ATTACHMENT - 1 QUESTIONNAIRE FOR HOUSEHOLD SURVEY

QUESTIONNAIRE

NO.	:
Area	:
Date	:

SURVEY ON PRESENT WATER USE AND HOUSEHOLD INCOME

This questionnaire is prepared by the JICA Study Team (the Japan International Cooperation Agency) in cooperation with WAJ (the Water Authority, Jordan) to upgrade the water service level in Zarqa District. Results of the survey are key information to formulate a water system improvement program. Your cooperation would be most grateful.

Name	
Address	
Occupation	

1. Number of family members living together

Adults : _____ persons
Children : _____ persons

2. House made of : 1) Brick 2) Concrete / stone 3) Wood 4) Others

3. Religion : 1) Islam 2) Christian (Catholic, Protestant, etc.) 3) Others

4. Major water source :

Source	Drinking & cooking	Laundering	Bathing	Toilet	Gardening	Others if any
1) WAJ'S Pipe Water House connection						
2) Tank lorry (private)						
3) Bottled Water						
4) Spring or wells						
5) Others						

5. Do you boil water before drinking?

1)Yes 2) No

6. How is water pressure at your house tap?

1) Low 2) Average 3) High

7. Do you use any water purifier (filter) at your house taps?

1)Yes 2) No

8. Do you use any house pumps?
1) Yes 2) No

9. How much water are you using?

_____ litre / day or _____ buckets / day

10. How many days a week you can have piped water?

1) One day 2) Tow days
3) Three days 4) More than 4 days
5) All days of the week

11. If the water is not limited, how much water do you consume?

1) Same as the present 2) 1.5 times
3) 2 times 4) 3 times or more

12. Do you have any water storage device in your house ?

1) Yes 2) No

13 . How much tariff do you pay for water, sewerage and electricity per month ?

1) Water : _____ JD / month
2) Sewerage
Puplic : _____ JD / month
Private : _____ JD / month
3) Electricity : _____ JD / month

14. Do you feel your monthly payment reasonable?

1) Yes 2) No

* If no, select the reason from the following:
1) Poor quanlity 2) Less quantity or pressure
3) Expensive as compared to the total income

15. Average monthly income:

1) Less than 100 JD
2) 100 JD - 200 JD
3) 200 JD - 300 JD
4) 300 JD - 400 JD
5) 400 JD - 500 JD
6) 500 JD - 600 JD
7) 600 JD or more, (Approximately _____ JD / month)

Thank you for your cooperation!

Tables

Table - C1 WATER CONSUMPTION BY CATEGORIES

Unite : m3

	94-1	94-2	94-3	94-4	Yearly Total	
Domestic	3,003,193	2,864,889	3,500,440	3,679,298	13,047,820 (	98.3%)
Municipality, etc.	35,607	38,697	39,179	41,450	154,933 (	1.2%)
Large Consumers	15,769	14,086	18,914	20,756	69,525 (	0.5%)
Total per Quarter	3,054,569	2,917,672	3,558,533	3,741,504	13,272,278	

Source: WAJ Zarqa

Table - C2 SAMPLE NUMBER FOR EACH MUNICIPALITY

	Zarqa	Rusaifa	Hashemeyah	Sukna	Total
Population	359,000	115,500	9,800	6,100	490,400
Percentage of Sampling	0.03%	0.08%	0.20%	0.25%	0.05%
Number of Samples	125	95	20	15	255

Source: JICA Study Team

Table - C3 PRIMARY DATA OF HOUSEHOLD SURVEY(1)

CITY NAME	BLOCK NO.	BILLING AREA NO.	JOB	ADULTS NO.	CHILDREN NO.	BUIDING MATERIALS	RELIGION	WATER SOURCE	BOILING WATER	WATER PRESSURE	FILTER	WATER CONSUMPTION	HOW MANY DAYS	WATER DEMAND	WATER STORAGE	WATER TARIFF	ELECTRICITY	SEWERAGE TARIFF	TYPE OF SEWERAGE SERVICES	SATISFACTION	INCOME	REASON FOR BEING UNSATISFIED
Z	1.1	45	Soldier	3	3	2	1	WAJ	2	2	2	108	2	1	3	2	5	0.0	Non	2	150	2
Z	1.1	44	Soldier	2	3	2	1	WAJ	2	1	2	103	2	1	3	4	5	0.0	Non	2	150	3
Z	1.1	45	Dead	4	3	2	1	WAJ	2	2	2	45	2	3	3	1	8	0.0	Non	2	75	3
Z	1.1	45	Employee	3	5	2	1	WAJ	2	2	2	46	2	1	3	5	7	0.0	Non	2	150	3
Z	1.1	45	Retired	2	5	2	1	WAJ	2	2	2	32	4	1	3	2	6	0.0	Non	2	150	3
Z	1.2	1	Farmer	4	6	2	1	WAJ	2	2	2	24	4	1	3	3	6	0.0	Non	2	75	3
Z	1.2	1	Employee	3	2	2	1	WAJ	2	2	2	20	4	1	3	2	6	0.0	Non	2	150	3
Z	1.2	1	Farmer	3	5	2	1	WAJ	2	2	2	8	2	3	3	3	6	0.0	Non	2	75	3
Z	1.2	1	Trader	6	10	2	1	WAJ	2	1	2	40	2	3	3	5	12	0.0	Non	2	150	3
Z	1.2	1	Unemployed	6	10	2	1	WAJ	2	2	2	-	4	1	3	5	30	0.0	Pu	1	250	4
Z	2	44	Dead	4	0	2	1	Tanks	2	1	2	-	2	1	3	1	4	0.0	Non	2	75	3
Z	2	44	Employee	4	4	2	1	Tanks	2	1	2	6	1	4	3	1	0	0.0	Non	2	150	2
Z	2	44	Driver	9	8	2	1	WAJ	2	1	2	-	2	1	3	20	0	0.0	Non	2	150	2
Z	2	44	Farmer	4	1	2	1	Tanks	2	1	2	30	1	3	3	2	0	0.0	Non	2	75	3
Z	2	44	Employee	7	7	2	1	Tanks	2	1	2	4	1	3	3	10	0	0.0	Non	2	150	2
Z	3	44	Employee	6	1	2	1	WAJ	2	1	2	82	2	4	3	10	15	0.0	Non	2	150	3
Z	3	45	Retired	4	5	2	1	WAJ	2	2	2	42	2	3	3	3	20	0.0	Non	2	150	3
Z	3	44	Employee	6	5	2	1	WAJ	2	2	2	39	2	3	3	2	5	0.0	Non	2	75	3
Z	3	44	Employee	4	5	2	1	WAJ	2	2	2	10	2	3	3	3	10	0.0	Non	2	75	3
Z	3	4	Employee	2	6	2	1	WAJ	2	2	2	82	2	3	3	4	10	0.0	Non	2	150	3
Z	4	44	Farmer	5	8	2	1	WAJ	2	2	2	64	1	3	3	2	10	0.0	Non	2	75	3
Z	4	44	Retired	3	4	2	1	Tanks	2	1	2	43	1	3	3	2	0	0.0	Non	2	75	2
Z	4	44	Employee	2	8	2	1	Tanks	2	1	2	155	1	3	3	2	5	0.0	Non	2	75	2
Z	4	44	Employee	4	7	2	1	WAJ	2	2	2	10	2	3	3	3	0	0.0	Non	2	150	2
Z	4	44	Trader	4	9	2	1	Tanks	2	1	2	48	1	3	3	3	0	0.0	Non	2	150	2
Z	5	44	Employee	3	3	2	2	WAJ	2	2	2	26	4	3	3	3	9	0.0	Non	2	150	3
Z	5	44	Retired	2	4	2	1	WAJ	2	2	2	196	4	1	3	3	5	0.0	Non	2	150	3
Z	5	1	Trader	2	6	2	1	WAJ	2	2	2	38	4	1	3	5	10	0.0	Non	2	150	3
Z	5	44	Employee	3	4	2	1	WAJ	2	2	2	30	4	1	3	3	4	0.0	Non	2	75	3
Z	5	1	Employee	2	3	2	1	WAJ	2	2	2	30	4	1	3	3	0	0.0	Non	1	150	4
Z	6	45	Retired	3	0	2	1	WAJ	2	2	2	49	4	1	3	1	55	0.0	Non	2	75	3
Z	6	45	Soldier	2	3	2	1	WAJ	2	2	2	44	3	1	3	1	0	0.0	Non	1	75	4
Z	6	45	Retired	3	4	2	1	WAJ	2	2	2	39	4	1	3	5	10	0.0	Non	2	150	3
Z	6	45	Retired	5	5	2	1	WAJ	2	2	2	5	4	1	3	2	8	0.0	Non	2	75	3
Z	6	45	Employee	4	7	2	1	WAJ	2	2	2	49	4	1	3	1	3	0.0	Non	2	150	3
Z	7	35	Accountant	2	1	2	1	WAJ	2	3	2	155	3	1	3	1.5	12	0.0	Non	1	150	4
Z	7	35	Teacher	8	0	1	2	WAJ	2	2	2	110	3	1	3	24	15	0.0	Non	2	150	3
Z	7	35	Employee	2	4	1	2	WAJ	1	3	2	15	3	1	3	1.5	7	0.0	Non	1	250	4
Z	7	35	Employee	2	4	2	1	WAJ	2	2	2	91	2	1	3	30	14	0.0	Non	2	250	3
Z	7	35	Unemployed	5	0	2	1	WAJ	2	3	2	-	3	1	3	4	4	0.0	Non	2	75	3
Z	8	34	Employee	3	4	2	1	WAJ	2	2	2	97	3	1	3	2	6	4.0	Pu	2	150	3
Z	8	3	Worker	2	0	2	1	WAJ	2	3	2	14	4	1	3	2	6	0.0	Non	1	75	1
Z	8	34	Retired	2	2	2	1	WAJ	2	3	2	13	4	1	3	3	8	0.0	Non	1	150	1
Z	8	3	Employee	4	2	2	1	WAJ	2	2	2	40	3	1	3	3	10	0.0	Pu	2	150	3
Z	8	34	Retired	3	4	2	1	WAJ	2	3	2	29	4	1	3	3	9	0.0	Non	1	150	1

Table - C3 PRIMARY DATA OF HOUSEHOLD SURVEY(2)

CITY NAME	BLOCK NO.	BILLING AREA NO.	JOB	ADULTS NO.	CHILDREN NO.	BUILDING MATERIALS	RELIGION	WATER SOURCE	BOILING WATER	WATER PRESSURE	FILTER	WATER CONSUMPTION	HOW MANY DAYS	WATER DEMAND	WATER STORAGE	WATER TARIFF	ELECTRICITY	SEWERAGE TARIFF	TYPE OF SEWERAGE SERVICES	SATISFACTION	INCOME	REASON FOR BEING UNSATISFIED
Z	9	36	Unemployed	5	3	2	1	WAJ	2	3	2	25	3	1	3	8	12	3.0	Pu	1	150	4
Z	9	36	Teacher	4	5	2	1	WAJ	1	2	2	19	3	1	3	8	20	3.0	Non	1	150	4
Z	9	36	Driver	5	4	2	1	WAJ	2	2	2	41	3	1	3	8	13	3.0	Pu	2	250	3
Z	9	36	Worker	5	0	2	1	WAJ	2	2	2	34	3	1	3	5	8	2.0	Pu	1	75	4
Z	9	36	Mechanic	8	7	2	1	WAJ	1	1	2	67	3	1	3	12	20	0.0	Non	2	150	3
Z	12	36	Employee	3	2	2	1	WAJ	2	2	2	20	3	1	3	20	20	0.0	Non	2	450	3
Z	12	36	Trader	5	2	1	1	WAJ	2	3	2	94	2	1	3	40	25	0.0	Non	2	350	2
Z	12	36	Unemployed	6	1	2	1	WAJ	2	2	2	79	2	1	3	30	9	0.0	Non	2	150	3
Z	12	36	Soldier	2	3	2	1	WAJ	2	2	1	73	2	1	3	4.5	5	0.0	Non	1	150	4
Z	12	36	Teacher	3	2	2	1	WAJ	1	3	1	50	3	1	3	4.5	10	1.0	Pu	1	150	4
Z	13	3	Retired	7	5	1	1	WAJ	2	2	2	50	4	1	3	40	25	15.0	Pr	2	75	3
Z	13	3	Soldier	2	7	2	1	WAJ	2	2	2	32	4	1	3	4.5	3.5	2.0	Pr	2	150	3
Z	13	3	Trader	4	5	2	1	WAJ	1	2	2	56	4	1	3	5	5.5	2.0	Pr	1	150	1
Z	13	3	Baker	5	2	2	1	WAJ	1	2	2	30	4	1	3	2	20	5.0	Pr	1	75	4
Z	13	3	Trader	7	0	2	1	WAJ	2	2	2	37	4	1	3	4	6	2.0	Pr	1	150	2
Z	14	1	Unemployed	11	0	2	1	WAJ	2	2	2	-	1	2	3	3	5	0.0	Pr	2	75	3
Z	14	1	Employee	3	7	2	1	WAJ	2	2	2	-	1	1	3	2	5	0.0	Pr	1	150	4
Z	14	1	Dead	5	5	2	1	WAJ	2	2	2	-	1	1	3	2	0	7.0	Pr	2	75	3
Z	14	1	Lawyer	4	3	2	1	WAJ	2	2	2	-	4	1	3	15	18	0.0	Pr	2	450	3
Z	14	1	Employee	3	5	2	1	WAJ	2	2	2	-	2	1	3	20	15	8.0	Pr	2	350	3
Z	15	1	Worker	2	4	2	1	WAJ	2	2	2	-	2	1	3	5	15	4.0	Pr	2	150	3
Z	15	1	Teacher	4	5	2	1	WAJ	2	2	2	-	2	1	3	5	0	0.0	Pr	1	150	4
Z	15	1	Employee	3	4	2	1	WAJ	2	2	2	-	1	1	3	2	0	4.0	Pr	2	150	3
Z	15	1	Employee	6	2	2	1	WAJ	2	2	2	-	2	1	3	5	12	0.0	Pr	2	150	3
Z	15	1	Employee	6	4	2	1	WAJ	2	2	2	-	1	1	3	2	8	7.0	Pr	2	150	3
Z	16	30	Accountant	2	0	2	1	WAJ	2	2	2	-	3	1	3	5	15	0.0	Pu	1	150	2
Z	16	30	Farmer	6	0	2	1	WAJ	2	3	2	-	3	1	3	4	12	0.0	Pu	1	150	2
Z	16	30	Worker	2	4	2	1	WAJ	2	3	2	-	2	1	3	4	8	0.0	Pu	1	75	3
Z	16	30	Accountant	2	2	2	1	WAJ	2	3	2	-	2	1	3	5	12	0.0	Pu	1	150	2
Z	16	30	Employee	4	2	2	1	WAJ	2	2	2	-	4	1	3	6	22	0.0	Pu	2	150	3
Z	17	20	Retired	6	5	1	1	WAJ	2	3	2	-	4	1	3	2	7	0.0	Pu	1	150	4
Z	17	19	Retired	7	3	1	1	WAJ	2	2	2	-	3	1	3	5	6	0.0	Pu	1	150	3
Z	17	20	Trader	6	5	2	1	WAJ	2	2	2	-	4	1	3	1.5	12	0.0	Pu	1	150	4
Z	17	20	Unemployed	5	3	2	2	WAJ	2	2	2	-	4	1	3	2	15	0.0	Pu	2	150	3
Z	17	20	Worker	4	6	2	1	WAJ	2	2	2	-	4	1	3	4	8	1.5	Pu	2	250	3
Z	18	19	Engineer	2	2	1	1	WAJ	1	2	2	28	4	1	3	4	8	0.0	Pu	1	350	3
Z	18	19	Doctor	3	4	2	1	WAJ	2	2	2	13	4	1	3	2	20	0.0	Pu	1	550	3
Z	18	15	Trader	2	6	2	1	WAJ	2	2	2	-	4	1	3	2	12	0.0	Non	2	150	3
Z	18	19	Trader	3	5	2	1	WAJ	2	2	2	39	4	1	3	6	12	0.0	Pu	1	150	3
Z	18	19	Trader	2	5	2	1	WAJ	2	2	2	73	4	1	3	2	15	0.0	Pu	1	75	3
Z	19	40	Unemployed	7	6	2	1	WAJ	2	3	2	77	4	1	3	20	25	0.0	Pu	2	250	3
Z	19	40	Trader	5	9	1	1	WAJ	2	3	2	78	4	1	3	25	11	0.0	Pu	2	650	3
Z	19	40	Retired	10	4	2	1	WAJ	2	3	2	40	4	1	3	14	12	0.0	Pu	2	150	3
Z	19	40	Driver	9	10	2	1	WAJ	2	2	2	70	4	1	3	15	18	0.0	Pu	2	150	3
Z	19	40	Trader	11	3	2	1	WAJ	2	2	2	52	4	1	3	8	20	0.0	Pu	2	75	3

Table - C3 PRIMARY DATA OF HOUSEHOLD SURVEY(3)

CITY NAME	BLOCK NO.	BILLING AREA NO.	JOB	ADULTS NO.	CHILDREN NO.	BUIDING MATERIALS	RELIGION	WATER SOURCE	BOILING WATER	WATER PRESSURE	FILTER	WATER CONSUMPTION	HOW MANY DAYS	WATER DEMAND	WATER STORAGE	WATER TARIFF	ELECTRICITY	SEWERAGE TARIFF	TYPE OF SEWERAGE SERVICES	SATISFACTION	INCOME	REASON FOR BEING UNSATISFIED
Z	20.1	18	Trader	4	2	1	1	WAJ	2	2	2	11	4	1	3	15	14	0.0	Pu	2	250	3
Z	20.1	25	Trader	2	7	2	2	WAJ	2	2	2	7	4	1	3	7	6	0.0	Non	2	75	3
Z	20.1	25	Retired	6	0	2	2	WAJ	2	2	2	44	4	1	3	12	15	0.0	Non	1	150	4
Z	20.1	18	Retired	4	5	2	2	WAJ	2	2	1	8	4	1	3	15	20	0.0	Pu	2	150	3
Z	20.1	25	Trader	11	4	2	1	WAJ	2	2	2	70	4	1	3	20	8	0.0	Non	1	150	4
Z	20.2	18	Employee	6	1	2	1	WAJ	1	2	2	-	4	1	3	20	19	30.0	Pr	2	150	3
Z	20.2	25	Employee	2	4	2	2	WAJ	2	2	2	33	4	1	3	3	10	0.0	Non	1	150	4
Z	20.2	18	Retired	4	3	2	1	WAJ	2	2	2	-	2	1	3	3	14	0.0	Non	2	150	3
Z	20.2	25	Guard	2	4	2	1	WAJ	2	2	2	13	4	1	3	12	7	0.0	Non	1	75	4
Z	20.2	18	Employee	2	3	1	1	WAJ	1	2	2	36	4	1	3	3	20	0.0	Pr	2	150	3
Z	21	25	Retired	2	0	2	1	WAJ	2	2	2	62	4	1	3	4	5	0.0	Non	1	150	4
Z	21	25	Retired	4	0	2	1	WAJ	2	2	2	46	4	1	3	5	14	0.0	Non	2	150	3
Z	21	25	Trader	4	2	2	1	WAJ	2	2	2	32	4	1	3	7	8	0.0	Non	1	150	4
Z	21	25	Retired	5	3	1	2	WAJ	2	2	2	57	4	1	3	4	12	0.0	Non	1	250	4
Z	21	25	Retired	7	0	2	2	WAJ	2	2	2	43	4	1	3	4	18	0.0	Non	1	150	4
Z	22	13	Worker	9	5	2	1	WAJ	2	2	2	59	3	1	3	18	20	0.0	Non	1	150	4
Z	22	43	Retired	8	0	2	1	WAJ	2	2	2	50	3	1	3	3	5	0.0	Non	1	150	4
Z	22	43	Farmer	4	7	2	1	WAJ	2	2	2	64	2	1	3	23	6	0.0	Non	2	75	3
Z	22	43	Farmer	7	7	2	1	WAJ	2	2	2	109	3	1	3	3	15	0.0	Non	2	75	3
Z	22	43	Driver	3	4	2	1	WAJ	2	2	2	50	3	1	3	4	4	0.0	Non	1	150	2
Z	23	6	Driver	5	9	2	1	WAJ	2	2	2	96	4	1	3	5	20	0.0	Pu	2	150	3
Z	23	6	Trader	6	3	2	1	WAJ	2	2	2	50	4	1	3	10	6	0.0	Pu	2	150	3
Z	23	6	Retired	7	0	2	1	WAJ	2	3	2	50	4	1	3	5	20	0.0	Non	2	75	3
Z	23	6	Driver	5	5	2	1	WAJ	2	2	2	30	2	1	3	3.5	9	0.0	Pu	2	150	3
Z	23	6	Retired	6	8	2	1	WAJ	2	3	2	-	4	1	3	20	20	0.0	Pu	1	75	4
Z	24	6	Trader	2	2	1	2	WAJ	2	3	2	-	3	1	3	1.3	5	0.0	Pu	2	150	3
Z	24	6	Employee	4	4	2	1	WAJ	2	3	2	45	4	1	3	1	10	0.0	Non	2	150	3
Z	24	6	Driver	1	2	2	1	WAJ	2	3	2	-	4	1	3	5	5	0.0	Pu	2	75	3
Z	24	6	Farmer	10	9	2	1	WAJ	2	3	2	-	4	1	3	3	15	0.0	Non	2	150	3
Z	24	6	Employee	2	4	2	1	Tanks	2	2	2	90	2	1	3	3	5	0.0	Pu	2	150	3
Z	25	5	Employee	3	5	2	1	WAJ	2	2	2	50	4	1	3	6	5	0.0	Pu	2	150	3
Z	25	5	Soldier	3	2	2	1	WAJ	2	2	2	4	4	1	3	2.5	2.5	0.0	Pu	1	75	4
Z	25	5	Employee	2	7	2	1	WAJ	2	2	2	18	4	1	3	3	4	0.0	Pu	2	150	3
Z	25	5	Employee	4	1	2	1	WAJ	2	2	2	116	4	1	3	10	10	0.0	Pu	2	150	3
Z	25	5	Soldier	2	2	2	1	WAJ	2	2	2	10	4	1	3	1.7	5	0.0	Pu	2	150	3
Z	26	7	Worker	2	7	2	1	WAJ	2	2	2	100	4	1	3	5	5	0.0	Non	2	75	1
Z	26	7	Driver	5	0	2	1	WAJ	2	2	2	57	1	1	3	6	7	0.0	Non	2	75	3
Z	26	7	Unemployed	5	0	2	1	WAJ	2	2	2	37	4	1	3	1.7	3	0.0	Non	2	75	3
Z	26	7	Employee	8	2	1	1	WAJ	2	2	2	178	2	1	3	18	20	0.0	Non	2	150	3
Z	26	7	Trader	9	1	2	1	WAJ	2	2	2	46	4	1	3	3	15	0.0	Non	1	150	4
Z	27	4	Retired	4	7	2	1	WAJ	2	2	2	98	4	1	3	3	4	9.0	Pr	2	75	3
Z	27	4	Farmer	5	0	2	1	WELL	2	4	2	50	4	1	3	0	10	0.0	Non	2	75	3
Z	27	6	Retired	6	0	2	1	WAJ	2	3	2	31	4	1	3	5	16	5.0	Pr	2	75	3
Z	27	4	Farmer	5	6	2	1	WELL	2	4	2	60	4	1	3	0	8	0.0	Non	2	150	3
Z	27	4	Soldier	2	2	2	1	WAJ	2	3	2	10	4	1	3	1.5	6	0.0	Non	2	150	3

Table - C3 PRIMARY DATA OF HOUSEHOLD SURVEY(4)

CITY NAME	BLOCK NO.	BILLING AREA NO.	JOB	ADULTS NO.	CHILDREN NO.	BUIDING MATERIALS	RELIGION	WATER SOURCE	BOILING WATER	WATER PRESSURE	FILTER	WATER CONSUMPTION	HOW MANY DAYS	WATER DEMAND	WATER STORAGE	WATER TARIFF	ELECTRICITY	SEWERAGE TARIFF	TYPE OF SEWERAGE SERVICES	SATISFACTION	INCOME	REASON FOR BEING UNSATISFIED
Z	28	4	Farmer	8	8	2	1	WAJ	2	2	2	50	4	1	3	4	17	2.0	Pr	2	75	3
Z	28	15	Driver	3	6	2	1	WAJ	2	2	2	-	4	1	3	1.3	5	3.0	Pr	2	150	3
Z	28	15	Driver	2	5	1	1	WAJ	2	2	2	-	1	1	3	2.8	10	0.0	Non	1	150	4
Z	28	15	Unemployed	2	5	2	1	WAJ	2	2	2	-	4	1	3	1.3	7	5.0	Pr	2	75	3
Z	28	15	Worker	2	1	2	1	WAJ	2	2	2	-	4	1	3	1.3	3	0.0	Non	1	150	4
Z	29	15	Worker	2	4	2	1	WAJ	2	2	2	-	4	1	3	2	7	0.0	Non	1	150	3
Z	29	15	Worker	2	5	2	1	WAJ	2	2	2	100	4	1	3	10	6	5.0	Pr	2	150	3
Z	29	15	Employee	2	4	2	1	WAJ	2	2	2	-	4	1	3	3	10	0.0	Non	2	150	3
Z	29	15	Trader	5	4	2	1	WAJ	2	2	2	-	4	1	3	0.4	8	0.0	Non	1	150	4
Z	29	15	Driver	2	6	2	1	WAJ	2	2	2	-	4	1	3	1	8	4.0	Pu	2	150	3
Z	30	15	Employee	2	2	2	1	WAJ	2	2	2	-	4	1	3	1	5	0.0	Non	1	150	4
Z	30	15	Employee	2	4	2	1	WAJ	2	2	1	-	4	1	3	1.3	5	2.0	Pu	2	150	3
Z	30	15	Unemployed	2	0	2	1	WAJ	2	1	2	-	4	1	3	1	6	1.0	Pu	2	75	3
Z	30	15	Worker	2	5	2	1	WAJ	2	1	2	-	4	1	3	2	5	0.0	Non	2	150	1
Z	30	15	Driver	3	6	2	1	WAJ	2	1	2	-	4	1	3	1	30	1.0	Pu	2	150	3
Z	31	8	Driver	7	2	2	1	WAJ	2	2	2	60	3	2	3	4	10	4.0	Pr	2	150	3
Z	31	8	Worker	7	1	2	1	WAJ	2	2	2	72	3	1	3	10	12	5.0	Pr	2	150	3
Z	31	8	Driver	3	7	2	1	WAJ	2	2	2	30	3	1	3	3	10	10.0	Pr	2	150	3
Z	31	8	Farmer	7	9	2	1	WAJ	2	2	2	-	4	1	3	5	10	10.0	Pr	2	150	3
Z	31	41	Retired	7	3	2	1	WAJ	2	3	2	40	4	1	3	3	5	5.0	Pr	1	150	4
Z	32	15	Driver	2	2	2	1	WAJ	2	2	2	200	4	1	3	0.5	5	0.0	Non	1	150	4
Z	32	15	Driver	3	4	2	1	WAJ	2	2	2	-	4	1	3	0.4	7	0.0	Non	1	150	4
Z	32	15	Unemployed	1	4	2	1	WAJ	2	2	2	-	4	1	3	1	7	0.0	Non	2	75	3
Z	32	15	Director	4	3	2	1	WAJ	2	2	2	-	4	1	3	0.4	5	2.0	Pu	2	75	3
Z	32	42	Worker	2	0	2	1	WAJ	2	2	2	-	4	1	3	0.5	7	0.0	Non	2	75	3
R	33	5	Director	8	5	2	1	WAJ	2	2	2	110	2	1	3	20	24	0.0	Pu	2	250	3
R	33	5	Employee	4	4	2	1	WAJ	2	2	2	-	1	1	3	10	7	0.0	Non	2	350	3
R	33	5	Teacher	5	1	2	1	WAJ	2	2	2	16	1	1	3	4	8	0.0	Pu	1	250	1
R	33	5	Unemployed	5	3	1	1	WAJ	2	4	2	30	1	1	3	5	16	0.0	Pu	2	75	2
R	33	5	Trader	6	6	2	1	WAJ	2	2	2	21	1	1	3	17	17	0.0	Non	2	250	2
R	34	17	Driver	5	5	2	1	WAJ	2	2	2	25	2	1	3	8	12	0.0	Pu	1	75	3
R	34	17	Trader	6	2	2	1	WAJ	2	2	2	5	2	1	3	3	9	7.0	Pr	1	75	1
R	34	17	Trader	4	4	2	1	WAJ	2	1	2	30	2	1	3	5	6	0.0	Pu	1	75	3
R	34	17	Carpenter	6	4	2	1	WAJ	2	2	2	-	2	1	3	6	12	0.0	Pu	2	150	2
R	34	17	Retired	4	8	2	1	WAJ	2	2	2	50	2	1	3	15	4	0.0	Pu	2	75	3
R	35	62	Teacher	5	3	1	1	WAJ	2	2	2	70	1	1	3	16	8	0.0	Non	1	150	3
R	35	62	Trader	2	2	1	1	WAJ	1	1	2	39	1	1	3	3	12	0.0	Non	2	75	2
R	35	62	Trader	3	5	2	1	WAJ	2	2	2	46	1	1	3	4	6	7.0	Pr	2	150	3
R	35	62	Retired	8	5	2	1	WAJ	2	2	2	70	1	1	3	8	15	0.0	Non	1	75	3
R	35	17	Worker	7	5	2	1	WAJ	2	2	2	95	2	1	3	20	10	0.0	Non	1	150	3
R	36	36	Retired	8	1	2	1	WAJ	1	2	2	44	4	1	3	3	8	0.0	Non	1	150	4
R	36	36	Trader	4	0	2	1	WAJ	1	2	2	100	3	1	3	7	10	7.0	Pr	1	150	4
R	36	36	Retired	8	3	2	1	WAJ	2	2	2	128	4	1	3	6	12	0.0	Non	2	75	3
R	36	36	Unemployed	6	2	2	1	WAJ	1	2	2	82	4	1	3	10	5	0.0	Non	2	250	3
R	36	36	Trader	6	8	2	1	WAJ	2	2	2	62	4	1	3	5	17	0.0	Non	1	150	4

Table - C3 PRIMARY DATA OF HOUSEHOLD SURVEY(5)

CITY NAME	BLOCK NO.	BILLING AREA NO.	JOB	ADULTS NO.	CHILDREN NO.	BUILDING MATERIALS	RELIGION	WATER SOURCE	BOILING WATER	WATER PRESSURE	FILTER	WATER CONSUMPTION	HOW MANY DAYS	WATER DEMAND	WATER STORAGE	WATER TARIFF	ELECTRICITY	SEWERAGE TARIFF	TYPE OF SEWERAGE SERVICES	SATISFACTION	INCOME	REASON FOR BEING UNSATISFIED
R	37	60	Retired	8	11	2	1	WAJ	2	2	2	34	4	1	3	1.5	19	0.0	Non	2	75	3
R	37	60	Unemployed	9	2	2	1	WAJ	2	2	2	30	4	1	3	1	12	0.0	Non	1	75	4
R	37	60	Worker	8	5	2	1	WAJ	2	2	2	61	4	1	3	6	13	0.0	Non	2	150	3
R	37	60	Retired	8	9	2	1	WAJ	2	2	2	30	4	1	3	1.5	8	0.0	Non	1	75	4
R	37	60	Employee	6	4	2	1	WAJ	2	2	2	10	4	1	4	1	20	0.0	Non	1	250	4
R	38	36	Retired	3	5	2	1	WAJ	2	2	2	73	4	3	3	4	10	0.0	Non	2	150	3
R	38	36	Retired	2	5	2	1	Tanks	2	1	2	41	2	1	3	1	4	0.0	Non	2	150	3
R	38	36	Farmer	4	2	2	1	WAJ	2	2	2	78	4	1	3	3	5	0.0	Non	2	150	3
R	38	36	Employee	4	5	2	1	WAJ	2	2	2	97	4	1	3	4	10	0.0	Non	2	150	3
R	38	36	Farmer	2	3	2	1	WAJ	2	2	2	71	4	3	3	4	4	0.0	Non	2	75	3
R	39	9	Worker	8	1	2	1	WAJ	2	2	2	73	4	1	3	5	30	0.0	Non	1	150	4
R	39	9	Driver	3	2	1	1	WAJ	2	2	2	90	3	1	3	5	13	0.0	Non	2	150	3
R	39	9	Trader	9	4	2	1	WAJ	2	2	2	88	2	1	3	5	12	0.0	Pu	2	75	3
R	39	9	Trader	7	14	2	1	WAJ	2	2	2	110	3	1	3	14	14	0.0	Non	2	150	3
R	39	9	Grocer	2	5	2	1	WAJ	2	2	2	26	2	1	3	0.6	7	0.0	Non	1	150	4
R	40	17	Retired	15	15	2	1	WAJ	2	2	2	120	2	1	3	14	33	2.0	Pu	2	250	3
R	40	17	Employee	15	3	2	1	WAJ	2	2	2	40	1	1	3	1	4	0.0	Non	1	150	4
R	40	17	Teacher	4	6	2	1	WAJ	2	2	2	60	2	1	3	2	8	0.0	Non	2	150	3
R	40	17	Driver	4	1	1	1	WAJ	2	2	2	-	1	1	3	5	30	0.0	Non	2	150	3
R	40	17	Driver	2	5	2	1	WAJ	2	2	2	30	1	1	3	1.5	8	0.0	Non	1	150	4
R	41	9	Unemployed	9	9	2	1	WAJ	2	2	2	50	3	1	3	2.5	10	0.0	Pu	1	75	4
R	41	9	Unemployed	14	4	2	1	WAJ	2	2	2	65	4	1	3	10	8	0.0	Pu	2	150	3
R	41	9	Unemployed	6	1	2	1	WAJ	2	2	2	60	2	1	3	4	15	0.0	Pu	1	250	3
R	41	9	Carpenter	11	11	2	1	WAJ	2	2	2	66	3	1	3	1.5	10	7.0	Pr	1	150	4
R	41	9	Retired	12	4	2	1	WAJ	2	2	2	86	1	1	3	5	30	0.0	Pu	2	150	3
R	42	9	Employee	10	10	2	1	WAJ	2	2	2	94	2	1	3	10	12	0.0	Pu	2	150	3
R	42	9	Driver	5	9	2	1	WAJ	2	2	2	65	2	1	3	4	30	0.0	Pu	1	150	4
R	42	9	Unemployed	10	7	2	1	WAJ	2	2	2	120	2	1	3	10	20	0.0	Pu	2	75	3
R	42	5	Dead	6	9	2	1	WAJ	2	2	2	95	2	1	3	1.5	12	0.0	Pu	1	150	4
R	42	5	Unemployed	11	8	2	1	WAJ	2	2	2	46	2	1	3	5	10	0.0	Pu	2	75	3
R	43	2	Employee	2	4	2	1	WAJ	2	2	2	5	3	1	3	5	7	0.0	Non	2	250	3
R	43	2	Officer	7	4	2	1	WAJ	2	2	2	61	3	1	3	5	12	0.0	Non	1	250	4
R	43	2	Worker	8	5	2	1	WAJ	2	2	2	97	3	1	3	8	14	0.0	Non	2	250	3
R	43	2	Retired	5	5	2	1	WAJ	2	1	2	51	2	1	3	3	7	0.0	Non	2	75	3
R	43	2	Worker	10	4	2	1	WAJ	2	2	2	88	3	1	3	6	8	0.0	Non	2	150	3
R	44	2	Trader	3	0	2	1	WAJ	2	2	2	88	3	1	3	7	20	0.0	Non	2	150	3
R	44	2	Trader	5	2	2	1	WAJ	2	2	2	20	3	1	3	3	6	1.0	Non	2	150	4
R	44	2	Trader	7	7	2	1	WAJ	2	2	2	50	2	1	3	4	15	0.0	Non	2	75	3
R	44	2	Trader	8	1	2	1	WAJ	2	2	2	35	3	1	3	3	20	0.0	Non	2	150	3
R	44	2	Trader	2	5	2	1	WAJ	2	2	2	34	3	1	3	7	3	0.0	Non	2	250	4
R	45	12	Retired	14	0	2	1	WAJ	2	2	2	40	1	1	3	4	10	0.0	Non	2	250	3
R	45	12	Employee	9	2	2	2	WAJ	2	2	1	44	1	1	3	2	6	2.0	Pu	2	150	3
R	45	12	Clerk	8	2	2	1	WAJ	2	1	2	15	1	1	3	2	7	0.0	Non	2	250	3
R	45	12	Police	7	2	2	1	WAJ	2	2	2	10	1	1	3	2	5	0.0	Pu	1	250	4
R	45	12	Dead	1	1	2	1	WAJ	2	2	2	35	1	1	3	2	10	0.0	Pr	2	75	3

Table - C3 PRIMARY DATA OF HOUSEHOLD SURVEY(6)

CITY NAME	BLOCK NO.	BILLING AREA NO.	JOB	ADULTS NO.	CHILDREN NO.	BUILDING MATERIALS	RELIGION	WATER SOURCE	BOILING WATER	WATER PRESSURE	FILTER	WATER CONSUMPTION	HOW MANY DAYS	WATER DEMAND	WATER STORAGE	WATER TARIFF	ELECTRICITY	SEWERAGE TARIFF	TYPE OF SEWERAGE SERVICES	SATISFACTION	INCOME	REASON FOR BEING UNSATISFIED
R	46	1	Employee	8	12	2	1	WAJ	2	3	2	102	4	1	3	25	20	0.0	Non	2	150	3
R	46	1	Trader	20	10	2	1	WAJ	2	2	2	18	4	1	3	30	30	0.0	Non	2	350	3
R	46	1	Retired	11	11	2	1	WAJ	2	1	2	60	3	1	3	4	2	0.0	Non	2	250	2
R	46	1	Trader	10	13	2	1	WAJ	2	2	2	50	2	1	3	15	25	0.0	Non	2	150	3
R	46	1	Worker	9	5	2	1	WAJ	2	1	2	67	1	2	3	8	20	0.0	Non	1	250	4
R	47.1	12	Worker	9	0	2	1	WAJ	2	2	2	20	1	1	3	2	7	10.0	Pr	2	150	3
R	47.1	1	Employee	7	3	2	1	WAJ	2	3	2	60	3	1	3	24	18	0.0	Non	2	350	3
R	47.1	1	Trader	8	1	1	1	WAJ	2	3	2	100	3	1	3	40	20	0.0	Non	2	150	3
R	47.1	12	Dead	6	2	2	1	WAJ	2	2	2	45	1	3	3	3	12	0.0	Non	1	250	4
R	47.1	12	Trader	5	7	2	1	WAJ	2	2	2	31	1	1	3	3	5	0.0	Non	1	350	4
R	47.2	1	Trader	8	4	2	1	WAJ	2	1	2	68	3	2	3	20	20	0.0	Non	2	150	3
R	47.2	12	Dead	8	0	2	1	WAJ	2	1	1	50	1	1	3	3	20	0.0	Non	2	350	3
R	47.2	1	Trader	3	4	2	1	WAJ	2	2	2	67	2	1	3	7	7	0.0	Non	1	150	4
R	47.2	1	Retired	6	4	2	1	WAJ	2	2	2	50	2	2	3	10	25	0.0	Non	1	150	4
R	47.2	12	Employee	2	4	2	1	WAJ	2	2	2	31	1	1	3	3	8	0.0	Pr	2	550	2
R	48	12	Trader	3	0	2	1	WAJ	2	3	2	30	1	3	4	3	7	2.0	Pu	2	150	3
R	48	12	Dead	7	1	2	1	WAJ	2	2	2	17	1	1	3	3	7	2.0	Pr	2	150	3
R	48	12	Driver	4	4	2	1	WAJ	2	1	2	35	1	3	3	2	8	1.0	Pu	2	75	3
R	48	12	Retired	5	5	1	1	WAJ	2	1	2	45	1	3	3	5	25	3.0	Pu	2	150	2
R	48	12	Unemployed	7	3	2	1	WAJ	2	2	2	26	1	2	4	4	12	1.0	Pu	2	150	3
R	49	64	Worker	4	3	2	1	WAJ	2	2	4	15	2	1	3	1.5	9	0.0	Pu	2	75	3
R	49	64	Worker	2	6	2	1	WAJ	2	1	2	26	2	1	3	1	8	0.0	Pu	2	150	3
R	49	64	Driver	8	3	1	1	WAJ	2	1	2	32	2	1	3	3	15	4.0	Pu	1	150	4
R	49	64	Unemployed	12	6	2	1	WAJ	1	2	2	40	2	1	3	2	10	0.0	Pu	2	150	3
R	49	64	Trader	8	5	2	1	WAJ	2	2	2	35	1	1	3	3	30	0.0	Pu	2	75	3
R	50	11	Farmer	12	3	2	1	WAJ	2	2	2	38	1	1	3	10	25	0.0	Pu	2	150	3
R	50	11	Retired	10	9	2	1	WAJ	2	2	2	50	2	1	3	5	8	0.0	Pu	2	150	3
R	50	11	Unemployed	5	0	2	1	WAJ	2	2	2	35	1	1	3	2	6	0.0	Pu	2	75	3
R	50	11	Trader	4	2	2	1	WAJ	2	2	2	40	3	1	3	2	5	0.0	Pu	2	75	3
R	50	11	Unemployed	12	7	2	1	WAJ	2	1	2	40	1	1	3	3	23	0.0	Pu	2	75	3

Source: JICA Study Team

Note: 1) Z : Zarqa, Hashemeyeh, Sukhna, New Zarqa, Awajan
R : Russifa, Shneller

2) Block No. : Survey block No. as shown on map
Billing Area No. : Billing area set up by WAJ

3) Building materials : 1 = Brick, 2 = Concrete/stone, 3 = Wood, 4 = Others

4) Religion : 1 = Islam, 2 = Christian, 3 = Others

5) Major water source : WAJ = WAJ's piped water, Tanks = Supplied by tank lorries

6) Boiling water : 1 = Yes, 2 = No

7) Water pressure : 1 = Low, 2 = Average, 3 = High, 4 = Others

8) Filter Equipped : 1 = Yes, 2 = No,

9) Water consumption per 3 months (m3) from meter reading records of WAJ.

10) How many days you receive water per week?: 1 = One day, 2 = Two day, 3 = Three days, 4 = More than 4 days

11) Water demand (How many times of water you want to use?): 1 = Same as present, 2 = 1.5 times, 3 = Two times, 4 = Three times

12) Water storage : 1 = Jar/bucket, 2 = Underground basin, 3 = Roof tank, 4 = Others

13) Water tariff : Payment for quarter (JD/3 months), Electricity : Payment for month (JD/month), Sewerage tariff for public services : Payment for quarter (JD/3 months), for private (JD/4 months)

14) Type of sewerage services : Pu = Public services, Pr = Private services, None = Not served

15) Satisfaction : 1 = Satisfied, 2 = Not satisfied

16) Income : 1 = Less than 100 JD/month, 2 = 100 - 200 JD/month, 3 = 200 - 300 JD/month, 4 = 300 - 400 JD/month, 5 = 400 - 500 JD/month, 6 = 500 - 600 JD/month, 7 = More than 600 JD/month

17) Reason of being not satisfied : 1 = Bad quality of water, 2 = Insufficient quantity, 3 = Payment is high as compared to income, 4 = No answer

Table - C4 FAMILY SIZE

City	Average (Person/Family)
Rusaifa	11.3
Zarqa	8.0
Average	9.2

Zarqa has a smaller family size than Rusaifa!

Table - C5 RELIGION

City	1. Islam	2. Christian	Total
Rusaifa	94(99%)	1(1%)	95
Zarqa	149(93%)	11(7%)	160
Total	243(95%)	12(5%)	255

Islamic population are 95% of the total. The remainings are christians.

Table - C6 BUILIDING MATERIALS

City	1. Brick	2. Concrete/stone	3. Wood	4. Others	Total
Rusaifa	2(2%)	92(97%)	0(0%)	1(1%)	95
Zarqa	4(3%)	156(98%)	0(0%)	0(0%)	160
Total	6(2%)	248(97%)	0(0%)	1(0%)	255

Most of houses, 97% of the total, are built of concrete and stone.

Table - C7 WATER SOURCE

City	WAJ Water	WAJ Water + Tanks as Alternatives	Wells	Total
Rusaifa	94(99%)	1(1%)	0(0%)	95
Zarqa	150(94%)	8(5%)	2(1%)	160
Total	244(96%)	9(4%)	2(1%)	255

Most people receive WAJ water, while a few percentage of households have alternative sources.

Table - C8 TYPE OF SEWERAGE SERVICES

City	Non	Private	Public	Total
Rusaifa	53 (56%)	8 (8%)	34 (36%)	95
Zarqa	87 (54%)	28 (18%)	45 (28%)	160
Total	140 (55%)	36 (14%)	79 (31%)	255

Smaller service ratio (45%) was summed up than 58 %, officially recorded by WAJ.

Table - C9 STORAGE DEVICES (Do you have any water storage device in your house for emergency?)

City	1. Jar/Bucket	2. Underground basin	3. Roof tank	4. Others	Total
Rusaifa	0(0%)	0(0%)	92(97%)	3(3%)	95
Zarqa	0(0%)	0(0%)	160(100%)	0(0%)	160
Total	0(0%)	0(0%)	252(99%)	3(1%)	255

Most families have storage devices.

Table - C10 BOILILNG WATER (Do you boil water before drink?)

City	1. Yes	2. No	Total
Rusaifa	5(5%)	90(95%)	95
Zarqa	9(6%)	151(94%)	160
Total	14(5%)	241(95%)	255

Most of population tend to use water without boiling for drinking purpose.

Table - C11 FILTER USAGE (Do you use any water purifier (filter) at your house tap?)

City	1. Yes	2. No	Total
Rusaifa	8(8%)	87(92%)	95
Zarqa	14(9%)	146(91%)	160
Total	22(8%)	233(92%)	255

About 10% of the households have filters at their taps.

Table - C12 FILTER VS. BOILING WATER

	Boiling Water		
Filter	1. Yes	2. No	Total
1. Yes	4(2%)	18(7%)	22(8%)
2. No	10(4%)	223(88%)	233(92%)
Total	14(5%)	241(95%)	255

The majority of the households drink water without treatment and boiling. Only a few households (2%) drink water after filtration and boiling.

Table - C13 SATISFACTION WITH WATER SUPPLY

City	1. Satisfied	2. Not satisfied	Total
Rusaifa	30(32%)	65(68%)	95
Zarqa	51(32%)	109(68%)	160
Total	81(32%)	174(68%)	255

One third of the population are not satisfaied with water supply.

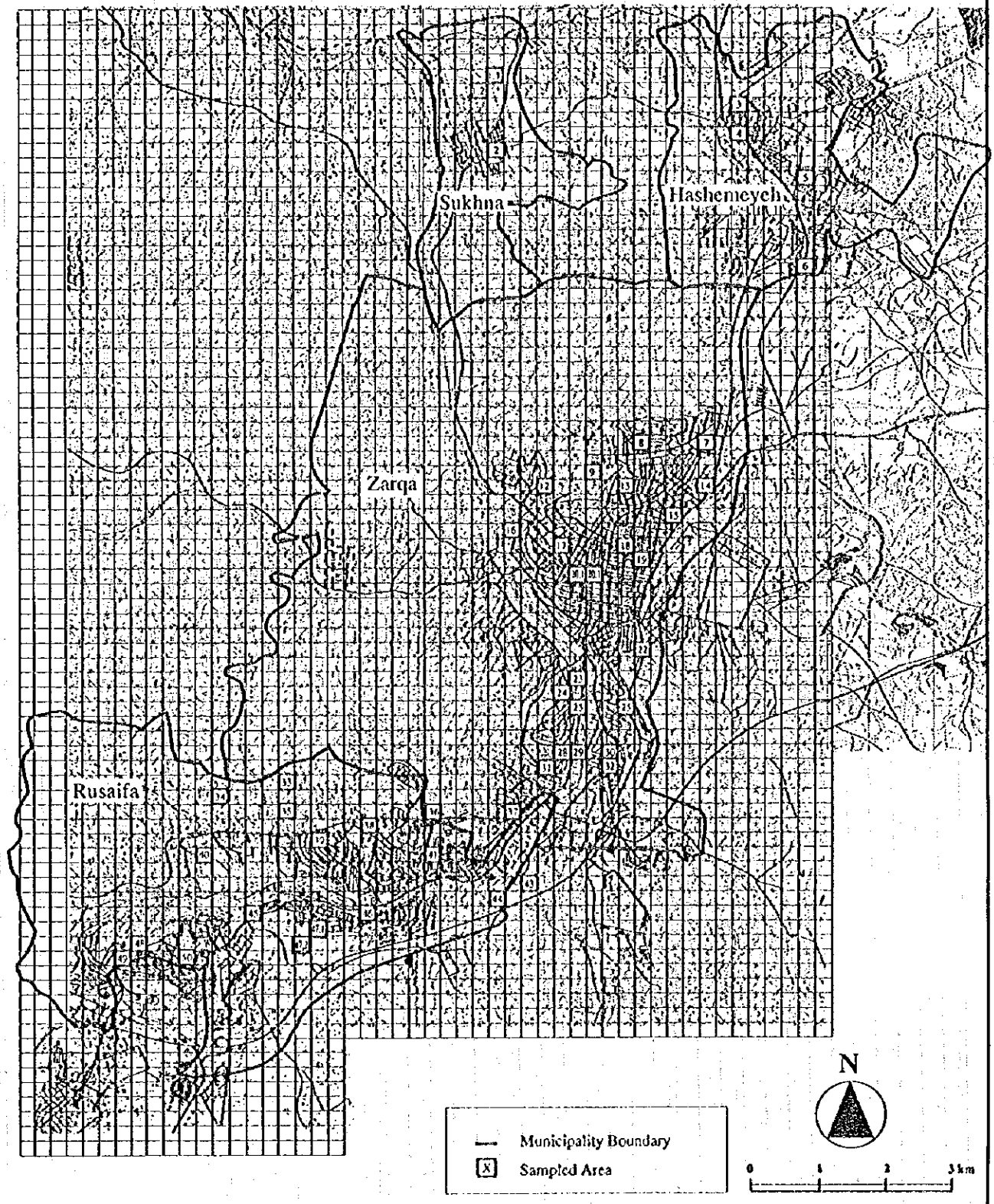
Table - C14 REASON FOR UNSATISFACTION

City	1. Bad quality of water	2. Insufficient quantity	3. High payment	4. No answer	Total
Rusaifa	2(2%)	7(7%)	62(65%)	24(25%)	95
Zarqa	6(4%)	14(9%)	105(66%)	35(22%)	160
Total	8(3%)	21(8%)	167(65%)	59(23%)	255

Unsatisfaction are mainly towards payment.

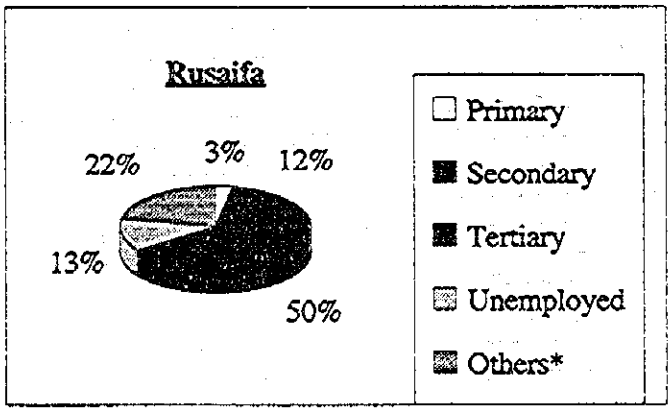
Source: JICA Study Team

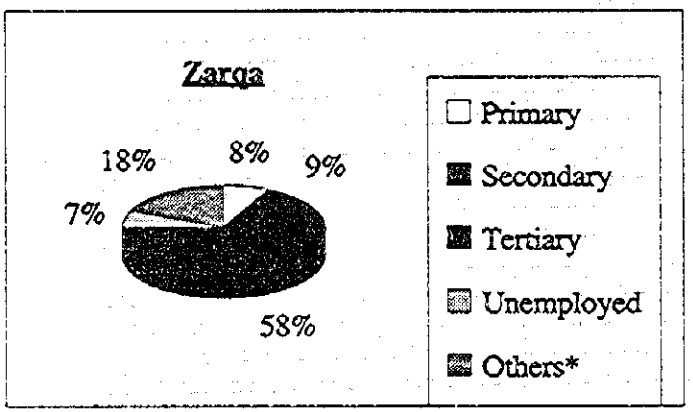
Figures



THE STUDY ON THE IMPROVEMENT OF THE WATER SUPPLY SYSTEM FOR THE ZARQA DISTRICT	Fig.- C1 SAMPLING AREA
JAPAN INTERNATIONAL COOPERATION AGENCY	

Unemployment ratio is high in Rusaifa!





Job

City	Primary	Secondary	Tertiary	Others	Unemployed	Total
Rusaifa	3(3%)	11(12%)	48(50%)	21(22%)	12(13%)	95
Zarqa	12(8%)	14(9%)	94(58%)	29(18%)	11(7%)	160
Total	15(6%)	25(10%)	142(56%)	50(20%)	23(9%)	255

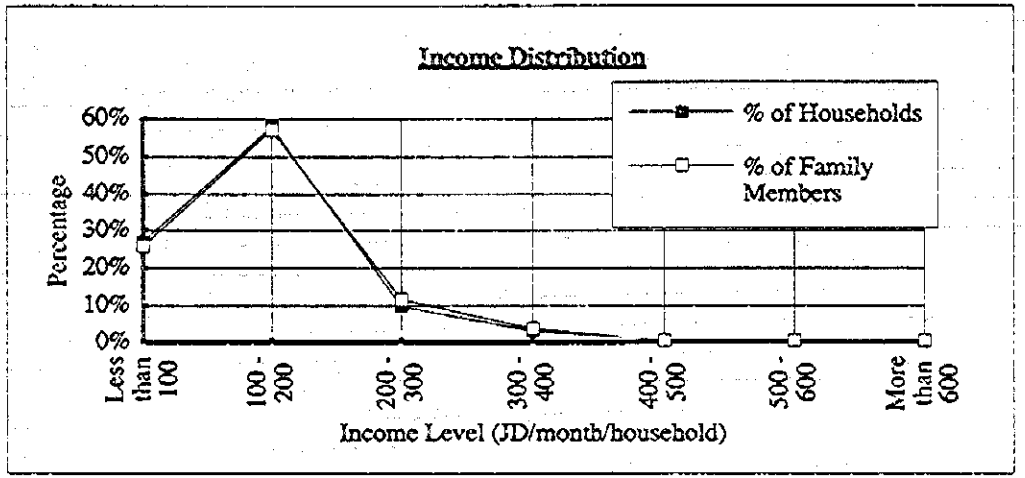
*.... Others include deads and retired.

THE STUDY ON
THE IMPROVEMENT OF THE WATER SUPPLY SYSTEM
FOR THE ZARQA DISTRICT

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig.- C2
OCCUPATION

Monthly income of more than half of households falls between 100JD and 200JD. An average percapita income is around 17JD/month. All households, although poor and rich, have a similar size of family.



Household Income Level	Total Households (Households)	Total Members (Persons)	Average Income Percapita (JD/Month)
Less than 100	69(27%)	607(26%)	8.5
100 - 200	148(58%)	1,342(57%)	16.5
200 - 300	25(10%)	274(12%)	22.8
300 - 400	8(3%)	87(4%)	32.2
400 - 500	2(1%)	12(1%)	75.0
500 - 600	2(1%)	13(1%)	84.6
More than 600	1(0%)	14(1%)	46.4
Average	255	2,349	16.6

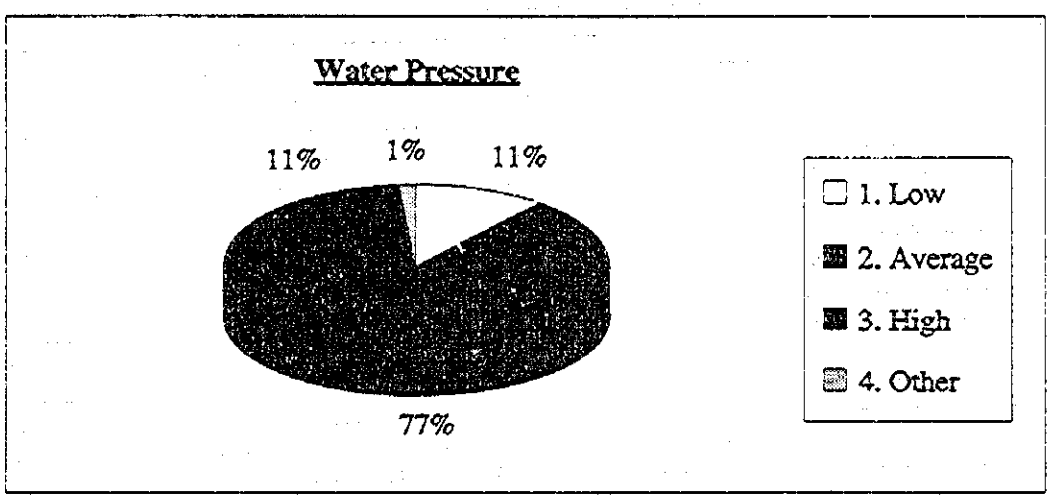
Source: JICA Study Team

THE STUDY ON
THE IMPROVEMENT OF THE WATER SUPPLY SYSTEM
FOR THE ZARQA DISTRICT

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig.- C3
HOUSEHOLD INCOME

Water pressure is not major problem for customers.

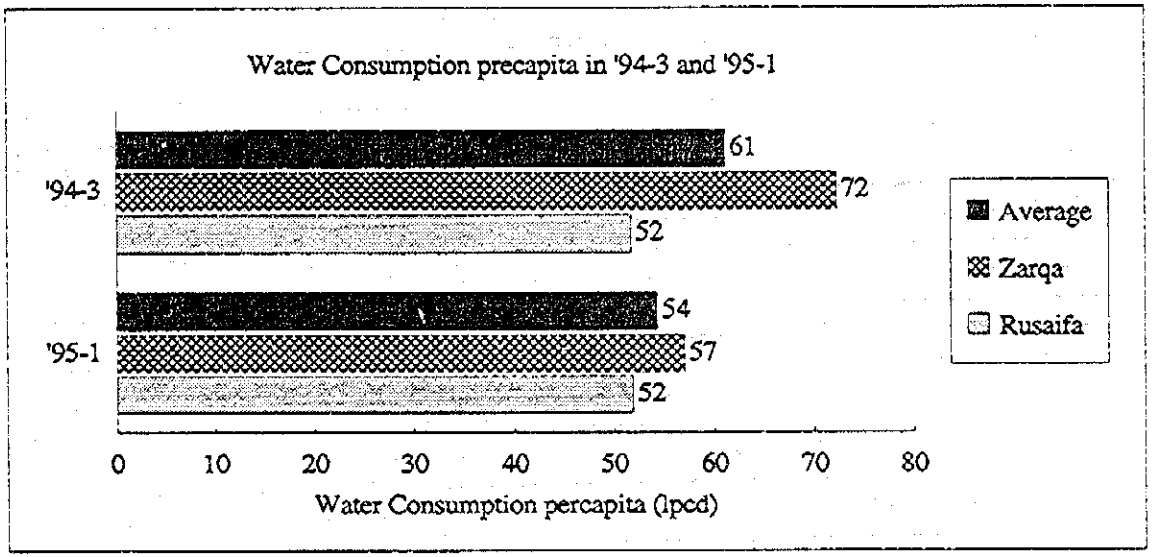


How is water pressure at your house tap?

City	1. Low	2. Average	3. High	4. Other	Total
Rusaifa	14(15%)	76(80%)	4(4%)	1(1%)	95
Zarqa	15(9%)	118(74%)	25(16%)	2(1%)	160
Total	29(11%)	194(77%)	29(11%)	3(1%)	255

Source: JICA Study Team

THE STUDY ON THE IMPROVEMENT OF THE WATER SUPPLY SYSTEM FOR THE ZARQA DISTRICT JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.- C4 WATER PRESSURE



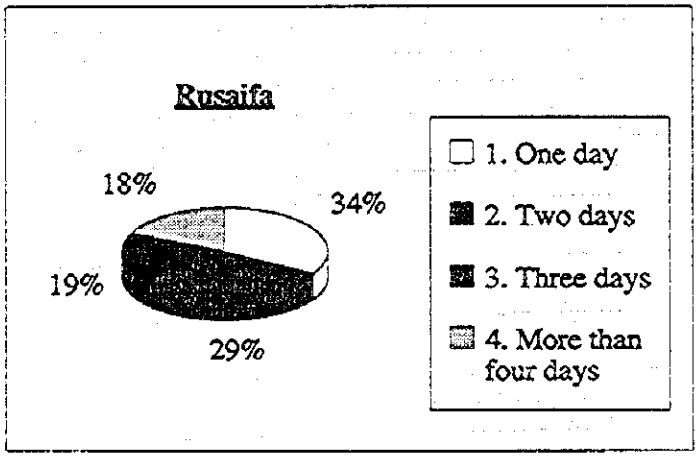
	City	Nos. of Samples	Water Consumption (m3/quarter)	Nos. of Family Members (person)	Water Consumption percapita (lpcd)
'94-3	Rusaifa	92	4,928	1,059	52
	Zarqa	111	5,860	901	72
	Average	203	10,788	1,960	61
'95-1	Rusaifa	91	4,859	1,041	52
	Zarqa	113	4,771	930	57
	Average	204	9,630	1,971	54

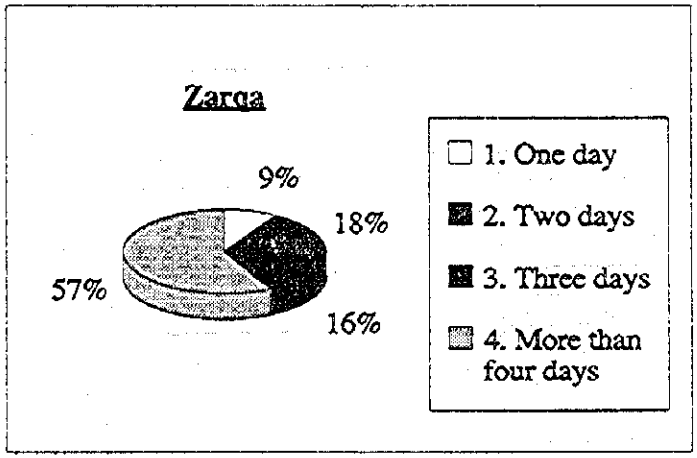
THE STUDY ON
THE IMPROVEMENT OF THE WATER SUPPLY SYSTEM
FOR THE ZARQA DISTRICT

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig.- C5
SEASONAL PERCAPITA
WATER CONSUMPTION

Water supply condition is worse in Rusaifa!





How many days a week you can have piped water?

City	1. One day	2. Two days	3. Three days	4. More than four days	Total
Rusaifa	32(34%)	28(29%)	18(19%)	17(18%)	95
Zarqa	14(9%)	29(18%)	25(16%)	92(58%)	160
Total	46(18%)	57(22%)	43(17%)	109(43%)	255

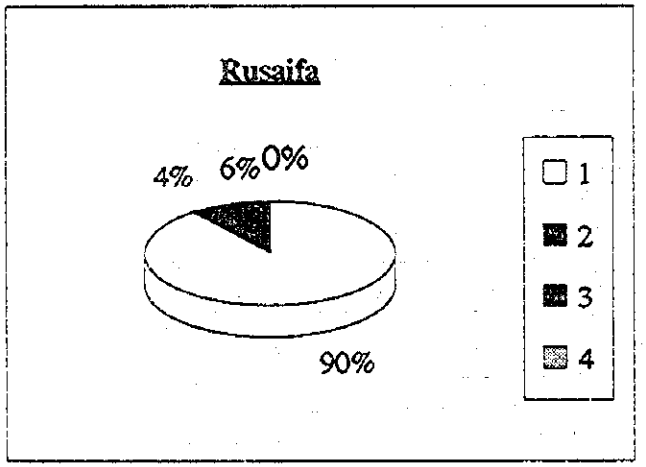
Source: JICA Study Team

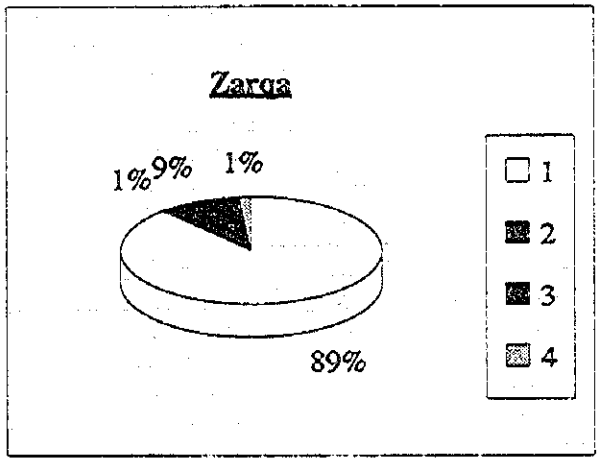
THE STUDY ON
THE IMPROVEMENT OF THE WATER SUPPLY SYSTEM
FOR THE ZARQA DISTRICT

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig.- C6
DAYS WATER RECEIVED

Most people are accustomed to the present water supply conditions?
Or they may be reluctant to express his opinion?



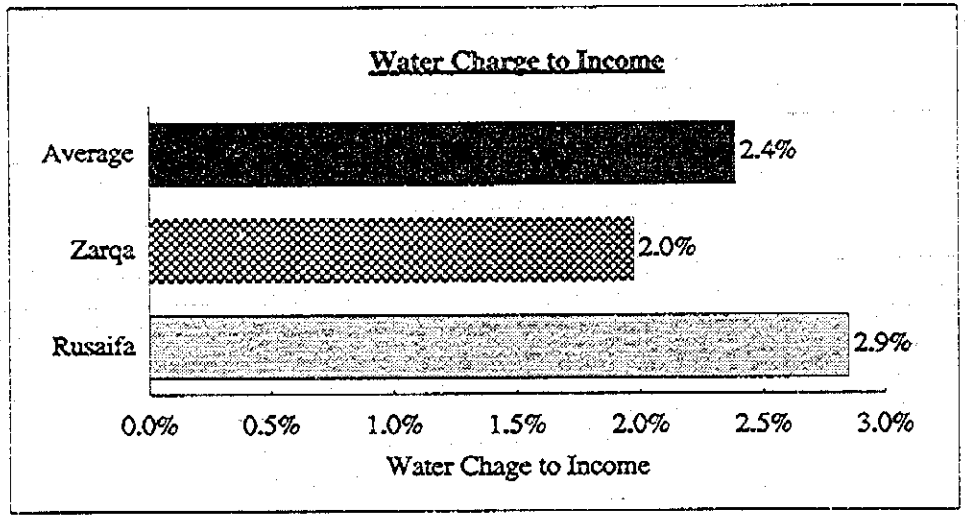


If the water is not limited, how much water do you want to use?

City	1. As the present	2. 1.5 times	3. 2 times	4. 3 times or more	Total
Rusaifa	85(90%)	4(4%)	6(6%)	0(0%)	95
Zarqa	141(88%)	2(1%)	15(9%)	2(1%)	160
Total	226(89%)	6(2%)	21(8%)	2(1%)	255

Source: JICA Study Team

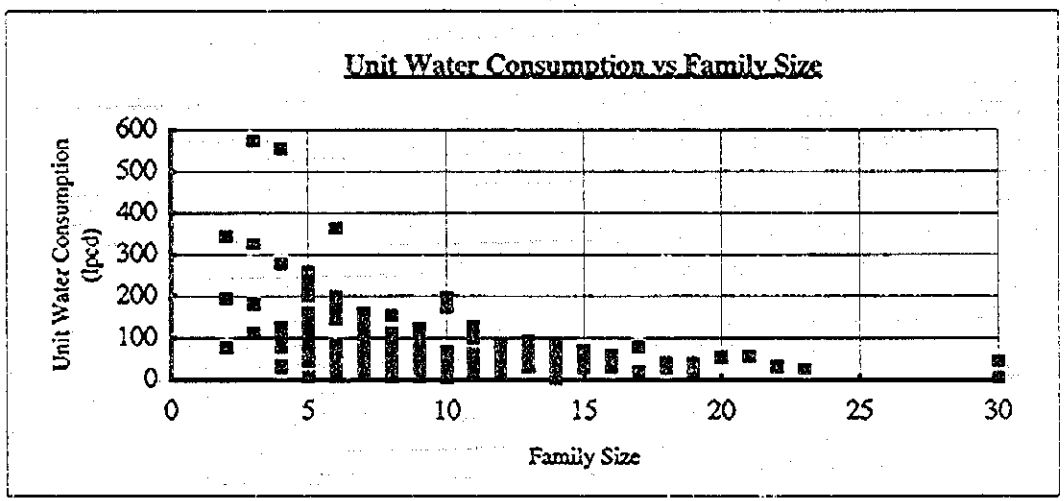
THE STUDY ON THE IMPROVEMENT OF THE WATER SUPPLY SYSTEM FOR THE ZARQA DISTRICT	Fig.- C7 WATER NEEDED
JAPAN INTERNATIONAL COOPERATION AGENCY	



City Name	Nos. of Samples	Water Charge (JD/3month)	Income (JD/month)	Water Charge/Income
Rusaifa	91	1263	14750	2.9%
Zarqa	113	988	16675	2.0%
Average	204	2251	31425	2.4%

THESTUDYON THEIMPROVEMENTOFTHE WATERSUPPLY SYSTEM FORTHEZARQADISTRICT JAPANINTERNATIONALCOOPERATIONAGENCY	Fig.- C8 WATER CHARGE TO INCOME

Family size closely relates to unit water consumption.



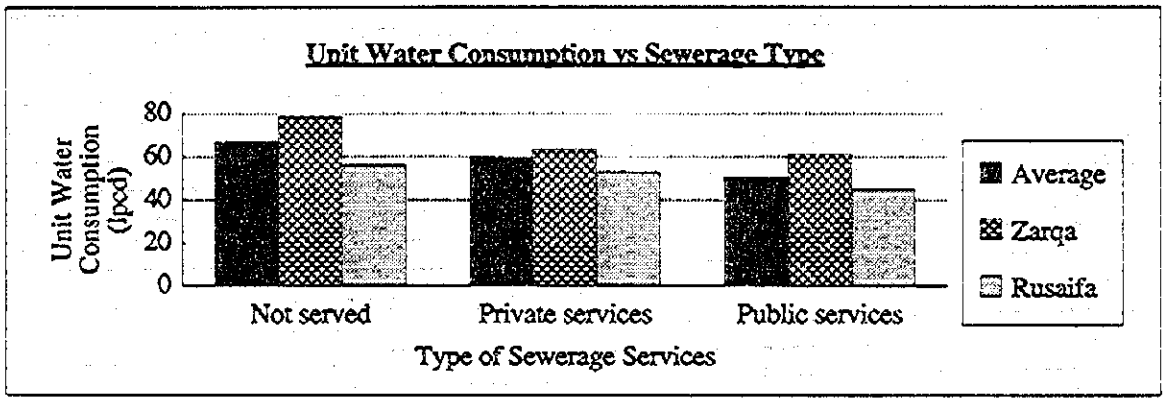
X(Family Size)	4	5	6	7	8	9	10
Y(Unit Consmp)	100	79	72	69	68	68	67

Y =	67.3 + 1774.3 exp(-X)
t - Value =	(13.3) (6.45)
F - Value =	41.7

Source: JICA Study Team

Note:
Correlation coefficient = 0.414
Nos. of Samples = 203

THE STUDY ON THE IMPROVEMENT OF THE WATER SUPPLY SYSTEM FOR THE ZARQA DISTRICT	Fig.- C9 UNIT WATER CONSUMP. VS. FAMILY SIZE
JAPAN INTERNATIONAL COOPERATION AGENCY	



'94(3)

Sewerage type	City Name	Nos. of Samples	Nos.of Family Members (person)	Water Consumption (m3/quarter)	Unit Water Consumption (lpcd)
Not served	Rusaifa	51	576	2,917	56
	Zarqa	71	550	3,898	79
	(Sub-Total)	122	1,126	6,815	67
Private services	Rusaifa	8	67	320	53
	Zarqa	14	126	722	64
	(Sub-Total)	22	193	1,042	60
Public services	Rusaifa	33	416	1,691	45
	Zarqa	26	225	1,240	61
	(Sub-Total)	59	641	2,931	51
Total (or Average)		203	1,960	10,788	61

THE STUDY ON THE IMPROVEMENT OF THE WATER SUPPLY SYSTEM FOR THE ZARQA DISTRICT	Fig.- C10 UNIT WATER CONSUMP. VS. SEWERAGE TYPE
JAPAN INTERNATIONAL COOPERATION AGENCY	

D. FACTORY SURVEY

Appendix D
- FACTORY SURVEY ON WATER USE -

Table of Contents

List of Tables

List of Figures

1. GENERAL

There are several studies being carried out by GTZ and USAID. Particularly, "Draft Report on Water Scarcity as a Challenge for Jordanian Industry" prepared by GTZ on April 1994 provides a complete set of information on 35 major factories in Amman and Zarqa area.

The Team, composed of JICA Study Team and WAJ Zarqa officials/engineers, accordingly, focused on obtaining information on water use pattern and future water demand of major factories located within the study area. Stress was also placed on whether they have keen concerns about nowadays issues such as water conservation and environmental pollution.

The factory survey, finally, involved total 43 factories in Zarqa and Rusaifa. First, 21 large and medium sized industries which have own wells were selected for the survey. The survey was conducted in a period from 14 January to 8 March 1995, having an interview with the managers concerned for inquiry. In the course of the field reconnaissance, it was found many small and medium sized factories exist in the study area, facing serious water shortage. Supplemental survey on the remaining 22 medium and small scale factories was, eventually, planned to have contact mainly by telephone. It required a whole month of July 1995. Particular attention was paid to their water sources, amount of groundwater usage, and willingness to connect with WAJ pipes.

2. MAJOR INDUSTRY OF THE AREA

Zarqa and Rusaifa are one of principal industrial center of the country, manufacturing a variety of goods. They are products from oil refinery, tanning, power generation, pulping, spinning, weaving, tanning, brewery, soft drinks, reinforced bars, steel pipes, chemical processing and dairy. These product are both for internal and overseas markets.

Large scale factories are Jordan Petroleum Co., Pepsi Cola Co. and Spinning and Weaving Co. in terms of number of employees. Most of the factories, 15 out of 21 factories surveyed, started operation in 1960s and 1970s when the government has stressed needs of urgent industrial development in the country. Employees working at these 43 factories exceed 10,000 persons in 1994. They are mainly residents in Zarqa and Rusaifa.

3. FACTORIES SURVEYED

Prior to the factory survey, the Team has asked WAJ Zarqa engineers to provide general information on major factories in the study area, including those of wastewater quality, water consumption, number of wellfields, etc., all available at WAJ. In review of the data collected, the Team determined to have direct or indirect contacts with several factories to update and supplement the data. Tentatively selected were 21 large and medium sized factories that have more than 30 employees and are consuming a large quantity of water from their wells. As described in the preceding section, 22 medium and small sized factories were then added to the survey. To show exact location of these factories the Team visited and telephoned, an industrial location map was prepared as seen in Fig.-D1.

4. METHOD OF SURVEY

As regards large scale factories, the Team prepared a questionnaire sheet prior to initiation of the survey as shown in tables in Attachment - 1. This arrangement is to fill out the latest data in an uniform format. Each item contained in the questionnaire sheet was inquired carefully to minimize miscommunication and misunderstanding. Any obscure remarks made by interviewees were reconfirmed and examined at the site.

As to the medium and small scale factories, inquiries are made by telephone to the selected 22 factories. Following are major inquiries:

1) How many wells are constructed and in operation in the factory?
2) How much drafting capacity does the pump have?
3) How much water do you abstract from the wells?
4) How much water are supplied daily from WAJ and by water tankers ?
5) How much water do you want from WAJ?
6) How many employees are working in the factory?

5. SUMMARY OF RECONNAISSANCE SURVEY AND INTERVIEW

Many valuable data and information were obtained in the survey. They are all helpful in familiarizing general aspects of industrial activities in the project area, in projecting future industrial water demand, and in assessing methods and processes applied for industrial wastewater treatment and disposal. All information obtained at the large and medium sized factories were filled out in the uniform format during the interview at the site.

Table - D1 shows a summary of present water use and future water demand of the factories. More detailed information are presented in Annex Tables - AD1 to AD42 including wastewater quality records of WAJ. Major findings are described hereunder with emphasis on present water use pattern and future water requirements.

5.1 WATER CONSUMPTION

From the survey results, total water consumption by these factories including groundwater from their private wells and water conveyed through WAJ pipes and/or by water tankers may exceed 18,000 m3/day.

There are more than 33 industrial wells constructed and being in operation in the study area. In addition, 7 wells exist and are not operated mainly because of aggravated water quality.

Groundwater from the wells is their major water source of the industry. Groundwater consumption accounts for approximately 90% of total consumption at the factories. Pumps installed in the wells have a drafting capacity 2,300m3/hour or 20.1 mcm annualy in total. Groundwater drafting by these factories may reach to 15,000 - 17,000m3/day or 5.5 - 6.2 mcm annualy, equivalent to approximately 30 % of the pump capacity. As compared to 25.5mcm, annual water production by WAJ Zarqa in 1993, their water consumption is considered not negligible (25%).

Fairly large number of 30, out of 43 factories, are receiving water through WAJ's pipes. The water supplied to these factories, however, are mainly for drinking purpose. WAJ data show relatively small water consumption, around 700 m3/day in 1994.

Out of them, Jordan Petroleum Co., Pepsi Cola Co. and Hussein Power Station are the largest water users. They operate 14 deep wells equipped with submersible pumps. Their groundwater consumption is approximately 12,000m3/day or 70 or 80 % of total water consumption by factories

surveyed.

In a broad term, large and medium scale factories rely on their private wells, while small scale factories depend on water tankers, of which water tariff is usually five to ten times as expensive as that set up by WAJ. Some of them, according to the survey, are being obliged to stop operation simply because of water shortage. It is recommended that some urgent remedial measures to curb this critical situation are of vital importance to enhance industrial activities in the area.

5.2 FUTURE WATER REQUIREMENT

Despite growing water demand according to expansion plans of the factories, large scale factories tend to rely on their own wells for future. Their willingness to receive WAJ's water stands relatively low. Most of them addressed their intention to receive WAJ's water only for drinking purpose of employees as enumerated in the tables. One exception is seen at Hussein Thermal Power Station where aggravation of groundwater quality is eminent. The manager we interviewed ardently showed his desire to receive WAJ's water which contains less TDS.

To the contrary, middle and small scale factories who have no bore holes are suffering from water shortage. This can be understood from the fact that they rely on tank water and their willingness to connect is comparatively large. Since WAJ places first priority on domestic water supply, they may not be allowed to use WAJ piped water for industrial purpose.

It can be concluded that large and medium sized factories will rely on their own wells rather than WAJ's piped water in future. This may be attributable to the fact that WAJ is currently practicing intermittent water supply at most of Rusaifa where many large scale factories are located.

To ensure industrial development of the area, however, it is considered essential 1) to supply piped water to the factories which have no wells and/or 2) to promote construction of private wells. Their water demand is tentatively estimated from the survey results at 600 m3/day at most excluding that of Hussein thermal power station. In the present study, this value is considered as additional industrial water demand.

6. TEAM'S FINDINGS AND RECOMMENDATION

The Government has been exerting effort to strengthen monitoring and management of wastewater and solid waste disposal. It was, however, observed during the survey that some factories are not necessarily taking appropriate measures for pollution control and monitoring. Following are Team's findings and recommendation related to the factory survey.

1) It is favorable that the Government of Jordan has introduced a groundwater abstraction charge since January 1994. Thanks to the enforcement, most of interviewees usually have their keen concern about water recycling insides plants. Some of them, however, are still at a low level of awareness about needs of wastewater quality control and conservation of the natural environment. Because of their nature of profit oriented companies, they tend to disregard their significant impacts on human life and environment. This can be explained from the fact that they, although considered a few, are not properly treating their contaminated industrial wastewater to a satisfactory level. Regulatory measures to enhance wastewater quality control and monitoring shall be established by the ministry concerned as early as possible.

2) It is desirable that WAJ Zarqa has been taking an appropriate measure, by periodically conducting wastewater sampling and testing at most of the factories in Zarqa Governorate. According to the laboratory testing, some factories often fail in meeting the industrial wastewater quality standards established by the Government. As WAJ Zarqa is not in a position to sue for this non-observance, Zarqa Governorate or related agencies may be recommended to take legislative measures against such factories in accordance with the law and regulation established.

3) The Team and WAJ officials have visited garbage and waste disposal sites in Rusaifa. All garbage from industry and households in Zarqa, Rusaifa and Amman, except liquid waste, are dumped at the designated garbage disposal site for land reclamation. It's located a few hundred meters east from Zarqa-Amman Highway. It collects 1,500 ton of garbage daily. To monitor groundwater contamination by infiltration and leach of the rainwater, periodical water samplings at a nearby obserbation well are conducted under the authority of the Amman Municipality. Number, depth and site of the observation wells are definitely inappropriate and insufficient. There is another liquid waste disposal site near boundary of Rusaifa and Amman municipalities. They receive waste of 35 - 40 tankers daily, each of which has a carrying capacity of 10m3. A wastewater pond constructed for 2 year use is a lagoon type that expects natural evaporation. The staff stationed there believes rainfalls during winter seasons are flushing out the contaminated wastewater into the tributary of the Zarqa River. Selection of disposal sites shall be carefully made in consideration of groundwater contour, topography, dominating wind direction, demographic features of the area, city planning, etc.

4) Recycling of wastewater is not always common in the factories. The survey shows merely 30 % of the factories achieved 50 % water recycling ratio. If the ratio could be raised, water consumption will drop simultaneously, resulting in water saving and conservation. In view of declined water table at most of the existing wells in Zarqa-Amman Aquifer, enhancement of water recycling by laws and regulation will be effective and beneficial on water conservation in the area.

5) For some end users, quality of water supplied is not major concern. Their requirements are variant to the purpose of the water usage. In the study area, WAJ Zarqa has several abandoned wells which are not in operation. It is also observed on the premises of the factories that total 7 wells constructed are abandoned mainly because of the declined groundwater quality. If dual water supply systems could be established to convey slightly brine water to such water users separately from the domestic water supply, these wells can significantly alleviate the water shortage of the area. For this purpose, further study to verify viability of this system is required.

6) A number of small scale factories which cannot afford having own wells are suffering from the chronic water shortage. They are obliged to use water supplied by water tankers, nevertheless it's costly, insufficient in quantity and unreliable. The government's policy is to push industrial development in the country. To support this policy, water supply through piping system to such factories shall be established as early as possible.

Tables

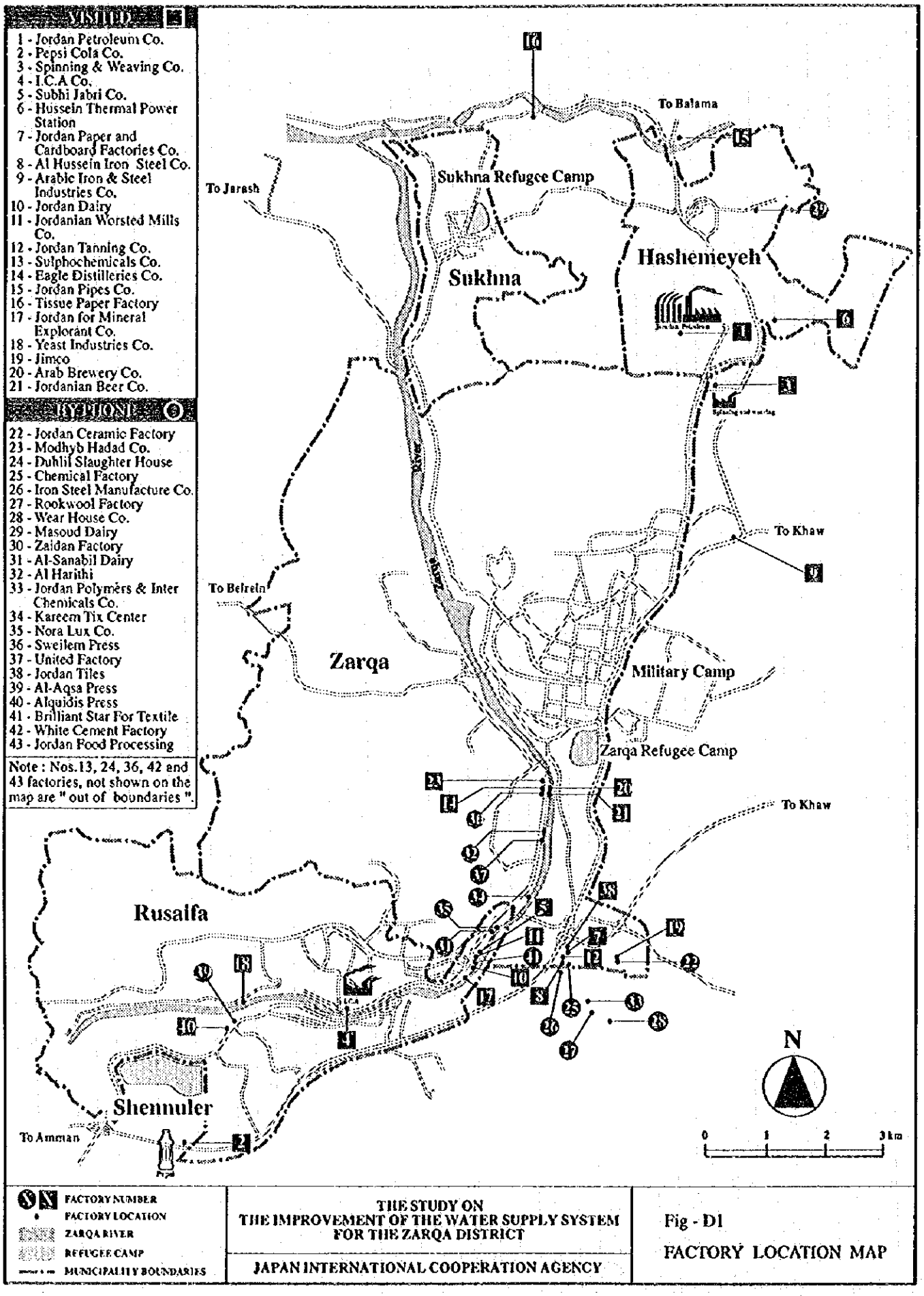
Table - D1 LIST OF FACTORY

No.	Name of Factory	Survey Method	Address	Nos. of Employees	Nos. of Wells 1)	Pump Cap. (m3/hour)	Water Consumption Wells (m3/day)	WAJ (m3/day)	Tanker (m3/day)	Add. Demand (m3/day)2)
1	Jordan Petroleum Co.	Visit	Hashemeyeh	4,064	5	960	6,000	0	0	0
2	Pepsi Cola Co.	ditto	Amman-Zarqa Highway	1,000	2	100	3,100	0	0	0
3	Jordan Spinning &Weaving Co.	ditto	Hashemeyeh	500	1	90	300	0	0	25
4	I.C.A. Co.	ditto	Zarqa-Rusaifa Road	461	1	70	420 - 650	0	0	0
5	Subhi Jabri Co.	ditto	Zarqa-Rusaifa Road	450	1	60	65	10	0	0
6	Hussein Thermal Power Station	ditto	Hashemeyeh	400	7+(2)	350	2,000 - 3,000	0	0	1,000-1680
7	Jordan Paper and Cardboard Factories Co	ditto	Zarqa bridge near Military	250	1	70	800	12	0	0
8	Al-Hussein Iron Steel Industries Co.	ditto	Factories Area	248	1+(1)	55	350	20	0	0
9	Arab Iron & Steel Industries Co.	ditto	Zarka Khaw	205	1	20	100 - 150	4	0	0
10	Jordan Dairy Co.	ditto	Zarqa-Rusaifa Road	175	1	40	150 - 200	10 - 15	0	0
11	Jordan Worsted Mills Co.	ditto	Zarqa-Rusaifa Road	170	1+(1)	62	160 - 200	3	0	0
12	Jordan Tanning Co.	ditto	Amman-Zarqa Highway	140	1+(1)	45	200	5	0	0
13	Sulphochemicals Co.	ditto	Osh Valley	130	1	20	150	0	0	0
14	Eagle Distilleries Co.	ditto	Zarqa-Rusaifa Road	130	1	20	130	10	0	0
15	Jordan Pipes Co.	ditto	Hashemeyeh	130	1	80	150 - 600	7	0	1
16	Tissue Paper Factory	ditto	Sukhna	120	1	11	240 - 350	8	0	100
17	Jordan for Mineral Explorant Co.	ditto	Zarqa-Rusaifa Road	105	1	15	40	5	0	7
18	Yeast Industries Co.	ditto	Al-Moshirfa	72	1	35	550	2 - 3	0	0
19	Jimeco	ditto	Factories Area	60	1	45	25 - 50	0	1	20
20	Arab Brewery Co.	ditto	Zarqa-Rusaifa Road	36	1	24	80	1	0	0
21	Jordanian Beer Co.	ditto	Zarqa-Rusaifa Road	36	1	20	110	2	0	2
22	Jordan Ceramic Co.	Phone	Factories Area	520	0	-	-	0	100	0
23	Modhyb Hadad Co.	ditto	Zarqa-Rusaifa Road	175	0	-	-	23	30	0
24	Duhlil Slughter House	ditto	Al-Duhlil	170	0	-	-	300 - 400	0	0
25	Chemical Factory	ditto	Factories Area	130	0+(2)	-	-	0	10	35
26	Iron Steel Manufacture Co.	ditto	Factories Area	115	0	-	-	0	18	0
27	Rookwool Factory	ditto	Factories Area	110	0	-	-	15	0	0
28	Wear House Co.	ditto	Factories Area	70	0	-	-	0	40	0
29	Masoud Dairy	ditto	Hashemeyeh	60	0	-	-	20	0	0
30	Zaidan Factory	ditto	Zarqa-Rusaifa Road	60	0	-	-	35	6-10	0
31	Al-sanabil Dairy	ditto	Zarqa-Rusaifa Road	55	0	-	-	5	0	0
32	Alharithi	ditto	Awajan Wosfi Altal St.	55	0	-	-	27	0	0
33	Jordan Polymers & Inter Chemicals Co.	ditto	Factories Area	30	0	-	-	3	20	0
34	Kareem Tix Center	ditto	Zarqa-Rusaifa Road	20	0	-	-	5	30	0
35	Nora Lux Co.	ditto	Rusaifa	20	0	-	-	10	100	0
36	Sweilem Press	ditto	Al-Azraq-Farmers Road	16	1	10	100	0	0	0
37	United Factory	ditto	ZarqaRisaofa Road	16	0	-	-	5	3 - 5	0
38	Jordan Tiles	ditto	Factories Area	15	1	40	12	8	0	0
39	Al-Aqsa Press	ditto	Al-Moshirfa	3	0	-	-	4	1 - 2	0
40	Alquidis Press	ditto	Al-Moshirfa	2	0	-	-	2	1	0
41	Brilliant Star for Textile	ditto	Rusaifa Awajan	2	0	-	-	20	0	0
42	White Cement Factory	ditto	Al-Duhlil	200	1	24	300	0	0	20
43	Jordan Food Processing Co.	ditto	Al Duhlil-Hallabat Road	50	1	20	20	13	0	60
	Total			10,776	36+(7)	2,286	15,552 - 17,307	594 - 700	360 - 367	1,270 - 1,950

Source: WAJ Zarqa and JICA Study Team, January1995

Note: 1) Figures show number of wells in operation, while those in parentheses give number of abandoned wells.
2) Additional or incremental water demand by factories for WAJ water excluding those for groundwater from their wells.

Figures


VISITED
1 - Jordan Petroleum Co.
2 - Pepsi Cola Co.
3 - Spinning & Weaving Co.
4 - I.C.A Co.
5 - Subhi Jabri Co.
6 - Hussein Thermal Power Station
7 - Jordan Paper and Cardboard Factories Co.
8 - Al Hussein Iron Steel Co.
9 - Arabic Iron & Steel Industries Co.
10 - Jordan Dairy
11 - Jordanian Worsted Mills Co.
12 - Jordan Tanning Co.
13 - Sulphochemicals Co.
14 - Eagle Distilleries Co.
15 - Jordan Pipes Co.
16 - Tissue Paper Factory
17 - Jordan for Mineral Explorant Co.
18 - Yeast Industries Co.
19 - Jimco
20 - Arab Brewery Co.
21 - Jordanian Beer Co.
BYPION
22 - Jordan Ceramic Factory
23 - Modhyb Hadad Co.
24 - Duhlil Slaughter House
25 - Chemical Factory
26 - Iron Steel Manufacture Co.
27 - Rookwool Factory
28 - Wear House Co.
29 - Masoud Dairy
30 - Zaidan Factory
31 - Al-Sanabil Dairy
32 - Al Harithi
33 - Jordan Polymers & Inter Chemicals Co.
34 - Kareem Tix Center
35 - Nora Lux Co.
36 - Sweilem Press
37 - United Factory
38 - Jordan Tiles
39 - Al-Aqsa Press
40 - Alquidis Press
41 - Brilliant Star For Textile
42 - White Cement Factory
43 - Jordan Food Processing
Note : Nos.13, 24, 36, 42 and 43 factories, not shown on the map are " out of boundaries ".
To Balama
Sukhna Refugee Camp
To Jarash
Sukhna
Hashemeyeh
To Khaw
To Belrein
Zarqa
Military Camp
Zarqa Refugee Camp
To Khaw
Rusaifa
Shemuler
To Amman
N
0 1 2 3 km
FACTORY NUMBER
FACTORY LOCATION
ZARQA RIVER
REFUGEE CAMP
MUNICIPALITY BOUNDARIES
THE STUDY ON
THE IMPROVEMENT OF THE WATER SUPPLY SYSTEM
FOR THE ZARQA DISTRICT
JAPAN INTERNATIONAL COOPERATION AGENCY
Fig - D1
FACTORY LOCATION MAP

ATTACHMENT - I QUESTIONNAIRE AND WASTEWATER TESTING RECORDS

(Tables - AD18 & 38 not prepared because of no water testing records)

Table - AD1 QUESTIONNAIRE SHEET OF FACTORY

Name of Factory: Jordan Petroleum Co.	*Address:* Hashemeyeh, Phone: 630150 Amman	*Ref. No. on Map:* 1
Year of Construction & Starting Operation: 1958 constructed, 1960 operation	*Number of Employees:* 4064	*Area:* 420ha
Raw Materials: Crude oil, derivatives,chemicals, fuel oil in emergency	*Major Products:* Petroleum derivatives	

Number of Wells:	*Extraction Rate of Groundwater:*	*Purpose of Usage:*	*Water Consumption of Piped Water (WAJ) in 1994:*
5 including one standby (200 x 2, 240 x 2, 80m3/h)	6,000m3/day	Boiler, cooling, washing, drinking & fire fighting	None

Treatment Process Applied before Usage:	*Disposal Method of Treated Wastewater and Sludge:*
Wells - Reverse Osmosis - Ion Exchange - Softener - Polisher	Sludge lagoon for evaporation - Burning - Disposal in the forest Treated wastewater - public sewers - As Samura
Wastewater Treatment Process Applied: Waste - Settling (gravity) - Settling (alum & polymer) - Floating - Skimming - Aeration & Chlorination	Human waste - Irrigation *Recycling Ratio of Wastewater:* 0% of wastewater, recycling of cooling water

Future Expansion Plan:

Expansion of production capacity depending on central government's policy

Future Water Requirements:

Increase according to the expansion plan

Remarks:

- Laboratory tests of industrial wastes are periodically conducted by WAJ Zarqa.

Source: JICA Study Team & WAJ Zarqa

Table -AD2 RESULTS OF WATER LABORATORY TEST

Name of Factory: JORDAN PETROLUM CO. Address: HASHMEIA TEL:911211 TLX: 21246

Date	BOD	TDS	TSS	COD	NH4	Fe	Cr	Pb	Zn	ABS	PO4	NO3	S	Al	Cd	pH	Remarks
18 Jan. '94	34	2,368	42	90	41.0						0.2					7.2	B=1.15
29 Mar. '94	18	2,556	61	64	21.1	0.12					0.9					8.0	
4 Apr. '94	22	2,376	35	124												8.2	B=1.13
11 May. '94	25	3,372	46	69	47.3	0.23					1.7					7.7	B=0.95
21 Jun. '94	45	3,012	83	111	6.4					0.9						7.7	B=0.93
16 July. '94	20	3,054	60	70	44.8						0.9					8.0	B=1.85
15 Aug. '94	23	2,778	48	66	53.5						0.2					8.0	B=1
20 Sep. '94	17	2,472	27	33	41.6						1.4					7.8	B=1.2
15 Oct. '94	32	1,610	22	58	29.0	0.30					0.2					8.6	
10 Nov. '94	19	2,534	181	69	25.0						1.2					7.8	B=0.6

Source: WAJ Zarqa

Table - AD3 QUESTIONNAIRE SHEET OF FACTORY

Name of Factory: Pepsi Cola Co.	*Address:* Amman - Zarqa Highway, Marka Tel: 89204, Fax: 897114	*Ref. No. on Map:* 2

Year of Construction & Starting Operation: 1963 in operation	*Number of Employees:* 1,000	*Area:* 2.3ha

Raw Materials:	*Major Products:*
Water, sugar, CO2, flavor, NaOH, Sulfuric Acids,	Pepsi Cola, Mirinda, 7-up, Diet Pepsi & 7-up

Number of Wells & Pump Capacity:	*Extraction Rate of Groundwater:*	*Purpose of Usage:*	*Water Consumption of Piped Water (WAJ) in 1994:*
2 (30, 70m3/hour)	3,100m3/day	Bottling, washing, drinking	None

Treatment Process Applied before Usage:	*Disposal Method of Treated Wastewater and Sludge:*
Well -RO - Softening (75%) - Chlorination - Dilution by softener (25%) - Bottle washing	Sludge produced is used as fertilizer because of high concentration of nitrogen Waste water discharged into public sewers
Wastewater Treatment Process Applied: To reduce pH, BOD of the waste water, 1) Acid addition 2) Fermentation	*Recycling Ratio of Wastewater:* 20 % as cooling water (30m3/day)

Future Expansion Plan:

Planned to expand Irbid plant.

Future Water Requirements:

Same

Remarks:

Source: JICA Study Team and WAJ Zarqa

Table - AD4 RESULTS OF WATER LABORATORY TEST

Name Of Factory: PEPSI COLA CO. Address: MARKA. Fax:897114

Date	BOD	TDS	TSS	COD	NH4	Fe	Cr	Pb	Zn	ABS	PO4	NO3	S	Al	Cd	pH	Remarks
5 Jan. '94	27	3,680	92	168												8.7	
28 Feb. '94	200	3,138	208	390	0.8					1.8						9.0	
29 Mar. '94	55	3,646	431	215	4.2						17.2					8.8	
25 Apr. '94	221	4,290	466	527	0.7						3.8					8.5	
11 May. '94	35	4,598	119	94	12.0						12.2					9.1	
15 Jun. '94	65	2,250	431	668	0.5											9.3	
16 July. '94	20	5,678	125	88	1.2						1.8					9.2	
17 Oug. '94	13	4,210	80	56	0.4					1.4						7.2	
27 Sep. 94	19	1,842	387	30	1.2					0.2	0.7					9.0	
12 Oct. 94	12	2,942	417	26	0.8					0.4						8.9	
22 Nov. 94	11	1,872	211	30	2.0					1.6							

Source: WAJ Zarqa

Table - AD5 QUESTIONNAIRE SHEET OF FACTORY

Name of Factory: Jordan Spinning & Weaving Co., Ltd.	*Address:* P.O.Box 6001 Hashemeyeh, Phone:911161	*Ref. No. on Map:* 3
Year of Construction & Starting Operation: 1979 constructed	*Number of Employees:* 500(35 from Amman & 49 from Irbid)	*Area:* 200ha
Raw Materials: Dye (organic), H2O2, Na2SO4 Cotton, polyester & viscous	*Major Products:* Yarn, knitted fabric, dyed fabric &dyed yarn (20-50% for internal market)	

Number of Wells & Pump Capacity:	*Extraction Rate of Groundwater:*	*Purpose of Usage:*	*Water Consumption of Piped Water (WAJ) in 1994:*
1 (90m3/hour)	300m3/day	Washing, boiler and finishing	None

Treatment Process Applied before Usage:	*Disposal Method of Treated Wastewater and Sludge:*
Wells - Softening - supply	Waste water - sewer line Sludge - damped into wastewater pumping station
Wastewater Treatment Process Applied: Neutralization (pH) - Settling (alum) - Aeration & cooling down - Disposal	*Recycling Ratio of Wastewater:* 0% of wastewater

Future Expansion Plan:

Wastewater treatmetn will be expanded, adding biological process, chlorination & RO process. These facilities are now under construction. Completion is expected in 1997.
Plant will consist of: Neutralization - Settling - Cooling down & aeration - Biological (return sludge) - Chlorination - RO - Recycling

Future Water Requirements:

Willingness to connect, receiving 25 m3/day from February 1995 for drinking purpose.

Remarks:

- Laboratory tests of industrial wastes are periodically conducted by WAJ Zarqa.

Source: JICA Study Team and WAJ Zarqa

Table - AD6 RESULTS OF WATER LABORATORY TEST

Name of factory: JORDAN SPINNING & WEAVING CO., LTD. Address: P.O.BOX 6001,Phone911161 HASHEMEYEH

	BOD	TDS	TSS	COD	NH4	Fe	Cr	Pb	Zn	ABS	PO4	NO3	S	Al	Cd	pH	Remarks
18 Jan. '94	106	3,324	222	550	10.2					1.6						9.1	B=0.6
28 Feb. '94	75	1,946	94	190	12.4					1.6						8.3	B=0.46
22 Mar. '94	224	1,852	99	512	8.4					0.6	6.2					8.0	B=0.77
14 Apr. '94	674	2,826	174	2,513						1.0						10.4	B=0.78
7 May '94	461	3,102	344	610	23.0					1.2						8.2	B=0.66
21 Jan. '94	135	11,318	179	322	3.6											9.4	B=0.49
5 July. '94	455	2,680	66	807						1.4		0.9				9.2	B=0.85
15 Aug. '94	91	3,300	62	735						10.0		8.9				9.6	B=0.82
1 Sep. '94	164	3,412	55	239						1.5		27.3				7.5	B=0.93
10 Oct. '94	413	24,453	1,327	1,306		0.79	0.1	0.0	0.5				0.1	0.1	0.0	10.3	Ni =0.56
12 Nov. '94	1,036	5,135	1,724	1,611						1.0						10.1	

Source: WAJ Zarqa

Table - AD7 QUESTIONNAIRE SHEET OF FACTORY

Name of Factory: ICA Co., Ltd.	*Address:* Zarqa - Rusaifa Road Rusaifa, Phone: 951945-7	*Ref. No. on Map:* 4
Year of Construction & Starting Operation: 1961 constructed 1962 in operation	*Number of Employees:* 461(400 from Zarqa, Amman & Rusaifa)	*Area:* 3ha
Raw Materials: Detergents, soap, toilet papers used, plastic container	*Major Products:* 1) Detergents 2) Soap 3) Perfumes	

Number of Wells & Pump Capacity: 1 (70m3/hour)	*Extraction Rate of Groundwater:* 420 - 650 m3/day	*Purpose of Usage:* Industrial, cleaning, coating, steam generation, & drinking	*Water Consumption of Piped Water (WAJ) in 1994:* None

Treatment Process Applied before Usage: Chlorination - Softening - RO - Demineralization - Filtration - Phosphate conditioning	*Disposal Method of Treated Wastewater and Sludge:* 1) Reserved in tank for recycling in soap factory 2) RO waste water to soap factory 3) Solid waste dumped in Rusaifa 4) Sludge to Ein Gazel pumping station
Wastewater Treatment Process Applied: Waste - Filtration - Mixing by aerator - Chemical precipitation - Greece removal - Aeration - Precipitation - Chlorination	*Recycling Ratio of Wastewater:* 100% of wastewater
Future Expansion Plan: All new factories will be established in Mafraq.	
Future Water Requirements: Not clearly informed.	
Remarks: - Laboratory tests of industrial wastes are periodically conducted by WAJ Zarqa. - Application of ISO 9000	

Source: JICA Study Team and WAJ

Table - AD8 RESULTS OF WATER LABORATORY TEST

Name of Factory: I .C .A CO., LTD. Address: RUSAIFA Phone:951945/7

Date	BOD	TDS	TSS	COD	NH4	Fe	Cr	Pb	Zn	ABS	PO4	NO3	S	Al	Cd	pH	Remarks
8 Jan. '94	11	988	24	57						2.8						7.4	
2 Feb.'94	8	1,394	29	57						0.8						8.0	
19 Mar. '94	7	1,154	125	32						0.7	5.0					8.3	B=0.21
7 May. '94	13	1,778	24	57						1.6		37.7				7.7	B=0.51
13 Jun. '94	10	984	30	31	1.4					0.4						8.2	B=0.39
4 July. '94	14	1,022	23	30	0.3					1.6	2.2					8.0	
25 Aug. '94	10	1,256	116	24	1.8					0.7	4.0					8.3	
13 Sep. '94	12	1,800	35	32	1.9					1.0	0.7					7.8	B=0.44
17 Oct. '94	26	1,114	164	87	1.6					2.0						8.2	
9 Nov. '94	7	1,500	17	30	1.2					1.1						8.2	

Source: WAJ Zarqa

Table - AD9 QUESTIONNAIRE SHEET OF FACTORY

Name of Factory: Subhi Jabri Co.	*Address:* Zarqa - Rusaifa Road, Phone: 953344, Fax: 953329	*Ref. No. on Map:* 5
Year of Construction & Starting Operation: 1990 constructed and 1991 in operation	*Number of Employees:* 450 (45 from Amman)	*Area:* 1.3ha
Raw Materials: Wheat flour, milk, vegetable oil, sugar, cocoa powder, salt, vanillin, flavor, butter, lecithin	*Major Products:* Biscuit, ice cream, chocolate	
Number of Wells & Pump Capacity: 1 (60m3/hour)	*Extraction Rate of Groundwater:* 65m3/day	*Purpose of Usage:* Manufacturing, cleaning, irrigation, boiling
Water Consumption of Piped Water (WAJ) in 1994: 10m3/day		
Treatment Process Applied before Usage: Well - mixed with WAJ water - Chlorination - softener (NaCl) - use	*Disposal Method of Treated Wastewater and Sludge:* Sludge by car tank for disposal at Rusaifa Landfill site	
Wastewater Treatment Process Applied: Collection - Sedimentation - discharged into public sewers	*Recycling Ratio of Wastewater:* 0% (irrigation)	
Future Expansion Plan: Its not known.		
Future Water Requirements: If there is expansion, water consumption will increase. (groundwater)		
Remarks: - Chemical Section and Bacterial Section conduct laboratory testing.		

Source: JICA Study Team and WAJ Zarqa

Table - AD10 RESULTS OF WATER LABORATORY TEST

Name of Factory: SUBHI JABRI CO. Address: ZARQA-RUSAIFA ROAD. TEL:953329 FAX: 953329

Date	BOD	TDS	TSS	COD	NH4	Fe	Cr	Pb	Zn	ABS	PO4	NO3	S	Al	Cd	pH	Remarks
8 Jan. '94	72	1,018	44	195	3.3											7.2	
8 Feb. '94	124	824	105	420	2.0											7.5	
19 Mar. '94	123	1,056	80	233						0.9						7.8	
19 Mar. '94	19,454	1,430	78,335	70,333												7.6	
9 Apr. '94	26	1,544	360	987	1.5											8.5	
4 May. '94	48	1,304	44	122	4.4											8.1	
4 Jun. '94	175	1,680	74	357	3.5					2.6						7.7	
7 Jul. '94	34	1,504	100	97	4.9											8.1	
13 Aug. '94	70	1,060	37	83	4.5											8.1	
12 Sep. '94	10	1,184	14	19	2.6											7.2	
8 Oct. '94	339	1,270	232	545												7.3	
9 Nov. '94	13	1,080	18	152	3.0											8.0	

Source: WAJ Zarqa

Table - AD11 QUESTIONNAIRE SHEET OF FACTORY

Name of Factory: Hussein Thermal Power Station	*Address:* Hashemeyeh, PO Box 633 Phone: 911202/9	*Ref. No. on Map:* 6
Year of Construction & Starting Operation: 1973 constructed, 1975 partially operated, 1984 in full operation	*Number of Employees:* 400(80 from Amman)	*Area:* 60ha
Raw Materials: Fuel, Air, Water, HCl, H_2SO_4, NaOH, Phosphate, Sulfur, Activated Sodium	*Major Products:* Electricity (4 units x 66 Megawatt, 3 units x 33 Megawatt)	
Number of Wells & Capacity: 9 (7 in operation), 350m3/hour	*Extraction Rate of Groundwater:* 2,000 - 3,000m3/day	*Purpose of Usage:* Thermal cycle for vapor, drinking, cooling
Water Consumption of Piped Water (WAJ) in 1994: None		
Treatment Process Applied before Usage: 1) Pretreatment - Chemical dosage - RO - Ion Exchange - Use for thermal cycle 2) Direct use (chlorine) - drinking 3) Direct use - cooling	*Disposal Method of Treated Wastewater and Sludge:* Sail or use 10- 15 tones of oil/year	
Wastewater Treatment Process Applied: Naturalization - oil separator - public sewers (40 m3/hour) - or collected time to time	*Recycling Ratio of Wastewater:* 20 % recycled (cooling water)	
Future Expansion Plan: No future expansion plan		
Future Water Requirements: 70 m3/hour required from WAJ due to aggravation of water quality (2500mg/l of TDS)		
Remarks: Laboratory test for water, steam and fuel are being conducted in the plant.		

Source: JICA Study Team and WAJ Zarqa

Table - AD12 RESULTS OF WATER LABORATORY TEST

Name of Factory: HUSSEIN THERMAL POWER STATION. Address: HASHMEIA, Phone:911202/9, Po Box:633.

Date	BOD	TDS	TSS	COD	NH4	Fe	Cr	Pb	Zn	ABS	PO4	NO3	S	Al	Cd	pH	Remarks
18 Jan. '94	10	992	21	23	3.5											6.4	
16 Mar. '94	8	956	41	26	1.0					1.0	12.0					7.9	
14 Apr. '94	8	910	13	55												8.4	
11 May. '94	7	17	10	28		0.38						27.3				7.6	
21 Jun. '94	12	956	25	105												7.9	
16 July. '94	12	888	30	30	1.0	0.60										7.5	
15 Aug. '94	9	1,030	22	34		0.81						21.0				8.0	
20 Sep. '94	10	720	51	27								16.8				7.5	
10 Oct. '94	506	1,700	78	1,100		0.05										7.5	
12 Nov. '94	6	1,102	22	73	0.6											8.2	

Source: WAJ Zarqa

Table - AD13 QUESTIONNAIRE SHEET OF FACTORY

Name of Factory:	*Address:*	*Ref. No. on Map:*
Jordan Paper and Cardboard Factories Co.	Zarqa bridge near military Phone: 981411, Fax: 998481	7

Year of Construction & Starting Operation:	*Number of Employees:*	*Area:*
1962constructed, 1966 production	250(6 from Amman)	51.7ha

Raw Materials:	*Major Products:*
Waste paper, alum, sizing materials, starch	Floating, test liner, chip board, duplex coated board

Number of Wells & Capacity:	*Extraction Rate of Groundwater:*	*Purpose of Usage:*	*Water Consumption of Piped Water (WAJ) in 1994:*
1 (70m3/hour)	800m3/day	Steam generation, cooling, process, sealing	12 m3/day for drinking purpose

Treatment Process Applied before Usage:	*Disposal Method of Treated Wastewater and Sludge:*
Well - 2 softeners - - Boiler	Treated waste water : recycled Sludge : disposed to Rusaifa collection area (3m3/biweekly)
Wastewater Treatment Process Applied: Waste - Collection pit - Sand trap - Inclined screen - Floating unit - Flocculation - Sedimentation - Aerated lagoon	*Recycling Ratio of Wastewater:* 75 % recycled, 25% evaporation

Future Expansion Plan:

Production capacity will increase from 12,000 ton to 30,000 ton yearly to produce duplex from wastewater.

Future Water Requirements:

1,200 m3/day with make up water 300m3/day

Remarks:

- Laboratory tests of industrial wastes are periodically conducted by WAJ Zarqa.

Source: JICA Study Team and WAJ Zarqa

Table - AD14 RESULTS OF WATER LABORATORY TEST

Name of Factory: JORDAN PAPER AND CARDBOARD FACTORIES CO. Address: P.O.BOX : 386 , Phone:981411, ZARQA BRIDGE NEAR MILITARY

Date	BOD	TDS	TSS	COD	NH4	Fe	Cr	Pb	Zn	ABS	PO4	NO3	S	Al	Cd	pH	Remarks
24 Jan. '94	16	1,736	37	113	6.7		0.2			2.4						7.4	B=0.92
23Feb. '94	60	1,936	76	308	24.6					2.0						7.4	
2 Mar. '94	34	1,832	86	196	9.6	0.14			0.1	1.6	1.1	8.8		0.3	0.1	7.6	B=1.6
19 Apr. '94	26	2,732	124	149	10.2											7.5	B=1.36
5 Mar. '94	64	3,240	216	223	6.7					0.3						7.5	
9 May. '94	27	2,056	94	135	14.6											7.9	B=1.17
15 Jun. '94	99	1,414	90	132	3.0											7.3	
12 July. '94	278	1,892	174	420	22.7											7.3	B=1.4
12 July. '94	2,989	4,710	3,580		84.1	3.38	0.0		1.4	30.0				0.6	0.0	3.7	B=1.99
27 Aug. '94	49	1,684	130	377	19.8											7.3	B=1.2
10 Sep. '94	65	1,690	477	196	2.7											7.6	B=1.18
17 oct. '94	92	1,654	80	145	5.8											7.4	
15 Nov. '94	71	1,798	75	219	4.0					1.8	2.8					7.5	

Source: WAJ Zarqa

Table - AD15 QUESTIONNAIRE SHEET OF FACTORY

Name of Factory:	*Address:*	*Ref. No. on Map:*
Al-Hussein Iron Steel Industries Co. Ltd.	Factories Area Phone: 981441, Fax: 657477, Amman	8

Year of Construction & Starting Operation:	*Number of Employees:*	*Area:*
1965 Start operation	248(50 from Amman)	1,000,000m2

Raw Materials:	*Major Products:*
Steel scrap, steel billet (USSR, Rumania), Oxygen, Additive (Carbon, manganese, silica)	Steel bars (40,000ton/year) of 8mm - 32mm in dia.

Number of Wells & Pump Capacity:	*Extraction Rate of Groundwater:*	*Purpose of Usage:*	*Water Consumption of Piped Water (WAJ) in 1994:*
2 (1 working, 55m3/hour)	350m3/day	Cooling, rolling, melting	20m3/day for drinking

Treatment Process Applied before Usage:	*Disposal Method of Treated Wastewater and Sludge:*
Filter - zeolite ion exchange (softening) - chemical additives (anti-scaling, anti-algae, pH correction, anti-corrosion)	Dredge every 6 months for disposal
Wastewater Treatment Process Applied: Wastewater - storage tanks - evaporation	*Recycling Ratio of Wastewater:* more than 80% recycled

Future Expansion Plan:

Expansion plan to construct waste water treatment plant

Future Water Requirements:

No increase

Remarks:

- 35m3/day of groundwater to Chemical Factory and 56m3/day to National Steel
- 3 cooling towers with 30m3 regeneration water

Source: JICA Study Team and WAJ Zarqa

Table - AD16 RESULTS OF WATER LABORATORY TEST

Name of Factory: AL-HUSSEIN IRON STEEL INDUSTRIES CO. LTD. Address:FACTORIES AREA. Phone:981441, Fax:657477

Date	BOD	TDS	TSS	COD	NH4	Fe	Cr	Pb	Zn	ABS	PO4	NO3	S	Al	Cd	pH	Remarks
28 March. '94		2,962	60	137		0.00				0.5						8.2	
20 April. '94	12	2,692	34	164		0.01										7.8	
12 May. '94	95	1,846	165	234	5.8	0.08										8.6	
18 June. '94	50	2,528	86	390	4.2	0.00										8.0	
13 July. '94	10	4,632	67	90	1.0	0.00										8.1	
13 Aug. '94	9	4,708	101	125		0.18						64.0				8.5	
10 Sep. '94		7,096	60	38		0.12										8.1	
13 Oct. '94	31	3,702	84	126	2.6	0.10										8.2	
7 Nov. '94		2,828	38	34												6.9	

Source: WAJ Zarqa

Table - AD17 QUESTIONNAIRE SHEET OF FACTORY

Name of Factory: Arab Iron & Steel Industries Co., Ltd.	*Address:* Khaw Phone: 982321, Fax: 682785, Amman	*Ref. No. on Map:* 9
Year of Construction & Starting Operation: 1975 start operation, 1980 expanded and in operation	*Number of Employees:* 205(20 from Amman)	*Area:* 86,000m3
Raw Materials: Steel billet (Turkey, USSR, Africa)	*Major Products:* Steel bars of 8mm - 25mm in dia. (56,000 - 90,000ton/year)	
Number of Wells & Pump Capacity: 1 (20m3/hour)	*Extraction Rate of Groundwater:* 100 - 150m3/day (Max 600m3/day)	*Purpose of Usage:* Cooling
Water Consumption of Piped Water (WAJ) in 1994: 4m3/day for drinking		
Treatment Process Applied before Usage: No treatment	*Disposal Method of Treated Wastewater and Sludge:* Sludge of fine sedimentation sold to cement factory (1,296ton/year)	
Wastewater Treatment Process Applied: Filter - cooling tower (160m3/3 months)	*Recycling Ratio of Wastewater:* 100% closed system	
Future Expansion Plan: Expansion plan to construct melting factory and water treatment plant before usage.		
Future Water Requirements: Groundwater use will be increased in future.		
Remarks:		

Source: JICA Study Team and WAJ Zarqa

Table - AD19 QUESTIONNAIRE SHEET OF FACTORY

Name of Factory: Jordan Dairy Co., Ltd.	*Address:* Zarqa - Rusaifa Road P.O.Box6474, Phone:953368, Fax:951193	*Ref. No. on Map:* 10

Year of Construction & Starting Operation: 1969 constructed	*Number of Employees:* 175(20 from Amman)	*Area:* 0.65ha

Raw Materials: Fresh milk	*Major Products:* Yogurt, cheese pasteurized, milk, juice

Number of Wells & Pump Capacity: 1(40m3/hr)	*Extraction Rate of Groundwater:* 150-200m3/day	*Purpose of Usage:* Cleaning	*Water Consumption of Piped Water (WAJ) in 1994:* 10 - 15m3/day for drinking

Treatment Process Applied before Usage: Cooling tower - Chlorination - Softener - Sand filters - Process - Boiler	*Disposal Method of Treated Wastewater and Sludge:* Sludge disposed at Rusaifa waste disposal site
Wastewater Treatment Process Applied: Screening - Balanced tank - Bio tower - Aeration - Sedimentation - Sewer lines	*Recycling Ratio of Wastewater:* 0% of wastewater
Future Expansion Plan: No expansion plan.	
Future Water Requirements: No increase of WAJ's water	
Remarks: - Laboratory tests of industrial wastes are periodically conducted by WAJ Zarqa.	

Source: JICA Study Team and WAJ

Table - AD20 RESULTS OF WATER LABORATORY TEST

Name of Factory: JORDAN DAIRY CO., LTD. Address: P.0.BOX: 6474 TEL: 953368, FAX: 951193, ZARQA RUSAIFA ROAD.

Date	BOD	TDS	TSS	COD	NH4	Fe	Cr	Pb	Zn	ABS	PO4	NO3	S	Al	Cd	pH	Remarks
8 Jan. '94	15	1,947	35	56	12.2											7.8	
16 Feb. '94	30	2,024	79	124	6.0											8.2	
24 Mar. '94	8	1,948	99	35												8.5	
21 Apr. '94	26	2,516	170	130	3.8						14.8					8.2	
4 May. '94	12	2,088	57	65	.0.81											8.3	
8 Jun. '94	20	2,648	8	185	2.4											8.0	
9 July. '94	26	2,516	48	95	0.8											8.6	
25 Aug. '94	11	2,204	39	21	11.8											8.4	
15 Sep. '94	24	3,410	76	80	1.1											8.2	
8 Oct. '94	40	1,822	11	104	0.8											8.3	
2 Nov. '94	37	1,970	94	149	4.3											8.0	

Source: WAJ Zarqa

Table - AD21 QUESTIONNAIRE SHEET OF FACTORY

Name of Factory: Jordan Worsted Mills Co.	*Address:* Zarqa - Rusaifa Road, P.O.Box 6060 Amman , Phone: 953428, Fax: 954913	*Ref. No. on Map:* 11

Year of Construction & Starting Operation:	*Number of Employees:*	*Area:*
1963 constructed, 1965 in operation	170(20 from Amman)	1.45ha

Raw Materials:	*Major Products:*
Wool, fiber from mostly Japan , Germany, England	Compound cloth for suits

Number of Wells & Pump Capacity:	*Extraction Rate of Groundwater:*	*Purpose of Usage:*	*Water Consumption of Piped Water (WAJ) in 1994:*
2 (one standby), 25 - 28m3/hour	160 - 200m3/day	Washing, drinking	100m3/month for drinking

Treatment Process Applied before Usage:	*Disposal Method of Treated Wastewater and Sludge:*
No treatment for only washing clothes by using soft soap & soft ash	Discharged to sewerage system
Wastewater Treatment Process Applied: No treatment	*Recycling Ratio of Wastewater:* 0 %

Future Expansion Plan:

No expansion plan for the time being.

Future Water Requirements:

Sufficient because it has a standby well

Remarks:

- Laboratory tests of industrial wastes are periodically conducted by WAJ Zarqa.
- Royal Scientific Society have been conducted water testing weekly since 1982 to 1987. After construction of sewerage system, it was stopped.

Source: JICA Study Team and WAJ

Table - AD22 RESULTS OF WATER LABORATORY TEST

Name of Factory: JORDAN WORSTED MILLS CO. Address: RUSAIFA PO. BOX:6060 Phone:953428, Fax:954913.

Date	BOD	TDS	TSS	COD	NH4	Fe	Cr		Zn	ABS	PO4	NO3	S	Al	Cd	pH	Remarks
8 Jan. '94	20	900	9	64						2.8						7.6	
16 Feb. '94		882	68	159	3.8					6.0	3.4					8.0	
24 Mar. '94	81	1,646	216	228						3.2	2.1					8.1	B=1.17
21 Apr. '94	115	962	46	595						3.8						7.8	B=8 ; N=15.9
9 May. '94	20	998	84	75	5.6					1.2						8.7	
14 July. '94	103	574	90	343						140.0		49.8				8.5	B=1.57
25 Ags. '94	10	966	5	24	2.9					0.9	4.4					8.6	
15 Sep. '94	18	1,150	23	47	2.9					3.5						8.4	
8 Oct. '94	26	852	32	73						3.4	0.3					8.3	
2 Nov. '94	83	1,956	70	193	0.8					0.3	16.4					4.2	

Source: WAJ Zarqa

Table - AD23 QUESTIONNAIRE SHEET OF FACTORY

Name of Factory:	*Address:*	*Ref. No. on Map:*
Jordan Tanning Co.	Zarqa-Amman Highway, Phone:981403	12

Year of Construction & Starting Operation:	*Number of Employees:*	*Area:*
1957 constructed, 1963 operation	140(47 from Amman)	38ha

Raw Materials:	*Major Products:*
Goat, cow, sheep hides Salt, CaOH, lime, Sodium sulfate, Chromium sulfate, H2So4, oils, dies	Leather for shoes, lacquer waxes, emulsion

Number of Wells & Pump Capacity:	*Extraction Rate of Groundwater:*	*Purpose of Usage:*	*Water Consumption of Piped Water (WAJ) in 1994:*
2 (1 not used), 45 m3/hour	200m3/day	for industrial use	Two lines, 150m3/m

Treatment Process Applied before Usage:	*Disposal Method of Treated Wastewater and Sludge:*
Softening - Boiler	Dumping to public sewers Collection wells - drying beds - gravitation - Burning
Wastewater Treatment Process Applied: Waste - Screening - Balancing tank - Settling - Filter Chromium separation (2 days a week) by filtration	*Recycling Ratio of Wastewater:* No recycling

Future Expansion Plan:

Washed and soaked water will be recycled.

Future Water Requirements:

No increase

Remarks:

- Laboratory tests of industrial wastes are periodically conducted by WAJ Zarqa.

Source: JICA Study Team and WAJ Zarqa

Table - AD24 RESULTS OF WATER LABORATORY TEST

Name of Factory: JORDAN TANNING CO. Address: AMMAN-ZARQA HIGHWAY, Phone:09/981403, Fax:09/991947.

Date	BOD	TDS	TSS	COD	NH4	Fe	Cr	Pb	Zn	ABS	PO4	NO3	S	Al	Cd	pH	Remarks
13 Jan. '94	34	6,320	176	185							12.8					6.7	
12 Feb. '94	90	300	52	209	1.3											6.2	
23 Feb. '94	45	8,110	277	369	128.0		0.8									6.8	B–0.28
2 Mar. 94	18	9,786	382	355	178.0		0.3		0.2	2.5	70.0	38.7		0.2	0.1	6.5	CU–0.0
19 Apr. '94	15	10,066	514	221	113.9	0.26	0.2				28.0					6.9	
9 May. '94	25	11,255	300	296	193.0	0.18	0.6				33.0					6.8	
15 Jun. '94	138	11,318	319	248	138.3											6.3	
12 July. '94	32	13,372	188	321	222.7	0.20	0.3			2.0	26.8					6.1	
27 Aug. '94	45	14,136	191	288	95.0		1.0				30.0					6.9	
21 Sep. '94	39	13,226	314	302	118.0						13.0					6.7	
15 Nov. '94	28	12,058	446	390	281.0		0.3									5.3	

Source: WAJ Zarqa

Table - AD25 QUESTIONNAIRE SHEET OF FACTORY

Name of Factory:	*Address:*	*Ref. No. on Map:*
Sulphochemicals Co., Ltd.	Osh Valley P.O.Box811643 Amman , Phone: 991434-5, Fax: 991433	13

Year of Construction & Starting Operation:	*Number of Employees:*	*Area:*
1983 constructed, 1986 in operation	130 (40 from Amman)	11.3ha

Raw Materials:	*Major Products:*
Linear alkylbenzene, fatty alcohols, fatty acid, mono & diethanolamines, sulfur, sodium carbonate, silica sand, H2SO4, tuluene, NaOH	Alkylbenzene sulphonic acids, sodium laurylether sulfate, sodium tuluene sulphonate, sodium silicates, mono and diethanol amides, soap, sodium silicate solution, sodium lauryl sulfates (liq., paste, powder), alkylbenzene sulphonate (liq. paste, powder)

Number of Wells & pump capacity:	*Extraction Rate of Groundwater:*	*Purpose of Usage:*	*Water Consumption of Piped Water (WAJ) in 1994:*
1 (20m3/hr)	150m3/day	Cooling, process, cleaning	None

Treatment Process Applied before Usage:	*Disposal Method of Treated Wastewater and Sludge:*
Well - Sand filter - Carbon filter - RO+Softener - Boilers - Process - Cooling - Cleaning	Waste water - evaporation (5m3/hour) Sludge - Collection - Stored in plant - ?
Wastewater Treatment Process Applied: Waste - Cooling - Evaporation - Process - No waste - Make up - Collect & Evaporate	*Recycling Ratio of Wastewater:* No

Future Expansion Plan:

Plant was expanded in 1994.

Future Water Requirements:

No increase

Remarks:

- Laboratory tests of industrial wastes are periodically conducted by WAJ Zarqa.

Source: JICA Study Team and WAJ Zarqa

Table - AD26 RESULTS OF WATER LABORATORY TEST

Name of Factory: SULPHOCHEMICALS CO., LTD. Address: OSH VALLEY, Phone:991434/5, FAX: 991433.

Date	BOD	TDS	TSS	COD	NH4	Fe	Cr	Pb	Zn	ABS	PO4	NO3	S	Al	Cd	pH	Remarks
3 Jan. '94	3,754	10,976	406	14,161												8.8	
5 Fep. '94	2,670	11,824	1,282	16,354	14.1					80,000.0	2.0					11.1	
5 Mar. '94	3,140	5,940	950	10,170	39.0	3.93	0.2	0.6	0.5	3,400.0	56.0			0.1	0.0	9.4	0.9 mg/L
5 Apr. '94	3,004	51,215	8,390	9,150	17.3	5.02	0.8	0.4	1.3	4,000.0	74.0			0.3	0.3	11.7	CA-0.22
10 May. '94	1,377	12,880	1,073	5,797	24.9	1.80	2.6		0.5	1,300.0	10.6					9.4	
6 Jun. '94	1,180	19,514	438	8,860	20.3	0.56				120,000.0						9.2	B-0.68
13 Jul. '94	1,232	15,528	498	10,348	9.0	0.05				4,000.0						10.5	B-3.49
13 Aug. '94	1,375	8,744	372	8,084	43.5	1.01	0.1		0.5	3,000.0	20.5					9.4	B-2.44
21 Sep. '94	3,232	8,766	419	4,264	10.0	1.48										9.8	
13 Oct. '94	2,283	3,282	2,266	3,451	33.3	1.10										11.5	
7 Nov. '94	4,227	5,058	2,158	10,341						15,000.0	72.0					7.7	B-2.8

Source: WAJ Zarqa

Table - AD27 QUESTIONNAIRE SHEET OF FACTORY

Name of Factory:	*Address:*	*Ref. No. on Map:*
Eagle Distilleries Co.	Zarqa - Rusaifa Road P.O.Box 4 , Phone: 986226-227, Fax: 901966	14

Year of Construction & Starting Operation:	*Number of Employees:*	*Area:*
1951 constructed	130(3 from Amman)	1.5ha

Raw Materials:	*Major Products:*
Raisin, grapes, dates	All alcoholic beverages except beer, such as wine, whisky, jin, vodka, and CO2 & dry ice as byproducts

Number of Wells & Pump Capacity:	*Extraction Rate of Groundwater:*	*Purpose of Usage:*	*Water Consumption of Piped Water (WAJ) in 1994:*
1 (20m3/hour)	130m3/day	Cooling, mixing, cleaning, boiler, mixes and drinking	10m3/day for drinking

Treatment Process Applied before Usage:	*Disposal Method of Treated Wastewater and Sludge:*
Well - Sand filter - Softening - 1) Direct use 2) Distillation - Mixes & boiler 3) Chiller - Cooling - Recycling to Chiller	Lagoon for evaporation - Sieving - Rusaifa Dry waste Collection Area
Wastewater Treatment Process Applied:	*Recycling Ratio of Wastewater:*
Waste - Screening -Aeration - Settling by Alum - 1) Sewer line 2) Lagoon	24 % (80% of cooling water)

Future Expansion Plan:

Bottling and Winery sections will be expanded in 1996 without extra employees.

Future Water Requirements:

No increase

Remarks:

- Laboratory tests of industrial wastes are periodically conducted by WAJ Zarqa.
- CIP (cleaning in place) system will be introduced to save water in 1997.

Source: JICA Study Team and WAJ Zarqa

Table - AD28 RESULTS OF WATER LABORATORY TEST

Name of Factory: EAGLE DISTILLERIES CO. Address: ZARQA-RUSAIFA ROAD, Phone:986226, Fax:901966, Box: 4.

Date	BOD	TDS	TSS	COD	NH4	Fe	Cr	Pb	Zn	ABS	PO4	NO3	S	Al	Cd	pH	Remarks
4 Jan. '94	100	1,096	32	212	13.0					1.6						7.7	
2 Feb. '94	445	1,296	305	598		0.11										9.7	
16 Mar. '94	170	1,338	148	317	1.8					0.5	16.8					10.7	
3 May. '94	75	730	70	157	2.0	0.02										7.8	
4 Jun. '94	713	1,080	29	2,453	1.4	0.00										7.5	
9 Jul. '94	720	1,072	23	1,180												8.0	
9 Aug. '94	105	1,284	58	366	0.6											7.7	
6 Sep. '94	94	804	63	173	0.5	0.06				1.1	15.0					8.0	
1 Oct. '94	205	862	180	460	1.2											7.8	
12 Nov. '94	80	1,032	88	122	1.3	0.13										9.6	

Source: WAJ Zarqa

Table - AD29 QUESTIONNAIRE SHEET OF FACTORY

Name of Factory:	*Address:*	*Ref. No. on Map:*
Jordan Pipes Co., Ltd.	Hashemeyeh, Phone: 985022	15

Year of Construction & Starting Operation:	*Number of Employees:*	*Area:*
1974 constructed	130(25 from Amman)	25ha

Raw Materials:	*Major Products:*
Clad steel	Galvanized steel pipe (1/2" - 3/4")

Number of Wells & Pump Capacity:	*Extraction Rate of Groundwater:*	*Purpose of Usage:*	*Water Consumption of Piped Water (WAJ) in 1994:*
1 (80m3/hour)	150 - 600m3/day	Cooling	7m3/day for drinking

Treatment Process Applied before Usage:	*Disposal Method of Treated Wastewater and Sludge:*
Well - Plant	Wastewater - Reused for agriculture(75%) - Drying bed (25%) for evaporation Sludge - Dredged and accumulated on the premises for disposal
Wastewater Treatment Process Applied: Waste - pH Adjustment - Aeration - Settlement	*Recycling Ratio of Wastewater:* 75 %

Future Expansion Plan:

It will be expanded in 1996. No need to expand bore holes. Employee will consume maximum160m3/month.

Future Water Requirements:

No increase of groundwater use, but 1 m3/day increase of WAJ water

Remarks:

- Laboratory tests of industrial wastes are periodically conducted by WAJ Zarqa.

Source: JICA Study Team and WAJ Zarqa

Table - AD30 RESULTS OF WATER LABORATORY TEST

Name of Factory: JORDAN PIPES CO., LTD. Address: HASHEMEYEH, Phone:985022.

Date	BOD	TDS	TSS	COD	NH4	Fe	Cr	Pb	Zn	ABS	PO4	NO3	S	Al	Cd	pH	Remarks
11 Jan. '94	3	3,352	42	26												7.2	
22 Mar. '94		3,584	41	70		0.0			0.0		29.4	31.3				7.1	B=0.65
4 May. '94		5,618	55	48	0.3	0.92										8.0	
8 Jun. '94	3	4,292	44	282		0.03			0.2							7.8	
11 Apr. '94		4,664	64	100		0.13			0.2			39.7				3.2	
5 July. '94		4,486	42	32		0.00			0.1							7.6	
15 Aug. '94		5,438	30	14		0.00			1.6			27.6				7.9	
1 Nov. '94		4,974	44	39		0.70										7.7	
3 Sep. '94	20	6,286	68	62	0.3				0.7							7.5	

Source: WAJ Zarqa

Table - AD31 QUESTIONNAIRE SHEET OF FACTORY

Name of Factory:	*Address:*	*Ref. No. on Map:*
Tissue Paper Factory	Sukhna, Phone: 911144, POBox: 6899	16

Year of Construction & Starting Operation:	*Number of Employees:*	*Area:*
1983 constructed, 1985 operation	120(10 from Amman)	14.7ha

Raw Materials:	*Major Products:*
Virgin pulp, waste paper, glue, alum, dye, and chemicals for stirring & softening	Tissue paper as rolls

Number of Wells & Pump Capacity:	*Extraction Rate of Groundwater:*	*Purpose of Usage:*	*Water Consumption of Piped Water (WAJ) in 1994:*
1 (11m3/h)	240 - 350 m3/day	Washing and boiler	Two lines, 80m3/m for drinking and 150m3/m for industrial use

Treatment Process Applied before Usage:	*Disposal Method of Treated Wastewater and Sludge:*
Softening - Plant use	Sludge lagoon for evaporation and tipping
Wastewater Treatment Process Applied:	*Recycling Ratio of Wastewater:*
Waste - Coagulation with polymer - Settling - Agriculture (inplant) & Sludge lagoon	70% of wastewater

Future Expansion Plan:

Productivity will be expanded from 22ton/year to 45ton/year by the year 1977. Feasibility of recycling system is currently under study.

Future Water Requirements:

330m3/day after 1977

Remarks:

- Laboratory tests of industrial wastes are periodically conducted by WAJ Zarqa.

Source: JICA Study Team and WAJ Zarqa

Table - AD32 RESULTS OF WATER LABORATORY TEST

Name of Factory: TISSUE PAPER FACTORY. Address: SUKHNA, Phone:911144, Po. Box: 689.

Date	BOD	TDS	TSS	COD	NH4	Fe	Cr	Pb	Zn	ABS	PO4	NO3	S	Al	Cd	pH	Remarks
11 Jan. '94	104	2,850	91	311	2.6					0.4						6.7	
1 Feb. 94	103	3,044	154	354	14.3					0.4						5.2	
16 Mar. 94	137	2,588	510	996	3.1						2.3					7.5	B=0.57
8 Jun. 94	54	2,998	52	358	13.8											7.7	
20 Sep. 94	137	3,204	85	238	1.6						1.2					7.2	
5 Oct. 94	65	3,362	55	158	7.0					0.2	0.5					7.7	B=0.68

Source: WAJ Zarqa

Table - AD33 QUESTIONNAIRE SHEET OF FACTORY

Name of Factory: Jordan for Mineral Explorant Co., Ltd.	*Address:* Zarqa - Rusaifa Road P.O.Box 386, Phone: 951075	*Ref. No. on Map:* 17
Year of Construction & Starting Operation: 1948 start operation, 1970 moved from Mahata	*Number of Employees:* 105(20 from Amman)	*Area:* 13,000m3
Raw Materials: Marble, granite	*Major Products:* Marble, tile, granite	

Number of Wells & Pump Capacity: 1 (15m3/hour)	*Extraction Rate of Groundwater:* 40m3/day	*Purpose of Usage:* Cooling, washing, direct use	*Water Consumption of Piped Water (WAJ) in 1994:* 5m3/day for drinking

Treatment Process Applied before Usage: Well - direct use with no treatment	*Disposal Method of Treated Wastewater and Sludge:* Sludge by car tank for disposal
Wastewater Treatment Process Applied: Waste -Precipitation -Recycling	*Recycling Ratio of Wastewater:* 80%

Future Expansion Plan:

Expansion plan starting from 1996 by installing new machine.

Future Water Requirements:

Groundwater use will be doubled after expansion to be 80m3/day. Drinking water will be increased to 7m3/day.

Remarks:

Source: JICA Study Team and WAJ Zarqa

Table - AD34 RESULTS OF WATER LABORATORY TEST

Name of Factory: JORDAN FOR MINERAL EXPLORANTS CO., LTD. Address: ZARQA-RUSIFA ROAD, Phone:951075 , PO. BOX: 386.

Date	BOD	TDS	TSS	COD	NH4	Fe	Cr	Pb	Zn	ABS	PO4	NO3	S	Al	Cd	pH	Remarks
19 Jan. '94		946	4,926													8.2	
16 Feb. '94		1,108	298	136	1.5											9.5	
21 Mar. '94		936	1,976	55						0.4		4.7				8.9	
5 May. '94		1,214	2,122	57												9.3	
18 Jun. '94		882	2,076	138	0.7											7.6	
4 Jul. '94		886	2,736	149								49.9				8.5	
17 Aug. '94		1,046	1,162													8.6	
13 Sep. '94		964	1,512	45	0.3							31.5				8.4	
13 Oct. '94		1,226	73	23												8.4	
15 Nov. '94		1,162	576	54								25.0				9.0	

Source: WAJ Zarqa

Table - AD35 QUESTIONNAIRE SHEET OF FACTORY

Name of Factory: Yeast Industries Co.	*Address:* Al-Moshirfa P.O.Box 4 , Phone: 885114, Fax: 897114	*Ref. No. on Map:* 18

Year of Construction & Starting Operation:	*Number of Employees:*	*Area:*
1976 constructed, 1978 in operation	72(6 from Amman)	1.1ha

Raw Materials:	*Major Products:*
Molds, magnesium, phosphate, sulfate, vitamins	Yeast (fresh, dry)

Number of Wells & Pump Capacity:	*Extraction Rate of Groundwater:*	*Purpose of Usage:*	*Water Consumption of Piped Water (WAJ) in 1994:*
1 (35m3/hour)	550m3/day	Industrial	2 - 3m3/day for drinking

Treatment Process Applied before Usage:	*Disposal Method of Treated Wastewater and Sludge:*
Well - Softening - Boiler & cooling tower (chlorination)	No sludge produced
Wastewater Treatment Process Applied:	*Recycling Ratio of Wastewater:*
No treatment, (natural land reclamation, irrigation, forest trees)	0 %

Future Expansion Plan:

Expansion in production capacity 25%.

Future Water Requirements:

Increased to 700m3/day for well

Remarks:

- Laboratory tests of industrial wastes are periodically conducted by WAJ Zarqa.
- CIP (cleaning in place) system will be introduced to save water in 1997.

Source: JICA Study Team and WAJ Zarqa

Table - AD36 RESULTS OF WATER LABORATORY TEST

Name of Factory: YEAST INDUSTRIES CO. Address: MOSHIRFA Phone: 885114. Fax: 897114.

Date	BOD	TDS	TSS	COD	NH4	Fe	Cr	Pb	Zn	ABS	PO4	NO3	S	Al	Cd	pH	Remarks
17 Jan. '94	5,775	2,662	755	18,491	155.5											6.4	
28 Feb. '94	3,750	2,026	572	7,940	274.0											6.0	
26 Mar. '94	7,749	9,750	1,125	31,666	346.8					12.0	0.2					6.2	B=5.57
5 May. '94	5,761	8,336	3,364	70,930							58.0					7.0	
13 Jun. '94	10,680	11,110	3,130	23,566	781.0											5.1	
7 July. '94	22,688	9,320	1,587	33,333	582.0											5.6	
17 Aug. '94	3,047	7,210	2,090	19,220	67.9					80.0	17.0					5.9	
13 Sep. '94	4,683	1,362	1,620	6,129	230.0						3.2					6.2	
15 Oct. '94	9,520	11,884	624	15,877	155.0						5.0					6.0	
9 Nov. '94	10,235	12,176	1,288	24,060	282.0						31.0					5.4	B=6.8

Source: WAJ Zarqa

Table - AD37 QUESTIONNAIRE SHEET OF FACTORY

Name of Factory: Jimco	*Address:* Phone: 989236, Fax: 651287	*Ref. No. on Map:* 19
Year of Construction & Starting Operation: 1976 start operation	*Number of Employees:* 60	*Area:* 56,000m2
Raw Materials: Wood, cartoon, potassium chlorite, grass powder, gelatin, lead phosphorous	*Major Products:* Matches	

Number of Wells & Pump Capacity:	*Extraction Rate of Groundwater:*	*Purpose of Usage:*	*Water Consumption of Piped Water (WAJ) in 1994:*
1 (45m3/hour)	25 -50m3/day	Process, softeners, irrigation, domestic	No, but buy 16m3/month from water tankers

Treatment Process Applied before Usage:	*Disposal Method of Treated Wastewater and Sludge:*
Softeners (3) - regenerated water collected in steel basin	Sludge from blow down by car tank for disposal Sludge reused as fillers in matches
Wastewater Treatment Process Applied: Waste - Precipitation and evaporation	*Recycling Ratio of Wastewater:* 0% (boilers closed system)

Future Expansion Plan:

No

Future Water Requirements:

It depends on market demand.

Remarks:

Source: JICA Study Team and WAJ Zarqa

Table - AD39 QUESTIONNAIRE SHEET OF FACTORY

Name of Factory: Arab Brewery Co., Ltd.	*Address:* Zarqa - Rusaifa Road Phone: 986263 - 4, Fax: 988950	*Ref. No. on Map:* 20
Year of Construction & Starting Operation: 1964 start operation	*Number of Employees:* 36 (2 from Amman)	*Area:* 4,000m2
Raw Materials: Sugar, malt, water, bottle	*Major Products:* Beer (1,000m3/year)	
Number of Wells & Pump Capacity: 1 (24m3/hour)	*Extraction Rate of Groundwater:* 80m3/day	*Purpose of Usage:* Industry, drinking and cleaning
Water Consumption of Piped Water (WAJ) in 1994: 1m3/day for drinking		
Treatment Process Applied before Usage: Sand filter - Chlorination - Carbon filters - Softening (NaCl base) - Cation-anion ion exchange	*Disposal Method of Treated Wastewater and Sludge:* Sludge - broken grass, cartoon and malt - sail	
Wastewater Treatment Process Applied: Regenerated water to public sewers	*Recycling Ratio of Wastewater:* Cooling (100%), 0%	
Future Expansion Plan: No future expansion plan		
Future Water Requirements: Planning to decrease		
Remarks: - Laboratory tests of 10- 15 samples per hour are conducted.		

Source: JICA Study Team and WAJ Zarqa

Table - AD40 RESULTS OF WATER LABORATORY TEST

Name of Factory: ARAB BREWERY CO., LTD. Address: ZARQA-RUSAIFA ROAD.

Date	BOD	TDS	TSS	COD	NH4	Fe	Cr	Pb	Zn	ABS	PO4	NO3	S	Al	Cd	pH	Remarks
6 Jan. '94	76	988	27	117												7.2	
5 May. '94	240	1,080	384	519							0.5					7.7	n=6.2
14 June. '94	607	2,338	356	833	19.2											6.8	
9 Aug. '94	17	1,206	56	40	2.5						1.0					9.4	
6 Sep. '94	152	2,572	193	284	2.7											8.5	
3 Oct. '94	274	1,390	60	406	2.3						0.5					11.6	
12 Nov. '94	1,005	1,932	88	2,220	4.6											8.6	

Source: WAJ Zarqa

Table - AD41 QUESTIONNAIRE SHEET OF FACTORY

Name of Factory: Jordan Beer Co.	*Address:* Zarqa - Rusaifa Rd, Phone: 986263, Fax:624655	*Ref. No. on Map:* 21
Year of Construction & Starting Operation: 1956 constructed, 1957 operation	*Number of Employees:* 70(4 from Amman)	*Area:* 1.2ha
Raw Materials: Hops, water, corn, barley	*Major Products:* Beer, bitter lemon, soda water, kiwi fizz, tatty fruity, tonic water, apple fizz, grenadine fizz	
Number of Wells & Pump Capacity: 1 (20m3/hour)	*Extraction Rate of Groundwater:* 110m3/day	*Purpose of Usage:* Industry, cleaning, rinsing, cooling, steam generation
Water Consumption of Piped Water (WAJ) in 1994: 1.5m3/day		
Treatment Process Applied before Usage: Filtration - Chlorination - R.O. - Brewing, - Softening to boiler, brewing, cooling	*Disposal Method of Treated Wastewater and Sludge:* Wastewater - Sewer lines Sludge - Sale	
Wastewater Treatment Process Applied: Not in operation	*Recycling Ratio of Wastewater:* None (cooling water 100%)	
Future Expansion Plan: 1) Bottling hall : increasing productivity 2) R.O. replacement		
Future Water Requirements: It may be doubled.		
Remarks: - Laboratory tests of industrial wastes are periodically conducted by WAJ Zarqa.		

Source: JICA Study Team and WAJ Zarqa

Table - AD42 RESULTS OF WATER LABORATORY TEST

Name Of Factory: JORDAN BEER CO. Address: ZARQA-RUSAIFA ROAD, Phone: 986264, Fax:624655.

Date	BOD	TDS	TSS	COD	NH4	Fe	Cr	Pb	Zn	ABS	PO4	NO3	S	Al	Cd	pH	Remarks
6 Jan. '94	17	450	8	48												7.5	
8 Feb. '94	159	380	51	550	0.4											8.0	
19 Mar. '94	1,685	1,214	90	5,170						0.7	21.2					10.7	
5 May. '94	219	542	100	389	4.8											8.0	
14 Jun. '94	767	752	24	1,130	2.7											5.9	
9 July. '94	800	932	20	1,902												6.0	
9 Aug. '94	11	652	23	16	0.1						1.0					7.7	
6 Sep. '94	10	426	6	21	0.8											7.7	
3 Oct. '94	128	550	133	162	1.1											7.5	
2 Nov. '94	213	690	14	557	0.8											7.9	

Source: WAJ Zarqa

E. SYSTEM LAYOUT

APPENDIX E SYSTEM LAYOUT

As the first step to perform a network analysis of the existing water supply system, system layout was prepared. We obtained the updated 1/10,000 scale topographic maps from the Royal Jordanian Geographic Center which were used to plot on them the existing water supply systems for the whole area from Sukhneh and Hashemiyah in the North to Russaifa and Schneller Camp in the Southwest. These maps have been organized on A1 size drawings (7 sheets). The town planning has been superimposed on these maps for the purpose of supporting and properly show the water lines.

Work on each area within the study limits is defined as follows:

- The distribution system in Sukhneh and Hashemiyah has been completed and drafted on the newly obtained topographic maps of scale 1/10,000. Only few locations were checked by excavation to verify information obtained.

- The location of the Zarqa city water mains have been completed and checked with WAJ staff and "as built " drawings for Zarqa Water Supply Project, Contract No. 56/90-C, dated 1993 and other drawings prepared by WAJ showing the pumps, wells and distribution mains, and plotted on the base maps to a scale of 1/10,000. Some time was spent before the permits from the concerned authorities could be obtained in order to be able to start the excavations to verify the pipes and connections.

- The Russaifa water supply mains data were collected and checked with the "as-built" drawings of Zarqa - Russaifa Water Distribution System and Sewerage System, Contracts 2A, 6A, 7A, 3B, 4B and 7C of 1982 - 1985 and other drawings prepared by WAJ showing the pumps, wells and distribution mains, and with the help of the WAJ staff including verification pits and plotted on the Russaifa base maps.

The System Layout Drawings of 7 sheets are produced which show alignment, size, material and installed year of the pipes of more than 80 mm in diameter.

F. FLOW & PRESSURE MEASUREMENT AND CALIBRATION

Appendix F
- Flow & Pressure Measurement and Meter Calibration -

Table of Contents

1. OBJECTIVES

Existing transmission mains are installed in 1980s. They are in use more than 15 years. WAJ's bulk meters are functioning but their accuracy is not known. In the service area, there are many large consumers who consume much water.

The Survey was organized to assess conveyance capacity of the major pipelines and to calibrate the existing bulk meters and large consumer meters.

2. PIPELINES, BULK METERS AND LARGE CONSUMER METERS SURVEYED

Figs.- F1(1) to (3), F2(1) to (2) and F3 show the location map of the transmission lines, WAJ's bulk meters, and the large consumer meters respectively, where surveys are conducted.

(1) Flow and Pressure Measurement Survey

For flow and pressure measurement, following three lines are selected in view of their relatively large flow rates.

1) Azraq - Khaw Line (600 mm in diameter, black steel pipes installed in 1980)
2) Khaldieh - Khaw Line (600 mm in diameter, black steel pipes installed in 1986)
3) Khaw - Zarqa Line (400 mm in diameter, black steel pipes installed in 1982)

(2) Calibration of WAJ's Bulk Meters

Calibration involved all existing bulk meters installed in pumping/booster pumping stations in Zarqa District. They are 22 in number which are given in the existing system flow chart. Flow meters calibrated in the flow and pressure survey stated above are excluded.

(3) Calibration of Large Consumer Meters

Large consumers scatters in Zarqa District. Selected 10 large consumers are based on the information provided by WAJ.

3. Survey Method

(1) Flow and Pressure Measurement Survey

To assess the performance of the existing transmission lines, flow rate and pressure were measured at the outlet of the pumping station, ie, the starting point of the water transmission and the terminal point of the inlet to tank/reservoirs at the same time. Flow meter used are portable Ultra-sonic Flow Meter. Continuous measurement was made for twelve (12) hours.

(2) Calibration of WAJ's Bulk Meters & Large Consumer Meters

Portable ultrasonic flow meters gave accurate results of flow rate measurement. Diameter of meters measured covers wide range of 25 mm - 600 mm. The flow rate recorded by the ultrasonic flow meters was then compared to the measurement made by WAJ and customer meters at the same time.

4. Survey Results

4.1 Flow and Pressure Survey

The results are summarized in the table below;

Line (From - To)	Pipeline Length (km)	Pressure at Upper point (Bar)	Pressure at Lower point (Bar)	Average Flow Rate (m3/hr)	Diff. Elevations (m)	C-Value
Khaldieh - Khaw	17.0	6.2	1.4	1,375	0	137
Khaw - Zarqa	8.0	10.0	1.5	1,268	-28	153
Azraq - Khaw	66.0	34	2.4	2,300	56	165

The C-values obtained are unexpectedly large in comparison with the general characteristics of the similar aged pipes. This may be attributable to the hydraulic profile of these pipelines which have less friction losses.

4.2 Calibration of WAJ's Bulk Meters

Most of the meters are functioning well within an allowable limit of 15% deviation. They have a general tendency to record lower flow rate than normal, particularly at Khaldieh pumping station and Murhib pumping station.

4.3 Calibration of Large Consumer Meters

Most of the meters are also likely to record lower flow rate than normal. This situation becomes worse at Jaber Zaidan and Talhony Mill. The flow meter calibration suggests necessity of meter replacement or further detailed pipeline survey at Al-Hikma Hospital.