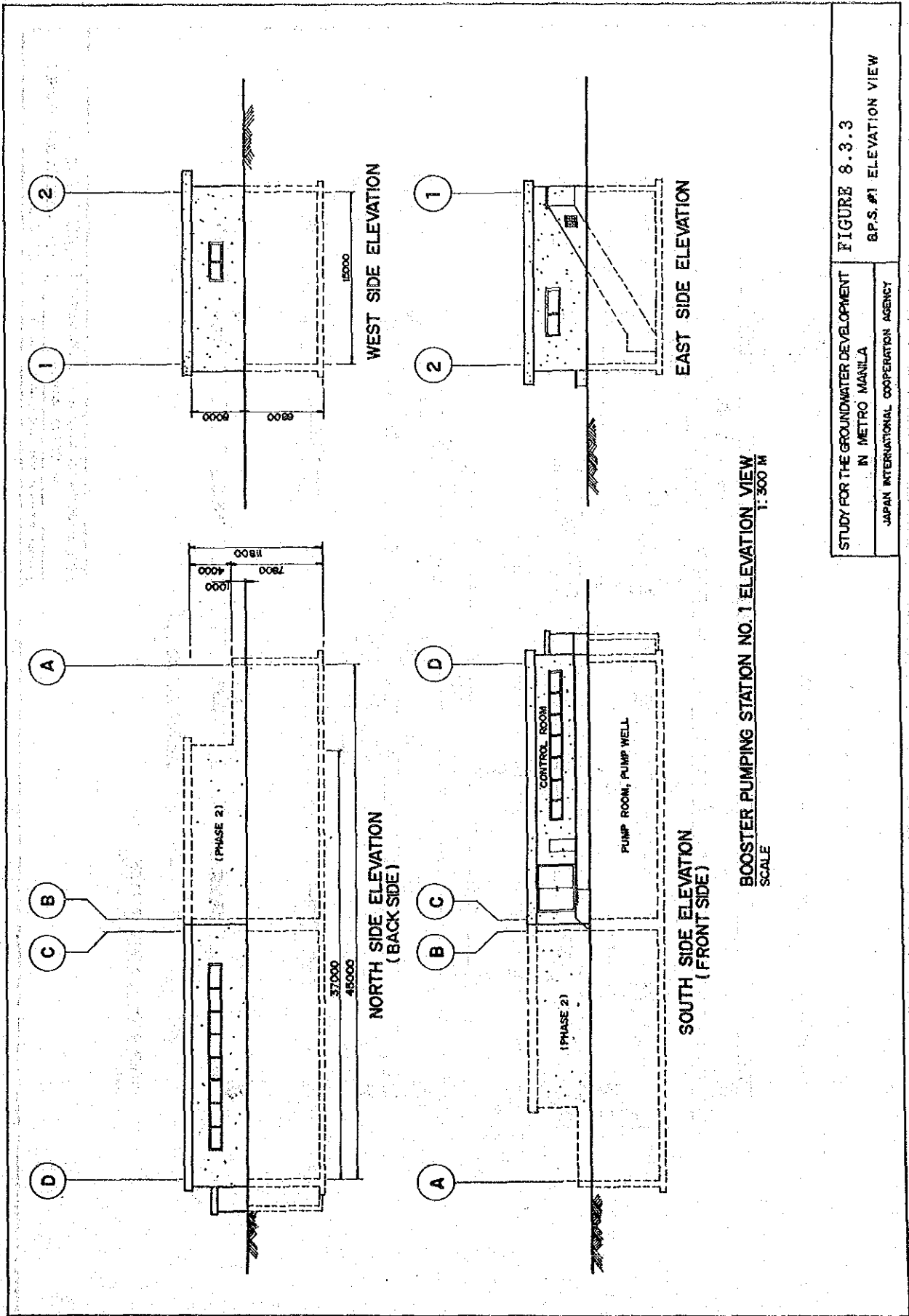


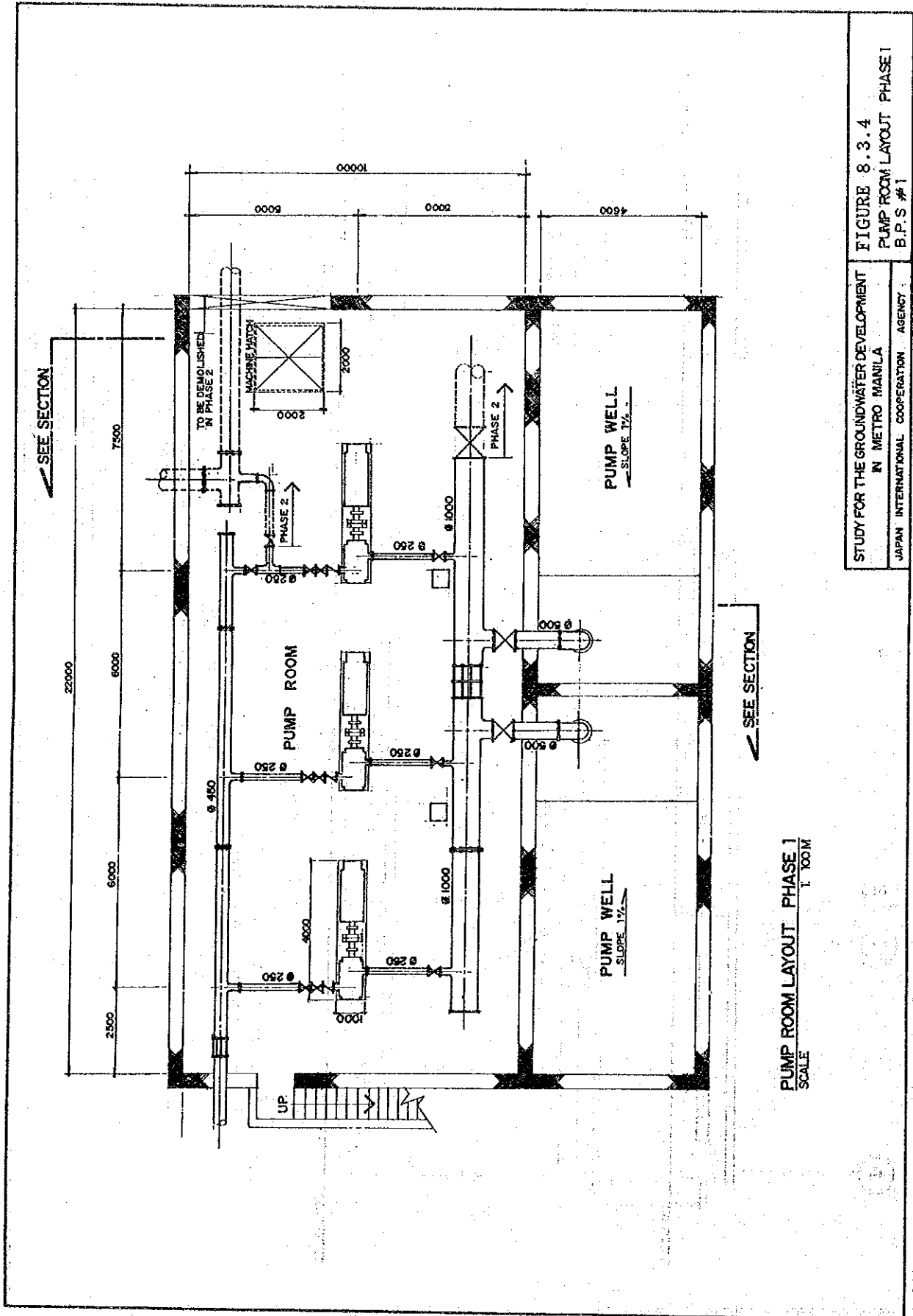
FIGURE 8.3.2
 B.P.S. #1 GENERAL LAYOUT

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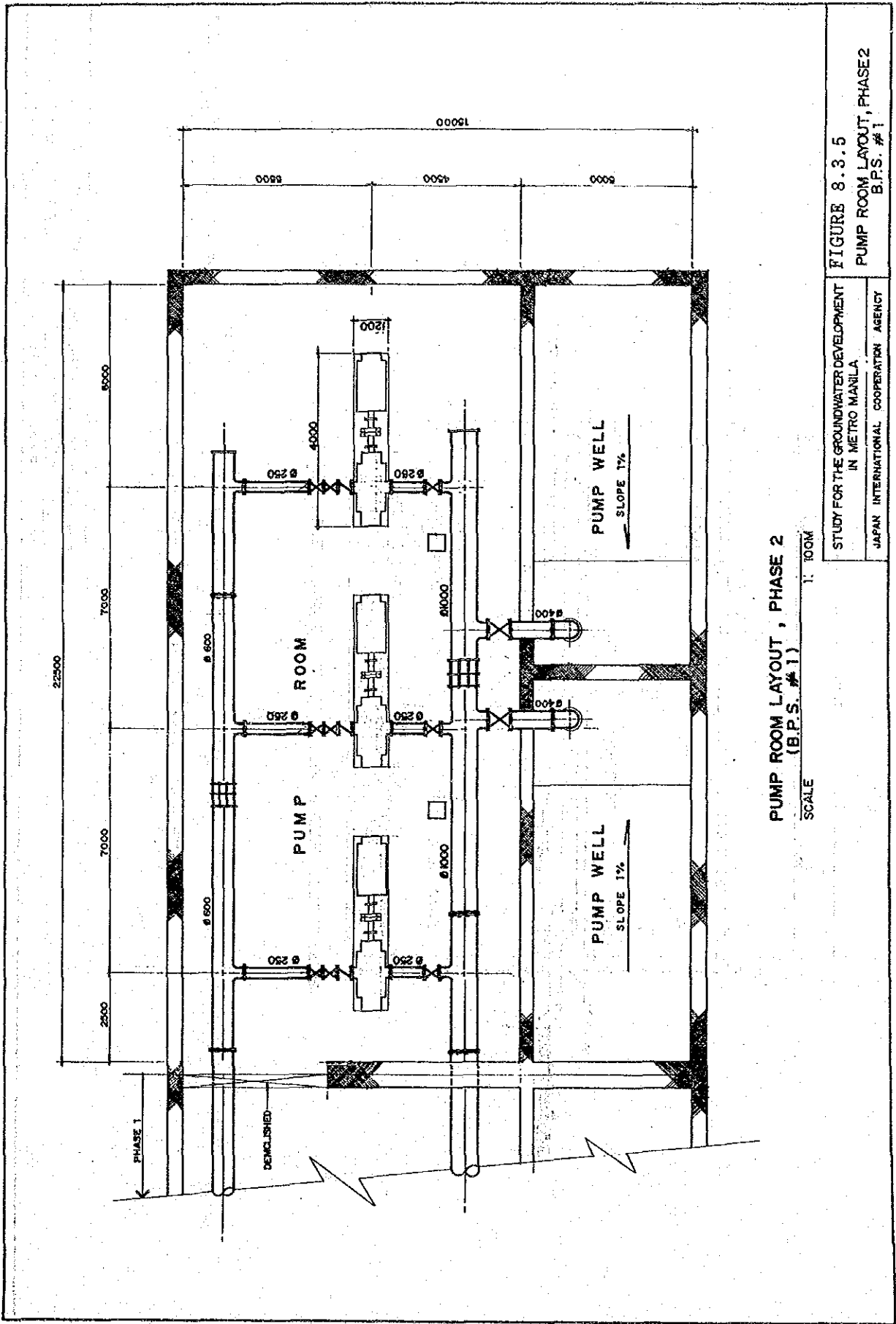
FIGURE 8.3.3
B.P.S. #1 ELEVATION VIEW

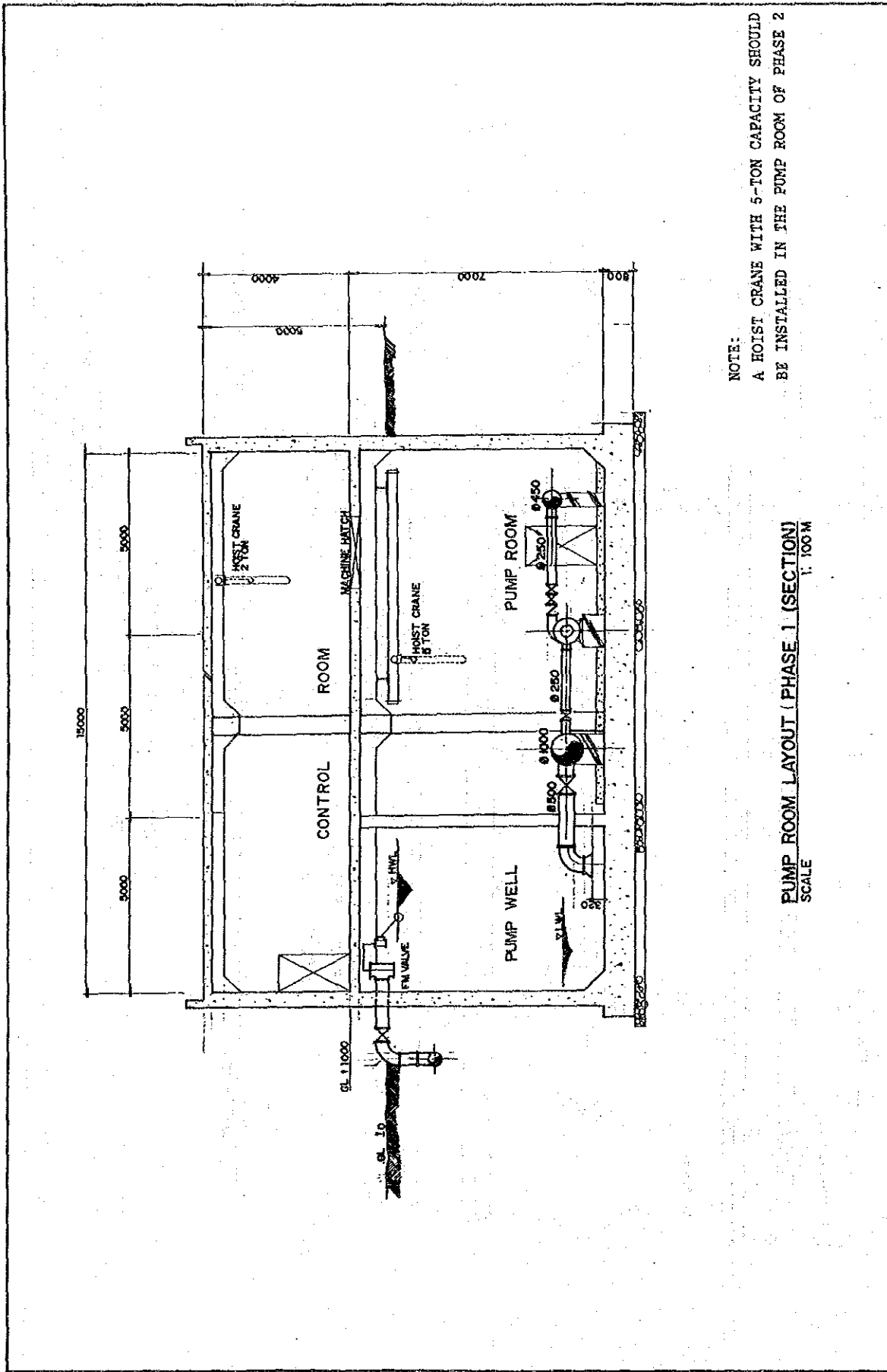


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FIGURE 8.3.4
PUMP ROOM LAYOUT PHASE 1
 B.P.S. #1

PUMP ROOM LAYOUT PHASE 1
 SCALE 1:100M

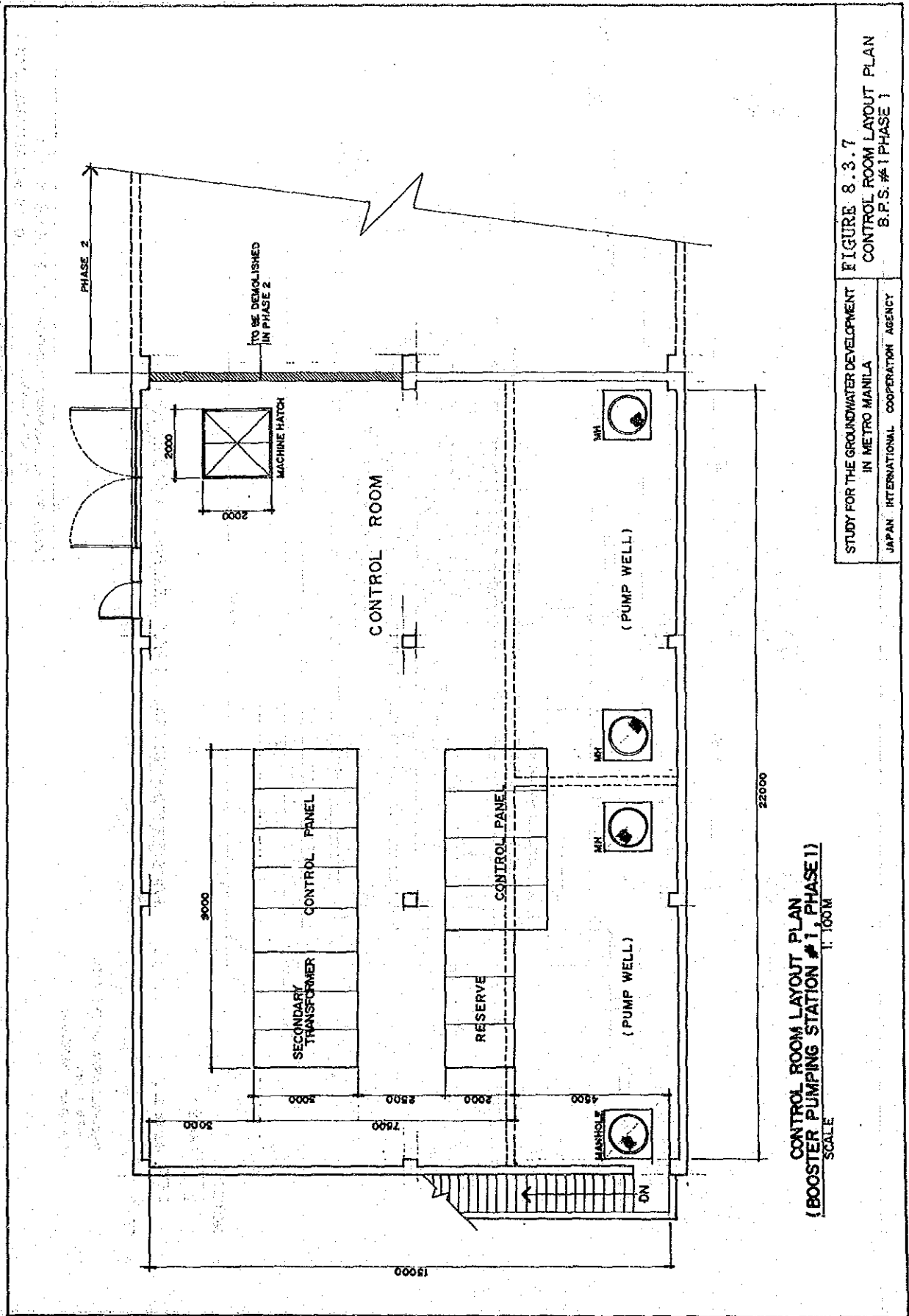




NOTE:
 A HOIST CRANE WITH 5-TON CAPACITY SHOULD
 BE INSTALLED IN THE PUMP ROOM OF PHASE 2

PUMP ROOM LAYOUT (PHASE 1 (SECTION))
 SCALE 1:100M

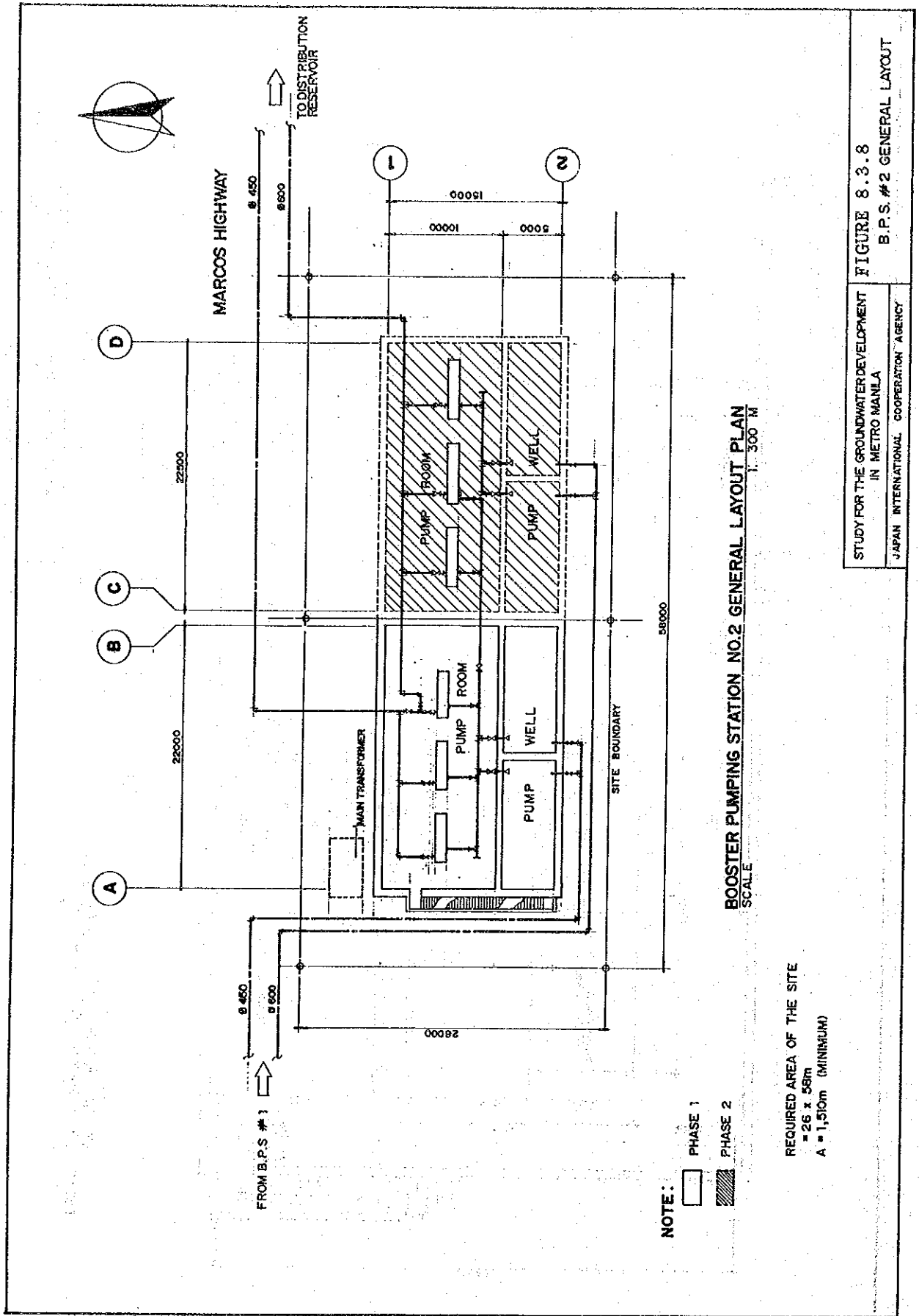
STUDY FOR THE GROUNDWATER DEVELOPMENT IN METRO MANILA	FIGURE 8.3.6 PUMP ROOM LAYOUT (SECTION) PHASE 1
JAPAN INTERNATIONAL COOPERATION AGENCY	



**CONTROL ROOM LAYOUT PLAN
(BOOSTER PUMPING STATION #1, PHASE I)**
SCALE 1:100M

STUDY FOR THE GROUNDWATER DEVELOPMENT
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**FIGURE 8.3.7
CONTROL ROOM LAYOUT PLAN
S.P.S. #1 PHASE 1**

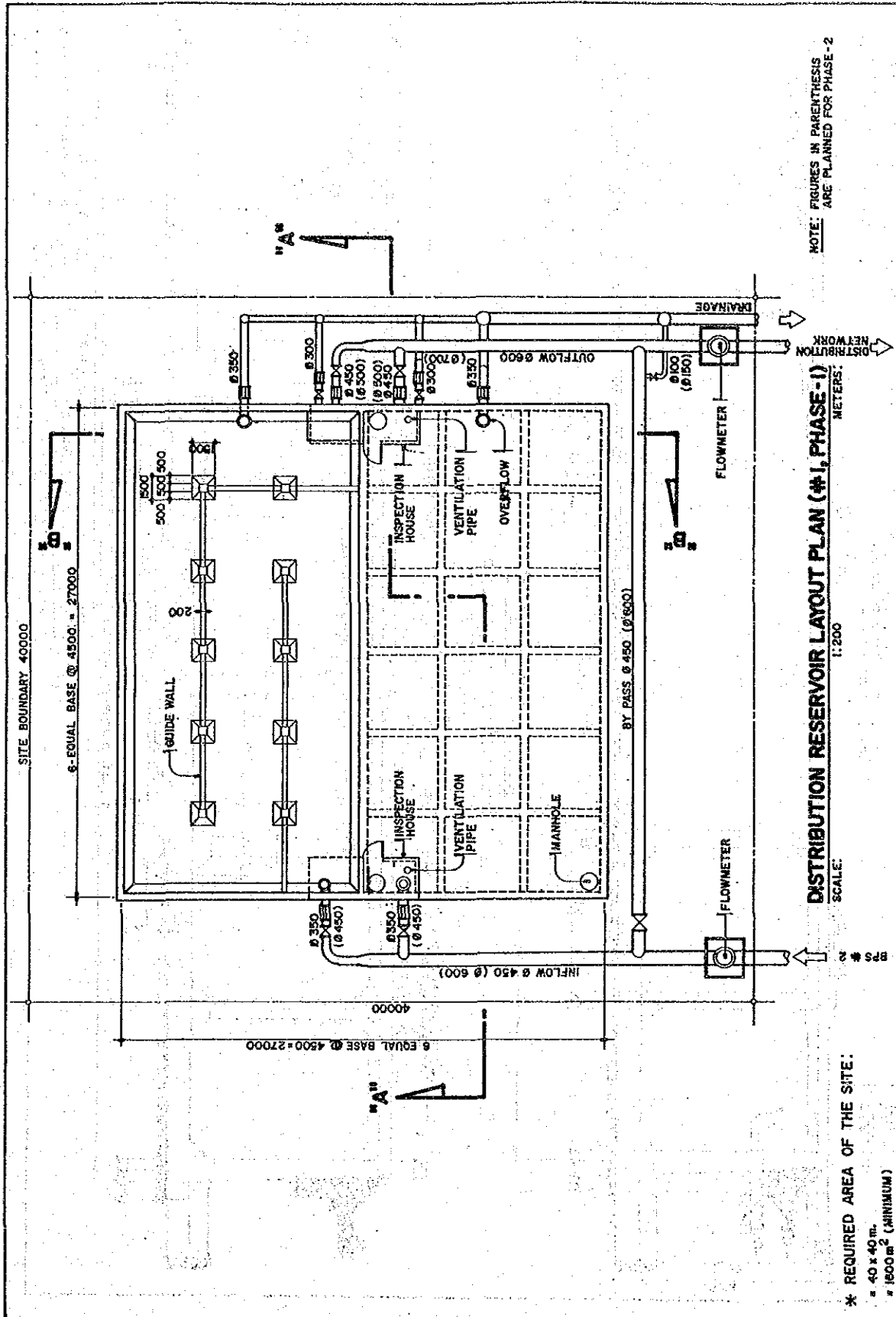


BOOSTER PUMPING STATION NO. 2 GENERAL LAYOUT PLAN
 SCALE 1:300 M

NOTE:
 [Hatched Box] PHASE 1
 [Unhatched Box] PHASE 2

REQUIRED AREA OF THE SITE
 = 26 x 58m
 A = 1,508m (MINIMUM)

FIGURE 8.3.8
B.P.S. # 2 GENERAL LAYOUT
 STUDY FOR THE GROUNDWATER DEVELOPMENT
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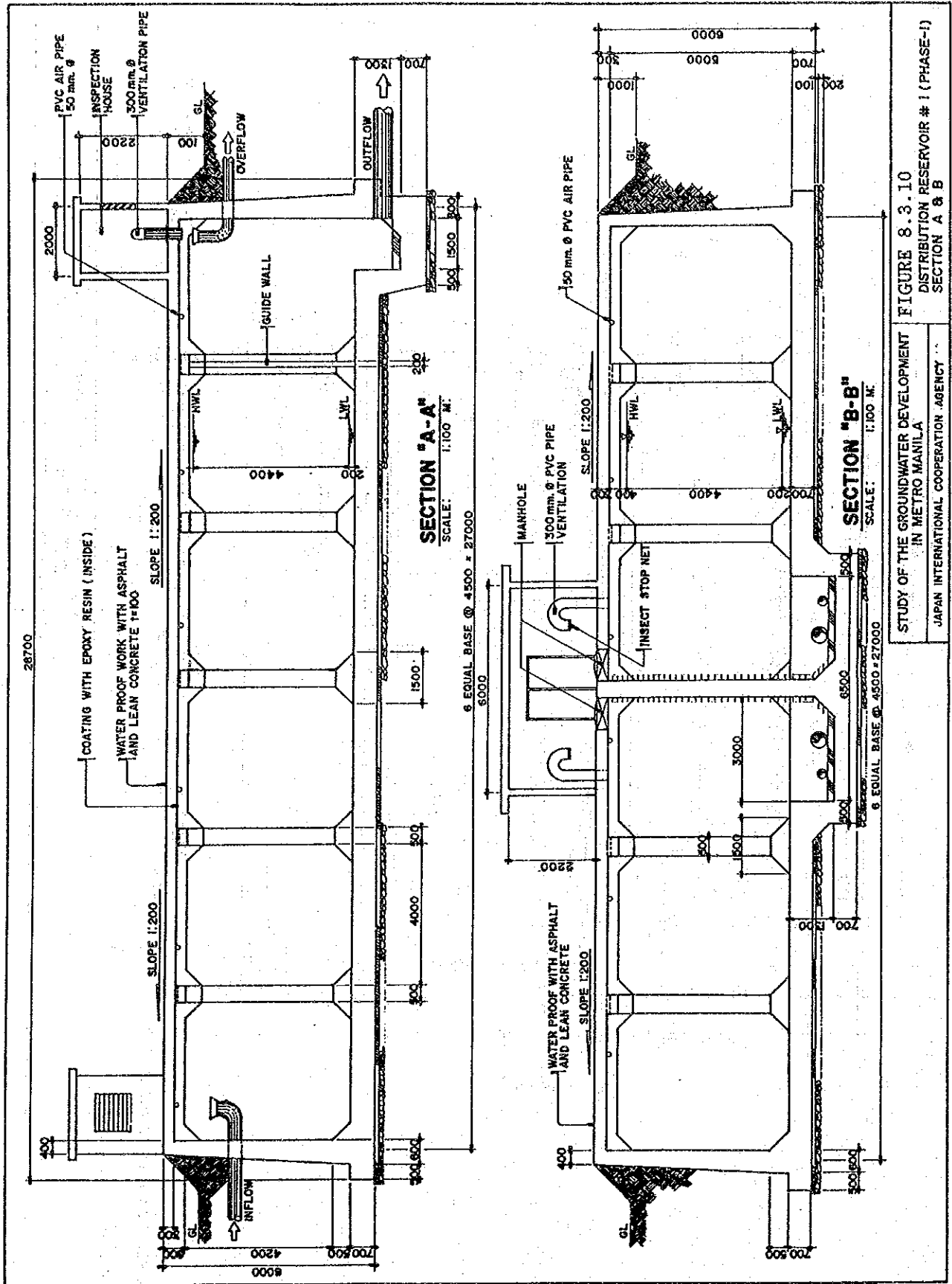
NOTE: FIGURES IN PARENTHESIS ARE PLANNED FOR PHASE - 2

DISTRIBUTION RESERVOIR LAYOUT PLAN (#1, PHASE - 1)
SCALE: 1:200 METERS

* REQUIRED AREA OF THE SITE:
= 40 x 40 m.
= 1600 m² (MINIMUM)

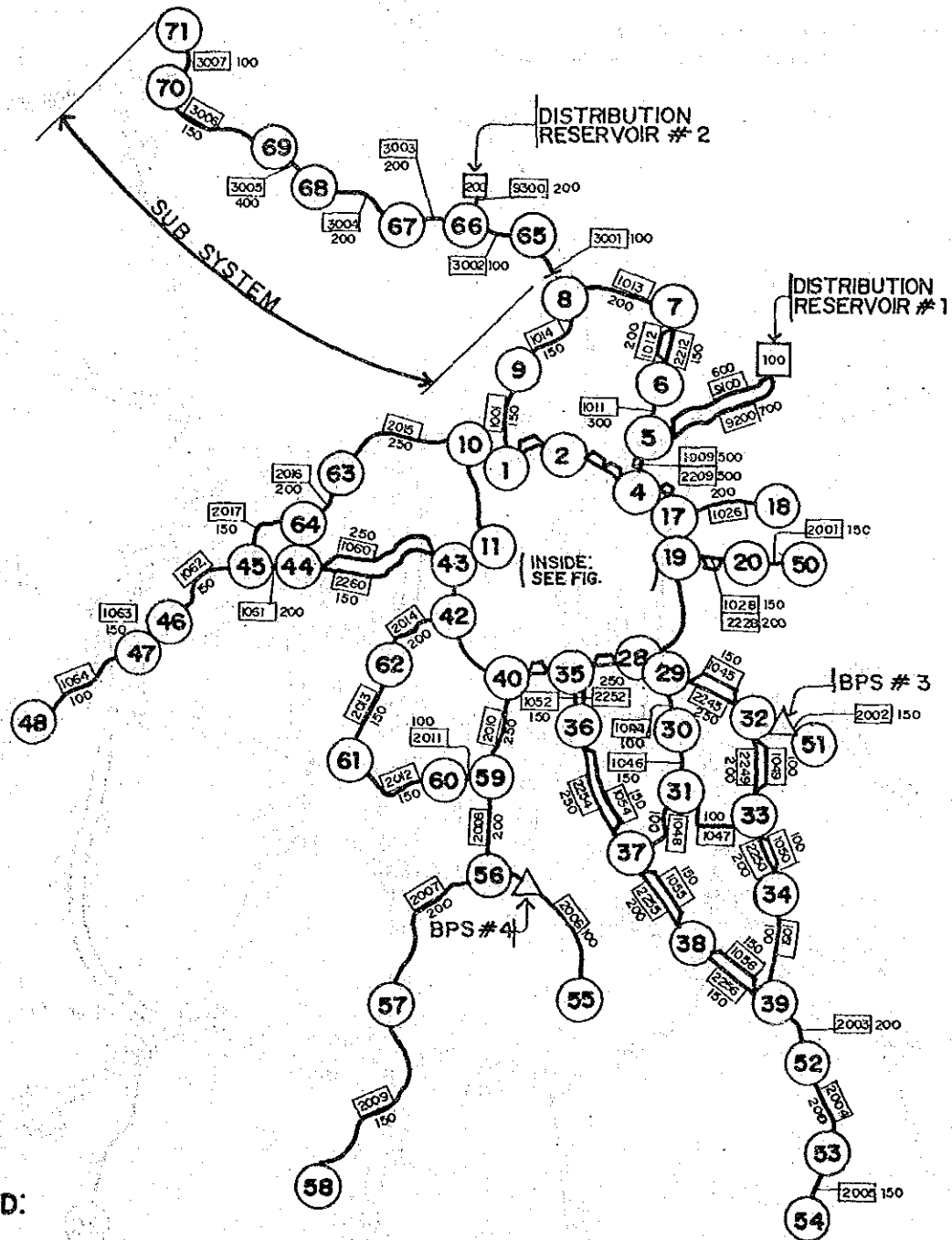
STUDY FOR THE GROUNDWATER DEVELOPMENT IN METRO MANILA
JAPAN INTERNATIONAL COOPERATION AGENCY

FIGURE 8.3.9
DISTRIBUTION RESERVOIR #1 (PHASE-1)
GENERAL LAYOUT



STUDY OF THE GROUNDWATER DEVELOPMENT
IN METRO MANILA
JAPAN INTERNATIONAL COOPERATION AGENCY

FIGURE 8.3.10
DISTRIBUTION RESERVOIR # 1 (PHASE-1)
SECTION A & B



LEGEND:

- PIPE LINE
- ① NODE NO.
- 1011/100 PIPE NO.
DIA. (MM)

NOTE: CONSTRUCTION PHASE

PIPES NO. 9100, 1001-1064 PHASE 1
 NO. 9200, 2201-2260, 2001-2017 } PHASE 2
 9300, 3001-3007

STUDY FOR THE GROUNDWATER DEVELOPMENT
 IN MANILA METRO MANILA
 JAPAN INTERNATIONAL COOPERATION AGENCY

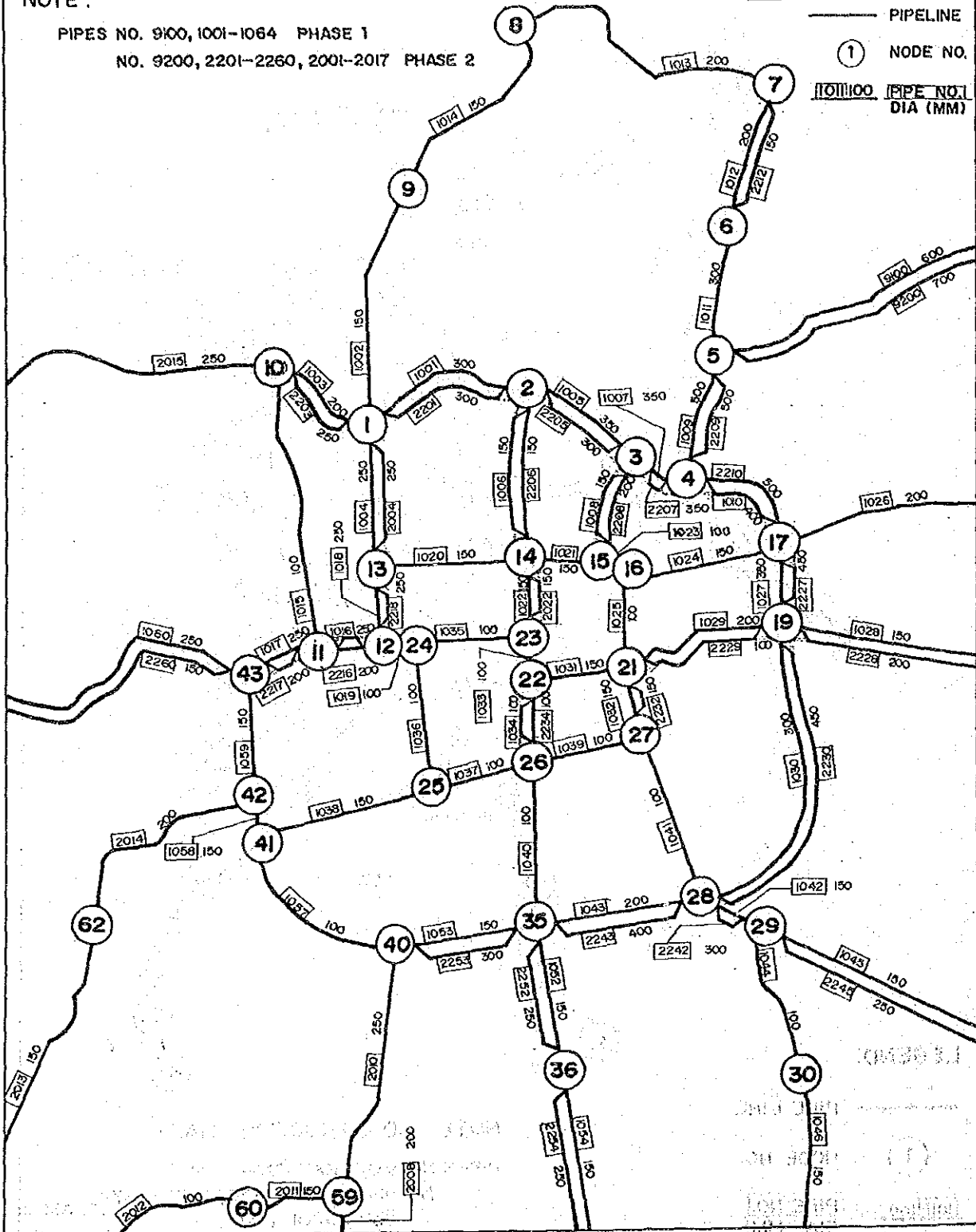
FIGURE 8.3.11
 DISTRIBUTION NETWORK ANALYSIS - 1

NOTE :

PIPES NO. 9100, 1001-1064 PHASE 1
 NO. 9200, 2201-2260, 2001-2017 PHASE 2

LEGEND:

- PIPELINE
- ① NODE NO.
- 1011100 PIPE NO./DIA (MM)



STUDY FOR THE GROUNDWATER DEVELOPMENT
 IN METRO MANILA
 JAPAN INTERNATIONAL COOPERATION AGENCY

FIGURE 8.3.12 DISTRIBUTION NETWORK ANALYSIS-2

FIGURE 8.3.13 IMPLEMENTATION SCHEDULE FOR THE PROJECT (PHASE 1)

ACTIVITIES	Y E A R									
	1992	1993	1994	1995	1996	1997	1998	1999	2000	
GROUNDWATER DEVELOPMENT										
1. REHABILITATION OF WELLS Detailed Eng'g Design Prep'n of Docs. Bid Preparation/Tendering Rehabilitation	**** **	** *****								
2. CONSTRUCTION OF NEW WELLS Detailed Eng'g Design Prep'n of Docs. Bid Preparation/Tendering Right-of-Way Acquisition Construction	**** ** **	***** *****	***** *****	** ***** **	** ** **					
SURFACE WATER DISTRIBUTION										
Feasibility Study Loan Sourcing/Processing Selection of Consultants Detailed Eng'g Design Prep'n of Docs. Bid Preparation/Tendering Right-of-Way Acquisition Construction Transmission Pipeline Booster Pump Stations Distribution Reservoir Distribution Pipelines Replacement of H.S.C. Installation of H.S.C.			***** ***** *	** ***** **						

CHAPTER 9

GROUNDWATER MANAGEMENT PLAN

CHAPTER 9 GROUNDWATER MANAGEMENT PLAN

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CHAPTER 9 GROUNDWATER MANAGEMENT PLAN

9.1 OBJECTIVES OF GROUNDWATER MANAGEMENT

9.1.1 Permissive Yield as a Target

Water level decline, saline water intrusion and land subsidence are negative responses of the natural aquifer system to human activities. They are anathema to the rational utilization of groundwater so that it is necessary for any sound groundwater management system to put up preventive measures for them.

Groundwater management must be forwarded under a pertinent selection of management objective. The objective, in other word, "target" of the management may be represented by "safe yield". The safe yield of a groundwater basin is the yearly amount of water which can be withdrawn from it without producing an undesired result (Todd, 1959).

Determination of safe yield of a groundwater basin requires identification of undesired results. Four factors are generally considered:

- 1) Recharge to the basin
- 2) Economics of pumpage from the basin
- 3) Quality of the groundwater
- 4) Water rights in and near the basin

In this study, however, the term "permissive yield" is used instead of safe yield. The permissive yield is the amount of groundwater which can be allowed to be withdrawn from the basin considering the benefits and risk for the inhabitants who are living there and using groundwater (Water Balance Research Group, 1976). Most importantly, the permissive yield used in this study considers the four factors enumerated above.

9.1.2 Prevention of Saline Water Intrusion

It is considered that even with the combined output of the various ongoing surface water supply projects, water supply in the MSA for a long time, shall still depend on groundwater sources, not only for

municipal use but also for commercial and industrial uses. An objective of groundwater management is to sustain the use of groundwater, with the saline water intrusion in Metro Manila being contained or prevented. Thus, the permissive yield may be determined by giving importance to the quality of groundwater.

According to Todd (1980), methods for controlling intrusion vary widely depending on the source of the saline water, extent of intrusion, local geology, groundwater use, and economic factors. Alternative methods are summarized as follows:

1) Modification of Pumping Pattern

Changing the locations of pumping wells by dispersing them inland and reducing the pumping of existing wells can effect recovery of groundwater levels and establish a seaward hydraulic gradient.

2) Artificial Recharge

Groundwater levels can be raised and maintained by artificial recharge, using surface spreading for unconfined aquifers and recharge wells for confined aquifers. However, this method necessitates development of a supplemental water source.

3) Extraction Barrier

An extraction barrier is created by maintaining a continuous pumping trough with a line of wells adjacent to the sea. Seawater flows inland from the ocean to the trough, while fresh water within the basin flows seaward toward the trough, as shown in Figure 9.1.1. The water pumped is brackish and normally is discharged into the sea.

4) Injection Barrier

This method maintains a pressure ridge along the coast by a line of recharge wells. Injected fresh water flows both seaward and landward, as indicated in Figure 9.1.2. High-quality imported water is required for recharge into wells. A combination of injection and extraction barriers is feasible. While this arrangement reduces both recharge and extraction

rates, it requires a large number of wells.

5) Subsurface Barrier

Construction of an impermeable subsurface barrier parallel to the coast and through the vertical extent of the aquifer can effectively prevent the inflow of seawater into the basin (Figure 9.1.3). Materials for constructing a barrier might include sheet piling, puddled clay, emulsified asphalt, cement grout, bentonite, silica gel, calcium acrylate, or plastics. Chief problems are construction cost and resistance to earthquakes and chemical erosion.

Construction of injection barrier requires artificial recharge. This method needs fresh surface water to be injected, virtually making it inapplicable not only in terms of construction cost, but also on the availability of fresh surface water in Metro Manila. On the other hand, extraction barrier is risky considering the locations of existing pumping wells. In addition, groundwater levels had already dropped heavily in the inland areas of Las Piñas, Parañaque, Muntinlupa, etc., thus making the extraction barrier also not applicable.

An example of a subsurface barrier is the underground cutoff wall that was constructed in Miyakojima Island, Japan to dam up and store groundwater. As illustrated in Figure 9.1.4, the underground cutoff wall not only dams groundwater that courses to the sea but also prevents seawater intrusion. In this case, the depth of the top of the impermeable bed is shallow, only about 50 to 60m. In contrast, the depth of salinized aquifer in the coastal areas of Metro Manila is approximately 100m. In addition, saline water intrudes into deep aquifers laterally from Manila Bay and vertically from shallow aquifer through leakage.

Therefore, the construction of cutoff walls, or of artificial recharge wells and extraction wells are extremely costly and would prove difficult to implement, considering the mechanism and the areal extent of saline water intrusion in the coastal area of Metro Manila. The reduction of pumpage is the most viable option.

The computer simulation predicted that the groundwater level shall decline by more than 50m from its present level, and the saline water

intruded area shall expand even in the most optimistic scenario (Pumpage in 2010: 1,064,000 CMD). Thus considered, plans for the reduction of pumpage in the Metro Manila groundwater basin were prepared and evaluated through computer simulations. A pumpage reduction plan in terms of prevention of saline water intrusion was established, in which a reduced pumpage is proposed as a tentative permissive yield of the basin, a target of the groundwater management.

9.2 INSTITUTIONAL AND LEGAL ASPECTS

9.2.1 Institutional Structure

Presently, the National Water Resources Board (NWRB) is the body responsible for coordinating and integrating all activities related to water resources development and management.

The Board is attached to the Department of Public Works and Highways (DPWH) and is composed of the heads of six departments and four line agencies involved in water resources. The departments are the DPWH, Department of Agriculture (DA), the National Economic and Development Authority (NEDA), the Department of Trade and Industry (DTI), the Department of Health (DOH), and the Department of Environment and Natural Resources (DENR); and the line agencies are the Metropolitan Waterworks and Sewerage System (MWSS), the National Irrigation Administration (NIA), the Local Water Utilities Administration (LWUA) and the National Power Corporation (NPC).

The NWRB has a full-time working staff composed of some 71 engineers, specialists, economists, and legal specialists and some 60 administrative, financial and technical support personnel.

The NWRB operates through its five divisions, which have four (4) sections each, as illustrated in Figure 9.2.1. The organizational structure is in consonance with NWRB's operational programs and directed to the main functional areas of Policy Formulation; Program/Project Evaluation and Coordination; Water Use Regulation; Regulation of Water Utilities Operations; and Monitoring of Water Appropriation and Utilization.