Chapter 5
Fresh Water

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Introduction

Due to limited freshwater resources vis-à-vis the growing demand caused by population increase and industrial, agricultural and other developmental activity boom, it was necessary to have an Egyptian water policy that employs integrated water management methodologies. This policy focuses on providing water in the amounts that should meet various needs, besides maintaining water quality against pollution, following scientific methods to rationalize water consumption in all developmental domains, and raising citizens' awareness at all levels on this end (to protect water against pollution and rationalize consumption). Moreover, all stakeholders would participate in the implementation of the integrated water management policy to ensure sustainability.

Surface freshwater pollution results from different population activities: industrial, agricultural, or tourist, etc. Thus, Water and Environmental Sanitation Programs have been developed with priorities including preventing industrial effluence into the Nile owing to its direct negative impacts on water quality. They involve the reuse of treated sanitary drainage water for irrigating woods instead of drainage into water courses. There is also coordination with the Ministry of Agriculture to rationalize pesticide use and, rather, use allowed types that shortly degrade in water.

Water Quality in the Nile

Due to increased developmental activities in Egypt, it was necessary to monitor and follow up the changes in water quality, consequently a number of periodical monitoring programs were developed to measure indicators of water quality: natural, chemical and microbiological indicators. In these programs, surface and ground water quality is monitored through monitoring networks all over Egypt, affiliated to water quality line ministries as follows:

1. Ministry of Water Resources and Irrigation (MWRI) network: 232 monitoring sites along the Nile, canals and drains, in addition to 203 control points to monitor ground water quality;
2. The Ministry of Health and Population (MOHP) network: 154 monitoring sites along the Nile, its two branches and some major canals such as Mahmoudia, Ismailia, Ibrahimia, as well as other large canals (Bahr Moussa, Bagouria, Qassed, Bahr Shebin) that directly branch off the Nile at al-Qanater al- Khayria and are fed by Tawfiqi and Monoufi main canals; other points along Bahr Youssef in Beni Soueif; and 20 points in Faiyum located along Bahr Youssef Canal. Monitoring is undertaken monthly by the Environmental Monitoring and Occupational Health Studies Center; and
3. MSEA network: 69 monitoring sites along the Nile. Monitoring is undertaken by EEAA RBO laboratories in different governorates.

Lake Nasser Water Quality

Lake Nasser is the main water reservoir in Egypt, managing Nile water in front of the High Dam with a storage capacity of 162bn m^3, at a level varying between 83 and 182 m. The Lake is about 500 km long, 350 of which lie in Egypt and 150 in Sudan (Nubia Lake). There are 85 bays in the lake, 48 of which are on the east side and 37 on the west. Lake activities vary from tourist (about 6 Nile cruisers) to industrial (fish processing) and limited agricultural activities. Water quality in the lake is monitored periodically through line ministries. Monitoring results in 2007 show that lake water still maintains good quality, with very little change thanks to limited developmental projects around it. Results demonstrated the absence of pesticide, fertilizer or heavy metal contamination, as well as small organic substance concentrations which were less than permissible limits prescribed in the Executive Regulations of Law 48/1982 on Protecting Water Courses Against Pollution, which proves that water quality was not affected by current industrial and agricultural activities. This makes lake water a reference point for water quality along the river and its branches.

Indicators of Water Quality in the River Nile and Branches

Nile water quality monitoring in 2007, according to analysis results by MOHP Environmental Monitoring Center and EEAA laboratories in different governorates, showed the following:

1. Average organic substance concentrations represented in BOD was less than permissible limits (6 mg/l) in all governorates, thanks to efforts made to prevent drainage into the Nile or into drains feeding the River. Figure (5.1) shows a comparison of average BOD concentrations among different governorates in 2007.

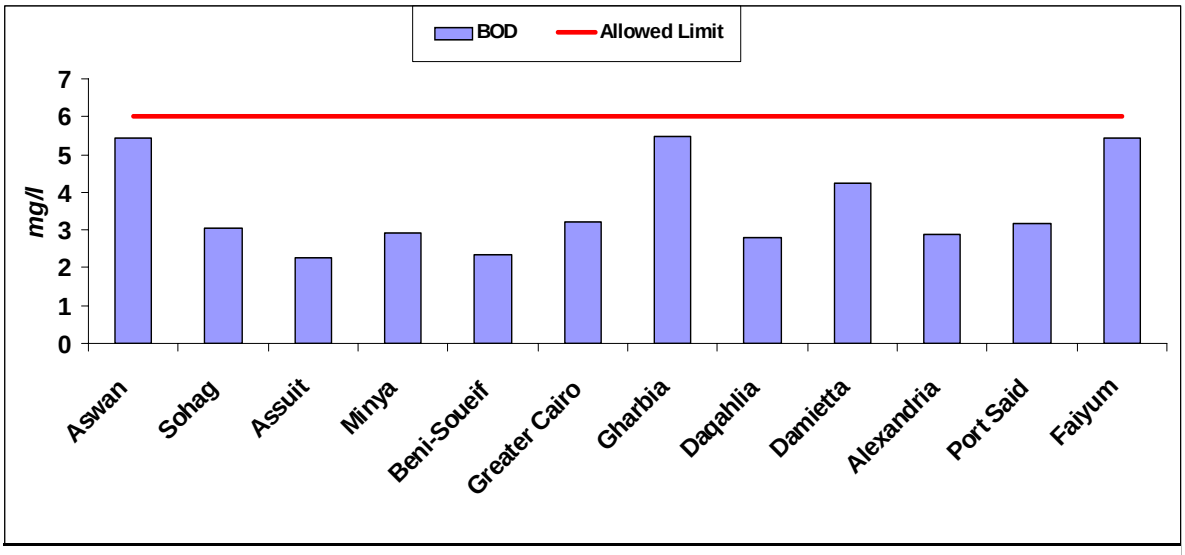

Figure (5.1) Comparison of BOD averages among Governorates in 2007

Figure (5.2) shows a comparison between average BOD concentrations in different governorates over the past six years (2002-2007) and indicates that concentrations were less than permissible, with an obvious decrease in Damietta, Port Said, Sohag, Aswan, Assiut and Minya. Although there is a mild increase in BOD average in Gharbia this year, it is still less than permissible limits for Nile water quality mentioned in the Executive Regulations of Law 48/1982.

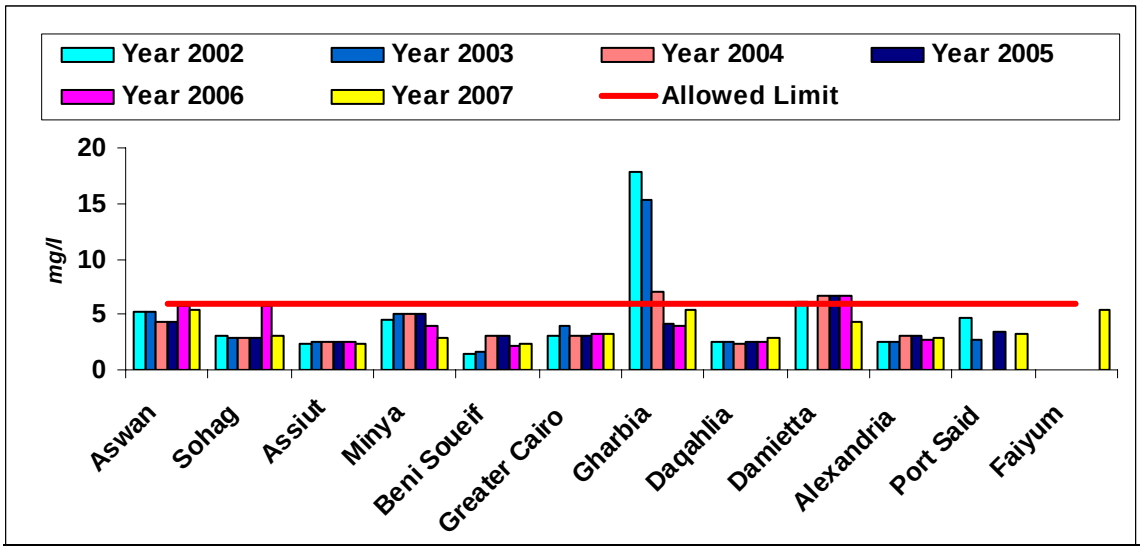

Fig (5.2) Comparison of average results of organic load expressed in BOD among Egypt governorates in 2002-2007

2. Results showed that average concentration of organic substances represented in COD decreased in most of the governorates compared to last year. Although there is a slight increase in concentration levels compared to allowed limits in Greater Cairo, Damietta, Alexandria, Gharbia, Sohag, Port Said, they decreased compared to last year's levels. There is also a mild increase in COD levels in Port Said, Beni Soueif and Sohag, and a considerable increase in Gharbia compared to last year. Figure (5.3) shows a comparison of average COD concentrations among different governorates in 2007 where it is clear that the highest average concentrations were some 17 mg/l, compared to 19.50 mg/l last year.

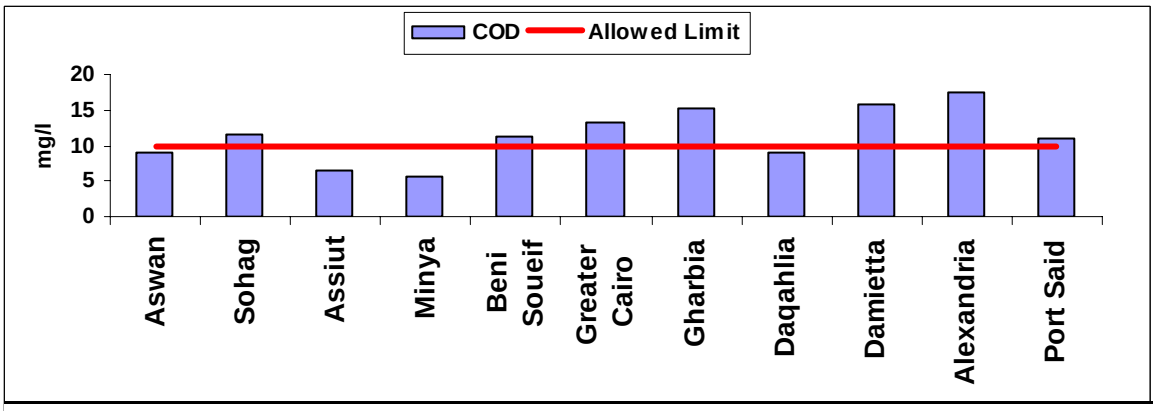

Figure (5.3): A comparison of average chemically consumed Oxygen among Governorates for the year 2007.

Figure (5.4) compares the average COD concentrations over the past 6 years in different governorates, where a considerable improvement from 2002 to 2007 can be detected.

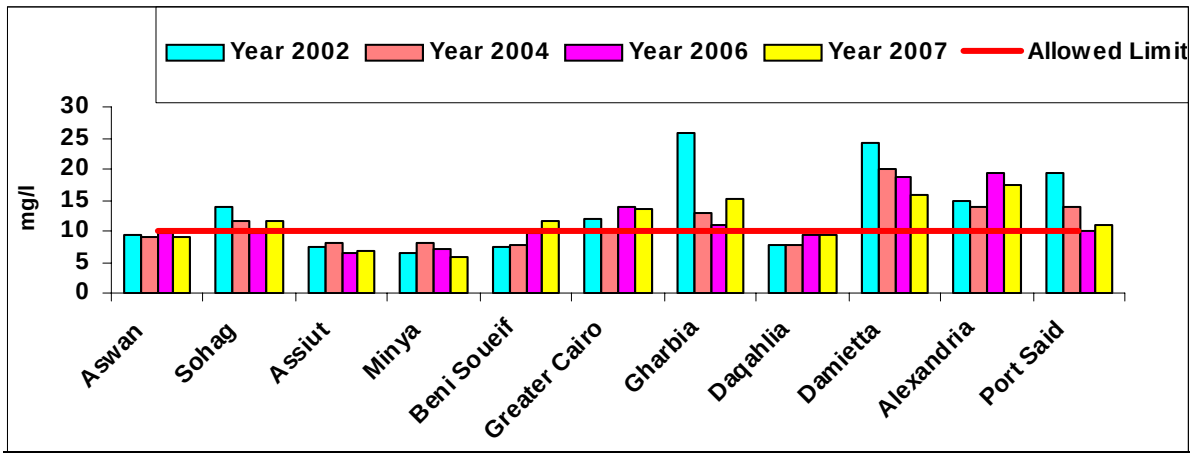

Fig (5.4) Comparison of the results of average organic load expressed in COD among Egypt governorates in 2002-2007

3. Monitoring results demonstrated that dissolved oxygen (DO) concentrations in all governorates are still above the minimum allowed limit for water quality (5 mg/l) as shown in Figure (5.5). The increase of DO level is an evidence of good water quality.

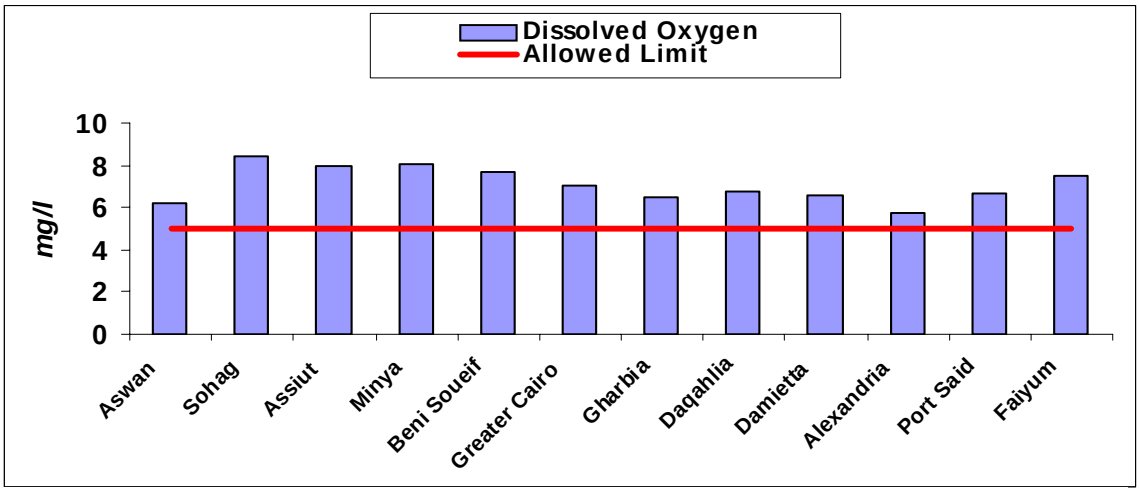

Fig (5.5) Comparison of average DO concentrations among Egypt governorates in 2007

4. Nutrient (ammonia, nitrates, phosphates) concentrations were within limits at 80-90% of the monitoring points. Ammonia concentrations were less than allowed (0.5 mg/l), but were higher than allowed in 2 points on Damietta Branch at 0.6 and 1.6 mg/l. Yet, they were less than last year's where 4 points were higher than permissible levels, ranging between 1.26 and 2.25 mg/l. In Rashid Branch, the concentrations exceeded the limits in three points, ranging between 0.56 and 0.82 mg/l. Yet, it is less than last year's where 5 points recording concentrations ranging between 1.54 and 1.90 mg/l. This may be due to agricultural drainage loaded with sewage wastewater discharging into Damietta and Rashid Branches. Nitrates concentrations ranged between 0.008 and 1 mg/l, although the allowed limit is 45 mg/l. Results also showed that phosphates concentrations ranged between 0.015 and 0.5 mg/l, whereas the allowed level is 1 mg/l.
5. Results showed that the annual average for fluorides and sulfates was within allowed levels in all monitoring points, with average fluorides concentrations in different governorates ranging between 0.12 and 0.47 mg/l, though the maximum allowed level is 0.5 mg/l, and sulfates between 13.8 and 66.6 mg/l. It is noted that increased sulfate concentrations is usually at water plant intakes which are affected by the drainage of the plants themselves, which are mostly located near the intakes. It is worth mentioning that this concentration is much less than the maximum level allowed of 200 mg/l.
6. TDS concentrations ranged between 145 mg/l and 416 mg/l as last year, whereas the allowed standard is 500 mg/l.
7. There were no traces of heavy metals (lead, chromium, cadmium) where readings of measuring equipment were less than the equipment minimum reading in most monitoring points. Average iron concentrations were between 0.001 and 0.69 mg/l, less than the allowed level (1 mg/l). Maximum manganese concentration was 0.1 mg/l, less than the allowed level (0.5 mg/l).

Efforts Made to Prevent Pollution of Freshwater and Lakes

MSEA makes more effort to improve water quality and treat sanitary drainage in coordination with line ministries focusing on improving the water quality of the River Nile, the main source for potable water in Egypt. Thus, MSEA is working at three levels to improve Nile water quality, which are: preventing drainage of untreated industrial effluence and sewage into the Nile and canals leading to it, as well as using treated sewage water in cultivating woods; improving agricultural drain water quality before pumping into water canals; and intensifying regular monitoring to control water quality changes. This can find proof in MSEA efforts to develop plans for eliminating pollution sources on the River Nile as follows:

A– Industrial Effluence

Industrial facilities are monitored and inspected on a regular basis, with 1513 inspections held in 2007. This helped in improving the quality of water significantly, as the rate of conformant drainage into the Nile was 99.57% of the total drainage. Moreover, industrial effluence was stopped by 0.23%, either through closing drainage offtakes or transferring it to the main sanitation network. For the remaining 0.2%, EEAA and RBOs follow industrial facility compliance plans to stop their effluence. Additionally, all necessary legal measures are taken against violating companies according to Law 4/1994 on Environment Protection and Law 48/1982 on Protecting Water Courses against Pollution.

B– Sanitary Drainage

MSEA, through its RBOs, carries out regular inspections on facilities discharging into drains and also on sanitary treatment plants. Legal measures are taken against violating facilities which are compelled to develop treatment units to comply with the environmental regulations. MSEA coordinates with relevant bodies in governorates to take necessary measures to remove solid wastes from drains, such as purification and waste lifting operations.

Coordination is made with the Ministry of Housing, Utilities and Urban Development (MOHUUD) to implement sanitation networks in cities and villages all over Egypt and provide financial allocations that help complete them in order to prevent random sanitary drainage, following which a plan was made to implement sanitation projects. MOHUUD, after developing a statement by line ministries on villages deprived from sanitary drainage services, assigned the implementation of such projects in 430 villages and satellites, the establishment of 61 new treatment plants, the upgrade of 113 existing plants, and the implementation of extensions in 17 treatment plants all over Egypt as Phase I during 2006/2007 to specialized contracting companies.

An experiment was carried out to use iron chloride in the sanitation treatment plant in Abou Rawash as follows:

- Forming a higher committee including EEAA, MOHP, MWRI, Environment and Water Police, MOHUUD, and the Holding Company for Potable Water and Sanitation to study how iron chloride can be used to increase treatment plant efficiency.
- MSEA financed the study where 100 tons of iron chloride were used during the implementation of this experiment.

- The experiment proved significantly successful through the decline in ammonia, TSS, and organic substances presented as BOD and COD levels in treated sanitation. Coordination was made with MOHUUD to replicate the experiment in primary treatment plants in all governorates, while continuation in Abou Rawash plant to decrease the organic load to Rahawy drain which discharges into Rashid Branch.

Coordination is also made with line ministries to develop the necessary plan for establishing treatment plants for sanitation-deprived villages, taking the following into consideration:

- Working in integrated scopes in each governorate for environmental improvement to be tangible.
- Conducting EIA studies before establishment.
- Providing areas and infrastructure to use treated water in cultivating woods.

C– Nile Cruisers

Regular inspection is conducted on 300 Nile cruisers between Luxor and Aswan and legal measures are taken against violators. Inspections revealed that sanitation treatment units in most of these cruisers do not operate efficiently due to nonconformant treatment technology, which leads to treated water nonconformity to limits provided for in Law 48/1982. In addition, sewage tank capacity is inadequate for discharged amounts, and river harbors equipped for receiving liquid wastes from cruisers are insufficient for cruisers. Inspection is regularly conducted on such cruisers by inspection committees formed from EEAA and RBOs in participation with the GD Environment and Water Police, GD Tourism and Antiquities Police and EMUs. Inspection campaigns resulted in 739 reports of environmental violation by cruisers in 2007.

Furthermore, a technical study was conducted in coordination with the Ministry of Tourism to achieve compliance in sanitation conditions in Nile cruisers via collecting it along with bulge water in river lighters and pumping them into sanitation networks in cities where such cruisers pass. Implementation study is currently being conducted to absolutely eliminate cruiser discharge into the Nile.

D– River Harbors

- To the end of protecting the River Nile from pollution and combat pollution resulting from Nile cruisers, MSEA developed 5 river harbors in Cairo (Athar al-Nabi), Minya, Assiut, Sohag and finally Aswan (al-Aaqab, north Aswan) for collecting and treating liquid wastes from Nile cruisers instead of discharge into the Nile without treatment. MSEA handed over harbors in Minya, Assiut, Sohag and Aswan to respective governorates for management and operation, as per their establishment purpose, and to drain the resulting treated water for the cultivation of woods.
- MSEA, in addition to regularly following up its harbors, also follows up and coordinates with stakeholders on existing river harbor reception of Nile cruiser wastes and discharging them either into cities' sanitation network or trenches that are swept regularly.
- It also follows up harbors under establishment, where 60 collective harbors are being established along 4.8 km on Aswan's corniche in coordination with the Ministry of Tourism and Aswan Governorate, in order to reduce anchorage along the river and before previously established harbors, and to provide operation services for cruisers.

- Furthermore, a harbor was established in Komombo where Phase I of the sanitation project was finished. Phase II implementation is underway and will be finalized in parallel with the sewage treatment plant in Komombo, to which the harbor will be connected. Another harbor is being established in Edfu (1292 m long).
- Establishing a new harbor for tourist cruisers in Luxor (3.5 km long) is currently studied. Additionally, 4 harbors in Luxor and other 2 in Esna are under construction and will be operated after finalizing the sanitation project for the city.

E– Drains

Coordination is made with MWRI to upgrade drain efficiency and conduct experiments on treating their water by aeration units so as to examine its efficiency before replication, as well as sharing drain monitoring data to determine water quality and take corrective actions to eliminate contamination and prevent its sources from discharging into the drains.

F– Environmental Monitoring

An annual program is implemented to monitor the water quality of the River Nile and other hotspots on canals and drains to determine water quality and contamination so as to take necessary corrective actions.

G– Environmental Awareness, Media and Training

- EEAA provides a number of training programs for water course protection and some industrial facility staff.
- Awareness programs are implemented in youth centers and for students in different educational stages.
- MSEA, through its competent departments and EEAA/RBOs all over Egypt, holds awareness seminars and workshops to raise awareness on the importance of maintaining water sources, rationalizing water use, and to encourage reusing treated water in environmentally-safe activities and recycling it in industrial facilities for using it in different manufacturing processes of for watering gardens in such facilities.

H– Environmental Inspection

EEAA participates in enforcing laws on protecting different water resources from municipal and industrial pollution, and in amending necessary indicators in such laws to achieve maximum protection of water quality. This is done through coordination and formation of competent committees from stakeholders (MWRI, MOHUUD, MOHP, EEAA and Environment and Water Police) so as to find the best solutions for problems and pollutants affecting water quality in the Nile and water courses.

References

(1) **Ministry of Health and Population: Annual reports for the results of the national network for monitoring water pollution in the Nile and its branches (2000 - 2007)**

(2) **Ministry of State for Environmental Affairs: Annual reports of Nile water quality (2000 - 2005)**

(3) **Plan of the Ministry of Water Resources and Irrigation in the field of Nile Water protection**

(4) **National Environmental Action Plan (2002 - 2017)**

(5) **Environmental conditions report (2004 - 2005)**

(6) **Executive regulation of law no. 48 of 1982**

(7) **WHO recommendations on allowed limits of potable water quality**

(8) **Recommendations of the higher committee of potable water on allowed limits of potable water quality for 1995**