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STATISTICS ON WATER SUPPLY, DISTRIBUTION AND QUALITY IN JORDAN

Paper submitted by the Jordan Department of Statistics[1]

Abstract

Due to the scarcity of water in Jordan, the Government gives first priority to management and planning in water sector. The gap between demand and supply, the water quality and water distribution among sectors and within each sector is the main environmental challenge in Jordan.

1 Prepared by Khamis Raddad.

A- water supply

1- surface water:

It includes rainfall / run off flood flow volumes and deep infiltration as well as the regionalization of base -flow volumes to rivers or wades sections.

Table No.1 - Rainfall in M.C.M (87/88-96/97)

Rainfall Water / Year	Rainfall (M.C.M)
1987 / 1988	12262
1988 / 1989	10205
1989 / 1990	7609
1990 / 1991	8379
1991 / 1992	10429
1992 / 1993	5898
1993 / 1994	8440
1994 / 1995	8524
1995 / 1996	6046
1996 / 1997	8746

By comparing the quantity of rainfall water in the above table it is observed that the quantity of water decreased from (12262 M.C.M) in 1987 / 1988 to (8746 M.C.M) in 1996 / 1997 about 28.7 %, and this percentage is quite high during the short period (10 years), which effects in decreasing availability of water meanwhile, the population during the same period increased about 59.4 %, then the gap between supply and demand has extremely increased by the time.

Table No.2 - surface water budget in the long term average 19937 - 1996

Rainfall M.C.M	EVAPORATION		FLOOD		INFITRATION	
	Volume M.CM	%	Volume M.C.M	%	Volume M.CM	%
8520.37	7858.0	92.25	204.0	2.40	455.8	5.35

The most of rainfall water (92.25 %) is lost because of evaporation. The high evaporation resulted from several factors like dry condition (low relative humidity in Jordan), the green cover, which is limited, and most quantity of rainfall fell on arid zone (the rainfall less than 100 m.). 68.7 % out of the total area of the kingdom.

Table No.3 - Quantity of water by source at 1997

SOURCE	Q(M3)	%
1- Surface water - Jordan valley - Spring - Base &flood	313.7 222.9 55.8 35.0	35.58
2 - Ground water - Renewable - Nonrenewable	509.1 437.5 71.6	57.74
3 - Treated waste water	58.9	6.68
Total	881.7	100.00

It is clear according to the above figure that the treated water still less than the level that could be targeted in the better situation if the number of housing units used public system for sewage water increased (the current situation is about 50%). This quantity could be easily increased, and the quality improved if they could provide funds for such project.

B - Water Distribution

The big challenge is how we distribute our limited quantity of water, and what is the main guidelines to do it, is it according to economic feasibility, or according to food production, or drinking water. The second point is the real cost of water and subsidized price fixed by government; the third point is the quantity of water lost from the main lines when pumping water to the end users.

Table No.4 - Water quantity in million cubic meter and percentage by purpose of use in 1996.

Item	Total	Irrigation	Livestock	Industrial	Municipal
Quantity	881.774	597.868	11.788	35.762	236.356
%	100	67.8	1.34	4.06	26.8

SERVICES SECTOR:

- Total	6,880,237.9 CM
- Hotels and restaurant	3,365,348.5 CM
- Education	705349.2 CM
- Health activities	768990.6 CM
- Others	2,040,549.6 CM

CONSTRUCTION SECTOR 783,924.0 CM

Industrial

- Total	17,483,503.2 CM
- Mining and quarrying	9,470,269.7 CM
- Manufacture of food Production and beverages	2,292,382.1 CM
- Manufacture of chemical Product	737,188.4 CM
- Manufacture of other Non- metallic mineral product	1489437.4 CM
- Sales, maintenance and Repair of motor vehicles and motorcycles retail sale of automotive fuel	931,208.8 CM
- Others	2563016.8 CM
-	
-	
-	

Table No.5 - Water Per capita distributed during the period 1985 - 1997

Year	Liter percentage /day
1985	95.2
1986	132.8
1987	142.9
1988	150.7
1989	149.9
1990	142.6
1991	133.6
1992	150.0
1993	151.6
1994	145.5
1995	157.1
1996	149.4
1997	142.9

The per capita distributed is reasonable, but if we know that above 54 % of it is lost before reaching the end user, this mean that the per capita in this case is very low.

C - Water quality

The main objective of detecting water quality is to protect health from any bad effect. The Ministry of Health and Ministry Of Water and other agencies are always concern about this topic. In this paper, the chemical analysis and biological analysis done by Environmental Health Department at the Ministry of Health is only our concern.

Table No.6 - Results of microbial test of drinking water during 1981-1998 in Jordan

Year	Total No.of Samples	Not applicable Number	%
1981	5787	1131	19.5
1982	6644	1143	17.2
1983	8509	1176	13.8
1984	10525	1053	10.0
1985	12640	844	6.6
1986	16047	855	5.3
1987	24010	740	3.0
1988	30.642	676	2.2
1989	32619	659	2.0
1990	40050	925	2.3
1991	30291	1493	4.9
1992	35.330	1671	4.7
1993	43.980	1338	3.0
1994	40799	862	2.1
1995	38788	619	1.6
1996	39494	594	1.5
1997	39375	712	1.8
1998	41744	814	1.95

From the above table it is observed that the water quality improved by time and number of samples tested increased gradually.

Table No.7 - Results of chemical and physical analysis for drinking water in Jordan during the period 1994 until 1998.

Parameter	Symbol	Jordanian Standard(286)		1994	1995			1996		1997		1998	
		Permit limit	Max. Limit	No	%	No	%	No	%	No	%	No	%
Turbidity	T	1.0	5.0	-	-	204	80.0	237	86.5	262	65.0	304	78.5
Color	C	10.0	15.0	-	-	-	-	242	96.8	491	96.0	298	95.2
pH	pH	6.5	9.0	259	99.6	262	100.0	274	100.0	396	99.0	392	99.0
Total dissolved	T.D.S	500.0	1500.0	153	59.5	203	76.9	80	29.2	224	43.0	169	40.7
Total hardness	TH	100.0	500.0	71	27.4	12	4.6	10	3.6	7	1.0	25	6.0
Calcium	Ca^{+2}	-	-	-	-	-	-	-	-	3	100.0	-	-
Magnesium	Mg^{+2}	-	-	-	-	-	-	-	-	3	100.0	-	-
Potassium	K^{+1}	-	-	-	-	-	-	-	-	4	100.0	-	-
Sulfate	So_4^{-2}	200.0	500.0	248	96.9	249	95.8	244	89.4	504	96.0	379	97.4
Sodium	Na^{+1}	200.0	400.0	93	98.9	79	100.0	-	-	2	100.0	70	100.0
Ammonium	NH_4^{+1}	0.5	-	-	-	-	-	-	-	-	-	56	80.0
Chloride	CL^-	200.0	500.0	209	86.0	229	86.7	230	83.9	420	79.0	334	84.6
Nitrate	NO_3^-	50.0	70.0	213	83.2	239	87.9	262	88.8	490	78.0	406	92.5
Nitrite	NO_2	2.0	-	-	-	-	-	-	-	297	100.0	357	92.5
Fluoride	F^-	1.0	1.5	-	-	-	-	132	91.0	466	90.0	276	91.4
Phosphate	PO_4^{-3}	-	-	-	-	-	-	-	-	2	100.0	-	-
Ammonia	NH_3	-	-	-	-	-	-	-	-	4	100.0	-	-
Iron	Fe^{+2}	0.3	1.0	-	-	13	92.9	32	68.1	7	100.0	67	89.3
Manganese	Mn^{+2}	0.1	0.5	-	-	1	100.0		-	7	100.0	71	100.0
Stallum	Sn^{+2}	-	-	-	-	-	-	-	-	4	100.0	-	-
Detergents	MBAS	0.2	0.5	-	-	-	-	4	50.0	58	100.0	73	100.0
Lead	Pb^{+2}	0.01	-	-	-	69	94.5	47	97.9	5	100.0	59	89.4
Fuel oil & gas	Fog	-	-	-	-	-	-	-	-	3	100.0	-	-
Aluminum	AL^{+3}	0.10	0.2	-	-	-	-	-	-	-	-	63	90.0
Cupper	Cu^{+2}	1.0	1.5	-	-	4.0	100.0	35	100.0	2	100.0	68	100.0
Zinc	Cd^{+2}	-	-	-	-	-	-	-	-	4	100.0	-	-
Nickel	Ni^{+2}	0.02	-	-	-	-	-	1	100.0	4	100.0	64	100.0

From this table, the turbidity and total dissolved solids and total hardness are increasing with the time. It is clear the percentage of samples meet the Jordanian standard for total hardness is very low (6 % in 1998) and also total dissolved solids is quite low (40.7 % at 1998).

The heavy metals test is limited and number of samples is small .It should be increased and results also should be extracted on monthly base due to high variation between months.