Prospective Strategy for Improving Quality of Agricultural Drainage Water for Irrigation

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ABSTRACT

The Nile River is the main source of surface freshwater in Egypt. Because of the limited share of Nile water to the country, the Egyptian authorities had planned to reuse non-conventional water sources, such as agricultural drainage water and treated wastewater, for irrigation. It is obvious that these two water sources are of low quality. As a result, specific laws were authorized by the Egyptian government for regulating the reuse of these waters for different purposes. Of the most important is Law 48/1982 and Decree 8/1983 which deal specifically with the discharges of effluents in water bodies. The main targets of this law is to protect the Nile River and waterways from pollution. In addition, the ministerial Decrees 256/1994 and 44/2000 were issued to specify quality requirements for unrestricted and restricted irrigation by wastewater.

Water quality index (WQI) has been employed for evaluating the quality category of water of the main drains in Egypt. The results indicated that the values of WQI of most drains of upper Egypt are categorized between very poor and very good, while those of east, middle and west Nile Delta were between very poor and good. This low water quality of most agricultural drains is due to the discharge of polluted effluent into these drains. It has been recognized that the drain catchment is supplied by water from small drains which contain usually very poor quality water. In order to improve water quality of the main drain, it must first reclaim water quality of small drains before discharge into the drain catchment. Constructed in-stream wetland treatment system can be successfully used for reclamation and treatment the water of small drains at a certain point before inflow the main drain. This system has high removal efficiency of most pollutants. It is also easy to construct, requires low investment and low maintenance time and expense. It can be managed successfully by operators having moderate training and by the local community.

Keywords: Drainage Water, Wastewater, Water Quality Index, Wetland system.

INTRODUCTION

The main source of surface freshwater in Egypt is the Nile River. According to the Nile Water Agreement with Sudan in 1959, Egypt's annual share of water is 55.5 billion cubic meter (BCM). Another source of water in Egypt is the groundwater of Nile Valley and Delta aquifers. The annual abstraction of this water was 2.6 BCM in 1990 (Abu Zeid, 1992) and exceeded to 5.1 BCM in 2000 and expected to increase to 6.3BCM in 2025 (Abdel Shafy and Aly, 2002). Because Egypt is an arid country, the average annual rainfall seldom exceeds 200 mm, mostly occurred during winter season along the northern coastal region and declines inland to reach about 25 mm or less near Cairo City. These quantities of water cannot meet the exceeding demands of water in the country as a result of the enormous growing of both population, industry and tourism sectors, beside agricultural sector. This critical situation obligated the Egyptian authorities to the diversion of a significant proportion of Nile freshwater from agricultural sector to the other formerly three sectors. It is evident, therefore, that the major challenge to agricultural development in Egypt is the shortage in the amount of freshwater available from River Nile.

Of a great concern, during the last seven decades, was the reuse of the non-conventional water resources, such as agricultural drainage water and treated wastewater for agricultural irrigation. Both can be considered significant water resources when managed properly. Because of that, the Egyptian authorities in 1980 included both these two waters as resources of significant components of Egypt's Water Master Plan (Abu Zeid, 1997). It is evident, therefore, as a substitute for freshwater in irrigation, whether partially or totally, non-conventional water has an important role to act within water resources management. Also, by releasing freshwater of Nile River for potable water supply and other priority uses, non-conventional water reuse makes asignificant contribution to water conservation. Moreover, the scheme of reuse of these waters, if properly planned and managed, can have positive environmental impact, besides providing increased agricultural yields.

The reuse of agricultural drainage water in irrigation has been started in 1930 alongside the construction of "Drainage Projects" in Egypt (El-Quosy, 1989). The amounts of drainage water reused annually were 3.97 and 7.00 BCM in 1996 and 2000, respectively and expected to increase to 8.00 BCM in 2025 (Abdel Shafy and Aly, 2002).

During the last three decades, the benefits of promoting wastewater reuse in irrigation has been

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recognized by Egyptian authorities. The country's plan was to improve and expand wastewater reuse especially for irrigating the new reclaimed lands in eastern and western deserts. It has been reported that the quantity of wastewater reused annually in irrigation was 0.2 BCM in 1990, increased to 1.1 BCM in 2000 and is expected to increase to 2.4 BCM by 2025 (Abdel Shafy and Aly, 2002).

2- Pollution of Drainage Water

The major pollutants in agricultural drainage water, in general, are salts, nutrients (N and P), pesticides and fertilizers residues, toxic organic and inorganic chemicals and pathogens. The source of pollutants in this water are mostly the discharges of domestic and partially treated or untreated effluents and leaching and seeping of agrochemicals. Most pollutants sources, not including agricultural flow, are domestic diffuse source (90.2%), domestic point source (3.2%) and industrial sources (6.6%). The magnitude of these sources may be increased in the future as a result of the absence of wastewater treatment facilities and increasing population (EWRP, 2003). Because of these pollutants, most agricultural drains in Egypt contain low quality water, or by another mean, marginal quality water (Elsokkary and Abukila, 2011 and 2012).

2-1- International Concern

The principals of how to eliminate and decrease water pollution, in general, were set up at "the United Nation Conference on the Human Environment" of Stockholm in 1972 (Dybern, 1974). Soon after, following the major experts meeting of WHO at Geneva in 1989 and at Stockholm in 1999, the International Water Association (IWA) published "Water Quality, Guidelines and Health for Safe Use of Water in Agricultural Irrigation" (Scott et al., 2004).

Despite of a long history of wastewater reuse in irrigation in many countries world wide, the question of safety remains an enigma. The international and national policy declaired that the main targets of controlling the reuse of marginal quality water in irrigation are the protection of human health and the prevention of crop damage. Because many countries do not have detailed standards and guidelines, the guidelines of WHO (1989) and of USEPA (1992a) are the basis for any discussion for granting permissions to any kind of wastewater reuse.

First water quality criteria for wastewater reuse in irrigation were set in 1973 by California Department of Health Services (CDHS, 1978). In 1971, the report of the first WHO meeting of experts on the reuse of wastewater in irrigation was published in 1973 and had served as a guideline (WHO, 1973). According to this report, the pathogen removal becomes the most important measure of wastewater treatment. The USEPA (1992b) guidelines stricted upon microbiological standards and quality standards for physicochemical parameters of wastewater reuse in irrigation. Other quality parameters of great concern are the potentially toxic trace elements and salinity besides the restrictions for crops selection to be irrigated by wastewater in order to protect the public health (WHO, 1989 and Pescod, 1992).

2-2- National Concern

Degradation of water quality due to pollution is a major issue in Egypt. As a result, the country during the last five decades authorized several laws and decrees to prevent and to protect the waterways and environment from deterioration. The most important of these laws are the Law 48/1982 and Law 4/1994 (EWPR, 2003).

Law 48/1982 deals specifically with the discharges of effluents to water bodies all over the country. This low prohibits the discharge to the Nile River, freshwater canals, drains, lakes, and groundwater without a license issued by the Ministry of Water Resources and Irrigation (Law 48/1982; 1983).

The Ministry of Irrigation, in 1983, issued the Decree No.8 to be the implementary regulation of Law 48/1982, regarding the protection of Nile River and waterways. This decree has been built upon reviewing both: (i) law 93/1962 concerning the discharge of liquids and wastes, (ii) law 38/1967 concerning public hygiene, (iii) law 74/1971 concerning irrigation of drainage, and (iv) law 48/1982 concerning the protection of the Nile River and waterways from pollution (EWPR, 2003):

The implementing Decree 8/1983 specified the water quality standards according to the following categories (APRP, 2000; APRP, 2002 and EWPR, 2003)

1- The Nile River and canals into which discharges are licensed (Article 60).
2- Treated industrial discharges to the Nile River, canals and groundwater: (i) upstream the Delta Barrages discharging more than 100 m^3/day (Article 61), (ii) downstream the Delta Barrages discharging more than 100 m/day (Article 61), (iii) upstream the Delta Barrages discharging less than 100 m^3/day (Article 62), and (iv) downstream the Delta Barrages discharging less than 100 m^3/day (Article 62).
3- Drain water to be mixed with waters of Nile River and canals (Article 65).
4- Treated industrial and sanitary waste discharges to drains, lakes and ponds (Article 66).
5- The drains, lakes and ponds into which discharges are licensed (Article 68).

The limits of microbiological parameters set by Law 48/1982 and Decree 8/1983 for discharged effluent to the River Nile, branches, ditches, groundwater, drainage water and brackish or saline surface water are indicated in Table 1.

The implementing Decree 8/1983 specified also that discharge of treated sanitary effluents, to the Nile River and canals, is not allowed (Article 63), and discharge of sanitary waste into the water bodies should be chlorinated (Article 67).

The Law 4/1994 states that all provisions of Law 48/1982 are not affected and Law 4/1994 covers coastal and seawater aspects. However, the Egypt's Environmental Affairs Agency (EEAA) is the authority responsible for preparing legislations and decrees to protect the environment in general, for setting standards for environmental monitoring and utilization of data including water quality (APRP, 2002).

Standards for irrigation with wastewater was specified in Decree 9/1989. This decree prohibits the use of raw effluent for irrigating vegetables, fruits, or crop consumed raw by human and grazing animals. It also specifies quality criteria for the reuse of effluent according to soil type. However, this decree did not specify restrictions on intestinal parasite eggs and other microbiological quality which are the major threats to human health.

The Ministerial Decree 256/1994 draft issued by Ministry of Health and Ministerial Decree 44/2000 draft issued by Ministry of Housing and New Communities, specified quality requirements for the unrestricted and restricted irrigation by wastewater (Table 2). These two draft decrees incorporated the WHO (1989) guidelines for reuse of treated wastewater for agricultural irrigation. Both decrees did not allow to irrigate vegetables, fruits and raw-eaten salad crops by wastewater, and presented detailed specification on environmental and hygienic requirements, suitable irrigation method, and suitable soil type to be irrigated by wastewater.

3- Water Quality Index

According to the Canadian Council of Ministers and the Environment (CCME, 2001) water quality index (WQI) provides a convenient mean of summarizing complex water quality data and facilitating its communication to a general audience. In addition, it provides a measure of the deviation of the quality of water from water quality guidelines. This index incorporates three elements: scope (the number of variables those objectives are not met), frequency (the number of times with which these objectives are not met), and amplitude (the amount by which the objectives are not met). These are combined to produce a single value between zero (worst water quality) and 100 (best water quality). These numbers are devided into 5 descriptive categories to simplify presentation. Once CCME WQI value has been determined, water quality is ranked by relating it to one of the following categories:

Excellent: (CCME WQI Value 95-100) – water quality is protected with a virtual absence of threat or imparement; conditions very close to natural or pristine levels.

Good: (CCME WQI Value 80-94) - water quality is protected with only a minor degree of threat or impairment, conditions rarely depart from natural or desirable levels.

Fair: (CCME WQI Value 65-79) - water quality is usually protected but occasionally threatened or impaired; conditions sometimes depart from natural or desirable levels.

Marginal: (CCME WQI Value 45-64) - water quality is frequently threatened or impaired, conditions often depart from natural or desirable levels.

Poor: (CCME WQI Value 0-44)– water quality is almost always threatened or impared; conditions usually depart from natural or desirable levels.

The assignment of CCME WQI values to these categories represents a critical but somewhat subjective process (CCME, 2001).

Several forms of water quality indices are available in the literature and allow the assessment and identification of water quality charges and trends (Ott, 1978). A study reported by EWPR (2003), for evaluating WQI of the drains in Egypt provided WQI classification in the order: very poor (0-25), poor (26-50), good (51-70) and very good (71-100). In this report (EWPR, 2003), nine parameters were selected to comprise the index. These parameters were DO, BOD_5, TDS, FC, pH, Temp., turbidity, NO_3^- and total P. This study included

Table 1. The limits of total coliform in effluent discharged in different water bodies (Decree 8/1983). Decree No. 8/2983 (EWPR, 2003)

Parameter	River Nile	Nile branches, main canals, ditches and groundwater reservoirs.	Drain water	Brackish or saline surface water
Total coliform (MPN/100ml)	2500	2500	5000	5000

Table 2. Treated wastewater quality for irrigation according to draft Decree 256/1994 and 44/2000 (APRP, 2000)

Parameter	Treatment level		
	Primary	Secondary	Advanced
BOD_5 (mg/l)	300	40	20
COD (mg/l)	600	80	40
TSS (mg/l)	350	40	20
Nematode eggs (c/l)	5	1	1
FC (MPN/100 ml)	-	1000	100

40 agricultural drains in upper Egypt discharge their waters directly to the Nile River; 6 drains in East Delta, 7 drain in Middle Delta and 7 drains in West Delta (Table 3).

In December 2007, Khan et al. (2010) developed the Egyptian water quality index (EWQI) on the basis of the Canadian Council of Ministers of the Environment (CCME, 2001). The purpose was to assess and evaluate the suitability of water of various water bodies for designated beneficial uses such as drinking water, irrigation, livestock, aquatic life and recreaction, and also to convert water quality data into information and knolowedge. According to their analysis of the data collected for River Nile water, the value of EWQI at Aswan was 80 (categorized as good) while those at Cairo/Giza and Kafr El-Zayyat were 75 (categorized as fair).

Elsokkary and Abukila (2011) employed nine parameters (TDS, pH, COD, BOD_5, NO_3^-, Cd, Cu, Pb and Zn) to comprise the WQI of the water of El-Umoum Drain catchment, western part of Nile Delta of Egypt by using the CCME (2001). They recorded wide range of WQI values which varied from 60 to 80 and categorized from marginal to good (Table 4). These data indicated that the water of the drains of El-Umoum catchment have been markedly polluted and the magnitude of pollution proceeded south-north direction.

4- Improving Drainage Water Quality

Agricultural drainage water of Nile Delta, as previously noted, are characterized by low quality and are categorized mostly within marginal and fair water quality (EWRP, 2003 and Elsokkary and Abukila, 2011). This is due to discharges of polluted water into these drains from several pollution point and non-point sources which are originated within the main drain catchment area. Most of these main drains are acting as receptors of polluted water from small drains. In turn, these small drains are acting also as receptors of effluents discharging from villages and small community settlements having no-sanitation and wastewater treatment facilities. This uncontrolled flow caused significant deterioration in the quality of water in the agricultural drains in Egypt.

The most appropriate wastewater treatment to be applied before effluent discharge in drain is that which will produce an effluent meeting the recommended microbiological and chemical quality guidelines (Law 48/1982 and Decree 8/1983), both at low cost and with minimal operational and maintenance requirement.

Table 3. Categories of WQI of the main agricultural drains in Egypt (EWPR, 2003)

Location of drains	Very good	Good	Poor	Very poor
Upper Egypt	27 drains	8 drains	El-Berba El-Ballas Esta	Khour El-Sail Aswan Kom Ombo
East Delta		Mahasma	Bahr Hadus Matereya Serw	Bahr El-Baqar Matereya Farasqur
Middle Delta		Tala Nashart Sabal Zaghlool		Gharbeia Omer Beck Tira
West Delta		Borg Rashed Nubaria	Barsik Edko	Abu Qir Moheet El-Umoum

Table 4. The values of WQI and categories of El Umoum Drain catchment during the period 1989-2010 (Elsokkary and Abukila, 2011)

Location of drain	1989		2000		2010	
	Value	Category	Value	Category	Value	Category
Abu Hommos	64.9	marginal	61.9	marginal		
US Abu Hommos PS	65.3	fair	63.5	marginal		
DS Abu Hommos PS	68.6	fair	68.4	fair	80.9	Good
Shrishra	67.9	fair	66.6	fair		
US Shrirshra PS	67.0	fair	66.3	fair		
DS Shrishra PS	69.2	fair	69.2	fair	79.1	fair
Trouga	66.5	fair	65.9	fair		
US Trouga PS	64.3	marginal	64.0	marginal		
DS Trouga PS	67.6	fair	64.7	marginal	64.8	marginal
El Deshoudy	61.2	marginal	61.1	marginal		
US El Deshoudy PS	61.3	marginal	61.1	marginal		
DS Dewshoudy PS	62.7	marginal	61.4	marginal	62.2	marginal
El Haris	65.2	fair	61.1	marginal		
US El Haris PS	65.2	fair	61.5	marginal		
US El Haris PS	65.7	fair	64.0	marginal	62.8	marginal
Bab El Abeed	61.0	marginal	60.2	marginal	64.2	marginal

Under rural Egyptian conditions, it is preferable to design water treatment system at point source, that must be efficient and of low investiment. It is obvious that water quality improvement for potable, domestic and industrial sectors requires high investiments and usually is costly while water improvement for agricultural irrigation sector requires improved management which is accompanied by low-cost in situ treatment. Several treatments alternatives that vary in efficiency and cost are available and can be successfully used in rural areas. The constructed in-stream wetlands for wastewater treatment can be one of the most successful systems. (Kadlec and Knight, 1996; Hammer, 1997; and Stott et al., 1999).

Constructed in-stream wetlands are man-made systems that are designed, built and operated to emulate natural wetlands for human desires and needs (Kadlec and Knight, 1996 and Hammer, 1997). These systems are capable of providing high levels of treatment and discharge relatively clear water, inexpensive to build, requiring little operation and maintenance time to expense, manageable by operators with very limited training, and capable of providing aesthetic/recreational/educational benefits (USEPA, 1992 b, Kadlec and Knight, 1996; Hammer, 1997; and El-Refaie et al., 2010).

Water quality parameters of great concern which are needed when applying wetland treatment system are BOD_5, TSS, pathogens, and nutrients (N and P), and under certain conditions, heavy metals and trace organics. Wetzel (1993) reported that wetland system can reduce high levels of BOD_5, TSS, total N, total P, appreciable levels of potentially toxic trace elements, trace organic compounds and total and fecal coliform. Mitsch (1993) reported that the removal efficiency of wetland system for TSS, BOD_5, COD, total N and total P was more than 50% for each relative to that of the influent (Table 5).

In order to achieve the best wetland system, certain conditions should be taken into consideration. Of these are (i) the proper and safe treatment of the dredged sediments and the outputs of used plants in order to prevent negative effects, and (ii) the assurance of public acceptance and contribution toward the management and restoration of the system.

Several studies have been carried out in Egypt during the last two decades to evaluate the feasibility of constructed wetlands for wastewater treatment.

Gravel bed hydroponic (GBH) constructed wetland system of 100 m long plant bed was operated in Egypt, by Stott et al. (1999). Their findings indicated high capacity of the system for efficient removal of the eggs of several parasites (*Ascaris sp.*, *Toxocara sp.*, and *Hymenolepis sp.*). All the eggs of these parasites were significantly removed within the first 25 m, and no eggs were detected in the final effluent from an influent containing 500 eggs/l.

Constructed wetland beds operated during 1998-2005 at Sues Canal Univ., Egypt, showed moderate efficiency of the system to remove the load of pathogenic bacteria from the influent. The removal efficiency of the system was 48% of *Salmonella sp*., 52% of *Shigella sp*., 49% of *Vibro sp*., and 49% *Pseudomonas sp*. (Abdulla et al., 2007).

Abdel Ghaffar and El-Saadi (2007) found that using free water surface-wetland system (FWS-WS), employed for wastewater treatment, removed 79% of total N, 93% of BOD_5, 95% of pathogens and 10% of TSS.

In 2001, Lake Manzala Engineering Wetland Project was designed at south west Port Said City (GEF, 2006). The project is a cooperative effort among the Global Environmental Facility (GEF), Egyptian Environmental Affair Agency (EEAA), and the United Nation Development Program (UNDP). The wetlands were designed to treat 250000 m^3/day of water from Bahr El-Baqar Drain. The analytical results from the collected data during 2003-2004 and during Aug. 2006 (Tables 6 and 7) indicated significant removal efficiency of the system for the major pollutants (GEF/UNDP, 2009). Zidan et al. (2005) used three wetland cells at Lake Manzala Project. They found high removal efficiency of the system for most pollutants (Table 8)

Study carried out by El-Refaie et al. (2010), on the impact of arid climate on the performance of the engineering wetland system of Lake Manzala, showed that the removal efficiency of the system for various pollutants differed markedly during summer and winter of 2008 depending upon detention time. The removal percentages of total N and BOD_5 were higher in summer than in winter while those of TSS and TC were the opposite (Table 9).

According to the available data, the performance of wetland system under Egyptian conditions can be able to be equivalent to the primary and, so for, to the secondary conventional wastewater treatment on the basis of the proper selection of designed detention time and aquatic plant species

Table 5. The expected removal efficiency of wetlands (Mitsch, 1993)

Parameter	Inflow	Outflow	Removal (%)
TSS (mg/l)	130	21	84
BOD_5 (mg/l)	40	17	58
COD (mg/l)	200	92	54
Total P (mg/l)	5	2.5	50
Total N (mg/l)	12	5	58
NH_4^+-N (mg/l)	10	5	50
FC (MPN/100 ml)	300000	30000	-

Table 6. The removal efficiency (%) of Lake Manzala Engineered wetland for samples collected during 2003-2004 (GEF, 2005)

Constituent	Removal (%)	Constituent	Removal (%)
BOD_5	70	Total N	50
TSS	80	TC	98
Total P	50	FC	98

Table 7. The removal efficiency (%) of Lake Manzala Engineered wetland for samples collected in Aug. 2006 (GEF/UNDP, 2009)

Constituent	Removal (%)	Constituent	Removal (%)
BOD_5	61.2	Total N	51.4
TSS	80.0	TC	25.9
Total P	15.0	FC	99.7

Table 8. The removal efficiency (%) of three cells of Lake Manzala Engineered wetland (Zidan et al., 2005)

Constituent	Cell 1	Cell 2	Cell 3	Average
BOD_5	72	72	69	71
TSS	63	63	63	63
Total N	41	44	42	42
Total P	41	44	42	42
TC	98	98	98	98

Table 9. Removal efficiency (%) of wetland facility of Lake Manzala as influenced by climatic conditions (El-Refaie et al., 2010)

Constituent	Summer, 2008	Winter, 2008
TSS	23	99
Total N	66	4.6
BOD_5	98	88
TC	34.5	99

CONCLUSION AND RECOMMENDATION

Agricultural drainage waters in Egypt are characterize, in general, as low quality water. This is due to the discharge of untreated and partially treated effluents from point and non-point sources in these drains. The drain catchment is comprised of drains network of which the smallest are considered the main supply of polluted effluent while the main drain is acting as a receptor of low quality water from these small drains.

Quantitatively, the values of water quality index (WQI) of the agricultural drains of upper Egypt are categorized between very poor and good water quality, while those of Nile Delta are categorized between very poor and poor water quality. In order to reuse agricultural drainage water directly for irrigation or after mixing with canal water, it must meet the regulations and standards requirements of the Egyptian Law 48/1982 and Decree 8/1983. This can be attained when polluted water of the small drain is subjected to suitable treatment at the pollution point source before discharge in the main drain.

Several wastewater treatment technologies are well established but because of the occurrence of pollution point source within the rural communities and small settlements, the conventional wastewater treatment facilities can not be applied. As a result, other wastewater treatment facilities can be suggested to be applied under these Egyptian conditions. The most promising treatment facility that can be applied, therefore, is the constructed wetland in- stream system. This system is easy to construct, has high removal efficiency of most pollutants, does not require high investiment, i.e. not costly, and can be managed successfully by operators of moderate training and by the local community. It is evident, therefore, that under Egyptian conditions, the wetland wastewater treatment system can be recommended as a promising strategy for improving the waters of the small drains within the main drain catchment area.

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الملخص العربي

الاستراتيجية المأمولة لتحسين نوعية مياه الصرف الزراعى للرى

ابراهيم حسين السكرى

يعتبر نهر النيل المورد الرئيسى للمياه السطحية العذبة فى مصر. ونتيجة لمحدودية نصيب مصر من هذه المياه فإن الهيئات المعنية المصرية قد وضعت فى خططها المائية إعادة إستخدام المصادر الغير تقليدية للمياه مثل مياه الصرف الزراعى والمياه العادمة فى الرى الزراعى ومن المعروف أن مياه هذين المصدرين ذات نوعية منخفضة أو رديئة مما أدى ذلك بأن وضعت الحكومة المصرية قوانين وتشريعات محددة عن إعادة إستخدام هذه المياه فى رى الأراضى الزراعية. ومن أهم هذه القوانين؛ قانون رقم (48) لعام 1982 والمرسوم رقم (8) لعام 1983 واللذان يحددان نوعية المياه التى تصرف فى المجارى المائية. ويعتبر الهدف الرئيسى لهذا القانون هو حماية نهر النيل والمجارى المائية من التلوث. بالإضافة إلى ذلك فإن المرسوم الوزارى رقم (256) لعام 1994 وكذا رقم (44) لعام 2000 يحددان المتطلبات الخاصة والمحاذير عند الرى بالمياه العادمة.

استخدم دليل نوعية الماء لتقييم رتبة نوعية ماء المصارف الرئيسية فى مصر. وقد أظهرت النتائج أن نوعية مياه مصارف مصر العليا ذات نوعيات تتراوح من رديئة جداً إلى جيدة جداً، بينما فى حالة مياه مصارف دلتا النيل فقد تراوحت النوعية أو الرتبة من رديئة جداً إلى جيدة. ويعزى تدهور نوعية هذه المياه إلى تأثير المياه الملوثة التى تصب فى هذه المصارف. وقد وجد أنه فى حالة حوض المصرف الرئيسى فإن المصارف الصغيرة تمد المصرف الرئيسى بمياه ذات نوعية رديئة.

ولكى يحدث تحسين فى نوعية مياه المصرف الرئيسى يجب أولاً معالجة مياه المصارف الصغيرة والتى تكون عادة رديئة النوعية. ويعتبر نظام الأرض الرطبة لمعالجة المياه العادمة مناسباً لمعالجة مياه المصرف الصغير على أن يجرى ذلك عند نقطة محددة قبل تدفق الماء المعالج إلى المصرف الرئيسى. وقد أوضحت الدراسات المتعددة أن هذا النظام ذات كفاءة عالية لإزالة معظم الملوثات من المياه العادمة، كذلك فإنه من السهل تصميم وبناء هذا النظام فى الموقع المناسب، كما أنه لا يتطلب رأس مال كبير بل أنه قليل التكلفة إلى جانب كونه من السهولة صيانته بإستخدام أفراد ومهنيين ذات خبرة متوسطة بالإضافة إلى امكانية مساهمة السكان المحليين فى إدارة هذا النظام بكفاءة ونجاح.