

TABLES



Table A-4.1 Summary of Flow Measurement

Measurement Line Cord	m3/day Measured Flow	m3/day Supplied Water of Large Block
II.E-D08.ND800mm	38,055	38,055
II.E-D08.ND800mm	28,692	28,692
I.E-B03.ND500mm	24,926	24,926
I.A-D04.ND250mm	6,218	
I.A-D04.ND500mm	10,103	Sub Total D04
I.A-D04.ND1000mm	44,140	60,461
II.O-D05.ND700mm	29,606	29,606
II.O-D06.ND1100mm	72,535	72,535
II.O-D10.ND1100mm	171,700	171,700
M.1-M01.ND800mm	53,562	23,572
M.2-M02.ND800mm	29,990	29,990
Total Flow	479,537	

Table A-4.3 Pipe Line Velocity

Pipe line name	HE 109, D800	HE 108, D800	FE 103, D500	EA 104, D75	EA 101, D500	EA 101, D1000	HO 105, D700	HO 106, D1100	HO 110, D1100	MI 101, D800	W2 102, D800
Measurement date	05.25.97	05.20.97	05.25.97	05.25.97	05.25.97	05.25.97	05.25.97	06.02.97	05.20.97	05.25.97	05.25.97
Unit	m/sec	m/sec	m/sec	m/sec	m/sec	m/sec	m/sec	m/sec	m/sec	m/sec	m/sec
Average Velocity	1.157	0.810	1.470	1.322	0.585	0.587	0.832	0.895	2.117	1.187	0.690
Maximum Velocity	1.522	1.057	1.689	1.670	0.721	0.661	1.225	1.030	2.397	1.517	0.873
Minimum Velocity	0.511	0.552	1.166	0.872	0.371	0.192	0.565	0.677	1.751	0.789	0.171

Table A-4.4 Pressure Record

Name of Reservoir	Name of Large Block	No	Measurement Point		Reservoir (2) Elevation m	Static Head (3) Elevation (3)-(2)-(1)m	Water Pressure (Kgf/Cm ²)		(6) Variable (6)=(4)-(5)	(7) Head Loss (7)=(5)-(4)m	Assessment
			Season (1) Elevation m	(1) Elevation m			(4) Max	(5) Min			
IE	B03	P1	Wet	753.00	785.00	32.00	3.0	2.3	0.7	2.0	not good
			Dry	753.00	785.00	32.00	2.5	0.7	1.8	7.0	not good
			Wet	767.00	785.00	18.00	14.0	4.0	10.0	-122.0	not good
			Wet	717.00	801.17	84.17	8.4	7.8	0.6	0.2	not good
			Wet	740.55	801.17	60.64	5.7	2.7	1.0	23.6	good
IA	D04	P2	Wet	740.55	801.17	60.64	3.9	2.9	1.0	21.6	good
			Dry	698.00	801.17	103.17	7.1	6.0	1.1	32.2	good
			Wet	698.00	801.17	103.17	1.7	3.5	1.2	56.2	good
			Dry	689.00	749.38	60.38	5.6	4.7	0.9	4.4	good
			Wet	672.00	749.38	77.38	5.6	3.0	2.6	21.4	good
IIE	D08	P1	Wet	696.00	755.50	59.50	5.4	4.2	1.2	5.5	good
			Dry	696.00	755.50	59.50	5.8	4.0	1.8	1.5	good
			Wet	690.00	755.50	65.50	5.1	3.2	1.9	14.5	good
			Wet	698.00	755.50	57.50	5.3	3.8	1.5	4.5	good
			Dry	698.00	755.50	57.50	5.0	3.5	1.5	7.5	good
IIO	D09	P3	Wet	689.00	755.50	66.50	6.2	4.4	1.8	4.5	good
			Dry	689.00	755.50	66.50	6.8	4.5	2.3	-1.5	good
			Wet	682.00	755.50	73.50	5.2	3.4	1.8	21.5	good
			Dry	682.00	755.50	73.50	5.0	3.3	1.7	23.5	good
			Wet	678.00	755.50	77.50	4.0	1.8	2.2	37.5	not good
M1	M01	P6	Wet	683.50	755.50	72.00	5.3	3.6	1.7	19.0	good
			Dry	683.50	755.50	72.00	5.1	2.5	2.6	21.0	not good
			Wet	686.00	755.50	69.50	5.0	2.5	2.5	19.5	not good
			Wet	675.00	755.50	80.50	3.8	1.5	2.3	42.5	not good
			Wet	675.00	755.50	82.50	3.5	1.0	2.5	47.5	not good
M2	M02	P2	Wet	673.00	755.50	82.50	4.0	1.7	2.3	42.5	not good
			Dry	720.00	772.25	52.25	4.3	2.7	1.6	9.3	good
			Wet	769.80	824.81	55.01	5.5	4.5	1.0	0.0	good
			Dry	769.80	824.81	55.01	5.0	4.1	0.9	5.0	good

(Source:DAWSSA&JICA)

Table A-4.5 Measurement Flow Data of House

Sample No	Kind of House	Area	Reservoir	Persons	Period		Flow Meter		House Meter	Meter Malfunction
					start	end	m ³ /day	m ³ /day		
1	Condominium	D10.6	Formal	With	7	7/7 12:42 to 7/8 12:22	5.369	3.040	3.040	10%
2	Small House	D10.5	Formal	Without	8	7/8 13:34 to 7/9 13:34	0.142	0.110	0.110	23%
3*	Small House	D10.5	Formal	With	14	7/13 11:26 to 7/14 12:40	0.287	0.000	0.000	
4	Police office	D10.6	Formal	With	8/2	15:00 to 8/4 12:14	30.970	0.840	0.840	97%
5	Small House	D10.6	Formal	With	11	8/5 16:07 to 8/4 16:15	6.670	1.040	1.040	84%
6*	Small House	D10.6	Formal	With	11	8/10 14:30 to 8/11 14:30	22.550	0.000	0.000	
7	Mosque	D10.5	Formal		8/4	19:46 to 8/5 19:25	4.750	not equip		
8	Small House	M05	Informal	With	4	8/4 12:14 to 8/4 12:14	40.140	no meter		
9	Small House	M05	Informal	With	10	8/6 12:46 to 8/7 13:08	5.070	no meter		
10	Small House	M05	Informal	With	12	8/5 16:13 to 8/4 17:15	35.010	no meter		

Note: *Not working

Table A-4.6 Water Storage Device in Pilot Area

(1)

Type of Building	District	Total	Availability of water storage device									
			No		Yes		Capacity of water storage device					
			Total	Percentage	Total	Percentage	<= 0.5 (m ³)		1.0 m ³		> 1.0 m ³	
							Total	Percentage	Total	Percentage	Total	Percentage
Houses	Meedan	23	1	4.3%	22	95.7%	14	63.6%	8	37.3%	2	9.1%
	Old Zahera	13	1	7.7%	12	92.3%	5	41.7%	7	53.3%	2	15.4%
	New Zahera	15	0	0.0%	15	100.0%	5	33.3%	9	60.0%	1	6.7%
	Yarmouk Camp	15	1	6.7%	14	93.3%	6	42.9%	7	50.0%	1	7.1%
	Palestine Camp	13	1	7.7%	12	92.3%	3	25.0%	9	75.0%	0	0.0%
	Tadamon Quarter	11	0	0.0%	11	100.0%	3	27.3%	8	72.7%	1	9.1%
Sub-Total		90	4	4.4%	86	95.6%	46	53.5%	33	38.4%	7	8.1%
Schools		4	0	0.0%	4	100.0%	0	0.0%	4	100.0%	0	0.0%
Hospitals		4	0	0.0%	4	100.0%	0	0.0%	4	100.0%	0	0.0%
Governmental Office Building		2	0	0.0%	2	100.0%	0	0.0%	2	100.0%	0	0.0%
Sub-Total		10	0	0.0%	10	100.0%	0	0.0%	10	100.0%	0	0.0%
Total		100	4	4.0%	96	96.0%	46	47.9%	33	34.4%	17	17.7%

(2)

Type of Building	District	Total	Availability of Water Storage Device (Cont.)													
			Yes (Cont.)						Frequency of filling up the water storage device in the day				Time of filling up the water storage device		Control of filling up the water storage device	
			One time per day		Two times per day		Three times or more per days		Day time		Night time		Automatic Control		Hand-operated control	
			Total	Percentage	Total	Percentage	Total	Percentage	Total	Percentage	Total	Percentage	Total	Percentage	Total	Percentage
Houses	Meedan	22	7	31.8%	0	0.0%	3	0.0%	1	4.5%	3	27.3%	15	68.2%	7	31.8%
	Old Zahera	12	1	8.3%	0	0.0%	0	0.0%	0	0.0%	1	8.3%	11	91.7%	1	8.3%
	New Zahera	15	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	15	100.0%	0	0.0%
	Yarmouk Camp	14	4	28.6%	0	0.0%	0	0.0%	1	7.1%	3	21.4%	10	71.4%	4	28.6%
	Palestine Camp	12	4	33.3%	0	0.0%	1	8.3%	1	8.3%	4	33.3%	7	58.3%	5	41.7%
	Tadamon Quarter	11	2	18.2%	0	0.0%	0	0.0%	0	0.0%	2	18.2%	9	81.8%	2	18.2%
Sub-Total		96	18	18.8%	0	0.0%	1	1.0%	3	3.1%	16	16.7%	67	70.0%	19	19.9%
Schools		4	0	0.0%	0	0.0%	1	25.0%	1	25.0%	0	0.0%	3	75.0%	1	25.0%
Hospitals		4	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	4	100.0%	0	0.0%
Governmental Office Building		2	0	0.0%	1	50.0%	0	0.0%	1	50.0%	0	0.0%	1	50.0%	1	50.0%
Sub-Total		10	0	0.0%	1	10.0%	1	10.0%	2	20.0%	0	0.0%	8	80.0%	2	20.0%
Total		96	18	18.8%	1	1.0%	2	2.1%	5	5.2%	16	16.7%	75	78.1%	21	21.9%

(3)

Sub-District	Water Tank > 1.0 m ³			Average
	Number of tanks	Capacity of Tank	Total Capacity	
Meedan	2	2	4	2
Old Zahera	2	2	4	
New Zahera	1	2	2	
Yarmouk Camp	1	2	2	
Palestine Camp	0	0	0	
Tadamon	1	2	2	
Sub-Total	7	10	14	
Schools	4	10	40	4.7
Hospitals	4	5	20	
Governmental Buildings	2	3	6	
Sub-Total	10	18	66	
Total	17	28	80	

(Source: JICA Study Team)

Table A-4.7 Water Storage Device in Mezze-Razy & Kafar Souseh-Lawan

(1)

District	Formality	Total of Houses	Availability of Water Storage Device									
			No		Yes		Capacity of water storage device					
			Total	Percentage	Total of Tanks	Percentage	<=0.5 (m3)		1.0 m3		> 1.0 m3	
							Total	Percentage	Total	Percentage	Total	Percentage
Mezze-Razi	Formal	32	1	3.1%	31	96.9%	10	32.3%	18	58.1%	3	9.7%
	Informal	38	1	2.6%	37	97.4%	16	43.2%	20	54.1%	1	2.7%
Sub-Total		70	2	2.9%	68	97.1%	26	37.1%	38	54.3%	4	5.7%
Lawan	Formal	12	0	0.0%	12	100.0%	8	66.7%	4	33.3%	0	0.0%
	Informal	18	1	5.6%	17	94.4%	7	41.2%	9	52.9%	1	5.9%
Sub-Total		30	1	3.3%	29	95.7%	15	50.0%	13	43.3%	1	3.3%
Total		100	3	3.0%	97	97.0%	41	41.0%	51	51.0%	5	5.0%

(2)

District	Formality	Total of Tanks	Availability of Water Storage Device (Cont.)													
			Frequency of filling up the water storage device in the day						Time of filling up the water storage device				Control of filling up the water storage device			
			One time per day		Two times per day		Three times or more per days		Day time		Night time		Automatic control	Hand-operated control		
			Total	Percentage	Total	Percentage	Total	Percentage	Total	Percentage	Total	Percentage	Total	Percentage	Total	Percentage
Mezze-Razi	Formal	31	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	3.2%	30	66.8%	1	3.2%
	Informal	37	1	2.7%	0	0.0%	0	0.0%	1	2.7%	0	0.0%	37	100.0%	1	2.7%
Sub-Total		68	1	1.5%	0	0.0%	0	0.0%	1	1.5%	1	1.5%	67	98.5%	2	2.9%
Lawan	Formal	12	4	33.3%	4	33.3%	0	0.0%	1	8.3%	8	66.7%	4	33.3%	8	66.7%
	Informal	17	9	52.9%	2	11.8%	0	0.0%	1	5.9%	11	64.7%	7	41.2%	11	64.7%
Sub-Total		29	13	44.8%	6	20.7%	0	0.0%	2	6.9%	19	65.5%	7	24.1%	19	65.5%
Total		97	14	14.4%	6	6.2%	0	0.0%	3	3.1%	20	20.6%	74	76.3%	21	21.6%

(3)

District	Formality	Total of Tanks	Availability of Water Storage Device (Cont.)							
			Yes (Cont.)							
			Time use of water storage device							
			All year		Winter		Summer		Every six months	
Total	Percentage	Total	Percentage	Total	Percentage	Total	Percentage			
Mezze-Razi	Formal	31	24	77.4%	1	3.2%	6	19.4%	1	3.2%
	Informal	37	29	78.4%	0	0.0%	8	21.6%	0	0.0%
Sub-Total		68	53	77.8%	1	1.5%	14	20.6%	1	1.5%
Lawan	Formal	12	11	91.7%	0	0.0%	1	8.3%	0	0.0%
	Informal	17	9	52.9%	0	0.0%	8	47.1%	0	0.0%
Sub-Total		29	20	68.9%	0	0.0%	9	31.0%	0	0.0%
Total		97	73	75.3%	1	1.0%	23	23.7%	1	1.0%

(Source: JICA Study Team)

Table A-4.8 Leakage Detection Survey

Survey Date		Name of Place	Type of Pipe	Diameter of Pipe (mm)	Number of Leakage Points	Type of Leakage Point	Surveyed Pipe Length (km)	Presumed Loss (m ³ /hr)
Date	Time							
June 22 1997	11:00 a.m. - 1:00 p.m.	Jennaraya Pumping Station	CIP	200	1	Distribution	0.3	10.0
July 01 1997	11:00 p.m. - 2:30 a.m.	Ibhal Ameen St. Nazem Basha St.	CIP	250	1	Soap Tap	1.8	2.0
		Omar Safar St.	DIP	200	0		0.3	0.0
July 08 1997	12:00 p.m. - 3:00 a.m.	Al. Majlis An Nyaby St. M. Ali Alaed St.	CIP	600	6 2	Distribution Service	2.2	64.5 30.6
July 15 1997	10:30 p.m. - 2:30 a.m.	Madhat Basha St. Bad Shargi St.	CIP	200	9 5	Distribution Service	1.5	63.5 6.1
		Khaled Iban Al. St. Wald St.	CIP	700	1 1	Distribution Service	0.8	30.0 2.4
Total			CIP		26		6.9	209.1
Frequency of Leakage per Pipe Length (km)								3.8
Unit Loss of System Leakage per Hour per Pipe Length (m ³ /hr/km)								30.3

(Source: JICA & DAWSSA)

Remarks : St.: Street

CIP: Cast Iron Pipe

DIP: Ductile Iron Pipe

Table A-5.1 Service Area and Population(1995)

Name of Area	Existing Damascus City		Study Area for Network Analysis	
	Population	Area (ha)	Population	Area (ha)
Ruku Aldyn	166,768	437	83,384	219
Mouhajreen	77,461	363	61,969	291
Mezze	110,002	1,328	99,002	1,195
Cafarsouse	96,021	1,200	96,021	1,200
Kanawat	66,761	269	66,761	269
Kadam	64,175	300	64,175	300
Midan	143,579	296	143,579	296
Old City	18,493	145	18,493	145
Shaghour	65,631	470	65,631	470
Sarouja	117,617	349	117,617	349
Yarmouk	214,689	227	214,689	227
Jobar	104,106	642	104,106	642
Berze	75,899	673	37,950	337
Kaboon	51,592	497	51,592	497
Dummar	49,415	473		
Kassiyoun Mountain		2,956		
Total	1,422,209	10,624	1,224,968	6,435
			134	190

(Source : Damascus Governate, DAWSSA and the Study Team)

Remarks: Population includes informal population with 26 %.

Table A-5.2 Water Charge Collection Centers

No.	Name of Center	Name of Sub District	Number of Customers	Number of Employer	Area (ha)	Population Served	Water Demand (m3/d)
1	DAWSSA	Kanawat Shaghour Sarouja Salhiehe	12,363	7	164	44,700	22,190
2	Kanawat	Kanawat	11,170	3	209	43,900	23,950
3	Bab Mosallah	Midan Ziftia	14,103	3	140	67,700	28,750
4	Rukn Aldyn	1-Akrad S. Yazid 2-Kassioun	20,407	4	286	109,100	46,000
5	Al Juser Al Abead	Salhiehe E. Akrad	10,936	3	116	39,800	16,860
6	Al Sbeke	Salhiehe W.	9,089	2	134	29,600	12,500
7	Mouhajreen	Mouhajreen Kassioun	15,471	2	179	38,100	9,120
8	Shaghour	Shaghour Kimarea	10,460	3	201	27,100	11,650
9	Bab Toma	Kimarea	9,762	2	123	31,200	13,270
10	Abasyin	Sharky Al Tijara Kimarea	10,379	3	170	40,500	17,150
11	Baghdad Street	Sarouja Kimarea	12,862	3	179	29,400	14,420
12	Massaken Berze	Massaken Berze Berze Albalad	10,073	14	591	71,500	38,250
13	Kaboon	Kaboon Berze	7,933	2	380	39,700	17,050
14	Al Achmar	Kadam Midan	11,461	3	315	105,000	44,570
15	Mezze	Mezze 1 Mezze 2	16,688	17	1,297	101,500	55,180
16	Dummar	Dummar Kywan Kora Al Wadee	12,458	3	3,539	74,500	33,100
17	Jobar	Jobar	9,705	2	481	69,700	29,630
18	Tabbaleh	Tabbaleh	8,090	10	346	51,900	22,020
19	Mokhayam	Mokhayam	18,466	5	227	214,700	90,470
20	Kafar Souse	Kafar Souse Midan Kadam	8,797	3	1,278	120,300	51,070
Total			240,673	94	10,353	1,349,900	597,200

(Source : DAWSSA)

Table A-5.3 Meter Reading Area

No.	Name of Area	Area (ha)	Population Served	Water Demand (m ³ /d)
1	Tabbaleh*	378	53,100	22,550
2	Ziftieh*	223	31,100	13,230
3	Midan*	551	178,300	77,280
4	Moukham*	227	214,900	90,450
5	Al Kadam	676	92,400	39,250
6	Al Shagour	230	33,900	14,570
7	Kanawat	235	57,800	31,090
8	Kafar Souse	948	85,400	37,610
9	Mezze	1,423	96,800	52,550
10	Techrine Garden	2,607	57,200	24,160
11	Mouhajreen	1,377	60,200	25,420
12	Kassioun	494	32,100	13,570
13	Iban Nafis	119	10,000	4,220
14	Massaken Berze	351	50,200	25,610
15	Akrad	62	23,500	9,930
16	Yazeed	66	23,000	9,330
17	Fayhaa	54	20,700	8,730
18	Sarouga	156	44,200	19,160
19	Keimarish	321	78,000	33,110
20	Green Area	106	12,000	6,540
21	Kassioun	278	29,000	12,680
22	Eastèr Tigara	38	12,800	5,420
23	Eastern Salhieh	94	29,000	12,260
24	Western Salhieh	99	22,500	9,490
25	Kiwan	35	2,900	1,580
26	Berze Village	278	28,800	12,240
27	Jobar	637	98,000	41,610
Total		12,060	1,477,800	653,640

(Source : DAWSSA)

* This meter reading area includes partially areas out of the City.

Table A-5.4 Service Reservoirs in The City

Code No.	Name	Location	Elevation (m)	Nos. of Tank	Capacity (m ³)	Surf. Area (m ²)	Effec. Depth (m)	Type	Completion Year
K.1	Kassioun Middle	Mt. Kassioun	840.00	2	4,045	508	7.95	Undergr.	1980
K.2	Akrad Middle	Akrad	832.00	2	1,061	265	4.00	Undergr.	1980
* K.3	Kassioun High	Mt. Kassioun	881.16	2	1,554	221	7.03	Undergr.	1955
K.7	Kassioun Superior	Mt. Kassioun	995.73	3	550	137	4.00	Elevated	1964
K.8	T.V	Mt. Kassioun	1,155.00	N/A	N/A	N/A	N/A	Elevated	1964
* I.S	Wali New	Mt. Kassioun	796.00	4	61,440	7,680	8.00	Undergr.	1980
* I.A	Wali Old	Mt. Kassioun	801.27	3	7,500	1,881	4.00	Undergr.	1958
I.E	Akrad Low	Akrad	785.00	2	4,100	804	5.00	Undergr.	1983
* I.E	Eastern	Berze	749.38	2	28,240	7,060	4.00	Undergr.	1963
B.1v	Berze Village	Berze	831.24	1	569	144	3.95	Elevated	1965
B.1b	Berze Bohooth	Berze pre fabricate	831.24	2	5,862	1,128	5.19	Undergr.	1983
B.2	Akrad High	Akrad	880.67	2	1,872	488	3.84	Undergr.	1967
I.I.O	Western	Shikar Sq. Mouhagerin	755.50	4	42,704	5,024	8.50	Undergr.	1982
* M.1	Mezze	Mezze Jabal	772.25	2	8,732	2,183	4.00	Undergr.	1953
M.2	Mezze High	Mezze Jabal	824.81	2	2,901	725	4.00	Undergr.	1960
M.5	Mezze #86	Mezze	850.00	1	500	-	-	Elevated	Under const.
N.1	Ibn Alnafeas	Berze	805.42	2	2,000	500	4.00	Undergr.	1983
R.k	Khorshad	Mouhagerin	815.23	2	2,000	500	4.00	Undergr.	1968
C.A	Abba Siin High	Abba Siin squar	686.22	1	387	82	4.85	Elevated	Not used
C.a	Kadam High	Kadam DAWSSA store	688.27	1	387	82	4.85	Elevated	1975
C.e	Bab Eastern	Bab Sharki	681.64	1	387	82	4.85	Elevated	Not used
C.j	Jobar High	Jobar	700.92		500	100	5.00	Elevated	Not used
C.k	Kaboon High	Kaboon street	728.99	1	387	82	4.85	Elevated	Not used
C.m	Bab Mosallah	Midan	685.67	1	387	82	4.85	Elevated	Not used
A	Ibn Assaker	Ibn Assaker street	675.83	2	2,470	625	4.00	Undergr.	1985
A.1	Oumawiyin Old	Oumawiyin Sq. west park	696.67	1	530	228	2.32	Elevated	1973
A.2	Oumawiyin	Oumawiyin Sq. west park	694.10	2	2,470	625	4.00	Undergr.	1990
J	Jobar	Jobar Akkash	N/A	2	2,470	625	4.00	Undergr.	1981 - 90
J.A	University City	Mezze	712.00	2	2,470	N/A	4.00	Undergr.	1993
K.m	Kadam Store	Kadam DAWSSA store	689.00	2	2,470	N/A	4.00	Undergr.	1991
K.s	Kadam Railway	Kadam Railway Station	687.55	2	2,470	N/A	4.00	Undergr.	1989
M.a2	Mazraa	Mazraa eastern park	694.38	2	2,470	625	4.00	Undergr.	1981 - 89

Note : 1. Mark (*) shows a service reservoir with booster pumps.

2. The Kaboon High service reservoir is not used at present because well pumps have no enough capacity for lifting water into the reservoir due to groundwater level drop.

(Source : DAWSSA)

TABLE A-5.5 Water Demand in The City

Name of District	1995 (Percentage of Population Served : 74 %)											Water Requirement m ³ /d		
	Served Population	Area (ha)	Density	Classified Consumption (m ³ /d)									Total	
				Domestic	University	Governmental	Commercial	Industrial	Manufacturing	Water Right	Public			
Existing Damascus City														
Ruku Aldyn	166,768	437	382	13,536		2,885	833			112	4,774	1,122	23,261	70,416
Mouhajreen	77,461	363	213	6,287		1,357	387			52	2,217	521	10,821	32,718
Mezze	110,002	1,328	83	8,928	4,456	1,913	550			74	3,149	740	19,810	59,957
Kafar Souseh	96,021	1,200	80	7,794		1,674	480	72		65	2,749	646	13,479	40,772
Kanawat	66,761	269	248	5,419	2,704	1,173	334	45		45	1,911	449	12,035	36,396
Kadam	64,175	300	214	5,209		1,129	321	48		43	1,837	432	9,019	27,256
Midan	143,579	296	485	11,654		2,488	717	108		97	4,110	966	20,139	60,955
Old City	18,493	145	128	1,534		348	125			12	529	168	2,717	8,160
Shaghour	65,631	470	140	5,327		1,154	328	49		44	1,879	441	9,223	27,874
Sarouja	117,617	349	337	9,546		2,044	588			79	3,367	791	16,415	49,669
Yarmouk	214,689	227	948	17,425		3,705	1,073			97	6,135	1,444	29,879	90,468
Jobar	104,106	642	162	8,450		1,812	520	78		70	2,980	700	14,611	44,203
Berze	75,899	673	113	6,160	3,074	1,330	379	57		51	2,173	511	13,735	41,548
Kaboon	51,592	497	104	4,187		914	258	39		35	1,477	347	7,257	21,916
Dummar	49,415	473	104	4,011		877	247			33	1,414	332	6,914	20,880
Kassioun Mountain		2,956											0	
Total of The City	1,422,209	10,624	134	115,467	10,235	24,802	7,139	452	910	40,700	9,610	209,315	202,400	633,188
Total of Study Area	1,372,794	7,195	3,636	111,456	10,235	23,926	6,892	452	876	39,286	9,278	202,400	202,400	612,308
Unit Water Demand per capita (lpcd)											110		147	446

Remark : Dummar & Kassioun Mountain are out of the F/S area.

(Source : Damascus Governate, DAWSSA & JICA)

Table A-5.6 Water Consumption of Large Blocks in The City

No. of Large Block	Pressure Zone	Name of Water Source (Service Reservoir and Production Well Center)	Area (ha)	Population	Water Consumption (m ³ /d)
E01	Eastern Berze High I	Kaboon Booster Pumping Station & High S.R. (C.k)	27	3,100	1,670
E02	Eastern Berze High I	Berze Village S.R. (B.1v)	68	7,900	4,300
B01	Berze High II	Akrad High S.R. (B.2)	39	4,500	2,410
B02	Berze High I	Berze Bobooth S.R. (B.1b)	115	13,800	7,300
B03	Berze Medium	Akrad Low S.R. (I.E)	208	23,500	11,710
B04	Berze Medium	Kaboon Booster Pumping Station & High S.R. (C.k)	123	13,200	5,500
D01	Damas Center Superior High	Kassioun Superior S.R. (K.7)	43	14,900	6,220
D02	Damas Center High II	Kassioun High S.R. (K.3)	78	26,800	11,240
D03	Damas Center High I	Kassioun Middle S.R. (K.1)	96	33,800	14,180
D04	Damas Center Medium	Wali S.R. (I.A)	276	84,900	35,530
D05	Damas Center Medium	Western S.R. (II.O) University P.W.C. (J.A)	227	13,700	15,260
D06		Western S.R. (II.O) Oumawiya P.W.C. (A.2)	632	157,900	69,820
D07	Damas Center Low	Ibn Al Nafeas S.R. (N.1) Mazraa P.W.C. (M.2a)	280	32,400	17,290
D08	Damas Center Low	Eastern S.R. (II.E)	280	95,200	39,850
D09	Damas Center Low	Eastern S.R. (II.E)	821	117,300	48,820
D10	Damas Center Low	Western S.R. (II.O) Ibn Assaker P.W.C.(A) Kadam Store (K.M) & Kadam Railway P.W.C(K.s) Takadom P.W.C (J)	2,150	581,100	254,220
D11	Damas Center Low	Wali S.R. (I.A)	586	67,200	21,670
M01	Mezze Medium	Mezze S.R.(M.1)	323	19,300	22,510
M02	Mezze High I & II	Mezze High S.R. (M.2)	154	9,500	11,310
M03	Mezze High I & II	Mezze High S.R. (M.2)	177	46,400	9,280
M04	Mezze High I & II	Wali S.R. (I.A)	35	2,900	1,550
Airport	Mezze Medium	Mezze S.R. (M.1): Bulk water supply	476	6,400	3,000
Total			7,214	1,375,700	614,590

(Source : DAWSSA & JICA)

- Remarks:
- 1) System loss is estimated based on the existing water demand (1995).
 - 2) Existing percentage of system loss is 35 %.
 - 3) Target percentage of system loss is 25 %.

Table A-5.7 Number & Water Yield of Existing Wells in Damascus City(1995)

Name of Wellfield	Production Wells	Wells not in service		Observation Wells	Total Number	Average Water Yield	
		New/Uncommiss.	Previously in service			Daily Max. (x 1000 m ³ /d)	Annual Average (million m ³ /year)
1 Mazraa	24			1	25	31.200	6.580
2 Ibn Assaker	18			2	20	28.600	5.670
3 Kaboon	5		5	1	11	7.000	0.862
4 Kadam Store	3	7			3		
5 Oumawiyin	13			1	14	20.400	3.335
6 Jobar	14			2	16	30.700	5.838
7 University	9		3	1	13	18.500	2.544
8 Kadam Railway	10			1	11	28.200	5.274
9 Dummar		5		1	8		
10 Jaramana		10		1	11		
11 Kywan		5			5		
12 Tishrin		10			10		
13 Takadom		10		1	11		
Sub-total	96	47	10	12	158	164.600	30.103
14 Fringe							
Working Boreholes	23				23	11.000	4.012
Emergency Boreholes	58				58		
Municipal Boreholes	55				55		
Sub-total	136				136	11.000	4.012
Total	232	47	10	12	294	175.600	34.115

(Source : DAWSSA)

Table A-5.8 Analysis Data of Fringe Well

No.	Borehole Name	Discharge (m ³ /h)	Working Hours (hrs/day)	Supplied Water		Reservoir V (m ³)	Booster Pump (hrs/day)	Assumed Head (m)
				(m ³ /day)	(m ³ /month)			
1	Hadaia	50	4	200	6,200	25		50
2	Halbneh	50	4	200	6,200	25	3	50
3	Burg Alzahera	50	15	750	23,250	25	10	50
4	Kat Al Nasha	50	4	200	6,200	25	4	50
5	Daf Alward	50	4	200	6,200	25		50
6	Daf Alloose	50	14	700	21,700	25	8	50
7	Karm Taha	50	8	400	12,400	25		50
8	Goret Al Shrabati	50	8	400	12,400	25	4	50
9	Karm Fida	50	14	700	21,700	25		50
10	Al Wali	50	3	150	4,650	25		50
11	Nasbat Omar (Ladba Omar)	50	10	500	15,500	25	6	50
12	Al Harmain	50	14	700	21,700	25	10	50
13	Alabara	60	12	720	22,320	30	12	50
14	Karm Noh	50	10	500	15,500	25	8	50
15	Al Kasr*	50				25		50
16	Al Kisari	50	4	200	6,200	25	4	50
17	Halaweh	50	14	700	21,700	25	4	50
18	Maze Kabakbieh	50	4	200	6,200	25	4	50
19	Kafar Souseh School	50	4	200	6,200	25	4	50
Total				7,620	236,220	480		

(Source : DAWSSA)

Note : * under repairing

Table A-6.1 Characteristic of Large Block in The City

No. of Large Block	Pressure Zone	Name of Water Source (Service Reservoir and Production Well Center)	Area (ha)	Population	Water Consumption (m ³ /d)	Estimated System Loss of Leakage		Saved Water by DMA (m ³ /d)	Pipe Length (km)
						without DMA (m ³ /d)	with DMA (m ³ /d)		
B01	Eastern Berze High I	Kaboon Booster Pumping Station & High S.R. (C.1)	27	3,100	1,670	35	25	10	0.37
B02	Eastern Berze High I	Berze Village S.R. (B.1v)	68	7,900	4,200	88	63	25	0.92
B03	Berze High II	Alrad High S.R. (B.2)	39	4,500	2,410	475	339	136	4.95
B02	Berze High I	Berze Boboob S.R. (B.1b)	115	13,800	7,300	590	422	169	6.15
B03	Berze Medium	Alrad Low S.R. (L1)	208	21,500	11,710	3,569	6,120	2,448	53.53
B04	Berze Medium	Kaboon Booster Pumping Station & High S.R. (C.1)	123	13,200	5,500	5,075	3,625	1,450	31.71
D01	Damas Center Superior High	Kassouh Superior S.R. (K.7)	43	14,900	6,220	364	260	104	3.79
D02	Damas Center High II	Kassouh High S.R. (K.3)	78	26,800	11,240	2,433	1,738	695	25.34
D03	Damas Center High I	Kassouh Middle S.R. (K.1)	96	33,800	14,180	8,828	6,306	2,522	63.05
D04	Damas Center Medium	Wall S.R. (L.A)	276	84,900	35,530	28,713	20,509	8,204	153.45
D05	Damas Center Medium	Western S.R. (L.O) University P.W.C. (L.A)	227	13,700	15,280	3,328	3,806	1,522	31.98
D06	Damas Center Low	Oumawiyin P.W.C. (A.2) Ibn Al Nafess S.R. (N.1) Mezraa P.W.C. (M.2)	632	157,900	69,820	7,890	5,636	2,254	46.11
D07	Damas Center Low	Eastern S.R. (L1E)	280	32,400	17,290	0	0	0	0.00
D08	Damas Center Low	Eastern S.R. (L1E)	280	95,200	39,850	4,047	2,891	1,156	21.24
D09	Damas Center Low	Eastern S.R. (L1E)	821	117,300	45,820	19,348	13,820	5,528	101.54
D10	Damas Center Low	Western S.R. (L.O) Ibn Assaker P.W.C. (A) Kadum Slope (K.M) & Kadum Railway P.W.C. (K-3) Talakom P.W.C. (4)	2,150	581,100	254,220	58,365	41,689	16,676	345.40
D11	Damas Center Low	Wall S.R. (L.A)	586	67,200	21,670	4,529	1,092	437	10.60
M01	Mezrae Medium	Mezrae S.R. (M.1)	323	19,300	22,310	13,754	9,825	3,930	95.25
M02	Mezrae High I & II	Mezrae High S.R. (M.2)	154	9,500	11,310	8,050	5,750	2,300	35.75
M03	Mezrae High I & II	Mezrae High S.R. (M.2)	177	46,400	9,280	0	0	0	0.00
M04	Mezrae High I & II	Wall S.R. (L.A)	35	2,900	1,580	3,525	2,518	1,007	18.18
Arport	Mezrae Medium	Mezrae S.R. (M.1) Bulk water supply	476	6,400	3,000	0	0	0	0.00
Total			7,214	1,375,700	614,590	177,007	126,434	50,574	1,049.31

(Source: DAWSSA & JICA)

Remarks: 1) System loss is estimated based on the existing water demand (1995).

2) Existing percentage of system loss is 35 %.

3) Target percentage of system loss is 25 %.

Table A-6.2 Characteristic of Medium Block in The City

No. of Large Block	No. of Medium Block	Area (ha)	Population	Water Consumption by M/P (m ³ /d)	Estimated System Loss of Leakage		Saved Water by DMA (m ³ /d)	Pipe Length (km)
					without DMA (m ³ /d)	with DMA (m ³ /d)		
E01	E01	27	3,100	1,670	35	25	10	0.37
E02	E02	68	7,900	4,200	88	63	25	0.92
B01	B01	39	4,500	2,410	475	339	136	4.95
B02	B02	115	13,800	7,300	590	422	169	3.16
B03	B03.1	81	9,400	5,000	3,337	2,384	954	20.85
	B03.2	64	6,800	2,820	2,636	1,883	753	16.47
	B03.3	63	7,300	3,890	2,595	1,853	711	16.21
B04	B04	123	13,200	5,500	5,075	3,625	1,450	31.71
D01	D01	43	14,900	6,220	364	260	104	3.79
D02	D02	78	26,800	11,240	2,433	1,738	695	25.34
D03	D03	96	33,800	14,180	8,828	6,306	2,522	63.05
D04	D04.1	97	37,300	15,630	10,091	7,208	2,883	53.93
	D04.2	94	29,200	12,240	9,779	6,985	2,794	52.26
	D04.3	85	18,400	7,660	8,842	6,316	2,526	47.26
D05	D05	227	13,700	15,280	5,328	3,806	1,522	31.98
D06	D06.1	97	21,000	8,750	1,211	865	346	7.08
	D06.2	115	30,200	12,620	1,437	1,026	411	8.39
	D06.3	137	51,200	21,460	1,710	1,222	489	10.00
	D06.4	130	33,900	17,690	1,624	1,160	464	9.48
	D06.5	153	21,600	9,300	1,909	1,363	545	11.16
D07	D07	280	32,400	17,290	0	0	0	
D08	D08.1	44	15,000	6,260	636	454	182	3.34
	D08.2	57	19,400	8,110	823	588	235	4.32
	D08.3	71	24,100	10,110	1,026	733	293	5.39
	D08.4	108	36,700	15,370	1,561	1,115	446	8.19
D09	D09.1	134	14,300	5,910	3,158	2,256	902	16.57
	D09.2	178	19,000	7,850	4,195	2,996	1,199	22.01
	D09.3	195	32,200	13,430	4,595	3,282	1,313	24.12
	D09.4	183	30,200	12,610	4,312	3,080	1,232	22.63
	D09.5	131	21,600	9,020	3,088	2,206	882	16.20
D10	D10.1	82	19,400	9,490	2,226	1,590	636	13.17
	D10.2	323	40,600	21,340	8,768	6,263	2,505	51.89
	D10.3	616	82,700	37,640	16,722	11,945	4,778	98.96
	D10.4	227	214,700	90,460	6,163	4,402	1,761	36.47
	D10.5	181	88,300	37,280	4,914	3,510	1,401	29.08
	D10.6	89	12,700	5,280	2,416	1,726	690	14.30
	D10.7	129	23,900	10,000	3,502	2,501	1,001	20.72
	D10.8	133	25,200	10,530	3,610	2,579	1,031	21.37
	D10.9	84	29,800	13,960	2,280	1,629	652	13.50
	D10.10	153	21,800	9,080	4,154	2,967	1,187	24.58
	D10.11	133	22,000	9,160	3,609	2,578	1,031	21.37
D11	D11	586	67,200	21,670	1,529	1,092	437	10.60
M01	M01.1	56	3,400	4,110	2,385	1,703	681	16.52
	M01.2	78	4,800	5,730	3,321	2,372	949	23.00
	M01.3	189	11,100	12,670	8,048	5,749	2,299	55.74
M02	M02.1	63	3,900	4,630	3,293	2,352	941	14.63
	M02.2	91	5,600	6,680	4,757	3,398	1,359	21.13
M03	M03	177	46,400	9,280	0	0	0	
M04	M04	35	2,900	1,580	3,525	2,518	1,007	18.18
Airport	Airport	476	6,400	3,000	0	0	0	
Total		7,214	1,375,700	614,590	177,007	126,434	50,573	1,046.31

(Source : DAWSSA & JICA)

- Remarks
- 1) Average loss of leakage from CIP is 30 m³/hr./km.
 - 2) Average loss of system leakage except CIP is 4 m³/hr./km.
 - 3) System loss is estimated based on the existing water demand (1995).
 - 4) Existing percentage of system loss is 35 %.
 - 5) Target percentage of system loss is 25 %.

Table A-6.3 DMA Pipe Length

Large Block No	Middle Block No	DIA - METRIC										Middle Block Total	Large Block Total				
		ND150 (mm)	ND200 (mm)	ND250 (mm)	ND300 (mm)	ND350 (mm)	ND400 (mm)	ND450 (mm)	ND500 (mm)	ND600 (mm)	ND700 (mm)						
B01																	
B02																	
B03	B03.1		2,000	900		1,700	1,400								1,800		8,500
	B03.2	1,500	2,700	2,100	2,300	450											11,050
B04																	
D01																	
D02																	
D03																	
D04	D04.1		2,000	2,300			2,500	2,500							2,500		11,800
	D04.2	2,800	900	2,500											2,950		9,150
	D04.3	800		4,500			1,200								2,200	500	10,600
D05		1,200	1,050	4,000	2,400	1,800									1,800	1,000	15,450
D06	D06.1	2,800		3,850			1,800								400		8,850
	D06.2	600	1,000	1,100	400	8,500											14,000
	D06.3	600	900	3,700	1,700		1,500										8,400
	D06.4	2,500	2,200	1,000	3,700		3,500										12,900
	D06.5	2,000	1,700	3,800	300		700	1,000									9,500
D07																	
D08	D08.1	1,000	2,200				1,000	1,100									5,300
	D08.2	1,100	100														1,200
	D08.3	2,700	2,500				1,800										7,000
	D08.4	1,000	2,200	3,200	600		300										7,600
D09	D09.1	500					500								600		2,380
	D09.2	300	1,600		500												3,300
	D09.3	3,500	2,500	1,000	1,600	1,900		1,000	1,000								12,500
	D09.4	1,500	2,700	1,700	700		300										7,600
	D09.5	300	2,300	1,800	1,070			2,400									7,870
D10	D10.1	2,250	6,450	1,500	1,670	530		900							1,100		14,720
	D10.2	4,750	6,300	1,000	2,330	300		100							600		16,280
	D10.3	11,500		1,710	21,300	1,570											36,080
	D10.4	5,650	2,030	6,500		830											15,070
	D10.5	800	4,200	13,600	1,000	500		550	2,800								23,450
	D10.6																0
	D10.7	1,410	4,420	520	670	300											7,320
	D10.8	2,200		1,000	2,800		1,500	600	1,000								9,100
	D10.9	600	4,650	1,400	1,000	500									600		9,650
	D10.10		4,200	2,000	2,000		600	500	500								9,800
	D10.11		500						500								1,000
D11		1,500	6,500	2,600													10,600
M01	M01.1	900	1,100		1,500		800	850									5,450
	M01.2	2,900	800		1,500		1,800	1,900	1,900								10,800
	M01.3	300	5,700	1,600	800												8,400
M02	M02.1	500	1,000	600	2,000	700	600	1,000									6,400
	M02.2		300	3,100	1,200	1,000											5,600
M03																	0
M04			1,400														3,000
TOTAL		1,500	55,460	79,830	48,930	84,290	13,470	19,390	21,850	22,800	900	11,850	900	4,200	2,300	367,670	

Table A-6.4 Summary of Proposed Blocks

No. of Medium Block	Area (ha)	Population	Water Consumption by M/P (m ³ /d)	Saved Water by DMA (m ³ /d)	Water Head (m)	Pipe Length (km)	CIP Length (km)
E01	27	3,100	1,670	10	-	0.37	
E02	68	7,900	4,200	25	-	0.92	
B01	39	4,500	2,410	136	-	4.95	
B02	115	13,800	7,300	169	-	6.15	
B03.1	81	9,400	5,000	954	41	20.85	2.14
B03.2	64	6,800	2,820	753	30	16.47	1.69
B03.3	63	7,300	3,890	741		16.21	1.66
B04	123	13,200	5,500	1,450	-	31.71	3.26
D01	43	14,900	6,220	104	-	3.79	
D02	78	26,800	11,240	695	-	25.34	
D03	96	33,800	14,180	2,522	100	63.05	4.45
D04.1	97	37,300	15,630	2,883	56	53.93	7.88
D04.2	94	29,200	12,240	2,794	77	52.26	7.63
D04.3	85	18,400	7,660	2,526	61	47.26	6.90
D05	227	13,700	15,280	1,522	62	31.98	3.62
D06.1	97	21,000	8,750	346	56	7.08	0.85
D06.2	115	30,200	12,620	411	55	8.39	1.01
D06.3	137	51,200	21,460	489	38	10.00	1.20
D06.4	130	33,900	17,690	464	47	9.48	1.14
D06.5	153	21,600	9,300	546	57	11.16	1.34
D07	280	32,400	17,290	0			
D08.1	44	15,000	6,260	182	48	3.34	0.51
D08.2	57	19,400	8,110	235	49	4.32	0.65
D08.3	71	24,100	10,110	293	72	5.39	0.82
D08.4	108	36,700	15,370	446	37	8.19	1.24
D09.1	134	14,300	5,910	902	28	16.57	2.51
D09.2	178	19,000	7,850	1,199	29	22.01	3.34
D09.3	195	32,200	13,430	1,313	24	24.12	3.65
D09.4	183	30,200	12,610	1,232	17	22.63	3.43
D09.5	131	21,600	9,020	882	25	16.20	2.46
D10.1	82	19,400	9,490	636		13.17	1.54
D10.2	323	40,600	21,340	2,505	< 5	51.89	6.07
D10.3	616	82,700	37,640	4,778	< 5	98.96	11.57
D10.4	227	214,700	90,460	1,761	47	36.47	4.27
D10.5	181	88,300	37,280	1,404	50	29.08	3.40
D10.6	89	12,700	5,280	690	42	14.30	1.67
D10.7	129	23,900	10,000	1,001	37	20.72	2.42
D10.8	133	25,200	10,530	1,031	42	21.37	2.50
D10.9	84	29,800	13,960	652	50	13.50	1.58
D10.10	153	21,800	9,080	1,187	20	24.58	2.88
D10.11	133	22,000	9,160	1,031	< 5	21.37	2.50
D11	586	67,200	21,670	437	< 5	10.60	0.82
M01.1	56	3,400	4,110	682	32	16.52	1.28
M01.2	78	4,800	5,730	949	41	23.00	1.78
M01.3	189	11,100	12,670	2,299	41	55.74	4.32
M02.1	63	3,900	4,630	941	18	14.63	3.03
M02.2	91	5,600	6,680	1,359	14	21.13	4.37
M03	177	46,400	9,280	0	-		
M04	35	2,900	1,580	1,007	86	18.18	2.85
Airport	476	6,400	3,000	0	-		
Total	7,214	1,375,700	614,590	50,574		1,049.31	122.23

(Source: DAWSSA & JICA)

Table A-6.5 (1/2) Evaluation of Priority for Proposed Blocks

No. of Large Block	Factor of Evaluation						Result of Evaluation
	Population	Informal Population	Water Consumption by M/P	Saving Water by DMA	Cast Iron Pipe Used Ratio	Differences between Forecasted and Measured Demand	
E01	C	B	C	C	C	C	C
E02	C	B	C	C	C	C	C
B01	C	B	C	C	C	C	C
B02	B	C	C	B	C	C	C
B03	B	C	B	B	B	C	B
B04	B	C	C	B	C	C	C
D01	B	B	C	C	C	C	B
D02	B	B	B	C	C	C	B
D03	B	C	B	B	B	C	B
D04	B	C	A	A	A	C	A
D05	B	C	B	B	A	C	A
D06	A	C	A	A	A	B	A
D07	B	C	B	C	C	C	B
D08	B	C	B	B	C	B	B
D09	A	B	A	A	B	C	A
D10	A	A	A	A	A	A	A
D11	B	A	B	C	B	C	A
M01	B	C	B	B	B	C	C
M02	B	C	B	B	B	C	B
M03	B	A	C	C	C	C	B
M04	C	C	C	B	C	C	C
Total Number							21

Remarks Evaluation factors are determined below:

A: High priority (6 Blocks)

B: Medium priority (8 Blocks)

C: Low priority (7 Blocks)

Evaluation	Population	Informal Population	Water Consumption by M/P (m ³ /d)	Saving Water by DMA (m ³ /d)	Cast Iron Pipe Used Ratio	Differences between Forecasted and Measured Demands
A	>100,000	>30,000	>30,000	>5,000	>12 %	>1.15 times
B	10,000-100,000	30,000-10,000	30,000-10,000	5,000-1,000	12 %-5 %	1.10 times- 1.00 time
C	<10,000	<10,000	<10,000	<1,000	< 5 %	None

(Source : DAWSSA & JICA)

Table A-6.5 (2/2) Evaluation of Priority for Proposed Blocks

No. of Proposed Block	Factor of Evaluation						Result of Evaluation
	Population	Informal Population	Water Consumption by MP	Saved Water by DMA	Cast Iron Pipe Used Ratio	Differences between Forecasted and Measured Demand	
E01	C	B	C	C	C	C	C
E02	C	B	C	C	C	C	C
B01	C	B	C	C	C	C	C
B02	B	C	C	B	C	C	C
B03.1	C	C	C	C	B	C	C
B03.2	B	C	C	C	B	C	C
B03.3	C	B	C	C	B	C	C
B04	B	B	C	A	B	C	B
D01	B	B	C	C	C	C	C
D02	B	B	B	B	C	C	B
D03	B	C	B	A	C	C	C
D04.1	B	C	B	A	C	C	C
D04.2	B	C	B	A	C	C	C
D04.3	B	C	C	A	A	C	B
D05	B	C	B	A	A	C	B
D06.1	B	C	C	C	A	B	B
D06.2	B	C	B	C	A	B	B
D06.3	A	C	A	C	C	B	A
D06.4	B	C	B	C	A	B	A
D06.5	B	C	C	B	A	B	B
D07	B	B	B	C	C	C	B
D08.1	B	C	C	C	B	C	C
D08.2	B	C	C	C	B	B	C
D08.3	B	C	B	C	B	B	B
D08.4	B	C	B	C	B	B	B
D09.1	B	B	C	B	A	C	B
D09.2	B	C	C	A	A	C	B
D09.3	B	B	B	A	B	C	B
D09.4	B	B	B	A	C	C	B
D09.5	B	C	C	B	B	C	C
D10.1	B	C	B	B	A	C	B
D10.2	B	C	B	A	C	C	B
D10.3	A	A	A	A	C	C	A
D10.4	A	A	A	A	A	A	A
D10.5	A	B	A	A	A	A	A
D10.6	B	B	C	B	C	A	B
D10.7	B	C	B	A	A	A	A
D10.8	B	C	B	A	A	B	A
D10.9	B	C	A	B	B	A	A
D10.10	B	B	C	A	A	B	A
D10.11	B	B	C	A	B	B	B
D11	A	A	A	C	B	C	A
M01.1	C	C	C	B	B	C	C
M01.2	C	C	C	B	B	C	C
M01.3	B	C	B	A	A	C	B
M02.1	C	C	C	B	A	C	B
M02.2	C	C	C	A	B	C	C
M03	C	A	C	C	C	C	B
M04	C	C	C	A	C	C	C
Total Number							49

Remarks Evaluation factors are determined below:

Evaluation	A: High priority (10 Blocks)		B: Medium priority (21 Blocks)		C: Low priority (18 Blocks)	
	Population	Informal Population	Water Consumption by MP (m ³ /d)	Saved Water by DMA	Cast Iron Pipe Used Ratio	Differences between Forecasted and Measured Demands
A	>50,000	>30,000	>20,000	>1,000	>12 %	>1.25 times
B	50,000-10,000	30,000-10,000	20,000-10,000	1,000-500	12 %-5 %	1.25 times- 1.0 time
C	<10,000	<10,000	<10,000	<500	<5 %	None

[Source: DAWSSA & JICA]

Table A-7.1 Flow Measurement at Pilot Area

Date	Time	2 D700 m ³ /sec	1 D250 m ³ /sec	3 D600 m ³ /sec	4 D300 m ³ /sec	5 D300 m ³ /sec	Total m ³ /sec
6.13.97	9.00	0.759	0.012	0.562	0.102	-0.036	1.400
	9.30	0.787	0.010	0.569	0.107	-0.037	1.436
	10.00	0.776	0.009	0.562	0.114	-0.043	1.418
	10.30	0.804	0.008	0.570	0.118	-0.044	1.456
	11.00	0.802	0.005	0.569	0.119	-0.048	1.447
	11.30	0.816	0.004	0.574	0.124	-0.051	1.467
	12.00	0.799	0.002	0.583	0.123	-0.051	1.456
	12.30	0.790	0.002	0.584	0.127	-0.050	1.453
	13.00	0.789	0.001	0.584	0.129	-0.050	1.453
	13.30	0.768	0.004	0.583	0.125	-0.050	1.430
	14.00	0.764	0.003	0.582	0.123	-0.048	1.424
	14.30	0.754	0.006	0.585	0.123	-0.049	1.419
	15.00	0.750	0.008	0.582	0.120	-0.047	1.412
	15.30	0.750	0.010	0.578	0.118	-0.047	1.408
	16.00	0.751	0.009	0.581	0.118	-0.047	1.411
	16.30	0.761	0.010	0.583	0.117	-0.050	1.421
	17.00	0.750	0.011	0.580	0.118	-0.050	1.410
	18.00	0.754	0.010	0.583	0.118	-0.047	1.418
	18.30	0.742	0.009	0.582	0.119	-0.047	1.405
	19.00	0.742	0.009	0.587	0.116	-0.045	1.410
	19.30	0.739	0.011	0.584	0.115	-0.048	1.400
	20.00	0.732	0.012	0.584	0.115	-0.043	1.400
	20.30	0.724	0.012	0.580	0.116	-0.042	1.390
	21.00	0.715	0.013	0.578	0.114	-0.043	1.376
21.30	0.724	0.013	0.577	0.111	-0.041	1.384	
22.00	0.717	0.012	0.578	0.107	-0.040	1.374	
22.30	0.712	0.011	0.573	0.108	-0.038	1.366	
23.00	0.693	0.012	0.568	0.108	-0.037	1.344	
23.30	0.690	0.012	0.567	0.106	-0.035	1.340	
6.14.97	0.00	0.671	0.012	0.559	0.103	-0.032	1.313
	0.30	0.655	0.013	0.552	0.099	-0.030	1.289
	1.00	0.644	0.014	0.544	0.093	-0.029	1.267
	1.30	0.631	0.014	0.535	0.089	-0.027	1.241
	2.00	0.626	0.015	0.529	0.087	-0.026	1.231
	2.30	0.624	0.015	0.519	0.084	-0.027	1.215
	3.00	0.621	0.015	0.514	0.081	-0.024	1.207
	3.30	0.618	0.014	0.510	0.080	-0.024	1.198
	3.31	0.615	0.014	0.508	0.080	-0.025	1.192
	3.32	0.616	0.014	0.508	0.081	-0.025	1.194
	3.33	0.620	0.014	0.509	0.080	-0.024	1.200
	3.34	0.622	0.015	0.509	0.080	-0.024	1.201
	3.35	0.620	0.015	0.510	0.081	-0.025	1.202
	3.36	0.620	0.015	0.514	0.080	-0.025	1.203
	3.37	0.614	0.015	0.508	0.080	-0.025	1.192
	3.38	0.620	0.015	0.509	0.080	-0.026	1.197
	3.39	0.625	0.014	0.509	0.080	-0.025	1.203
	3.40	0.621	0.015	0.510	0.080	-0.025	1.200
	4.00	0.627	0.015	0.509	0.081	-0.026	1.206
	4.24	0.627	0.015	0.505	0.078	-0.026	1.198
	4.25	0.622	0.014	0.504	0.078	-0.026	1.192
	4.26	0.622	0.015	0.506	0.079	-0.026	1.196
	4.27	0.625	0.015	0.501	0.079	-0.025	1.195
	4.28	0.628	0.015	0.507	0.078	-0.024	1.203
4.29	0.621	0.015	0.504	0.078	-0.025	1.193	
4.30	0.624	0.015	0.509	0.078	-0.026	1.200	
5.00	0.630	0.014	0.507	0.079	-0.026	1.204	
5.30	0.652	0.015	0.506	0.080	-0.029	1.224	
6.00	0.667	0.015	0.515	0.081	-0.032	1.246	
6.30	0.674	0.016	0.531	0.084	-0.036	1.268	
7.00	0.704	0.014	0.530	0.087	-0.036	1.299	
7.30	0.722	0.014	0.540	0.092	-0.038	1.330	
8.00	0.752	0.013	0.547	0.099	-0.040	1.371	
8.30	0.763	0.012	0.555	0.100	-0.037	1.393	
9.00	0.771	0.010	0.564	0.108	-0.035	1.417	
Total Consumption							117.247 m ³ /day

Table A-8.1 Work Volume

month	blocks to survey	total length (km)	length/team (km)
1	4	98	49
2	"	"	"
3	"	"	"
4	"	"	"
5*	5	122	61
6	4	98	49
7	"	"	"
8	"	"	"
9	"	"	"
10	"	"	"
11	"	"	"
12	"	"	"
Total	49	1200	600

" : same as above

* : There are 49 blocks to cover in 12 month. Therefore, one extra block was allotted in May when the wheather is mild.

Table A-9.1 Summary of Flow Meters, Pipes and Valves for DMA System

Items	Description	Unit	Quantity	Remarks
1. Flow Meter for Standing Monitor				
Flow Meter and Sensor	ND1200mm, Ultrasonic type	nr	2	
"	ND1100mm, Ultrasonic type	nr	2	
"	ND1000mm, Ultrasonic type	nr	1	
"	ND800mm, Ultrasonic type	nr	3	
"	ND600mm, Ultrasonic type	nr	8	Including Mezze-Razy area
"	ND500mm, Ultrasonic type	nr	12	
"	ND400mm, Ultrasonic type	nr	3	
"	ND250mm, Ultrasonic type	nr	1	
Total of Meter			32	
2. Flow Meter for Seasonal Monitor				
Flow Meter	Ultrasonic type	nr	20	
Sensor of Flow Meter	ND600mm to ND800mm	nr	19	excluding sensor
"	ND300mm to ND500mm	nr	51	only sensor
"	ND100mm to ND250mm	nr	63	only sensor including Lawan area
Battery for Flow Meter		nr	20	
Total of Sensor			133	
3. Flow Meter Chamber				
Meter Chamber	ND1000mm to ND1200mm	nr	5	2.0m X 1.5m X 2.8m, RC
"	ND600mm to ND800mm	nr	30	2.1m X 1.5m X 2.4m, RC
"	ND300mm to ND500mm	nr	66	2.0m X 1.5m X 2.1m, RC
"	ND100mm to ND250mm	nr	64	2.0m X 1.5m X 1.65m, RC
Total of Meter Chamber			165	
4. Pipes and Valves for DMA Shared area				
Ductile iron Pipe				
"	ND600mm, push on joint	m	100	
"	ND400mm, push on joint	m	1250	
"	ND300mm, push on joint	m	600	
"	ND200mm, push on joint	m	52	
Butterfly Valve	ND500mm, Flange joint	nr	2	
Gate Valve	ND150mm, Flange joint	nr	3	
Reduction Valve	ND800mm, Flange joint	nr	1	
"	ND400mm, Flange joint	nr	1	
"	ND150mm, Flange joint	nr	1	

Table A-9.2 (1.2) Flow Meters, Pipes and Valves for DMA System

Large Block Name	Medium Block Name	Measurement Type				Chamber	Adapt. Block No.	Pipe			Valve Gate (mm)	Reduction (mm)		
		Standing Monitor		Seasonal Monitor				ND (mm)	Length (mm)	Butterfly (mm)				
		Flow Meter and Sensor (mm)		Only Sensor (mm)										
D01		22	100			with								
		23	200			with								
D02		14	100			with								
		15	250			with								
		4	500			with								
		17	300			with								
D03	D03.1	4	500			with								
				1	150	with	D03.1							
				2	300	with								
				4	250	with								
				5	300	with								
				6	500	with	D03.2							
				7	100	with								
	D03.2			3	150	with								
	D03.3													
D04											150			
D02		24	150			with								
		26	250			with								
D03											100			
D04		25	100			with								
		6	1100			with								
		7	250			with								
		8	500			with								
		9	1000			with								
		26	100			with								
D04.1				75	250	with	D04.2							
				76	300	with	D04.2							
				88	150	with	D04.2							
		D04.2			62	250	with	D04.3						
					73	250	with	D04.3						
D04.3				23	300	with	D04.3							
				74	250	with	D04.3							
				60	600	with	D06.1							
D05		28	1100			with		600	100		800			
		29	600			with								
		30	250			with								
						55	250	with						
						56	200	with	D10.2					
						57	250	with	D10.1					
						58	1100	with	D10.1					
						59	250	with	D10.1					
						W21	500	with						
						W25	250	with						
						W25	250	with						
		D06		5	600			with						
				11	600			with						
				12	600			with						
				27	1200			with						
D06.1					61	600	with	D06.2						
					63	150	with	D06.2						
					64	150	with	D06.2						
D06.2					67	500	with	D06.3						
					68	200	with	D06.3						
					69	500	with	D06.3						
					71	150	with	D10.1						
					87	200	with	D06.3						
					W26	100	with							
D06.3						65	150	with	D10.10					
						70	150	with	D10.10					
				51	200	with	D10.2							
				52	100	with	D10.2							
				53	250	with								
D06.4				66	200	with	D10.10							
				24	150	with	D10.13							
				24	200	with	D10.13							
				25	100	with	D10.13							
D07				77	250	with								
				89	250	with								
				90	250	with								
				91	250	with								
D08	D08.1	2	800			with								
				9	500	with	D08.3							
				10	150	with	D08.2							
				96	600	with	D08.2							
		D08.2			15	150	with	D10.13						
					19	150	with	D08.3						
					29	200	with	D10.13						
						85	150	with	D08.3					
D08.3														
D08.4														
D09				22	500	with	D08.3	200	50	500x2				
				21	200	with	D08.2							
				3	600	with								
				19	300	with								
				21	100	with								
		D09.1				8	600	with	D09.1					
						W1	100	with						
				D09.2			11	250	with	D09.3				
							12	300	with	D09.3				
					13	100	with	D09.3						
D09.3				92	500	with	D09.3							
				93	250	with								
				94	250	with								
				95	250	with								
				14	150	with	D09.3							
				16	300	with	D09.4							
D09.4				17	150	with	D09.4							
				18	150	with	D09.5							
D09.5				W2	500	with								
				97	600	with	D09.1							
				98	600	with	D10.11							

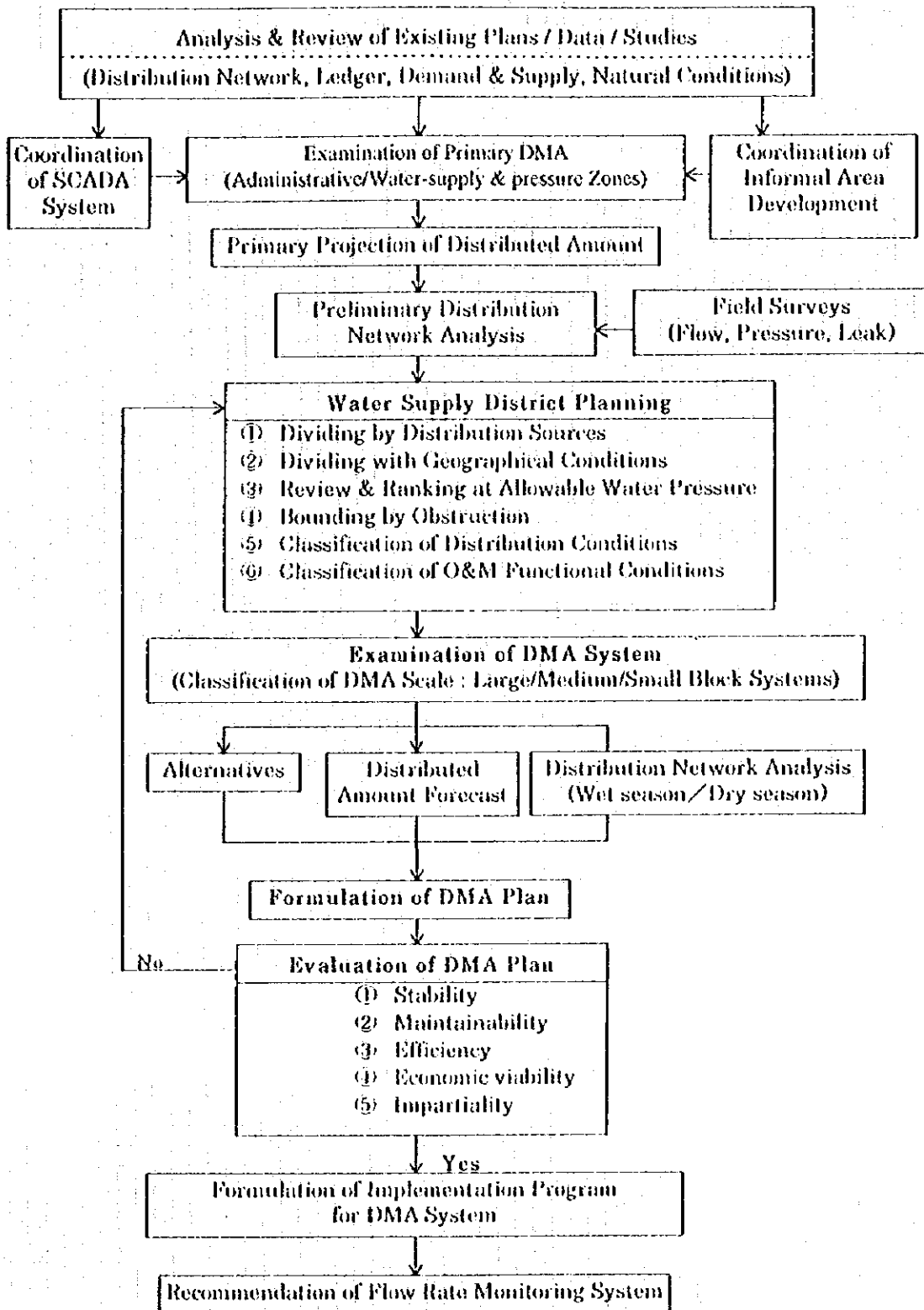
Table A-9.2 (2.2) Flow Meters, Pipes and Valves for DMA System.

Large Block Name	Medium Block Name	Measurement Type				Chamber	Adjoin Block No	Pipe		Butterfly (mm)	Valve Gate (mm)	Reduction (mm)	
		Standing Monitor		Seasonal Monitor				ND (mm)	Length (mm)				
		Flow Meter and Sensor (mm)		Only Sensor (mm)									
D10	D10.2	1	1100	54	500	with	D10.3						
				W27	250	with							
	D10.3				W19	100	with				150		
					45	600	with						
	D10.4				46	500	with	D10.6					
					47	200	with						
	D10.5				48	100	with	D10.6					
					W9	300	with						
	D10.6				W10	100	with						
					W12	100	with						
	D10.7				W13	100	with						
					W14	100	with						
	D10.8				W15	100	with						
					W16	100	with						
	D10.9				W17	100	with						
					W18	100	with						
	D10.10				42	200	with	D10.6					
					43	400	with						
	D10.11				44	200	with	D10.6					
					W5	100	with						
	D10.12				W6	100	with						
					W7	200	with						
	D10.13				W8	200	with						
					36	600	with						
	D10.14				37	250	with	D10.8					
					38	300	with						
	D10.15				49	250	with	D10.8					
					50	250	with						
	D10.16				W11	500	with	D10.10					
					W20	100	with						
	D10.17				W21	100	with						
					99	250	with						
	D10.18				100	250	with						
					101	250	with						
	D10.19				102	250	with	D10.9					
					33	250	with						
	D10.20				34	250	with	D10.9					
					35	250	with						
	D10.21				26	500	with	D10.12					
					27	100	with						
	D10.22				28	400	with	D10.12					
					30	200	with						
	D10.23				31	150	with	D10.10					
					32	600	with						
	D10.24				W4	400	with	D10.10					
					39	500	with						
	D10.25				40	1000	with	D10.2					
					41	250	with						
D10.26				29	400	with							
				W4	100	with							
D11		31	600	103	250	with							
				104	250	with							
M01	M01.1	10	600	78	400	with	M01.2						
				79	250	with							
M02	M02.1	32	100	82	300	with	M02.1						
				83	250	with							
M03	M03.1	18	250	84	250	with	M03.2						
				85	500	with							
M04	M04.1	19	250	81	200	with	M04.2						
				80	250	with							
SCADA 01				105	250	with							
				106	250	with							
Total		32		107	250	with							
				ND1200	1	433						ND800 Over	4
Total				ND1100	3		ND600 to ND800	9	ND1400	1250m		ND100V1	
				ND1000	1		ND300 to ND300	28	ND1300	600m		ND150V1	
Total				ND800	1		ND100 to ND250	92	ND200	52m			
				ND600	7		Portable Flow Meter	20					
Total				ND5500	3								
				ND400	4		Butters For Flow Meter	20					
Total				ND300	2								
				ND250	5								
Total				ND200	2								
				ND150	1								
Total				ND100	2								

Note: W1 to W26 are installed at production fringe wells.

FIGURES

Flow Chart for Formulation of DMA Plan



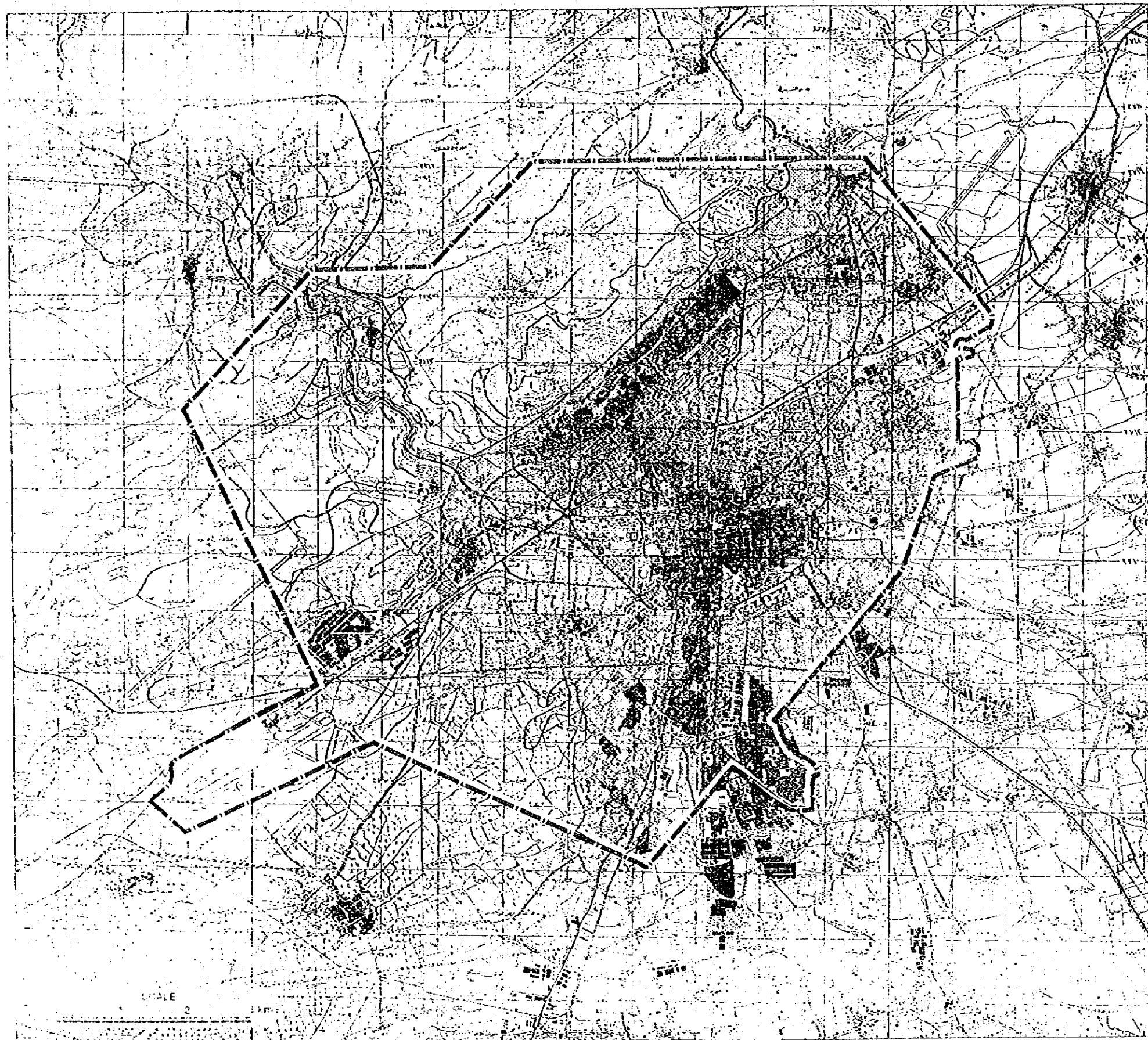
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WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY




Figure A-3.1

Flow Chart of DMA Planning

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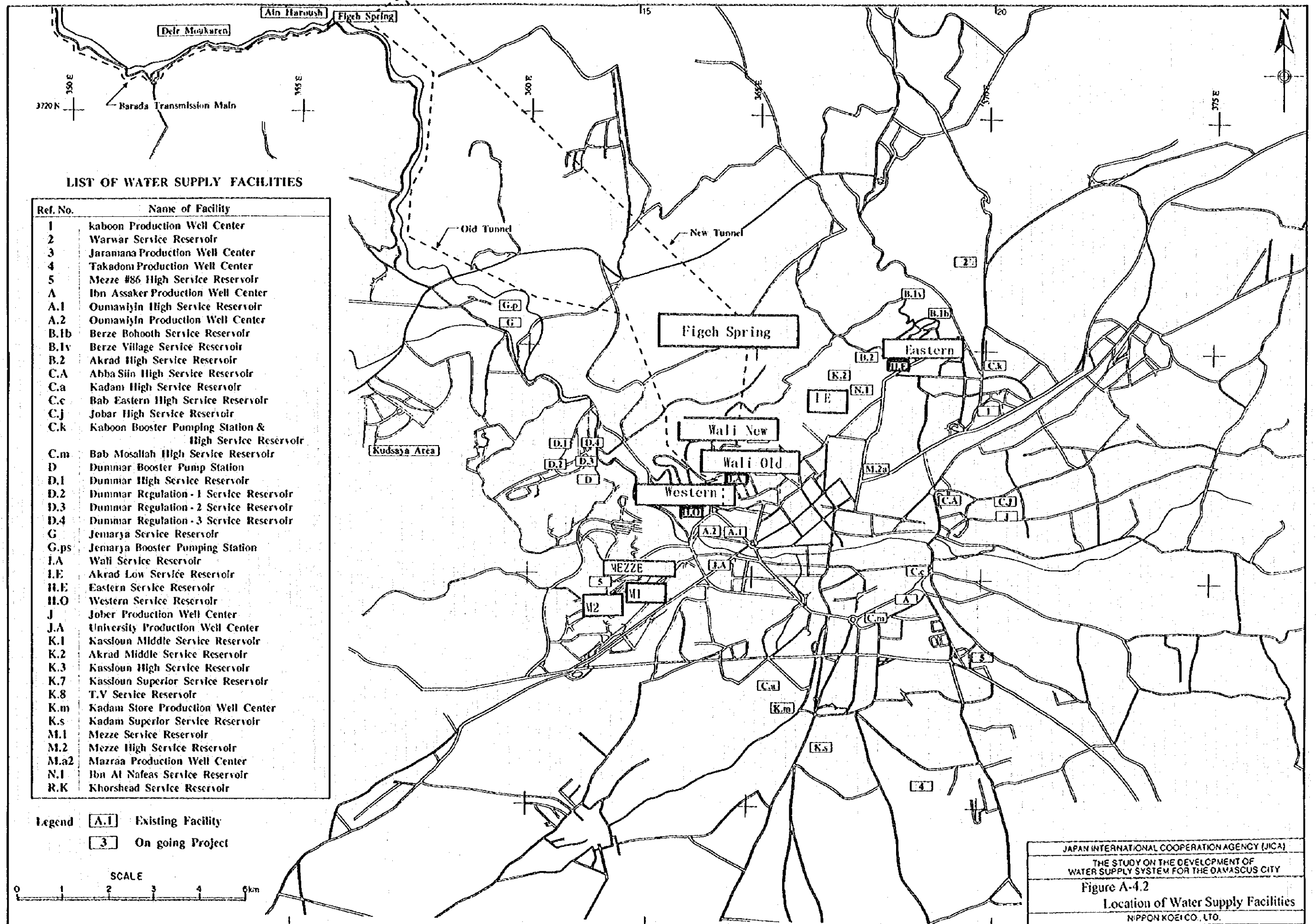
Legend

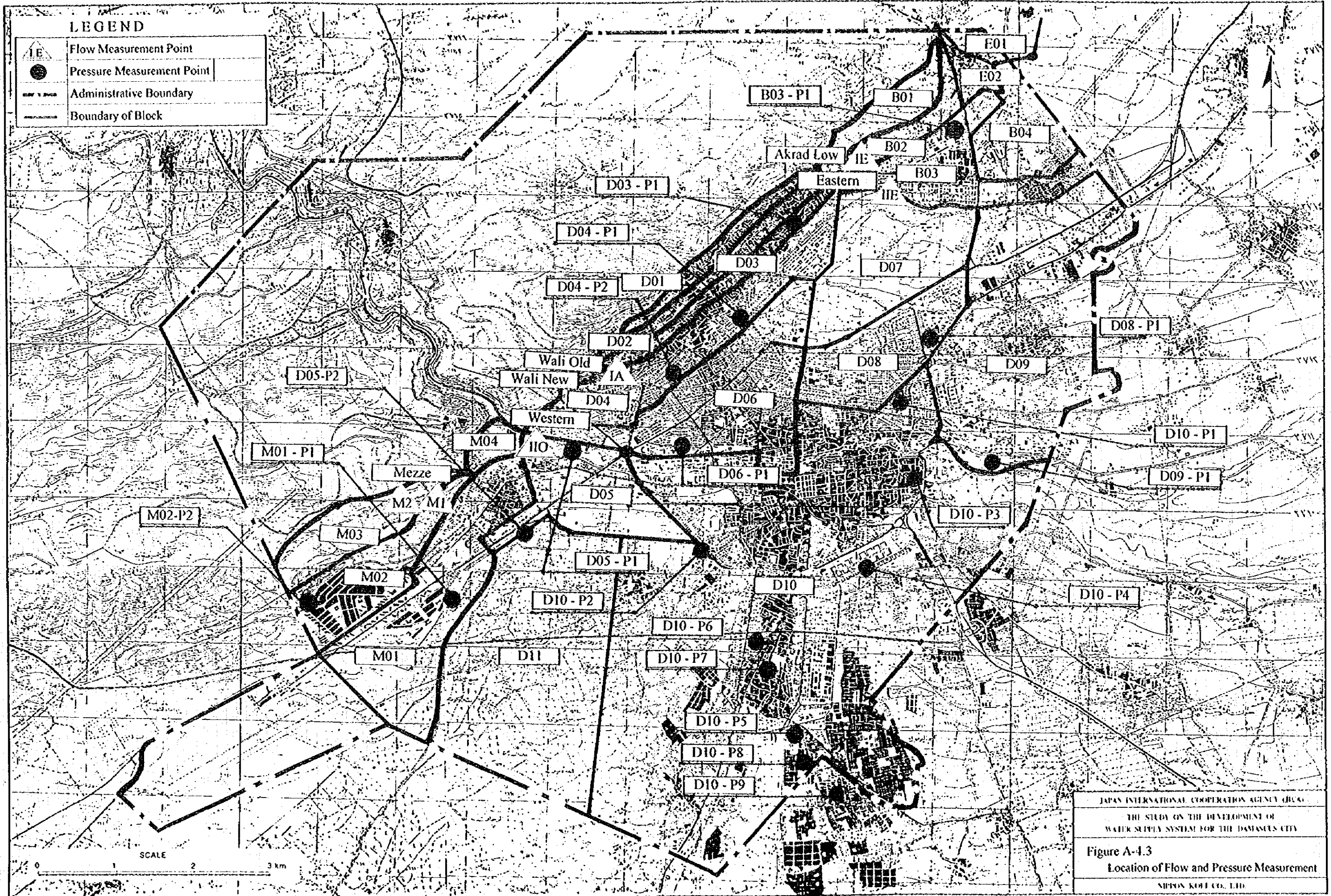
-  Mezze-Razy & Kafar Souseh Informal Area
-  Leakage Reduction Program Area
-  Existing Boundary of The City

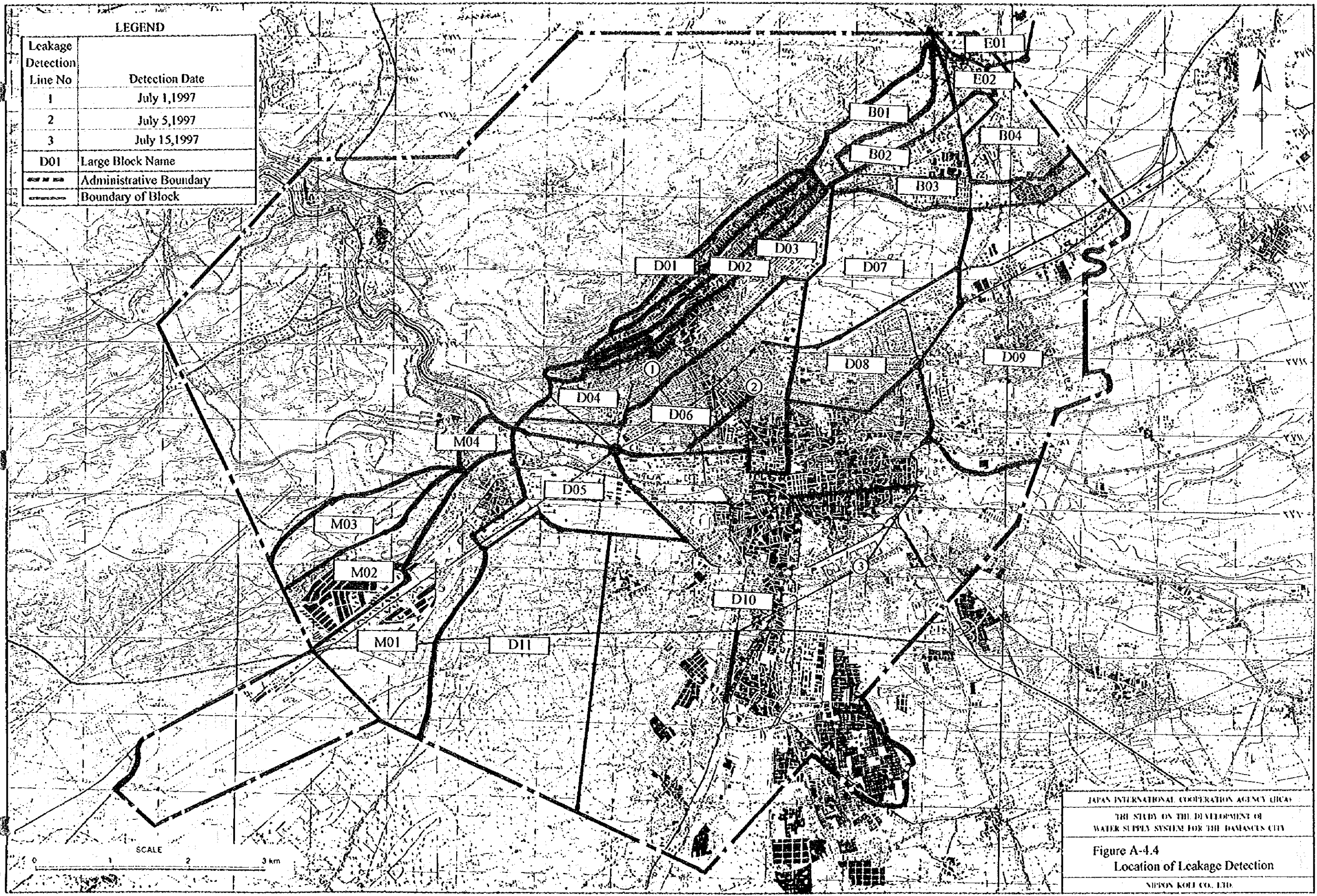
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Figure A-1.1
 Study Area

NIPPON KOEI CO., LTD.





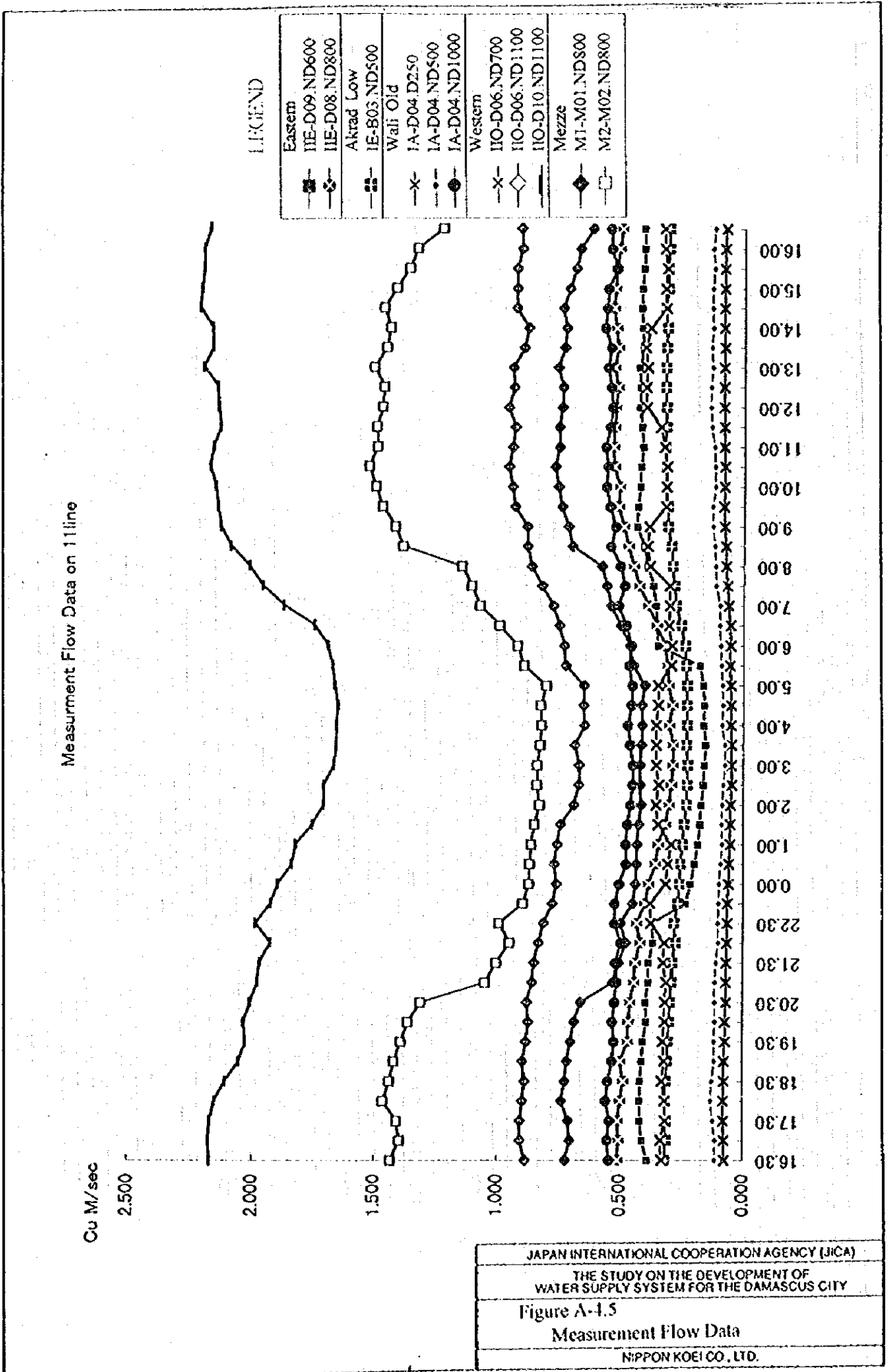


LEGEND	
Leakage Detection Line No	Detection Date
1	July 1, 1997
2	July 5, 1997
3	July 15, 1997
D01	Large Block Name
	Administrative Boundary
	Boundary of Block

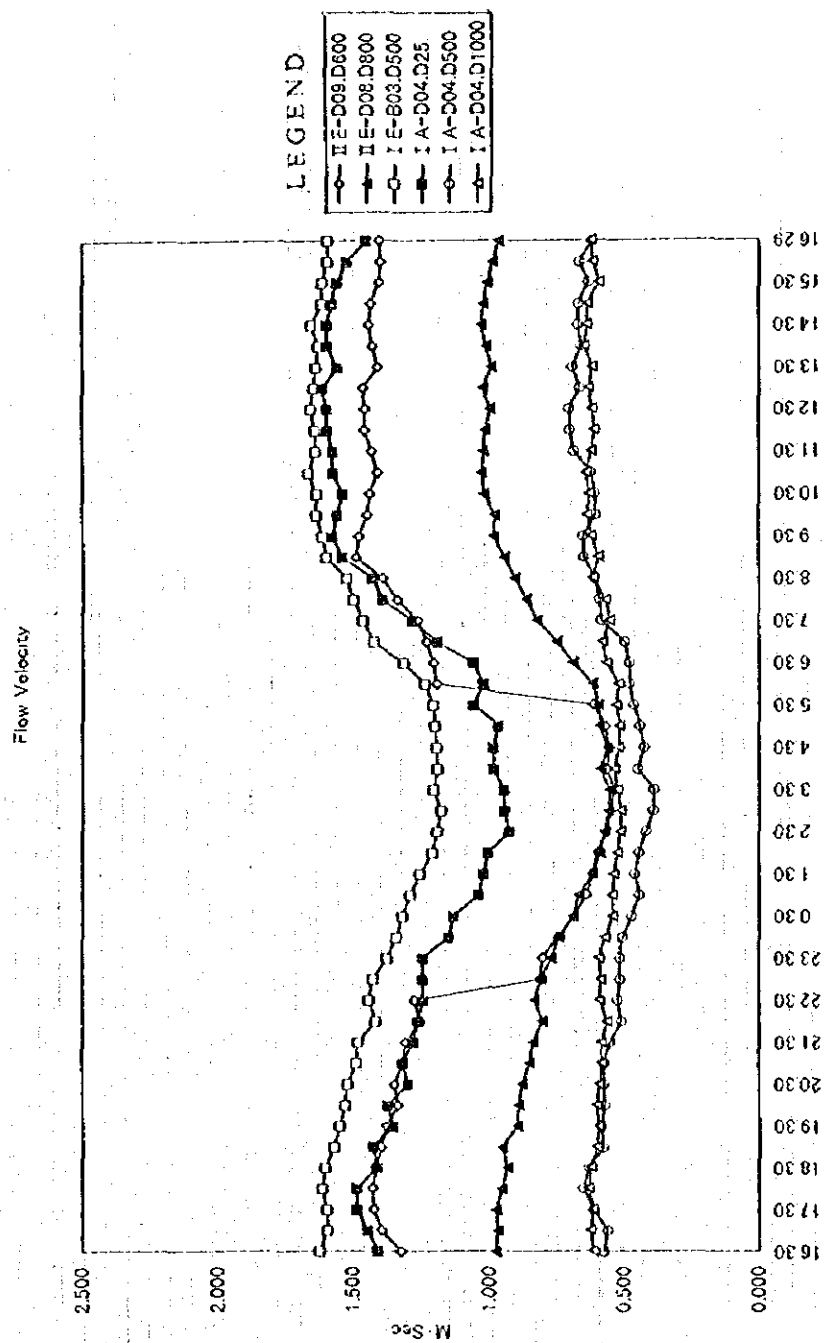
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Figure A-4.4
Location of Leakage Detection

NIPPON KOGI CO., LTD.



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 Figure A-4.5
 Measurement Flow Data
 NIPPON KOEI CO., LTD.

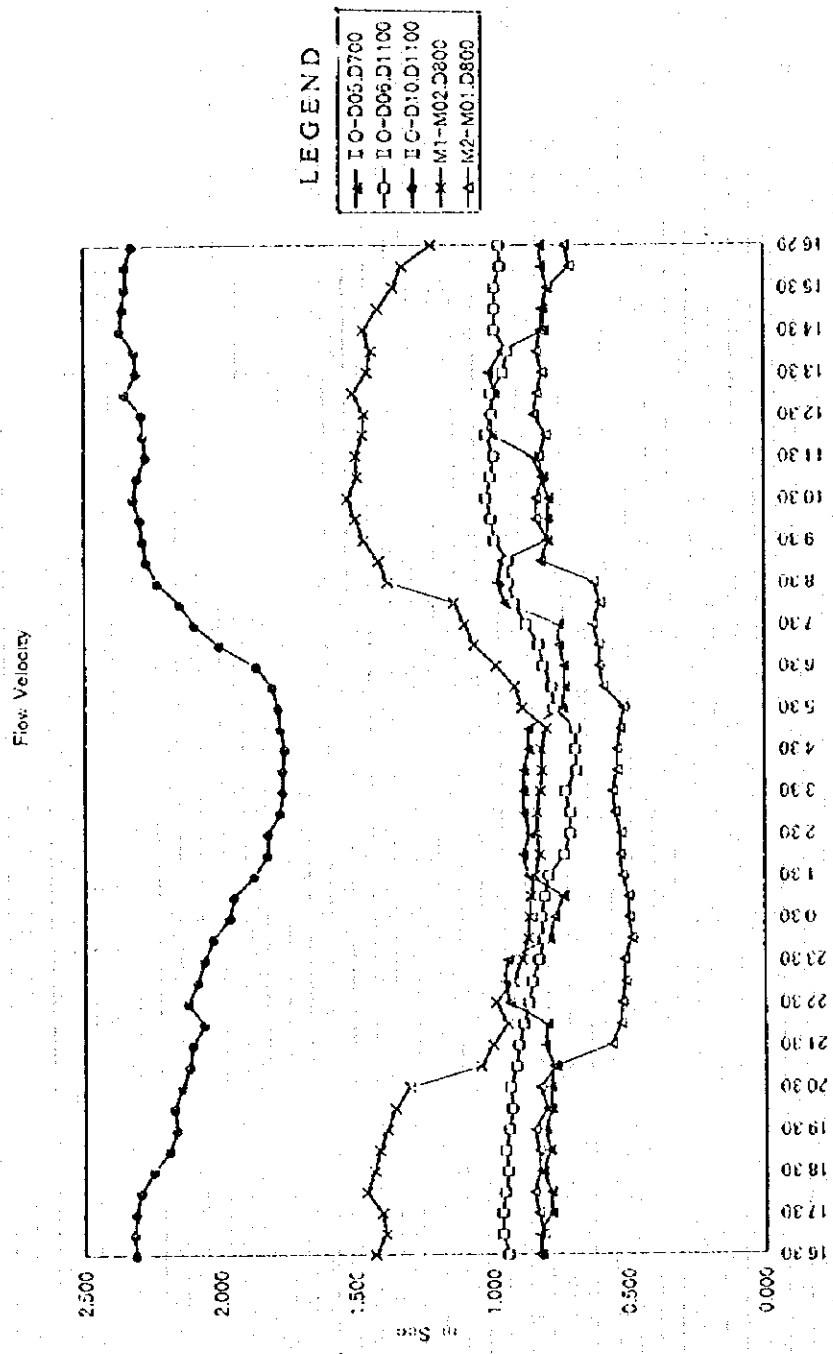


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THE STUDY ON THE DEVELOPMENT OF
WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure A-4.6 Flow Velocity at Reservoirs (IIE & IA)

NIPPON KOEI CO., LTD.

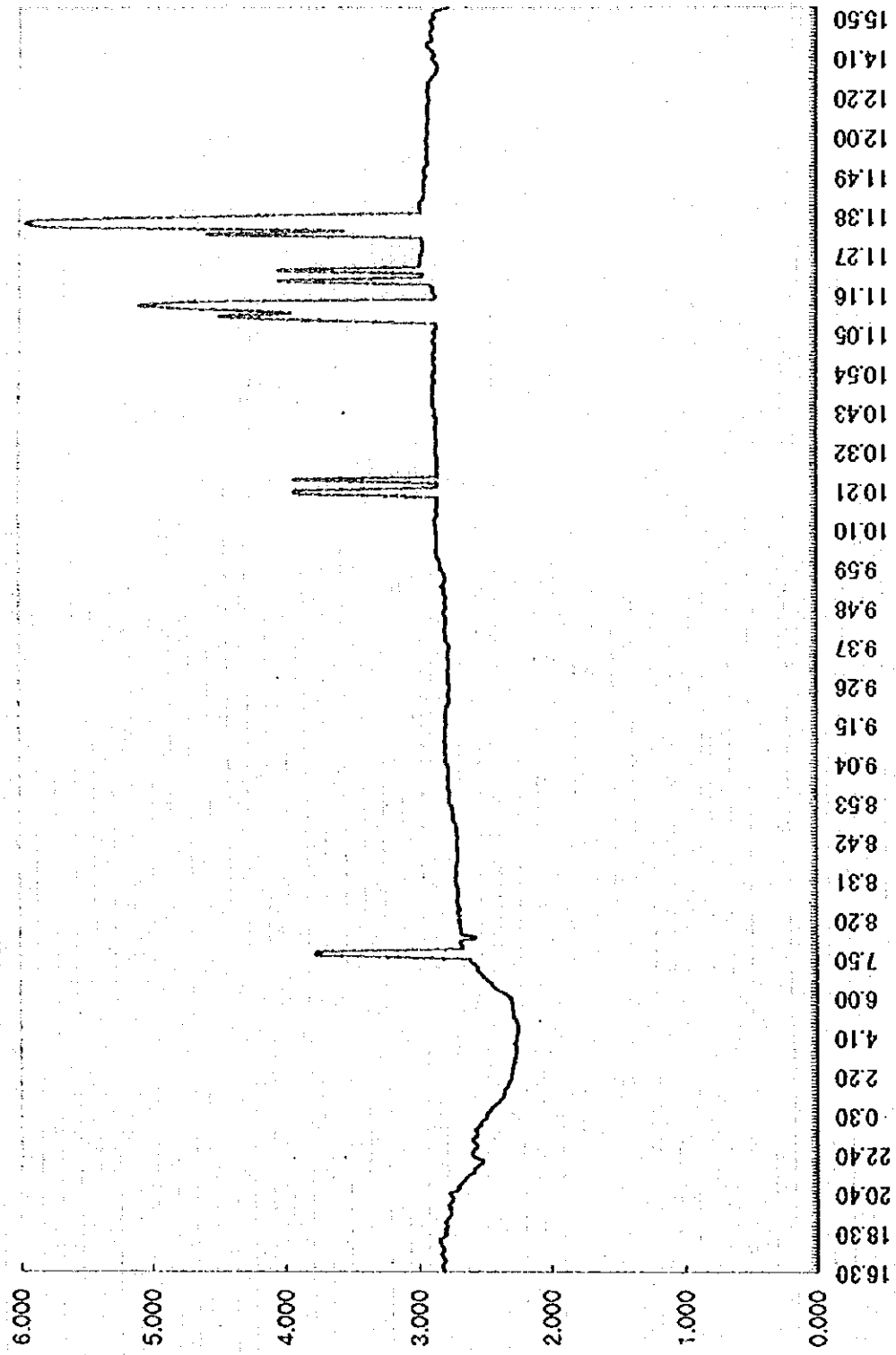


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 THE STUDY ON THE DEVELOPMENT OF
 WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure A-4.7
Flow Velocity at Reservoirs (IIO, M1 & M2)
 NIPPON KOEI CO., LTD.

FLOW VELOCITY OF II O-D10.1000
 Measured at JUN 03,97

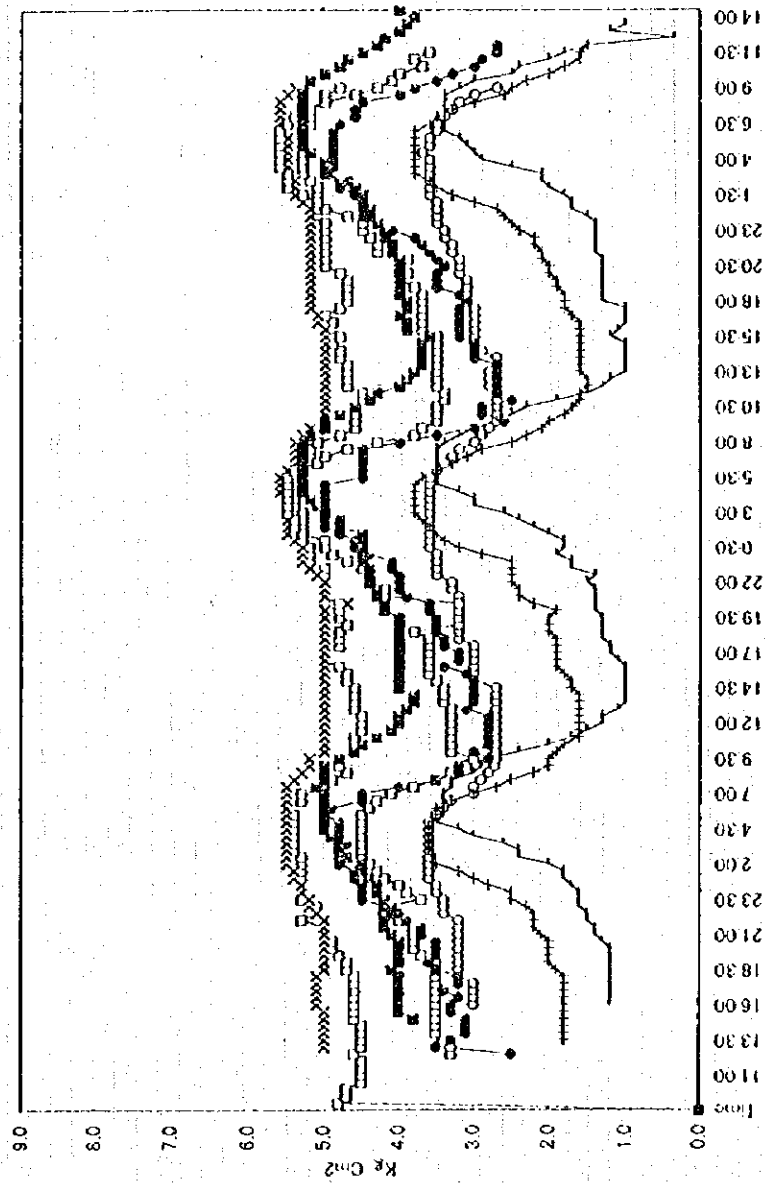
LEGEND

— II O-D10.D1100



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 WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
 Figure A-4.8
 Maximum Flow velocity at II O-D10
 NIPPON KOEI CO., LTD.

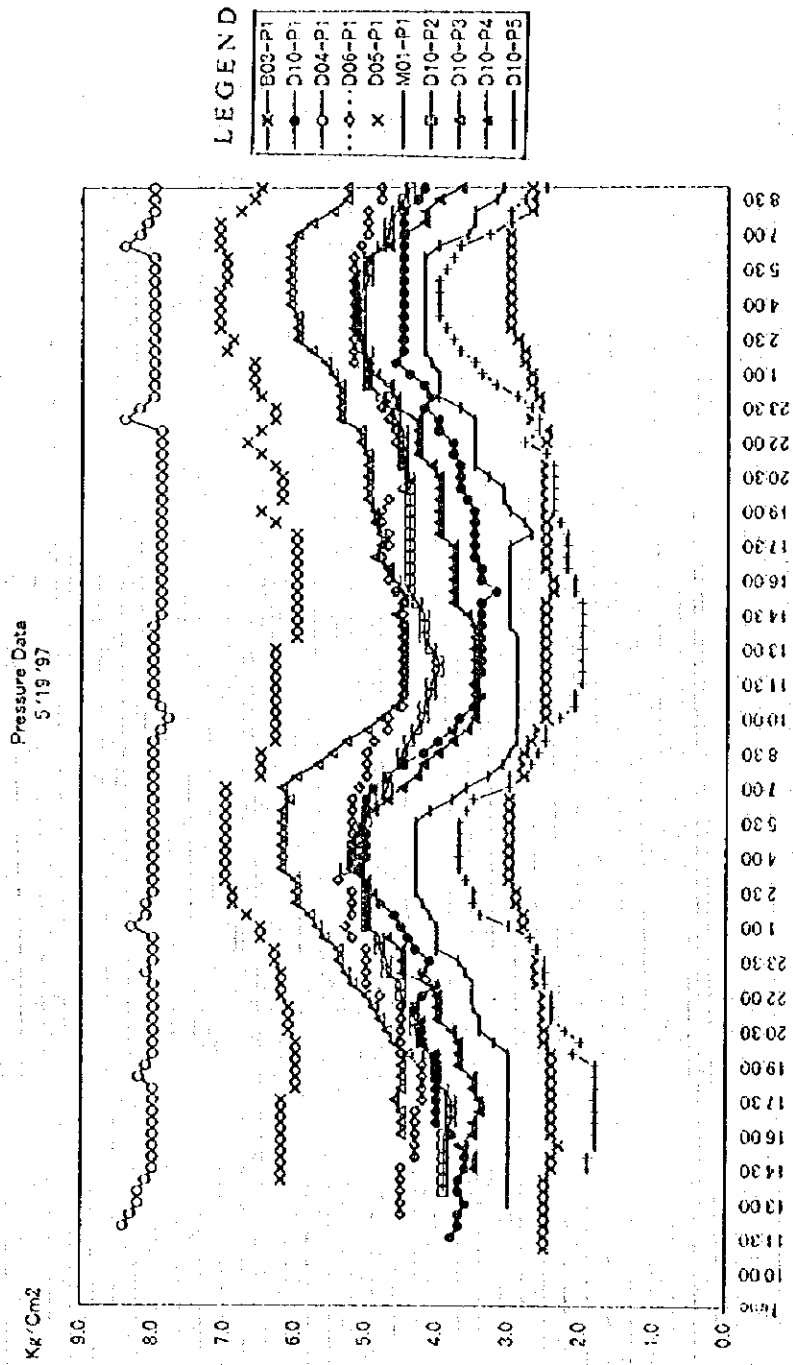
Pressure Date
6/10/97



LEGEND

- MO1-P1
- D04-P2
- X— D08-P1
- D09-P1
- D10-P6
- D10-P7
- D10-P8
- D10-P9

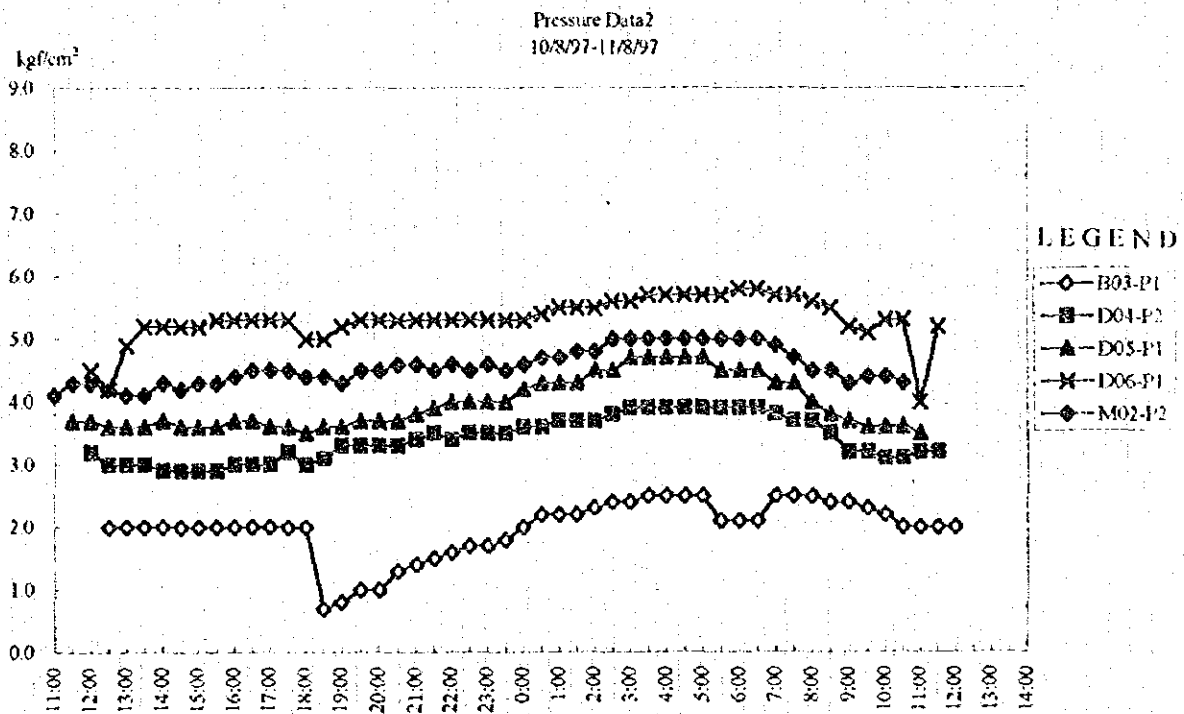
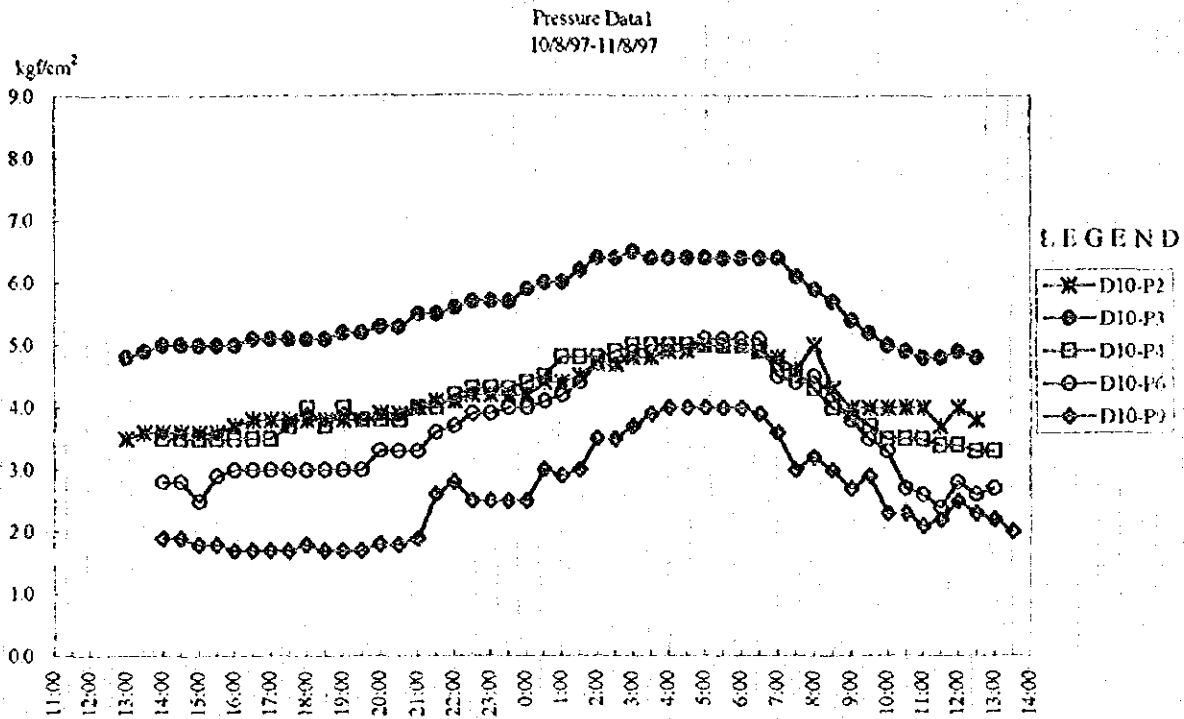
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Figure A-4.9
Pressure Record on 10 June, 1997
NIPPON KOEI CO., LTD.



LEGEND

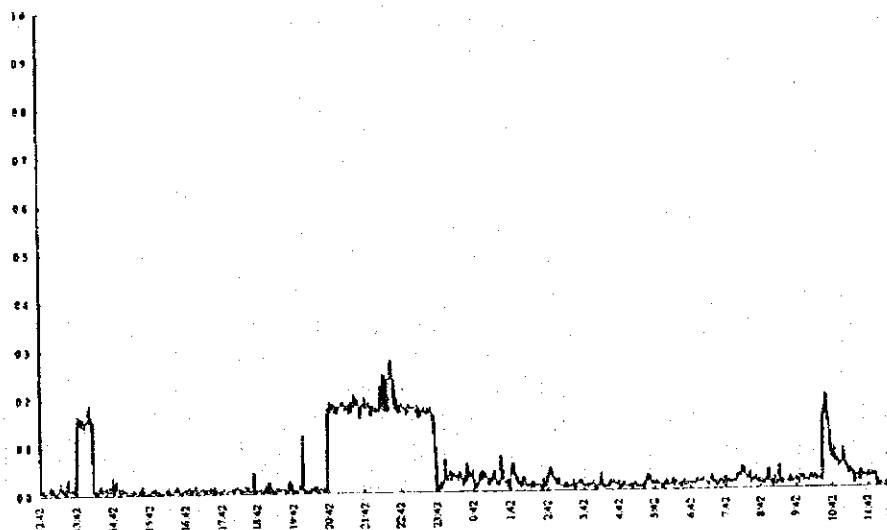
X	B03-P1
●	D10-P1
○	D04-P1
⋯	D05-P1
X	D05-P1
—	M01-P1
—	D10-P2
—	D10-P3
—	D10-P4
—	D10-P5

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 Figure A-4.10
 Pressure Record on 19 May, 1997
 NIPPON KOEI CO., LTD.

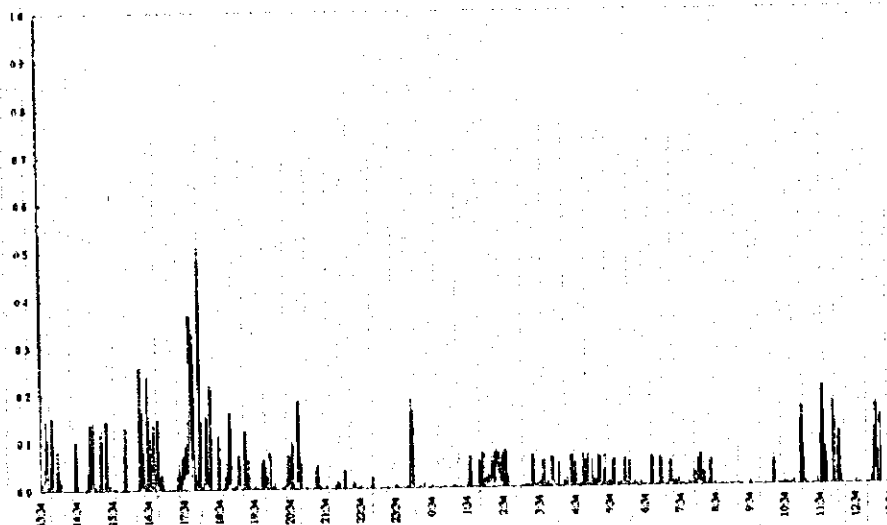


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 Figure A-4.11
 Pressure Record on 11 August, 1997
 NIPPON KOEI CO., LTD.

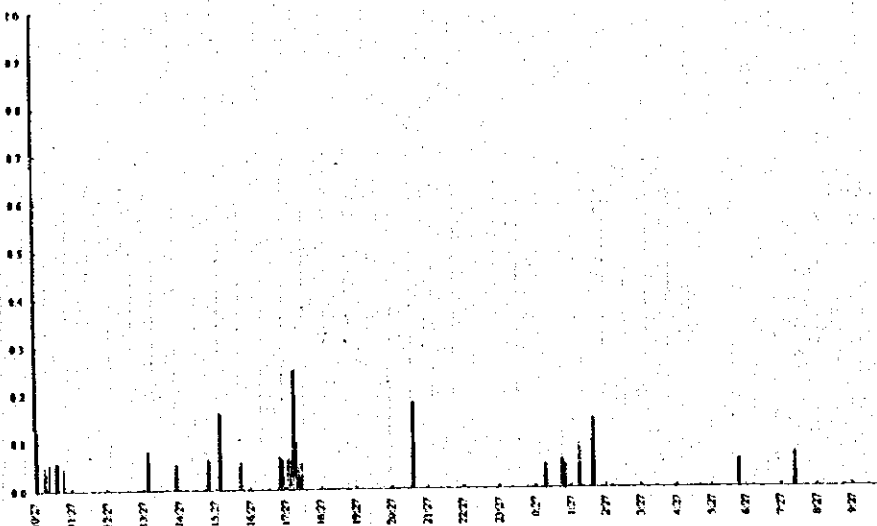
No.1 (LTR/SEC)



No.2 (LTR/SEC)

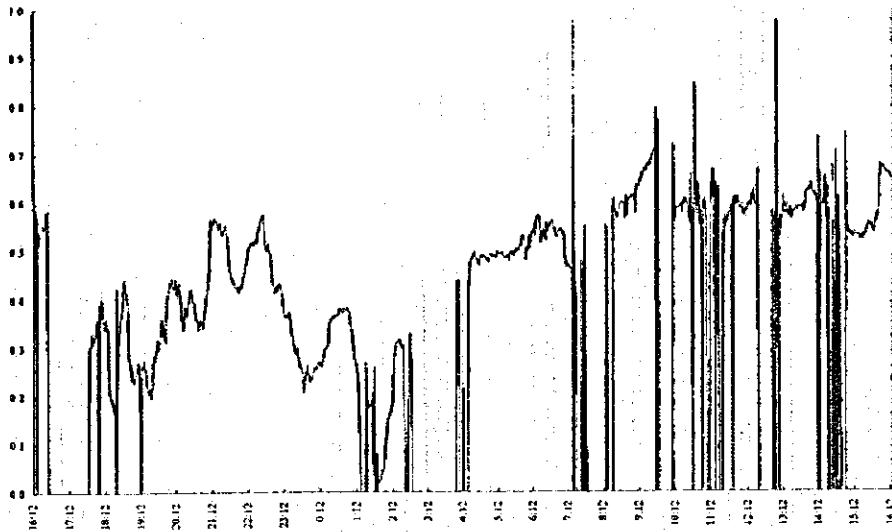


No.3 (LTR/SEC)

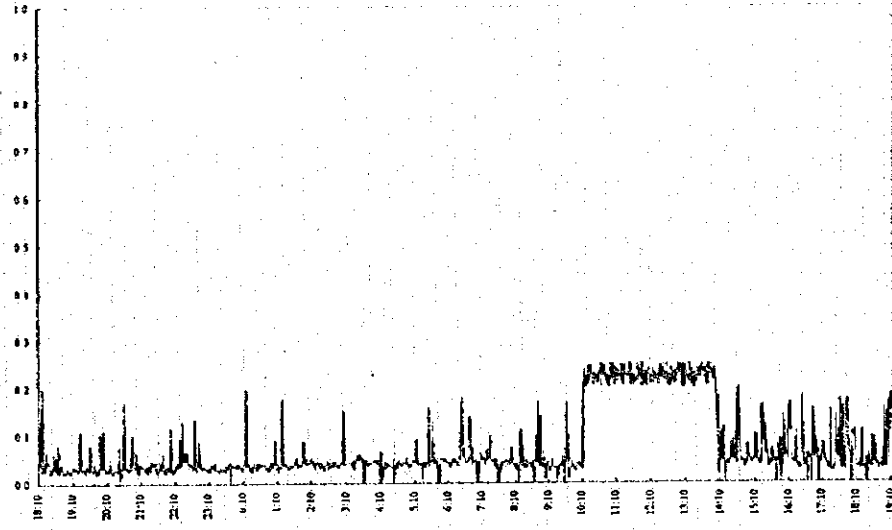


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THE STUDY ON THE DEVELOPMENT OF
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Figure A-4.12
Flow Data at House (Formal Area No.1, 2 & 3)
NIPPON KOEI CO., LTD.

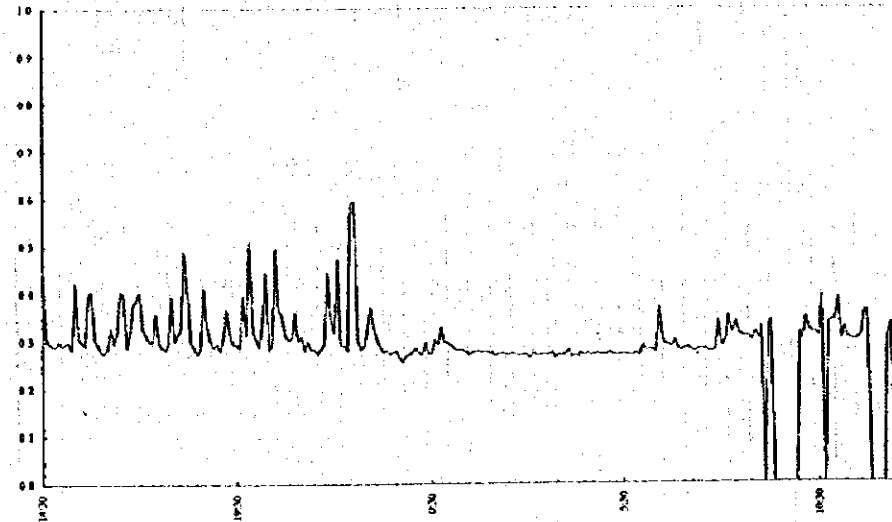
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No.5 (LTR/SEC)

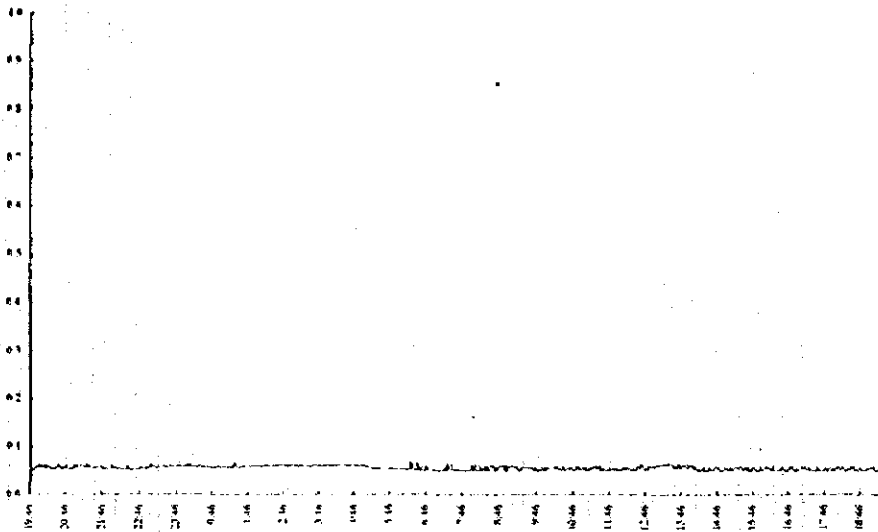


No.6 (LTR/SEC)



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Figure A-4.13
Flow Data at House (Formal Area No.4, 5 & 6)
NIPPON KOEI CO., LTD.

No.7 (LTR/SEC)



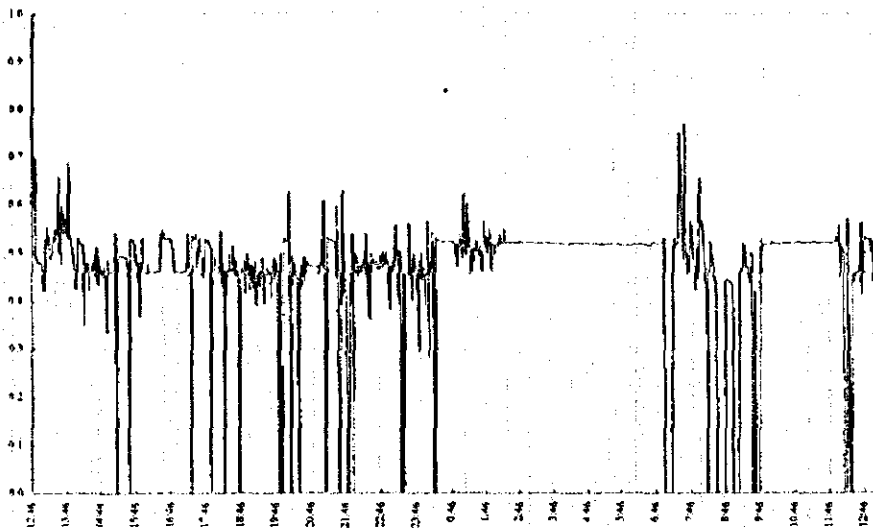
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THE STUDY ON THE DEVELOPMENT OF
WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

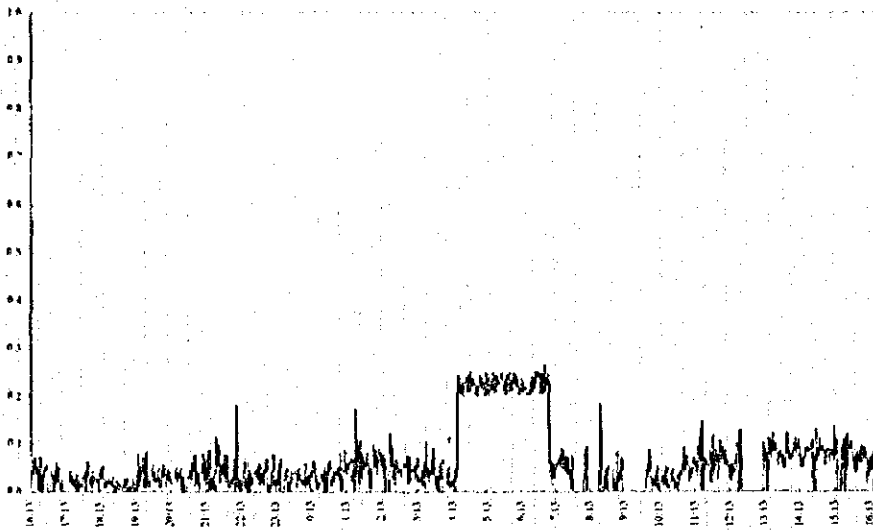
Figure A-4.14
Flow Data at House (Formal Area No.7)

NIPPON KOEI CO., LTD.

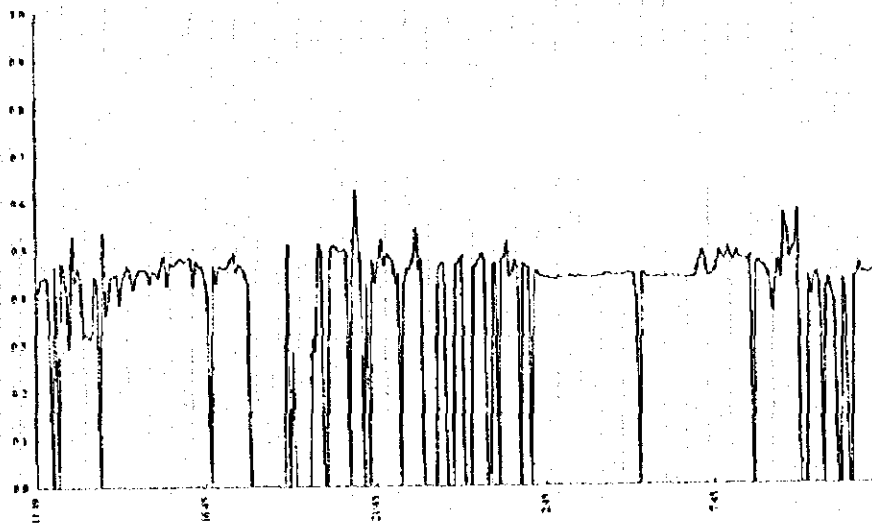
No.8 (LTR/SEC)



No.9 (LTR/SEC)



No.10 (LTR/SEC)



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THE STUDY ON THE DEVELOPMENT OF
WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure A-4.15

Flow Data at House (Informal Area)

NIPPON KOEI CO., LTD.

