Environmental Impacts of Metal Pollution Sources on Rosetta Branch Water Quality

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Abstract: The purpose of the present paper is to study the environmental impacts of trace elements pollution source son, Egypt Rosetta branch, water quality. Water quality studies on Rosetta Branch were performed through the analyses of twenty three geographical station water samples collected periodically through February and June months to represent the two seasons of year 2012. Water Quality along Rosetta Branch was determined. The worth case was found along El–Rahawy drain at the area between Abu Rawash City and Nekla Village. Correlation Matrix, chemical parameter characteristics, was computed and the result of correlation matrix for the data shows some clear hydro-chemical relationships can be readily inferred.
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Introduction:

The River Nile is one of the most remarkable geographic features of Africa. Its catchment's area covers 2,900,000 km²; it extends from latitude 4° S to latitude 31° N.A few km to the north of Cairo begins the Delta or Lower Egypt, which composed of three parts; The Delta proper and the two branches of the Nile. The two branches are the Rosetta arm on the west and the Damietta on the east.

Egypt is an arid country where water is a scare precious resource. Agriculture depends on irrigation from the River Nile. Closing food gap exasperated by population growth compels the country to use unconventional marginal water, such as drainage water, brackish ground water and treated sewage water for expanding irrigated agriculture.

Rosetta branch of River Nile has a greatest vital importance as an important source of water for municipal, industrial, agricultural, navigational and feeding fish farms. Rosetta branch subjects to two main sources of pollution which, potentially affects and deteriorates the water quality of the branch.

The first source is El-Rahway drain (Fig.1), which disposes its wastes into the branch. Its wastes are mixture of agricultural and domestic waste and sanitary drainage from large area of Great Cairo. It is thought that the impact of this source on the water quality of the branch is extended to long distance from the source.

The second source of pollution is several small agricultural drains that Discharge their waters into the branch in addition to sewage discharged from several cities and its neighboring villages that are distributed along the two banks of the Rosetta branch (Mancy and Hafez, 1979 a & b (. The policy of the Egyptian Government is to use drainage water with salinity up to 4.5 ds/m and blend it with fresh Nile water to form blended water of a salinity equivalent to 1.0 ds/m. Rhoades, et. al. (1992).

The measuring of a specific chemical agent in the contaminated aquatic environment is important in a determining the potential toxicity and health effects of those agents on living organisms utilizing that environment Wrona, et. al., (1996).

Results and Discussion

In most modern urban environments, metal pollution likely poses a greater direct threat to ecosystems than it does to drinking water. Chemical precipitation and redox consideration studies reveal that; in most cases, the pH of stream water is a master variable controlling both the adsorption of metals onto colloidal and particulate surfaces and the precipitation of metals.

In stream water, Cu, Zn, Pb, and Cd are all ‘‘alkaline’’ type metals that precipitate with increasing pH. However, the precipitation of trace metals to form crystalline solids is often only a minor geochemical process in that metal concentrations in most river systems are usually exceedingly low and therefore surface waters remain grossly under saturated with respect most metallic mineral phases.

Stream water oxidation state is an another key variable controlling the precipitation of metals. Typically, the non-stagnant river water is anoxic due to high-organic loads. Under these ‘‘micro-reducing’’ conditions, metals can precipitate to form sulfide minerals and then possibly become remobilized as reduced sediments subsequently dissolve under oxidizing conditions. The single most important control upon the oxidation state of most urban streams is the degree to which they are polluted and thereby electrochemically reduced with organic matter from sewage effluent and other sources.

Trace metal concentrations (notably zinc, nickel, Copper, lead, and cadmium) within urban watersheds on all continents remain higher than background levels primarily as the result of pollution (Church, T.M., et. al., 1998; Davis, A., et. al., 2001; Ortega, R., 2002 and Siegel, F.R., 2002).

Fire (1): Monitoring location on Rosetta Branch River Nile.

Metal contamination can be generated within a given urban watershed (endogenous pollution) or originate from and spread beyond its watershed boundaries (exogenous pollution). In high concentrations, heavy metals, including nickel, cadmium, and lead, can be toxic, carcinogenic, and mutagenic (Siegel, 2002).

Lead has been implicated as an agent of mental retardation and chromium and cadmium are known to cause immunosuppressant effects in humans. A few of the health problems as well as a few of the common sources of metals in drinking water are given in (Table 1). In addition to medical Problems, elevated concentrations of trace metals entering streams and rivers from the urban environment may result in Significant damage to ecosystems (Callender, E., 2004; Fasfous, I.I., et. al. 2004 and Gaillardet, J., et. al. 2004).

In the present study, we focus primarily upon lead (Pb), zinc (Zn), and copper (Cu) in that these metals are readily associated with the urban environment and have been identified as priority pollutants in urban runoff (EPA, 1986 and 2005; Filippelli, G.M., et. al., 2005).

Water quality studies on Rosetta Branch were performed through the analyses of twenty three geographical station water samples collected periodically through February and June months to represent the two seasons of year, 2012.

Trace metal concentrations cadmium, copper, lead, zinc, nickel, Iron, and Manganese within Rosetta branch watersheds were measured and presented by tables (2 - 3).

In addition to, correlation matrix studies on the environmental impacts of ammonia nitrogen (NH3), Nitrate (NO3), Ortho phosphorus (PO4) and fecal coliform (E. Coli) on metal pollution sources were done.

Table (1): USEPA National Primary Drinking Water Quality Standards (MCL), sources, and common medical effects for trace metals (from EPA, 2005).

Metal	MCL ($\mu g l^{-1}$)[a]	Potential health effects from water ingestion [a]	Common industrial or urban sources of contaminant in drinking water [a] b
Cadmium	5	Kidney damage	Galvanized pipes, refineries waste batteries and paints; anti-corrosive coatings, coal combustion
Copper	1300	Gastrointestinal distress, liver, kidney damage	Corrosion of household plumbing systems, paint pigments, alloys
Lead	15	Delays of physical and mental development, kidney damage, high blood pressure	Corrosion of household plumbing systems, antiknock fuel agents, tetra methyl lead, lead-acid batteries, paint pigments, plastics, alloys, pipes

* MCL, Maximum concentration limit.*[a] EPA (2005).*b Siegel (2002).

Cadmium (Cd):

Cadmium concentrations as low 1–10 mg can have lethal effects upon aquatic organisms (Benjamin, M. M., et. al., 1981and Eisler, 2000) and metal poisoning can occur via direct intake from water or indirectly from contaminated sediment or nutrients.

Table (2): Rosetta Branch chemical analysis (Drains and Nile Feb. 2012).

	Locations	Trace Elements (ppm)						
		Cd	Cu	Zn	Pb	Ni	Fe	Mn
Drain	Abu Rawash City (Rahawy drain)	0.001	0.001	0.033	0.004	0.001	0.46	0.002
	Nekla Village (Rahawy drain)	0.003	0.003	0.054	0.006	0.002	0.46	0.153
	Rahawy Drain outfall	0.004	0.003	0.033	0.005	0.003	0.54	0.136
	Tamalay Village (Sabal drain)	0.002	0.048	0.017	0.001	0.001	0.08	0.107
	Nadir Village (Sabal drain)	0.001	0.003	0.022	0.002	0.003	0.09	0.021
	Ganoub El Tahrir drain	0.001	0.006	0.012	0.002	0.002	0.07	0.033
	Zawieyt El-bahr drain	0.002	0.004	0.021	0.001	0.001	0.04	0.005
	Kafr El Zayat City at km 35 from Tala drain	0.001	0.024	0.012	0.002	0.001	0.83	0.112
	Kafr El Zayat City (outlet of Tala drain)	0.003	0.006	0.004	0.002	0.003	0.04	0.006
	Average	0.002	0.011	0.023	0.003	0.002	0.290	0.064
Nile	Delta Barrage firest of Rosetta branch	0.001	0.008	0.013	0.002	0.001	0.01	0.003
	Wardan Village	0.001	0.007	0.021	0.005	0.003	0.09	0.008
	Bani Salama Village	0.000	0.010	0.052	0.002	0.001	0.05	0.005
	Kafr Meshla Village	0.000	0.005	0.053	0.001	0.001	0.03	0.017
	Kafr -El Zayat City at Maliya Factories	0.000	0.004	0.026	0.001	0.001	0.03	0.004
	Benover Village After Maliya Factories1 km	0.000	0.003	0.027	0.003	0.001	0.59	0.112
	Abig Village	0.000	0.006	0.041	0.001	0.003	1.24	0.014
	El Farastaq Village	0.000	0.006	0.072	0.002	0.003	0.42	0.115
	Mehallat apo Ali Village	0.000	0.005	0.031	0.002	0.002	1.09	0.126
	Fuoa City	0.000	0.004	0.003	0.001	0.002	0.18	0.054
	El Mahmoudya City	0.039	0.006	0.032	0.001	0.002	0.22	0.036
	Motubis City	0.001	0.006	0.04	0.001	0.002	0.19	0.043
	Edfina Barrage end of Rosetta branch	0.001	0.005	0.032	0.001	0.002	0.12	0.034
	Average	0.003	0.006	0.034	0.002	0.002	0.326	0.044

Table (3): Rosetta Branch chemical analysis (Drains and Nile Jun. 2012).

	Locations	Trace Elements (ppm)						
		Cd	Cu	Zn	Pb	Ni	Fe	Mn
Drain	Abu Rawash City (Rahawy drain)	0.002	0.005	0.027	0.005	0.003	0.33	0.152
	Nekla Village (Rahawy drain)	0.001	0.004	0.032	0.005	0.004	0.29	0.211
	Rahawy Drain outfall	0.035	0.170	0.224	0.004	0.005	0.45	0.192
	Tamalay Village (Sabal drain)	0.001	0.004	0.025	0.003	0.004	0.36	0.053
	Nadir Village (Sabal drain)	0.023	0.060	0.099	0.002	0.007	0.45	0.087
	Ganoub El Tahrir drain	0.022	0.089	0.074	0.001	0.003	0.66	0.142
	Zawieyt El-bahr drain	0.028	0.099	0.033	0.005	0.004	0.11	0.128
	Kafr El Zayat City at km 35 from Tala drain	0.002	0.003	0.009	0.002	0.004	0.52	0.007
	Kafr El Zayat City (outlet of Tala drain)	0.001	0.190	0.023	0.044	0.003	0.37	0.005
	Average	0.013	0.069	0.061	0.008	0.004	0.39	0.10
Nile	Delta Barrage firest of Rosetta branch	0.001	0.004	0.012	0.001	0.002	0.00	0.002
	Wardan Village	0.001	0.003	0.012	0.003	0.002	0.18	0.009
	Bani Salama Village	0.000	0.002	0.022	0.002	0.001	0.22	0.008
	Kafr Meshla Village	0.000	0.005	0.011	0.003	0.003	0.31	0.022
	Kafr -El Zayat City at Maliya Factories	0.001	0.007	0.055	0.003	0.002	0.22	0.007
	Benoxer Village After Maliya Factories 1 km	0.000	0.006	0.014	0.001	0.001	0.17	0.006
	Abig Village	0.000	0.005	0.031	0.002	0.001	0.14	0.003
	El Farastaq Village	0.000	0.004	0.022	0.001	0.002	0.22	0.004
	Mehallat abo Ali Village	0.001	0.006	0.042	0.000	0.003	0.28	0.009
	Fuoa City	0.000	0.003	0.009	0.001	0.002	0.23	0.002
	El Mahmoudya City	0.000	0.002	0.013	0.002	0.001	0.19	0.003
	Motubis City	0.001	0.005	0.018	0.003	0.002	0.28	0.007
	Edfina Barrage end of Rosetta branch	0.001	0.006	0.029	0.001	0.002	0.24	0.005
	Average	0.000	0.004	0.022	0.002	0.002	0.20	0.007

Many of the so-called urban metals including lead, cadmium, zinc, and chromium are to some extent available to aquatic organisms. Cadmium has a considerable environmental and health significance due to its increase mobilization and toxicity to many life forms. The maximum recommended concentration by local standard (Low 1948 for 1982) is 0.01 mg/L. potential health effects kidney damage. But all concentration of Cadmium are within the limits of Low 1948 for 1982 (0.01 mg/L).

Copper (Cu):

The primary sources of copper include domestic waste and manufacturing process involving metals electrical production and dumping of sewage sludge. Copper is highly toxic to most species of aquatic plants and is routinely used as an algaecides and herbicide (Swallow, K.C., 1980).

It is one of the most toxic heavy metals to fish where ionic copper Cu^{2+} and ionized hydroxides are the most toxic forms. The maximum recommended concentration by local standard (Low 1948 for 1982) is 1 mg/L. Toxic to a number of plants at 0.1 to 1.0 mg/L in nutrient solutions. And potential health effects from water ingestion cause Gastrointestinal distress, Liver, Kidney damage. But all concentration of copper are within the limits of Low 1948 for 1982 (1 mg/L).

Zinc (Zn):

Zinc is likely the most prevalent urban metal contaminant today and therefore can be harmful to aquatic ecosystems (notably estuaries downstream of major urban centers) even at low concentrations. Metal concentrations in many urban and non-urban stream systems today are at low-trace levels (i.e., 0.1 mg). Anaerobic conditions lead to the formation of Zinc. Zinc Toxicity for aquatic plants is highly variable (effective concentration ranging from 0.01 to 100 mg/ L) (Shiller, A. M., et. al., 1985; Councell, T.B., 2004 and Ren, J., 2004).

The maximum recommended concentration by local standard (Low 1948 for 1982) is 1.0 mg/L. The toxicity of zinc salts is very low. It was found that zinc toxicity to fish increased with the increase in water temperature and reduction of dissolved oxygen.

Concentrations of zinc for both Drain and Nile samples are within the limits of Low 1948 for 1982 (1 mg/L). The low level can be attributed to the presence of organic matter together with inorganic particulate debris produce stable chelates of trace metals and prevents their precipitation as insoluble inorganic salts in freshwater bodies (Goldman and Horne, 1983).

Lead (Pb):

Lead is emitted in large amounts from municipalities. Inorganic lead is moderately toxic to aquatic plants. Under many test condition it is more toxic than chromium, manganese, zinc and iron but is less toxic than cadmium, mercury and copper (Treyfrey, J.H., 1985; Callender, E., et. al., 2000 and Filippelli, G.M., et. al., 2005).

The maximum recommended concentration by local standard (Low 1948 for 1982) is 1 mg/L. potential health effects cause kidney damage, high blood pressure. but all concentration of Lead are within the limits of Low 1948 for 1982 (1 mg/L).

Nickel (Ni):

Ni^{+2} is moderately to highly toxic to most species of aquatic plants. However Ni^{+2} are relatively nontoxic to fish both marine and freshwaters. The maximum recommended concentration by local standard (Low 1948 for 1982) is 1mg/L. Toxic to a number of plants at 0.5 mg/L to 1.0 mg/L; reduced toxicity at neutral or alkaline pH.

All concentration of Nickel is within the limits of Low 1948 for 1982 (1 mg/L). The low level can be referred to the presence of organic matter together with inorganic particulate debris produce stable chelates of trace metals and prevents their precipitation as insoluble inorganic salts in freshwater bodies (Goldman and Horne, 1983).

Iron (Fe):

The chemisorption of metals upon oxyhydroxide surfaces is dependent upon numerous factors including the ionic potential and concentration of the metal, solution pH, the type and concentration of sorbent, ligand concentrations (Benjamin, et. al., 1981 and Bondietti, G., et. al., 1993), and redox conditions.

The mean values of Iron concentration recorded in the point sources of pollution along Rosetta Branch during 2012 are tabulated in tables (7, 8, 9 and10) The average monthly Iron concentration ranges from 1.1 mg/L to 0.025 mg/L with an average value of 0.520 mg/L. the maximum recommended concentration by local standard (Low 1948 for 1982) is ≤1 mg/L. The concentration of Iron in Rosetta Branch recorded maximum values of 1.024 in February and 1.012mg/L in Rahawy drain these values exceed the permissible limit of law 48/1984 (1mg/L) for iron, while it is within the permissible limit for another locations.

Manganese (Mn):

The mean values of Manganese concentration recorded in the Rosetta Branch during 2012 are tabulated in tables (7, 8, 9 and 10). the average monthly Manganese concentration is ranging from 0.711 mg/L to 0.002 mg/L with an average value of 0.136 mg/L. The maximum recommended concentration by local standard (Low 1948 for 1982) is ≤1.5 mg/L. but all concentration of Manganese are within the limits of Law 1948 for 1982 (1 mg/L).

Metal Pollution Correlation Matrix:

The changes in Physiochemical Parameters of the water are followed by significant changes intrace metal concentrations. Therefore, the quality of Rosetta Branch water should be assessed on the basis of metal pollution parameters in order to provide complete spectrum of information for proper water management. The data obtained (tables 2-3) were statistically treated whereas, the correlation Matrix was calculated. Correlation coefficient and probable error were calculated between all the variables detected in Rosetta Branch tables (4 -6).

Values of unity or zero is very rarely found and typical figures usually of the order of 0.6 to 0.9. if (r) is greater than 0.40, but less than 0.60, there will be fair degree of correlation between the two variables. If (r) is less than 0.35; there will be limited degree of correlation between the two variables. The employed variables reveal that; Comparative Correlation Matrix for Rosetta Nile and Drain Rosetta water during February and June months show that the result of correlation matrix for the data shows some clear hydro-chemical relationships can be readily inferred.

Cadmium (Cd) is strongly and positive correlated with copper (Cu)), during February Nile water (r = +0.95) and vice versa for February and June Rosetta Drain water. Cadmium (Cd) shows bad correlation with Lead (Pb), ammonia nitrogen (NH3), nutrients (NO_3), PO4 and fecal coliform (E.Coli) during February and June (Rosetta Nile and Drain water).

Copper (Cu) shows bad correlation with Zinc, Lead, Nickel, iron, manganese, ammonia nitrogen (NH3), nutrients (NO_3), Ortho phosphorus (PO_4) and fecal coliform (E.Coli) during February and June (Rosetta Nile and Drain water).

Zinc (Zn) shows bad correlation with copper (Cu) (r = -0.33 and r = - 0.11) and PO4 (r =+0, 48 and r = + 0.22) during February and June (Rosetta Drain water) respectively. Zinc (Zn) is strongly and positive correlated with Lead (Pb) (r = +0.84), ammonia nitrogen NH3 (r = +0.89), NO3(r = +0.67) and E.Coli (r = +0.87) during February Drain water and vice versa for June Rosetta Drain water **Lead** (Pb) shows bad correlation, during February Nile and Drain water, with copper (Cu) (r = + 0.28 and r = - 0.33) and fair correlation (r = +0.61) during June Drain water. Lead (Pb) shows bad correlation, during February and June Nile and Drain water, with Rosetta water ammonia nitrogen (NH3), nutrients (NO3) and Ortho phosphorus (PO4). Lead (Pb) is strongly and positive correlated with E.Coli during, February Nile and Drain water (r = + 0.77 and r = + 0.95), and vice versa for June Rosetta Drain water (r = - 0. 15).

Nickel (Ni) shows bad correlation with, iron, manganese, ammonia nitrogen (NH3), nutrients (NO_3), Ortho phosphorus (PO_4) and fecal coliform (E.Coli) during February and June (Rosetta Nile and Drain water).

Iron (Fe) shows bad correlation with manganese, ammonia nitrogen (NH3), nutrients (NO_3), Ortho phosphorus (PO_4) and fecal coliform (E.Coli) during February and June (Rosetta Nile and Drain water).

Manganese (Mn) shows bad correlation, during February and June Drain water, with copper (Cu), Lead (Pb) ammonia nitrogen (NH_3), nutrients (NO_3) and Ortho phosphorus (PO4).

Manganese is strongly and positive correlated with E.Coli during June Drain water (r = + 0.71) and vice versa for February Drain water (r = + 0.47).

Ammonia nitrogen (NH_3) is strongly and positive correlated with nutrients (NO_3) during February Drain water (r = + 0.91), Ortho phosphorus (PO4) during June Drain and Nile water (r = + 0.91andr = + 0.89 respectively) and fecal coliform (E.Coli) during February and June Drain water (r = + 0.77 and r = + 0.97 respectively).

Nutrients (NO_3) is strongly and positive correlated with Ortho phosphorus (PO_4) during February and June (Rosetta Nile and Drain water) and fecal coliform (E.Coli) during February Drain water (r = + 0.92).

Ortho phosphorus (PO_4) is strongly and positive correlated with fecal coliform (E.Coli) during February and June Drain water (r = + 0.76 and r = + 0.88 respectively) and vice versa for Nile water.

Table (4): Metal Pollution Correlation Matrix (FEB. 2012).

	Cd		Cu		Zn		Pb		Ni		Fe		Mn		NH_3		NO_3		PO_4		E.Coli	
	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N
Cd	1.00	1.00																				
Cu	-0.07	0.95	1.00	1.00																		
Zn	0.10	-0.01	-0.33	0.21	1.00	1.00																
Pb	-0.60	-0.18	-0.33	0.20	0.84	-0.02	1.00	1.00														
Ni	0.48	0.06	-0.46	0.03	0.02	0.43	-0.46	0.23	1.00	1.00												
Fe	0.46	0.09	-0.003	-0.23	0.20	0.17	-0.48	-0.02	-0.20	0.43	1.00	1.00										
Mn	-0.03	-0.06	0.35	-0.46	0.55	0.18	0.29	0.10	0.04	0.19	0.07	0.51	1.00	1.00								
NH_3	0.12	-0.12	-0.16	-0.06	0.69	-0.09	-0.26	0.30	-0.04	0.50	0.07	0.43	0.21	0.40	1.00	1.00						
NO_3	0.34	-0.04	-0.38	0.24	0.67	-0.08	-0.58	0.31	0.21	-0.02	0.40	-0.36	0.03	-0.19	0.91	0.06	1.00	1.00				
PO_4	0.33	-0.15	-0.04	-0.44	0.48	-0.30	0.38	-0.45	0.25	0.15	0.33	0.30	-0.01	0.42	0.87	0.74	0.89	0.09	1.00	1.00		
E.Coli	0.50	0.49	-0.40	0.07	0.87	0.09	0.95	0.77	0.22	-0.03	0.52	-0.02	0.47	-0.18	0.77	0.05	0.92	0.50	0.76	0.32	1.00	1.00

Table (5): Metal Pollution Correlation Matrix **(June 2012)**.

	Cd			Zn		Pb			Mn		NH3			NO3			PO4		
	Feb		June	Feb	June	Feb		June	Feb	June	Feb	June		Feb	June		Feb	June	
	Drain	Nile	Drain	Drain	Drain	Drain	Nile	Drain	Drain	Drain	Drain	Drain	Nile	Drain	Drain	Nile	Drain	Drain	Nile
Cu	-0.07	0.95	0.26	-0.33	-0.11	-0.33	0.28	0.61	0.35	0.04	-0.16	-0.07	0.12	-0.38	0.11	0.55	-0.04	0.10	0.30
Pb	-0.60	-0.18	0.32	0.84	-0.11	1.00	1.00	1.00	0.29	-0.45	-0.26	-0.18	0.59	-0.58	-0.27	0.39	-0.38	0.05	0.65
NH3	0.12	-0.32	0.03	0.89	0.16	0.26	0.30	0.18	0.21	0.72	1.00	1.00	1.00	0.91	0.63	0.64	-0.87	0.91	0.89
NO3	0.34	-0.04	0.44	0.67	0.56	-0.58	0.31	-0.27	0.03	0.57	0.91	0.63	0.64	1.00	1.00	1.00	0.89	0.67	0.82
PO4	0.33	-0.15	-0.01	0.48	0.22	-0.38	-0.45	0.05	-0.01	0.49	0.87	0.91	0.89	0.89	0.67	0.82	1.00	1.00	1.00
E. Coli	0.50	0.49	0.09	0.87	0.01	0.95	0.77	- 0.15	0.47	0.71	0.77	0.97	0.60	0.92	0.55	0.05	0.76	0.88	0.39

Table (6): Comparative Metal Pollution Correlation Matrix for Rosetta Drain and Nile waters (February And June Seasons).

	Cd		Cu		Zn		Pb		Ni		Fe		Mn		NH_3		NO_3		PO_4		E .Coli	
	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N
Cd	1.00	1.00																				
Cu	0.26	0.42	1.00	1.00																		
Zn	0.31	0.39	-0.11	0.63	1.00	1.00																
Pb	-0.32	0.06	0.61	-0.08	-.027	-0.04	1.00	1.00														
Ni	0.46	0.44	0.004	0.03	0.33	0.15	-0.34	-0.05	1.00	1.00												
Fe	0.06	-0.07	0.04	-0.20	0.14	0.20	-0.14	0.18	0.02	0.43	1.00	1.00										
Mn	0.42	-0.04	-0.04	0.19	0.12	0.04	-0.45	0.44	0.05	0.56	-0.16	0.57	1.00	1.00								
NH_3	0.03	-0.12	-0.07	0.12	0.16	0.21	-0.18	0.59	-0.01	0.04	-0.18	0.36	0.72	0.56	1.00	1.00						
NO_3	0.44	0.08	0.11	0.55	0.56	0.58	-0.27	0.39	0.58	-0.12	-0.16	-0.31	0.57	0.12	0.63	0.64	1.00	1.00				
PO_4	-0.01	0.09	0.10	0.30	0.22	0.31	0.05	0.65	0.01	-0.05	-0.03	-0.31	0.49	0.42	0.91	0.89	0.67	0.82	1.00	1.00		
E.Coli	-0.09	0.49	-0.40	0.42	0.01	-0.11	-0.15	0.34	-0.06	-0.25	-0.17	0.01	0.71	-0.18	0.97	0.60	0.55	0.05	0.88	0.39	1.00	1.00

Conclusions:

Water Quality along Rosetta Branch was determined. The worth case was found along El–Rahawy drain at the area between Abu Rawash City and Nekla Village. Correlation Matrix, of metal pollution**,** chemical parameters, was computed and the result of correlation matrix for the data shows some clear hydro-chemical relationships can be readily inferred.

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