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EFFECT OF WATER POLLUTION IN SOME WATER STREAMS ON IRRIGATION WATER QUALITY IN NORTH DELTA

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ABSTRACT

The shortage of water resources in many countries all over the world, especially in arid and semi arid regions, has dictated the need for using different water qualities and even low qualities for irrigation purposes.

The study was carried out in Kafr El-Sheikh, Governorate. The present work was conducted to study the Effect of water pollution in some water streams such as canals, drains and Al-Burullus lake on irrigation water quality in North Delta.

Eleven sites were chosen in the North Delta along some canals, drains and Al-Burullus lake.Three sites were chosen along Mit Yazied canal, Bahr Tera canal and drain no.7 and one site on Al- Bahrawy drain and Al-Burulus lake.Water samples were collected and analyzed monthly during the period from May 2007 till February 2008.

The results obtained may be summarized as follows:

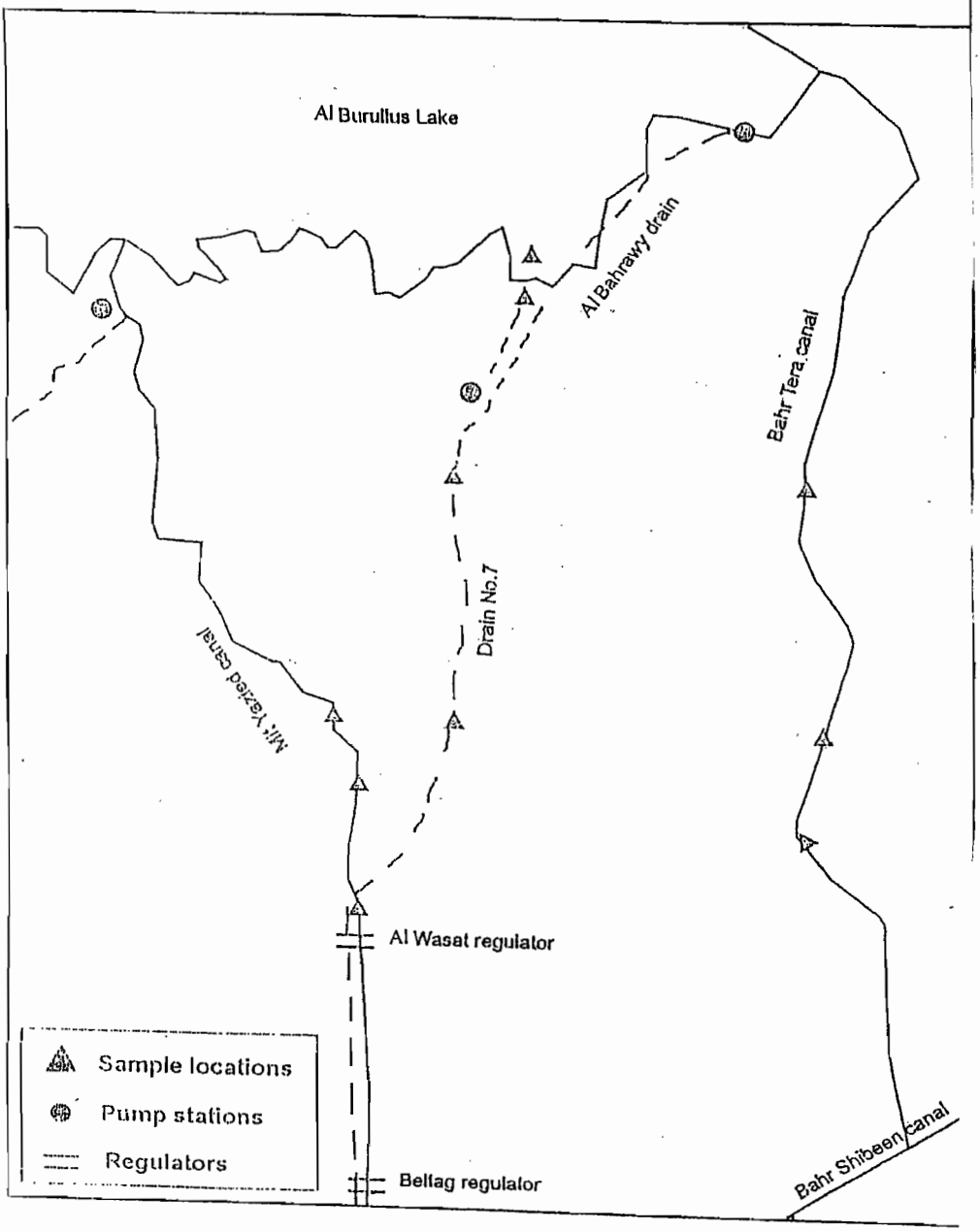
1- Irrigation water was classified according to the United States Salinity Laboratory (USSL) (C_2-S_1) (medium salinity -low sodium).
2- Drainage water was classified as (C_3 - S_2), (C_4-S_2)(high salinity– medium sodium) while Al- Burullus lake classified as (C_4 -S_4) (very high salinity – high sodium).
3- The values of zink (Zn), manganize (Mn), nickel (Ni), and cobalt (Co) ranged from 0.001 to 0.025, 0.001 to 2.044, 0.001 to 0504 and 0.001 to 1.376 ppm, respectively.

With exception ,cobalt concentration in water canals and drains was higher than the value of standard irrigation water standard (WHO, 1995), so that using this water is harmful for human health , animals, plants and soil.

INTRODUCTION

Egyptian water resources are limited ,Consequently improving irrigation systems, increasing water use efficiency and reuse of drainage water are a must for irrigation. The components of water losses in the Delta of the River Nile are subsurface drainage, surface run off in irrigation fields, canal tail end losses , seepage and some other sources such as municipal, domestic and industrial wastes (El-Quosy, 1990).

The use of low water quality such as drainage water might be important. About 7.7 billion m^3 of drainage water is expected to be used for irrigation in the Delta by the year 2000 (Abu-Zeid, 1995). The policy of ministry of water resources and irrigation is to reuse drainage water for irrigation. It can be used directly if its salinity is less than 700 mg/l or by mixing it with fresh water in different ratios . The mixing ratios are 1: 2 and 1: 3 for salinity concentrations which coincided with 700 to 1500 mg/l and from 1500 to 3000 mg/l , respectively.



Map 1: Locations of the studied sites either in the canals drains ar

Al-Burullus lake

Mowelhi *et al.* (1995); Abd-Allah (1995); Amer *et al.* (1997) and Sobh *et al.* (1997) found that using drainage water for irrigation increases the total storage of salt components (TSS) in the soil ,while using fresh water took the opposite trend. The levels of metal traces in all environmental compartments (air , water and soil) are become increasing stressful and toxic with contributions from a wide variety of industrial and domestic activities (Nriagu, 1991). On a global scale, the emissions of lead (pb), cadmium (Cd), vanadium (V) and Zn from anthropogenic sources exceed those from natural sources by 12-, 5-, 3-, 3- and 3- fold, respectively. For other metals such as antimony (Sb), arsenic (As), chromium (Cr), copper (cu), mercury (Hg), nickel (Ni) and selenium (Se) the industrial emissions are comparable or slightly exceed the natural fluxes. Soil represents the major sink for metal traces released into the biosphere.

Metal solubility is depended on soil characteristics and strongly influenced by soil pH (Harter, 1983) and the degree of complexation with soluble ligands (Norvell, 1984). Today there are approximately 400 known metal, hyper accumulators in the world (Baker and Walker, 1989; Baker *et al.*, 1994; Brown *et al.*,1994; Cunningham and Lee, 1995; Kumar *et al*, 1995 and Blaylock *et al.*, 1997).

The aim of this investigation is to study the Effect of water pollution in some water streams such as canals, drains and Al-Burullus lake on irrigation water quality in North Delta.

MATERIALS AND METHODS

1. Experimental site:

To collect water samples, eleven sites were chosen in the North Delta along some canals , drains and AL-Burulus lake .Three sites were chosen on Mit Yazied canal which is 63.0 km long and serves 151000 feddanas,the sites were at km 34.0, 42.0 and 46.0. Bahr Tera canal runs 66.2 km and serves 155.8 thousand feddans,the chosen sites were at km 20.0, 26.0 and 40.0. Drain N0. 7 is 29.39 km long and serves 8600 feddans , also three sites were chosen at the end of km 12.5 and at km 28.0.Al-Bahrawy drain is 19.2 km long and serves 37000 feddans. One site at km 3.0 of Al-Bahrawy drain and one site on Al-Burullus lake downstream pump station No.7 were chosen . The chosen sites are shown in Map (1).Water samples were collected monthly during the period from May /2007 till February /2008.

2. Chemical analysis:

2-a. pH and the total dissolved solids (TDS):

The pH was determined by PH controller model 5997. TDS was pproximated by using the following equation:

$$TDS,(mg/L) = EC,(ds/m) * 640$$

Where:

EC is the electrical conductivity in decisiemens per meter measured by CDM83 conductivity, meter.

The parameters used for assessing the salinity namely Ca^{++}, Mg^{++}, Na^{+}, K^{+}, Hco^{-}_{3} , So^{-}_{4} and Cl^{-} .

2-b. Adjusted sodium adsorption ratio:

Adjusted sodium adsorption ratio (adj SAR) was calculated by using the following equation (Ayers and westcat, 1976):

$$adj\,SAR = SAR\,[1 + (8.4 - pHc)]$$

Where

$$SAR = \frac{Na^{+}}{\sqrt{\frac{Ca^{++} + Mg^{2+}}{2}}}$$

$$PHc = (Pk_2 - Pk_c) + P\,(Ca + Mg) + P(ALK)$$

Na^{+} = sodium in mg/L .

Ca^{++} = a modified calcium value in mg/L.

Mg^{++} = magnesium in mg/L.

$(pk_2 - pk_c)$ is evaluated from the concentration sum of (Ca+Mg+Na) in mol/m^3.

$p(Ca+Mg)$ is obtained from using the concentration sum of (Ca+Mg) in mol/m^3.

P (ALK) is evaluated from the concentration sum of Co_3 +Hco_3 in mol/m^3.

2-c. Heavy metals

A part of water samples was digested as described by Kopp and Korner (1967) and total heavy metals (Zn,Mn,,Ni and Co) were measured using Elmer Perkin atomic absorption spectrophpto meter model 2380.

RESULTS AND DISCUSSION

1. Salinity hazard:

1-a. Canals:

Three sites in Mit Yazied canal were considered. Data in Table (1) and Fig. (1) shows the differences in chemical composition of water along these sites. The EC and TDS values varied from 0.3 to 0.98 dS/m and 234.7 to 665.2 ppm, respectively. According to the United States Salinity Laboratory (USSL.) Staff (1954), the EC values which ranged between 0.3 – 0.98 dS/m are considered a medium salinity.

Also three sites in Bahr Tera canal were considered. Data in Table (2) and Fig. (2) shows the differences in chemical compositions of water along these sites. The EC and TDS values varied from 0.3 to 0.7 dS/m and 234.7 to 487.9 ppm , respectively . So according to (USSL) Staff (1954) the range between 0.3 to 0.7 dS/m is considered a moderate salinity.

3-1-b. Drains

Data in Table (3) and Fig. (3) show the water quality of drain No.7. It is noticed that EC values represent high salinity (EC values range from 1.08 to 3.72 dS/m). The increase in EC values of drainage water was through flushing of salts from soils. The EC and TDS values of AL-Bahrawy drain are presented in Table (4) and Fig. (4). The data indicated that the values of EC and TDS ranged from 0.6 to 5.45 dS/m and 424.6 to 3495 ppm respectively. It could be concluded that EC of AL-Bahrawy drain was considered very high in salinity.

Table (1) : Chemical analysis of Water quality measurments - Mit Yazied canal

Location	Month	PH	EC	Cations (meq/l)				Anions (meq/l)				T.D.S	SAR	Adjust	Water class
			(ds/m)	Ca^{++}	Mg^{++}	Na^{+}	K^{-}	Co_3^{--}	HCo_3^{-}	Cl^{-}	So_4^{--}	(ppm)		SAR	USDA
Km 34.000	May /2007	7.8	0.3	0.77	0.77	0.96	0.62	-	1.30	1.70	0.12	234.74	1.09	1.42	$C_2 - S_1$
	June /2007	8.1	0.33	0.98	0.99	1.2	0.73	-	2.00	1.43	0.47	253.73	1.21	1.2	$C_2 - S_1$
	jule /2007	7.2	0.57	1.75	1.3	2.5	0.08	-	1.10	0.60	3.93	405.65	2.02	2.23	$C_2 - S_1$
	Aug. /2007	7.2	0.57	1.75	1.3	2.5	0.08	-	1.10	0.60	3.93	405.65	2.02	2.23	$C_2 - S_1$
	Sep. /2007	7.8	0.39	1.8	0.12	1.88	0.40	-	1.50	1.56	1.14	291.71	1.92	2.94	$C_2 - S_1$
	Oct. /2007	7.8	0.36	1.53	0.55	1.42	0.20	-	1.70	1.32	0.68	272.72	1.39	2.1	$C_2 - S_1$
	Nov. /2007	7.5	0.45	0.98	0.46	2.68	0.38	-	1.80	1.55	1.15	329.69	3.16	4.43	$C_2 - S_1$
	Jan. /2008	7.8	0.57	1.14	1.79	2.26	0.81	-	3.60	1.65	0.75	405.65	1.87	3.37	$C_2 - S_1$
	Feb. /2008	7.6	0.48	1.3	0.99	2.2	0.81	-	3.00	1.35	0.95	348.68	2.06	3.76	$C_2 - S_1$
Km 42.000	May /2007	7.7	0.3	0.63	0.95	1.12	0.93	-	1.61	1.88	0.14	234.74	1.26	1.64	$C_2 - S_1$
	June /2007	7.8	0.32	0.93	1.03	1.12	0.63	-	1.80	1.15	0.76	247.4	1.13	1.13	$C_2 - S_1$
	jule /2007	7.6	0.32	0.77	0.92	1.35	0.57	-	1.40	1.20	1.01	247.4	1.47	1.47	$C_2 - S_1$
	Aug. /2007	7.4	0.48	1.96	1.56	1.55	0.06	-	1.10	0.90	3.13	348.68	1.17	1.34	$C_2 - S_1$
	Sep. /2007	7.9	0.34	1.63	0.62	1.45	0.15	-	1.90	1.20	0.75	260.06	1.37	2.3	$C_2 - S_1$
	Oct. /2007	7.9	0.34	1.47	0.67	1.26	0.15	-	1.70	1.54	0.31	260.06	1.22	1.83	$C_2 - S_1$
	Nov. /2007	8.7	0.73	1.83	2.07	2.89	0.18	-	2.90	1.90	2.17	506.93	2.07	3.18	$C_2 - S_1$
	Jan. /2008	7.5	0.73	1.68	2	3.12	0.78	-	3.20	1.80	2.58	506.93	2.30	4.12	$C_2 - S_1$
	Feb. /2008	7.4	0.98	2.68	1.18	5.41	0.83	-	2.80	4.50	2.80	665.18	3.89	7.78	$C_3 - S_1$
Km 46.000	May /2007	7.7	0.3	0.81	0.77	1.14	0.50	-	1.50	1.08	0.64	234.74	1.28	1.66	$C_2 - S_1$
	June /2007	7.8	0.31	0.91	0.91	1.32	0.57	-	2.00	0.90	0.81	241.07	1.38	1.39	$C_2 - S_1$
	jule /2007	7.9	0.32	0.91	0.91	1.14	0.54	-	1.60	0.71	1.19	247.4	1.20	1.56	$C_2 - S_1$
	Aug. /2007	7.7	0.7	1.75	1.36	3.46	0.06	-	1.00	1.10	4.53	487.94	2.77	3.05	$C_2 - S_1$
	Sep. /2007	8	0.35	1.15	0.97	1.78	0.18	-	2.00	1.26	0.82	266.39	1.73	2.6	$C_2 - S_1$
	Oct. /2007	8	0.34	1.06	0.28	2.04	0.30	-	1.70	1.44	0.54	260.06	2.49	2.74	$C_2 - S_1$
	Nov. /2007	8.2	0.59	1.72	2.08	2.12	0.18	-	4.30	1.75	0.05	418.31	1.54	3.23	$C_2 - S_1$
	Jan. /2008	7.7	0.42	1.88	1.15	1.87	0.25	-	2.00	1.35	1.80	310.7	1.52	2.28	$C_2 - S_1$
	Feb. /2008	7.6	0.44	1.18	1.72	2.07	0.13	-	2.40	1.65	1.05	323.36	1.72	2.94	$C_2 - S_1$

Table (2) : Chemical analysis of Water quality measurments - Bahr Tera canal

Month	pH	Ec	Cations (meq/l)				Anions (meq/l)				T.D.S	SAR	Adjust	Water class
		(ds/m)	Ca^{++}	Mg^{++}	Na^{+}	K^{+}	Co_3^{--}	HCo_3^{-}	Cl^{-}	So_4^{--}	(ppm)		SAR	USDA
May /2007	7.8	0.3	0.65	0.62	1.37	0.53	-	1.50	1.35	0.32	234.74	1.72	1.73	$C_2 - S_1$
June /2007	7.8	0.3	0.92	0.92	1.11	0.61	-	1.35	1.50	0.71	234.74	1.16	1.16	$C_2 - S_1$
jule /2007	8	0.3	0.72	0.59	1.42	0.45	-	1.20	1.50	0.48	234.74	1.75	2.98	$C_2 - S_1$
Aug. /2007	7.5	0.45	1.89	1.36	1.27	0.11	-	0.80	0.80	3.03	329.69	1.00	0.86	$C_2 - S_1$
Sep. /2007	7.9	0.3	1.37	0.4	1.23	0.33	-	1.40	1.32	0.61	234.74	1.31	1.18	$C_2 - S_1$
Oct. /2007	7.9	0.3	1.58	0.24	1.38	0.13	-	1.40	1.30	0.63	234.74	1.45	1.6	$C_2 - S_1$
Nov. /2007	8.7	0.46	1.57	2.6	2.7	0.13	-	2.80	1.70	2.50	336.02	1.87	3.9	$C_2 - S_1$
Jan. /2008	7.5	0.4	1.7	0.87	1.8	0.13	-	2.00	1.70	0.80	298.04	1.59	2.31	$C_2 - S_1$
Feb. /2008	7.5	0.4	1.7	0.87	1.8	0.13	-	2.00	1.70	0.80	298.04	1.59	2.31	$C_2 - S_1$
May /2007	7.8	0.31	0.49	0.42	1.76	0.60	-	1.60	0.85	0.82	241.07	2.61	2.63	$C_2 - S_1$
June /2007	7.6	0.31	0.87	0.97	1.19	0.47	-	2.20	0.95	0.35	241.07	1.24	1.24	$C_2 - S_1$
jule /2007	7.8	0.31	0.87	0.55	1.4	0.54	-	1.70	0.60	1.06	241.07	1.66	2.84	$C_2 - S_1$
Aug. /2007	7.6	0.48	1.75	1.26	1.71	0.11	-	0.70	0.50	3.63	348.68	1.39	1.02	$C_2 - S_1$
Sep. /2007	8	0.33	1.74	0.53	1.46	0.23	-	1.40	1.70	0.86	253.73	1.37	1.22	$C_2 - S_1$
Oct. /2007	7.9	0.34	1.26	0.27	1.77	0.28	-	1.80	1.44	0.34	260.06	2.02	2.23	$C_2 - S_1$
Nov. /2007	8.7	0.49	1.82	1.35	1.8	0.23	-	3.10	1.65	0.45	355.01	1.43	2.15	$C_2 - S_1$
Jan. /2008	7.4	0.43	1.44	1.33	1.8	0.13	-	2.40	1.65	0.65	317.03	1.53	2.3	$C_2 - S_1$
Feb. /2008	7.3	0.45	1.12	1.61	2.24	0.13	-	3.00	1.30	0.80	329.69	1.92	2.87	$C_2 - S_1$
May /2007	8.2	0.34	0.45	0.65	1.71	0.80	-	1.50	1.11	1.00	260.06	2.31	2.31	$C_2 - S_1$
June /2007	8	0.31	0.77	0.46	1.45	0.72	-	1.50	0.86	1.04	241.07	1.85	3.16	$C_2 - S_1$
jule /2007	8	0.31	0.77	0.46	1.45	0.72	-	1.50	0.86	1.04	241.07	1.85	3.16	$C_2 - S_1$
Aug. /2007	7.2	0.7	1.89	1.47	3.46	0.11	-	0.90	1.90	4.13	487.94	2.67	3.01	$C_2 - S_1$
Sep. /2007	8.2	0.33	1.74	0.35	1.51	0.21	-	1.80	1.26	0.75	253.73	1.48	2.22	$C_2 - S_1$
Oct. /2007	8	0.32	1.45	0.15	1.75	0.15	-	1.90	1.12	0.48	247.4	1.96	2.76	$C_2 - S_1$
Nov. /2007	8.5	0.52	1.82	1.98	1.45	0.25	-	3.20	1.55	0.75	374	1.05	1.89	$C_2 - S_1$
Jan. /2008	7.1	0.45	1.23	0.96	2.43	0.17	-	3.00	1.15	0.64	329.69	2.32	3.35	$C_2 - S_1$
Feb. /2008	7.1	0.54	1.8	1.25	2.49	0.21	-	2.80	1.65	1.30	386.66	2.02	3.03	$C_2 - S_1$

Table (3) : Chemical analysis of Water quality measurments - Drain No 7

Ec	Cations (meq/l)				Anions (meq/l)				T.D.S	SAR	Adjust	Water class
(ds/m)	Ca^{++}	Mg^{++}	Na^{+}	K^{+}	Co_3^{-}	HCo_3^{-}	Cl^{-}	So_4^{-}	(ppm)		SAR	USDA
1.9	2.43	4.32	11.1	1.28	-	4.88	8.93	5.32	1247.5	6.04	13.27	C_3 - S_2
1.82	3.97	4.23	8.41	1.99	-	4.00	7.50	7.10	1196.9	4.15	9.57	C_3 - S_1
1.85	2.56	3.98	10.46	1.96	-	5.87	9.10	3.99	1215.9	5.78	13.94	C_3 - S_1
1.5	2.73	4.83	5.39	2.15	-	2.80	4.60	7.70	994.34	2.77	5.56	C_3 - S_1
1.7	3.6	5.85	6.9	1.05	-	3.40	13.48	0.52	1120.9	3.17	6.36	C_3 - S_1
1.65	3.15	5.64	7.3	0.51	-	4.00	11.80	0.80	1089.3	3.48	7.55	C_3 - S_1
2.2	3.38	4.32	13.89	0.46	-	8.20	12.25	1.60	1437.4	7.08	17.73	C_3 - S_2
2.78	1.89	2.6	23.18	0.53	-	4.00	18.50	570%	1804.6	15.47	32.45	C_4 - S_4
3.22	1.98	1.44	28.63	0.35	-	4.80	26.25	1.35	2083.1	21.89	34.96	C_4 - S_4
1.01	1.06	4.14	3.98	1.00	-	2.70	4.80	2.68	684.17	2.47	4.11	C_3 - S_1
0.84	1.45	3.92	2.63	0.98	-	2.20	3.15	3.63	576.56	1.61	2.72	C_3 - S_1
0.84	0.81	4.14	2.54	1.02	-	3.40	3.75	1.36	576.56	1.61	2.92	C_3 - S_1
1.16	2.83	2.2	6.72	0.08	-	1.60	4.20	6.03	779.12	4.24	7.19	C_3 - S_1
1.11	0.9	4.44	5.4	0.46	-	6.90	3.00	1.30	747.47	3.30	7.28	C_3 - S_1
1.08	2.52	1.72	6.3	0.46	-	3.00	6.72	1.28	728.48	4.33	5.05	C_3 - S_1
1.18	2.73	4.77	4.42	0.18	-	5.15	4.95	2.00	791.78	2.28	5.24	C_3 - S_1
1.14	2.25	3.42	5.6	0.43	-	4.80	3.00	3.90	766.46	3.33	7.33	C_3 - S_1
1.62	1.8	3.33	10.94	0.43	-	4.20	3.60	8.70	1070.3	6.83	15.05	C_3 - S_2
2.94	3.33	10.53	15.02	1.46	-	6.20	15.40	8.74	1905.9	5.71	14.28	C_4 - S_2
2.9	4.25	10.53	12.51	2.92	-	7.50	16.50	6.21	1880.5	4.60	12.88	C_4 - S_2
2.97	2.97	11.25	14.55	1.93	-	4.80	20.10	5.80	1924.9	5.46	13.65	C_4 - S_2
2.45	4.48	1.29	9.13	0.90	-	1.80	17.60	-3.60	1595.7	5.38	10.2	C_4 - S_2
2.11	1.08	2.22	16.92	1.08	-	3.20	16.68	1.42	1380.5	13.17	13.33	C_4 - S_3
2.15	9.9	0.41	10.47	0.92	-	2.70	13.88	5.12	1405.8	4.61	9.16	C_3 - S_1
3.45	4.17	15.14	14.63	0.86	-	4.00	29.25	1.55	2228.7	4.71	11.75	C_4 - S_2
3.72	4.86	11.97	20.24	0.43	-	4.80	24.65	8.05	2399.6	6.98	17.45	C_4 - S_2
3.55	4.95	11.98	17.91	0.91	-	2.45	3.60	29.70	2292	6.16	9.23	C_4 - S_2

Table (4) : Chemical analysis of Water quality measurments - Al Bahrawy drain & Al- Brolous lake

Location	Month	PH	Ec	Cations (meq/l)				Anions (meq/l)				T.D.S	SAR	Adjust	Water class
			(ds/m)	Ca^{++}	Mg^{++}	Na^{+}	K^{+}	Co_3^{--}	HCo_3^{-}	Cl^{-}	So_4^{--}	(ppm)		SAR	USDA
El-Bahrawy drain (Km 3.000)	May /2007	7.8	3.57	5.78	12.7	16.29	1.23	-	7.60	18.70	9.70	2304.7	5.36	15.01	$C_4 - S_2$
	June /2007	8.2	3.47	5.68	12.17	15.7	2.59	-	5.33	24.00	6.81	2241.4	5.26	13.65	$C_4 - S_2$
	jule /2007	7.8	3.4	4.95	10.62	15.95	2.78	-	5.60	26.00	2.70	2197	5.72	15.44	$C_4 - S_2$
	Aug. /2007	7.4	2.41	3.01	1.09	7.45	0.85	-	1.60	19.70	-8.90	1570.4	5.20	6.17	$C_4 - S_2$
	Sep. /2007	7.6	2.48	1.87	5	16.63	1.77	-	4.40	18.80	2.07	1614.7	8.97	18.9	$C_4 - S_2$
	Oct. /2007	7.8	2.47	1.78	4.18	17.44	1.49	-	3.90	17.60	3.39	1608.4	10.10	21.17	$C_4 - S_3$
	Nov. /2007	9	5.45	8.55	21.42	23.22	1.31	-	6.40	47.07	1.03	3494.7	6.00	11.61	$C_4 - S_2$
	Jan. /2008	7.3	0.66	1.89	1.63	2.87	0.51	-	3.60	2.25	1.05	462.62	2.16	3.89	$C_2 - S_1$
	Feb. /2008	7.2	0.6	1.89	1.42	2.45	0.64	-	3.00	2.30	1.10	424.64	1.90	2.85	$C_2 - S_1$
El - Brolous lake(D.S pump No7)	May /2007	8	3.5	5.06	13.68	16.28	1.18	-	7.60	18.70	9.90	2260.3	5.32	14.9	$C_4 - S_2$
	June /2007	7.3	3.47	3.35	14.85	14.88	2.03	-	3.60	18.40	13.11	2241.4	4.93	12.33	$C_4 - S_2$
	jule /2007	8.1	3.54	3.95	13.5	16.56	1.99	-	5.07	24.60	6.33	2285.7	5.61	12.9	$C_4 - S_2$
	Aug. /2007	7.3	2.3	3.41	8.4	11.65	0.84	-	1.90	20.50	1.90	1500.7	4.79	10.07	$C_4 - S_2$
	Sep. /2007	8.1	2.56	1.85	1.3	22.9	1.21	-	5.40	19.40	2.46	1665.3	18.25	29.38	$C_4 - S_4$
	Oct. /2007	8.2	2.62	1.47	1.1	22.53	1.26	-	5.40	20.20	0.76	1703.3	19.88	31.9	$C_4 - S_4$
	Nov. /2007	8.8	3.85	4.9	14.15	18.97	0.88	-	4.65	32.50	1.75	2481.9	6.15	15.35	$C_4 - S_2$
	Jan. /2008	7.4	0.85	1.89	2.17	4.23	0.51	-	4.88	3.20	0.72	582.89	2.97	5.96	$C_4 - S_1$
	Feb. /2008	7.3	0.89	2.43	2.59	3.78	0.81	-	2.40	1.80	5.41	608.21	2.39	3.59	$C_4 - S_1$

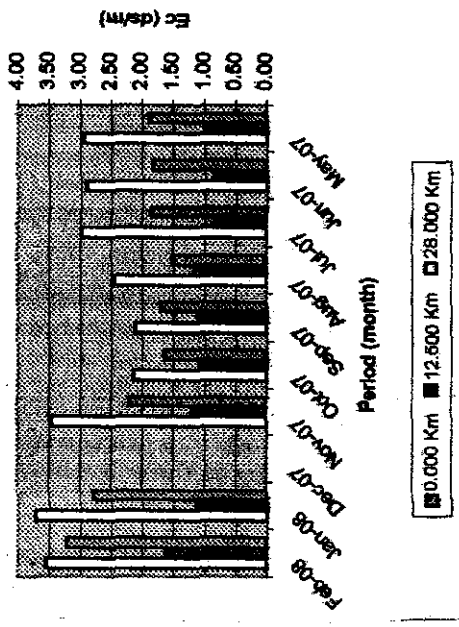


Fig. 3: Drain No.7

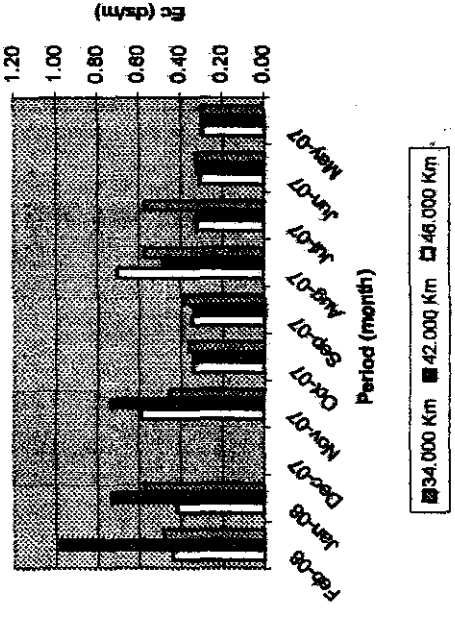


Fig. 1: Mit Yazied canal

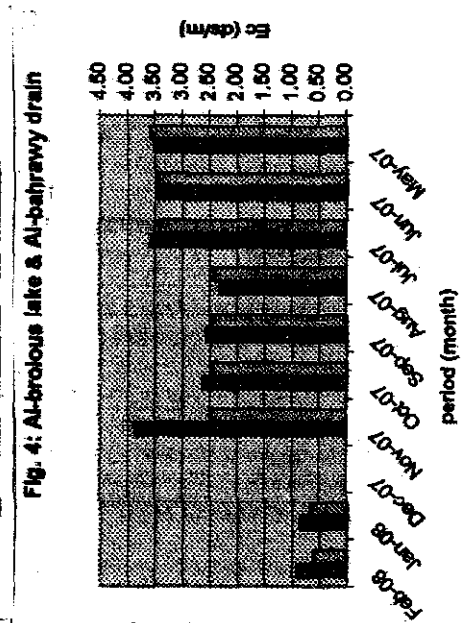


Fig. 4: Al-brolous lake & Al-bahrawy drain

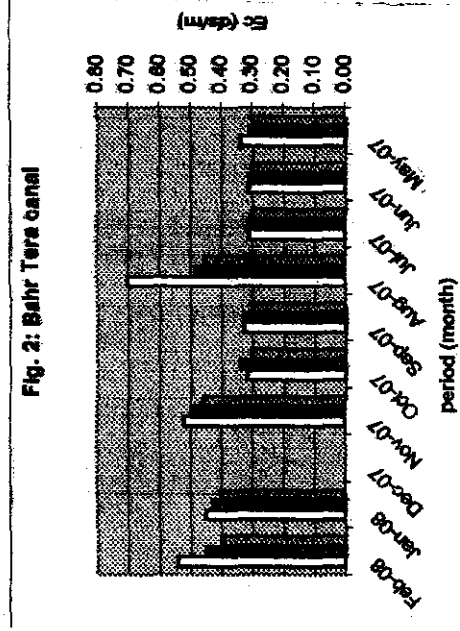


Fig. 2: Bahr Tera canal

1-c. AL Burulus lake

Al-Burulus lake is considered one of the main open lake in Egypt. It represents an important source for fishing and many people gain income from it. Most of the middle Delta drainage water discharge goes into Al-Burullus lake via pumping stations. Data in Table (5) and Figs. (4 and 6) showed that EC values are more than 2.3 dS/m except during Jan. and Feb., the values were 0.85 and 0.89 dS/m, respectively. It could be noticed that EC of AL-Burullus lake was considered very high in salinity, except during the months of Jan. and Feb.

2. Sodium Hazard

According to United States Salinity Laboratory System to classify the irrigation water, the Sodium adsorption ratio (SAR) was calculated and shown in Tables (1, 2, 3 and 4) and Figs. (5, 6, 7 and 8).The data showed that SAR values ranged from 1.2 to 778 in water canals, while it ranged from 1.61 to 21.89 in drain water. Finally, it ranged from 2.39 to 19.88 in Al-Burullus lake. It can be concluded that irrigation water in canals was considered low in Sodium adsorption ratio, while the water in drains and AL-Burullus lake was considered high in Sodium adsorption ratio .

3. pH

The pH values of water for Mit Yazie and Bahr Tera canals ranged between 7.2 to 8.7 as shown in Tables 1 and 2. The high pH value was observed in November. While the pH values ranged from 7.1 to 9.0 in drains No.7 and Al-Bahrawy as shown in Tables 3 and 4. Finally, the pH values in Al-Burullus lake ranged from 7.33 to 8.8.

4. Levels of heavy metals in canals, drains and Al-Burullus lake

Levels of the four heavy metals (Zn.,Mn, Ni, and Co) were measured in canals ,drains and El-Burullus lake as shown in Tables (5,6 and 7). The data showed that values of Zn, Mn, Ni,and Co range from .001 to .025 , .001 to 2.044 ,0.001 to .504 and .001 to 13.76 ppm respectively .With the exception of cobalt (Co) metal, concentrations in drainage water were lower than in irrigation water and standard values (WHO, 1995).

Table (5) : Average values of micro elements (PPm)

Location	Mit Yazied canal				Bahr Tera canal			
Month	Zn	Mn	Ni	Co	Zn	Mn	Ni	Co
May /2007	0.001	0.320	0.052	0.533	0.009	0.696	0.034	0.5667
June /2007	0.055	0.061	0.043	0.867	0.001	0.675	0.052	0.7333
jule /2007	0.006	0.163	0.031	0.833	0.001	0.798	0.050	0.7000
Aug. /2007	0.010	0.343	0.113	0.633	0.006	1.037	0.040	0.5667
Sep. /2007	0.001	0.522	0.028	0.333	0.001	1.275	0.030	0.4667
Oct. /2007	0.000	0.116	0.076	0.700	0.001	0.783	0.037	0.5667
Nov. /2007	0.002	0.006	0.010	1.100	0.001	0.567	0.065	0.9333
Jan. /2008	0.001	0.058	0.173	0.00003	0.002	0.006	0.002	0.0004
Feb. /2008	0.001	0.108	0.022	0.00002	0.001	0.009	0.002	0.0002
Critical level*	2.00	0.20	0.20	0.05	2.00	0.20	0.20	0.05

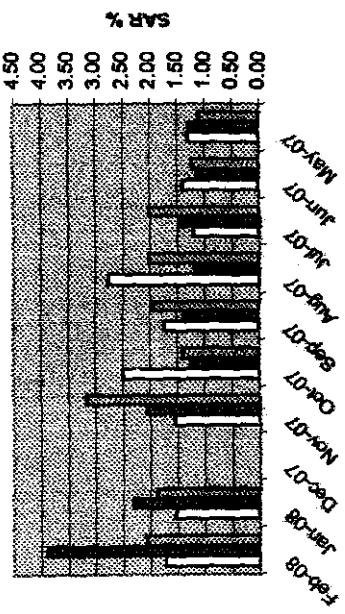


Fig. 4: Mit Yazied canal

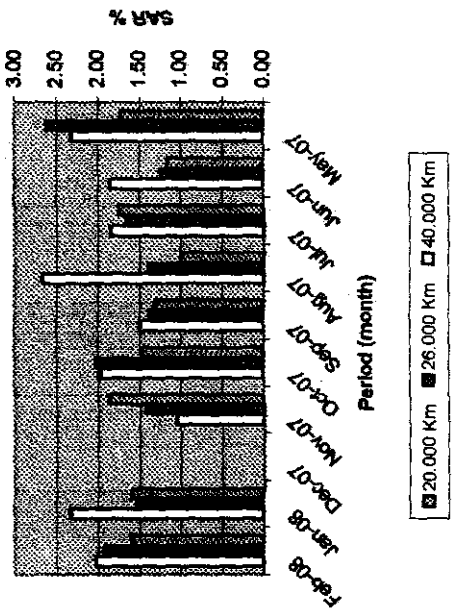


Fig. 5: Bahr Tera canal

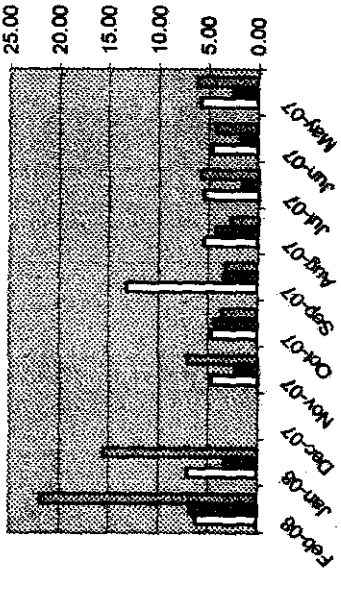


Fig. 6: Al-brolous lake & Al-bahrawy drain

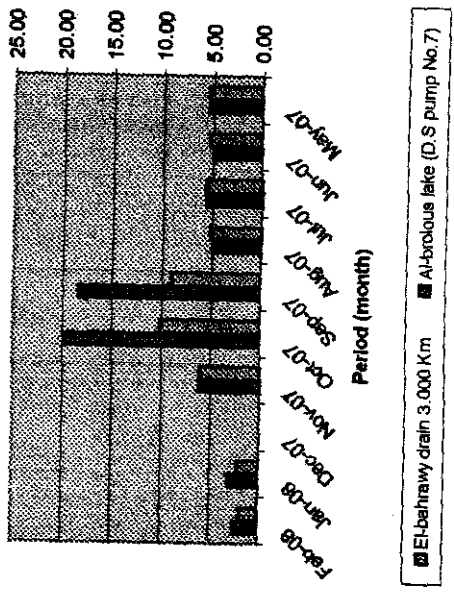


Table (6) : Average values of micro elements (PPm)

Location	Drain No. 7				Al-Bahrawy drain			
Month	Zn	Mn	Ni	Co	Zn	Mn	Ni	Co
May /2007	0.0017	0.4237	0.0810	1.2667	0.025	1.056	0.022	0.3000
June /2007	0.0017	0.2053	0.0797	0.7050	0.015	0.533	0.024	0.6000
jule /2007	0.0107	0.2233	0.0510	0.9333	0.002	0.537	0.019	0.4000
Aug. /2007	0.0057	0.3410	0.0387	0.9000	0.002	0.800	0.016	0.3000
Sep. /2007	0.0010	0.4583	0.0230	1.3767	0.001	1.063	0.012	1.1000
Oct. /2007	0.0010	0.3883	0.1283	0.7000	0.002	0.148	0.032	0.5000
Nov. /2007	0.0017	0.0217	0.0203	0.9667	0.001	0.017	0.016	0.6000
Jan. /2008	0.5940	0.0413	0.2023	0.0586	0.002	0.003	0.004	0.0004
Feb. /2008	0.0010	0.2837	0.0357	0.0006	0.001	0.001	0.003	0.0009
Critical level*	2.00	0.20	0.20	0.05	2.00	0.20	0.20	0.05

Table (7): Average values of micro elements-Al-Burullus lake (PPm

Month	Zn	Mn	Ni	Co
May /2007	0.0020	0.4640	0.0380	0.3700
June /2007	0.0010	0.3470	0.0380	0.9000
jule /2007	0.0150	0.2380	0.0330	0.7000
Aug. /2007	0.0010	0.2420	0.0300	0.6000
Sep. /2007	0.0000	0.2450	0.0260	0.6000
Oct. /2007	0.0010	0.6820	0.4900	0.5000
Nov. /2007	0.0010	0.0110	0.0270	1.3000
Jan. /2008	0.0010	0.0020	0.0030	0.0014
Feb. /2008	0.0010	0.0090	0.0020	0.0008
Critical level*	2.00	0.20	0.20	0.05

Critical level* =ain Shams Intrnational Conference, 1997

Conclusion

Generally, it could be concluded that in the North Delta the quality of irrigation water located from $C_2 - S_1$ class, while the quality of drainage water located from $C_3 - S_1$ to $C_4 - S_4$ classes, Al-Burullus water quality matched the $C_4 - S_1$ to $C_4 - C_4$ classes according to USDA (Richards, 1969). The drainage water could be re-used in irrigation purposes under special management for leaching the highly saline soils.

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تأثير تلوث المياه في بعض القنوات المائية على نوعية مياه الري بشمال الدلتا

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إن النقص في مصادر المياه في العديد من بلاد العالم خاصة في المناطق الجافة وشبه الجافة قد أفضى إلى الاحتياج لنوعيات مختلفة وحتى المنخفضة الجودة منها لأغراض الري .

اختير احد عشر موقعاً في شمال الدلتا على كل من القنوات والمصارف وبحيرة البرلس، ثلاثة مواقع في كل من ترعة ميت يزيد ، بحر تيرة ، ومصرف نمرة ٧، وموقعاً على كل من مصرف البحراوى وبحيرة البرلس .

عينات المياه قد تم تجميعها وتحليلها شهرياً خلال الفترة من مايو ٢٠٠٧ حتى فبراير ٢٠٠٨.

ويمكن تلخيص النتائج المتحصل عليها كالآتي :

١- صنفت مياه الري إلى متوسطة الملوحة – منخفضة الصوديوم (C_2-S_1)

٢- صنفت مياه الصرف إلى عالية الملوحة جداً – متوسطة الصوديوم (C_3-S_2)

٣- صنفت بحيرة البرلس إلى عالية الملوحة جداً – عالية الصوديوم (C_4-S_4)

وقد تم التصنيف طبقا لمعمل الملوحة الأمريكي لعام ١٩٥٤ م (USSL) قيم كل من الزنك ، المنجنيز ، النيكل والكوبلت تراوحت من (٠,٠٠١ إلى ٠,٠٢٥) ، (٠,٠٠١ – ٢,٠٤٤) (٠,٠٠١– ٠,٥٠٤) و (٠,٠٠١ – ١,٣٧) جزء في المليون على الترتيب .

وبالاستثناء فإن تركيز الكوبلت في مياه الترع والمصارف كان أعلى من القيم القياسية لمياه الري طبقاً لمنظمة الصحة العالمية (١٩٩٣) لذا فإن استخدام هذه المياه يكون ضاراً لصحة الإنسان والحيوان وكذلك على النبات والأرض . لذلك يوصى بعدم استخدام تلك المياه إلا بعد المعالجة.

قام بتحكيم البحث

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