Egypt Water Sector M&E Rapid Assessment Report

MISR CONSULT
Envir. & Infra Str. Studies

MEWINA
مشروع التقييم والمتابعة لقطاع المياه بدول شمال أفريقيا
Monitoring and Evaluation for Water in North Africa

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African Water Facility
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Mobilising Resources for Water in Africa

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Executive Summary

This report was prepared as part of the project entitled "The assessment of monitoring and evaluation systems and water indicators for 6 North African countries and 4 transboundary Basins", administered by The Center for Environment and Development for the Arab Region and Europe (CEDARE). The report was prepared by Misr Consult for Infrastructure Services as part of its consulting services to this project.

This report followed the guidelines and templates developed by the African Water Facility (AWF). It presents a diagnostic analysis of: water resources management (WRM), water supply and sanitation (WSS), and the existing monitoring and evaluation (M&E) system of the water sector in Egypt. The aim of the report is to analyze gaps and identify strategic objectives to improve Egypt's institutional capabilities to achieve effective IWRM and WSS services and realize the Millennium Development Goals (MDGs) and the Vision of Africa 2025, among other international targets. Aspects of governance, financial sustainability, and institutional capacity were part of the analysis. Key water related performance indicators as proposed by AMCOW Pan African water and sanitation monitoring, evaluation and reporting guidelines were a main part of this report.

Due to the time limitation allocated to prepare this document, Misr Consult has prepared brief questionnaires to gather the required information. These questionnaires were sent to project stakeholders in Egypt in order to gather the requested information. This was followed be a field visit and face-to-face interviews in order to discuss data availability, gaps, and challenges. Upon the receipt of the filled questionnaires, Misr Consult has prepared this document to contain all information required by the AWF and the performance indicators proposed by AMCOW Pan African M&E team.

Egypt is a country with limited water resources that cannot keep up with the current increase in all sectorial water demands without a well-planned and implemented IWRM that tackle the problems at hand with innovative solutions. As such, Egypt has formulated the National Water Resources Plan (NWRP) until the year 2017 and have formed the NWRP coordination platform (NWRP-CP) from members of all water related stakeholder ministries in Egypt in order to follow up the implementation of the plan and dynamically monitor the progress of the NWRP based on 120 indicators to follow up the implementation of the 39 measures of the plan and 15 indicators to assess the impacts.

The general objective of the NWRP-CP is to assist the various functional actors involved in NWRP implementation at central and de-central levels in getting the planning and decision making process on the ground for the efficient and timely implementation of the NWRP. This has created a receptive and supportive environment for the implementation of the NWRP with all stakeholders at different levels (central, de-central) and provided the first block towards a good M&E unit for the water sector in Egypt at large. It served building human and technical capacity that can be used in M&E&R of IWRM, WSS, and the State of the environment in Egypt. It also served in building enhanced capacity in the three pilot governorates of the project, and between central and de-central levels.

In terms of water supply and sanitation (WSS), Egypt has recently grouped all WSS stakeholders under the management of the newly formed Ministry of Drinking Water and Sanitation Facilities (MDWSF) to better coordinate, plan, budget, and finance new projects and operation and maintenance activities. Egypt has already achieved the MDGs for water supply and has planned to keep up with the increased demand of population for water supply. However, rural sanitation is still at 12% and the overall country coverage for sanitation is currently below 50%, making it difficult to achieve the MDGs for coverage of rural sanitation. Cost recovery has been enhanced in recent years and thus will help to better manage existing infrastructure.

In terms of M&E&R, Egypt is in a good position in terms of database infrastructure, technical, and human capacity. There is a synergy in data collection and annual reports containing many of the proposed water related indicators are already being produced by the Central Agency for Public Mobilization and Statistics

(CAPMAS) and by the Ministry of State of Environmental Affairs (MSEA). The two ministries share information with all water related agencies in Egypt.

It is logical that the NWRP-CP stretch their mandate to include an annual state of water rapid assessment report, making use of the existing database and capacity used for the M&E&R of the NWRP.

Finally, the assessments and proposals presented in this report have been based on information and data collected by the author, discussions with experts and senior managers in the water sector along with literature reviews and reference materials and guidelines prepared by several international agencies. Time constraints, the broad and complex nature of water governance, and lack of comprehensive, updated and concise data may cause some deviations from existing up-to-date reality.

Table of Contents

List of Tables

List of Figures

List of Appendices

List of Acronyms

AMCOW	African Ministers' Council on Water
Bm^3/yr	Billion cubic meters per year
BOT	Build, Operate and Transfer
CAPMAS	Central Agency for Public Mobilization and Statistics
CCRMP	Climate Change Risk Management Programme
DRI	Drainage Research Institute, NWRC
DSS	Decision Support System
DWB	District Water Board
EEAA	Egyptian Environmental Affairs Agency
EGP	Egyptian Pound
EPADP	Egyptian Public Authority for Drainage Projects
EWRA	Egyptian Water Regulatory Agency
FAO	Food and Agriculture Organization
FtC	Facing the Challenge strategy
GDP	Gross Domestic Product
GAFRD	General Authority for Fish Resources Development
GIS	Geographic Information System
GoE	Government of Egypt
GWS	Ground Water Sector, MWRI
HAD	High Aswan Dam
HDI	Human Development Index
IAS	Irrigation Advisory Services
IIIMP	Integrated Irrigation Improvement Management Project
IIP	Irrigation Improvement Project
IMT	Irrigation Management Transfer
IRU	Institutional Reform Unit
IWMD	Integrated Water Management District
IWMGD	Integrated Water Management General Directorate
IWRM	Integrated Water Resources Management
JMP	Joint Monitoring Program
MARS	Monitoring, Analysis and Reporting System
M&E	Monitoring and Evaluation

M&E&R	Monitoring and Evaluation and Reporting
m^3/yr	Cubic meter per year
MALR	Ministry of Agriculture and Land Reclamation
MDGs	Millennium Development Goals
MEWINA	Monitoring & Evaluation for Water in North Africa
MOEE	Ministry of Energy and Electricity
MoPIC	Ministry of Planning and International Cooperation
MHUUD	Ministry of Housing, Utilities, and Urban Development
mm/yr	millimeter per year
Mm^3/yr	Million cubic meters per year
MDWSF	Ministry of Drinking Water and Sanitation Facilities
MoHP	Ministry of Health and Population
MoIFT	Ministry of Industry and Foreign Trade
MoT	Ministry of Transport
MSEA	Ministry of State for Environmental Affairs
MWRI	Ministry of Water Resources and Irrigation
NAWQAM	National Water Quality and Availability Management
NBI	Nile Basin Initiative
NOPWASD	National Organization for Potable Water and Sewage Disposal
NSAS	Nubian Sandstone Aquifer System
NWRC	National Water Research Centre, MWRI
NWRP	National Water Resources Plan
NWRP-CP	National Water Resources Plan Coordination Panel
O&M	Operation and Maintenance
PPP	Public Private Partnership
RAR	Rapid Assessment Report
RWMA	Regional Water Management Administration
RWSS	Rural Water Supply and Sanitation
SRU	Strategic Research Unit, NWRC
SWERI	Soils, Water and Environmental Research Institute, MALR
UNDP	United Nations Development Program
UNESCO	United Nations Education, Science and Culture Organization
USAID	United States Agency for International Development
UWSS	Urban Water Supply and Sanitation

WB	Water Boards
WRM	Water Resources Management
WSS	Water Supply and Sanitation
WSI	Water Scarcity Index
WPI	Water Poverty Index
WUA	Water Users Association
WTP	Water Treatment Plant
WWTP	Waste Water Treatment Plant

1. Country Background

1.1. Geography

Egypt lies between latitudes 22° and 32°N, and longitudes 24° and 36°E. It is a transcontinental country situated mainly within North Africa, with its Sinai Peninsula forming a land bridge in Southwest Asia. Covering an area of about 1 million square kilometers, Egypt is bordered by the Mediterranean Sea to the north, the Red Sea to the east, Sudan to the south and Libya to the west (Figure 1).

Figure 1. Egypt Location showing border countries

1.2. Climate

Egypt has two seasons: a mild winter from November to April and a hot summer from May to October. In the coastal regions, temperatures range between an average minimum of l4°C in winter and an average maximum of 30° C in summer. Temperatures vary widely in the inland desert areas, especially in summer, when they may range from 7° C at night to 43° C during the day. During winter, temperatures in the desert fluctuate less dramatically, but they can be as low as 0° C at night and as high as l8° C during the day. The average annual temperature increases in the southward direction from the Delta to the Sudanese border, where temperatures are similar to those of the open deserts to the east and west. The general climate of Egypt is dry, hot, and desertic, with a mild winter season with rain over the coastal areas, and a hot and dry summer season. Data collected by the Egyptian Meteorological Authority and local universities for the period 1961 to 2000 indicate that there is a general trend towards warming of the air temperature, with increases in the number of hazy days, the misty days, turbidity of the atmosphere, frequency of sand storms and hot days, increasing the risk of water stress in Egypt (UNFCCC, 2010).

Most rain falls along the coast as indicated in Figure 2, but even the wettest area, around Alexandria, receives only about 200 mm of precipitation per year. Moving towards the south, the amount of precipitation decreases drastically. Cairo receives a little more than one cm of precipitation each year. The areas south of Cairo receive only traces of rainfall. This makes Egypt among the most arid countries in

Africa, with a severe water stress that is expected to even worsen due to climate change (Abd-Elshafy et al., 2010). Figure 2 depicts the rainfall distribution over Egypt.

Figure 2. Annual rainfall distribution over Egypt. Source: MWRI, 2005.

1.3. Population and Economic Indicators

Egypt is one of the most populous countries in Africa and the Middle East. The great majority of its over 82 million people (CAPMAS, 2012) live near the banks of the Nile River, an area of about 40 thousand square kilometers, where the only arable land is found. The current population growth is approximately 2.05% per year (CAPMAS, 2012).The large regions of the Sahara Desert, which constitute most of Egypt's territory, are sparsely inhabited. Nearly 43 % of Egypt's residents live in urban areas, with the most spread across the densely populated centers of greater Cairo, Alexandria and other major cities in the Nile Delta.

The economy of Egypt is one of the most diversified in the Middle East, with sectors such as tourism, agriculture, industry and services at almost equal production levels. The current GDP and HDI of Egypt are estimated to be 229 Billion US$ and 0.644, respectively. Main financial and development indicators are listed in Table 1.

Table1. Basic statistics for Egypt

Index	GDP [1] (2012)[2]		HDI (2011)[3]	WSI (2012)[4]	WPI (2011)[5]
	Total	Per capita			
Value	$229 billion[1]	$2,860	0.644 Rank = 112	Extreme stress Rank = 10	61.9

[1]GDP: $218 billion (2011) $200 billion (2010) and $180 billion (2009)
[2]Source: CAPMAS, 2012
[3]Source: (UNDP, 2013)
[4]Source: (Maplecroft, 2012)
[5]Source: (Estimated from Lawrence et al., 2002)

2. National Water Development Strategies and Policies

National strategies for Integrated Water Resources Management (IWRM), rural WSS and urban WSS exist in Egypt can be summarized as follows:

For IWRM, A National Water Resources Plan (NWRP) has been developed and approved in 2005 with the objective to describe how Egypt will safeguard its water resources in the future, both with respect to water quantity and quality, and how it will best use these resources from both socio-economic and environmental perspectives. The plan is based on an IWRM approach, taking into account the objectives of all water users, covering a period until 2017 (MWRI, 2005), and as presented in Appendix 1. By including the policy areas of other ministries, the plan was, in principle, 'owned' by all stakeholders involved. The NWRP also targeted enhancing planning capacity at the governorate level in the three pilot governorates of Qena, Fayoum, and Behira in line with the policy of decentralization to governorate level, as promoted by the Government of Egypt.

In 2010, a national strategy for the development and management of water resources until 2050 has been formulated (MWRI, 2010). The strategy has 6 pillars: (1) development of conventional and nonconventional water resources, (2) increase water use efficiency, (3) continue upgrading water resources infrastructure including hydraulic structures, (4) combat water resources pollution, (5) address climate change impacts and formulate adaptation strategies, and (6) enhance integrated water resources planning and management. A summary of the strategy is presented in Appendix 2.

In addition to the above, the Nile Pollution Prevention Programme (NPPP) was launched in July 1997 by the Ministry of State for Environmental Affairs (MSEA) to reduce industrial pollution to the Nile.

For rural and urban WSS, a program was launched to update the Regional Master Plans for all Egyptian governorates. The Master Plans, completed in 2009, offer a snapshot of the current situation of the provision of WSS services, and a twofold investment plan to satisfy water and sanitation needs of the population in the medium and long-term plans up to 2037. Those Regional Master Plans have been compiled to develop a national strategy for water and sanitation including its first Rural Sanitation Strategy (NSWSS, 2009 as per Appendix 3). This is mainly to ensure an efficient capital investment and the rational use of the available water resources. (HCWW, 2013).

In addition, the Ministry of Agriculture and Land Reclamation (MALR) has also formulated its strategy until 2030 (MALR, 2009) which has profound impacts on water withdrawal in a country that uses close to 85% of its water in agriculture (Appendix 4).Among the strategic objectives is to sustain the use of natural agricultural resources; increase the productivity per units of both land and water. It proposes increasing water-use efficiency in agriculture via improved field irrigation systems, and reducing are as allocated for producing rice. The estimated saved quantities of water, as per the strategy estimates, could reach 5.3 and 12.4 billion cubic meters assuming that areas benefiting from irrigation improvements are about 2,250 million Fadden to be increased to five million Fadden by the years 2017 and 2030, respectively. The conserved water can be used towards expanding reclaimed areas. It is estimated that about 1,250 million Fadden will be reclaimed by 2017 to increase to 3.10 million Fadden by 2030. The strategy also recommends maximizing the sustainable returns of rain fed agriculture by providing an area of 350 thousand Fadden with supplementary source of irrigation to grow drought-tolerant crops, such as barely, olives and figs. It also calls for maintaining and protecting agricultural land from a) sprawl and encroachment of human settlements, and b) degradation of soil fertility. Furthermore, the strategy addresses issues related to livestock, poultry and fisheries. The strategy includes several supportive measures, such as developing capacities, institutional reform, etc. (Appendix 4).

In 2013, a new Climate Change Adaptation Strategy for the water sector in Egypt was formulated focusing on climate change impacts, possible scenarios, and adaptation measures.

The above policies and strategies have been influenced by the country's need to further develop it economy and people welfare and, in addition, by other global initiatives such the MDGs and the African Water Vision 2025. For example, the WSS strategies endeavor to ensure Environmental Sustainability which is one of the MDGs by providing safe drinking water and sanitation facilities to all of the country population. The above plans also focus on poverty reduction by providing water to all users in time with right amount and quality. This in turn helps sectors such as agriculture and industry to achieve a higher income which is positively reflected on population's wellbeing and income.

The government is adopting the African Water Vision 2025 and millennium development goals (MDGs) as targets for the above policies and strategies influencing monitoring and evaluation (M&E) of water sector (HCWW, 2013). It is also worth noting that polices in Egypt do not explicitly address gender equity.

Based on the national policies, each involved ministry develops its own sectorial policy and 5- year plan as follows (MWRI, 2005):

Ministry of Water Resources and Irrigation (MWRI):

1. Objectives of the plan: reach best possible benefits of available water resources in terms of the supply of good drinking water, the support of the development in various economic sectors and the protection of the inland aquatic environment.
2. Elements of the plan:

- Increase of water supply from rainfall and flash flood harvesting, ground water sustainable development, agriculture drainage and wastewater reuse, and desalination
- Support horizontal expansion goals of the government
- Improve water management by user participation, new technologies and privatization
- Improve coordination with other agencies
- Increase public awareness
- Fulfill international agreements

Ministry of Agriculture and Land Reclamation (MALR):

1. Objectives of the plan: to improve food security and increase national agricultural production through maximizing the net return per unit of water (maximum crop per drop)
2. Elements of the plan:

- Continue the policy of liberalization and demand management
- Increase irrigation area as water availability permits
- Increase farmers participation in the management of irrigation systems

Ministry of Housing, Utilities, and Urban Development (MHUUD):

1. Objectives: to provide sufficient drinking water of good quality to the population and to treat the municipal wastewater in such a way that the discharge of the effluent does not pose and health or environmental risks.
2. Elements of the plan:

- Increase the number of water treatment plants and increase the capacity of existing plants
- Increase the number and capacity of wastewater treatment plants and to reuse more of the treated wastewater
- Give priority to municipal and industrial water supply in River Nile water and groundwater allocations
- Minimize water losses in distribution networks

In addition, all water concerned ministries are in the process of preparing sectorial strategies which must include action plans rather than 5-year plans (Ahmed and El-Kadi, 2013).

3. Water Sector Overview

3.1. Water Resources and Their Uses

3.1.1. Surface Water

Egypt receives more than 95% of its fresh water resources form River Nile, which originates outside its international borders. River Nile has been the lifeblood for Egypt since the cradle of civilizations, noting that Egypt is the estuary state for the Nile River, which runs in 11 African countries with a length of about 6700 km. The average annual yield of the river is estimated to be 84 Bm^3/yr at Aswan. This yield is subject to wide seasonal variations. Out of this yield, Egypt's annual share of the river water is determined by international agreements to be 55.5 Bm^3/yr (FAO, 2013; MWRI, 2005).

The major control structures on the Nile in Egypt include the High Aswan Dam (HAD), the old Aswan dam, and a number of downstream barrages. The old Aswan dam has a storage volume of 5 Bm^3/yr. The HAD was built upstream of the old Aswan dam with a storage reservoir (Lake Nasser) that has a live storage approaching 90 Bm^3/yr (Table 2) (MWRI, 2005).

Table 2. Storage capacity of Lake Nasser upstream of HAD

Storage zone	Level (above MSL)	Volume (BCM)	Cum. volume (BCM)
Dead storage	< 147	31.6	31.6
Active storage	147 – 175	89.7	121.3
Flood control storage	175 – 178	16.2	137.5
Maximum surcharge storage	178 – 183	31.4	168.9

Downstream of Aswan, the water levels and water distribution are controlled by a number of barrages. These barrages have locks to allow the passage of boats. There exists a fairly complex canal system that diverts water just upstream of the barrages into irrigation directorates. These canals have regulators or weirs at intervals depending on their slopes and the locations of the lower order canals. The canal system in Egypt is very extensive, in particular in the Delta area. Branch canals that take off from the main or lateral canals deliver the water to smaller distributary canals, which in turn deliver water to the mesqas. In addition, there are over 100 big pumping stations along the system to deal with elevation differences. A thorough description of the water distribution and drainage system in Egypt can be found in the NWRP (Appendix 1).

Rainfall in Egypt is very scarce except in a narrow band along the northern coastal areas (Figure 2), where limited rain-fed agriculture is practiced. Rainfall occurs in winter in the form of scattered showers along the Mediterranean shoreline. The total effective rainfall used for drinking water and agriculture is about 1.3 BM^3/yr (MWRI, 2005).

3.1.2. Groundwater

The contribution of groundwater to total water supply in Egypt has been very moderate over the years; however, it remains to be an important freshwater resource. It is the sole source of water for people living in the Egyptian desert. The main groundwater systems in Egypt are: Nile aquifer system, Nubian Sandstone Aquifer System (NSAS), the fissured carbonate aquifer, the coastal aquifer, the Moghra aquifer, and the Hardrock aquifer system (Figure 3).

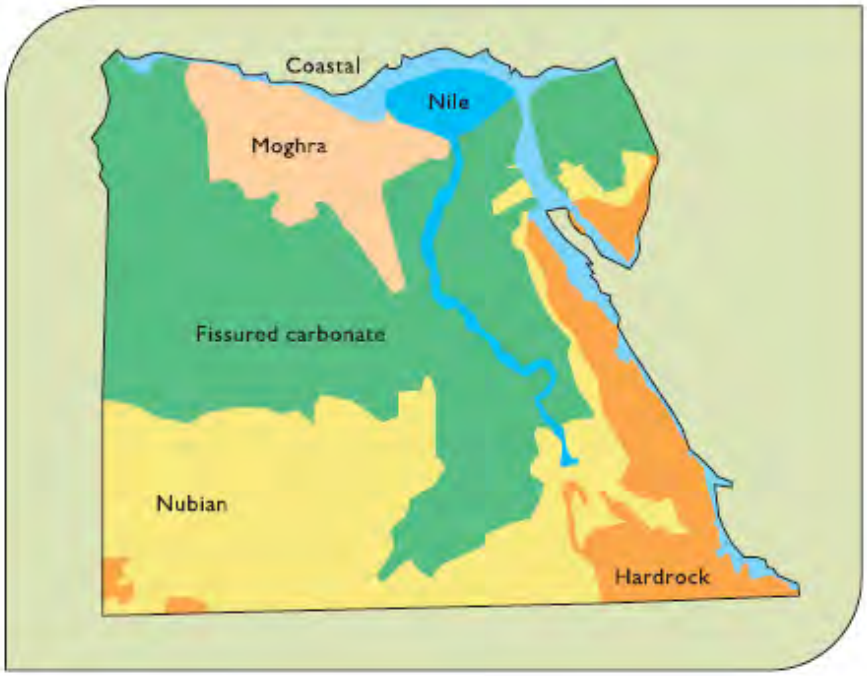


Figure 3. Egypt groundwater systems

Groundwater in the Nile aquifer gets its water from percolation losses from irrigated lands and seepage losses from irrigation canals. Therefore, it can be considered as a reservoir in the Nile River system with over 6.1 BCM per year of rechargeable live storage (CEDARE, 2011). Groundwater also exists in the non-renewable deep aquifers in the Western Desert region and Sinai with the current total abstraction estimated at only 1.65 BCM per year (CEDARE, 2011).

The NSAS covers an area of more than two million square kilometers of Northeast Africa, of which 235,000 km^2 (11%) are in Chad, 828,000 km^2 (38%) in Egypt, 760,000 km^2 (34%) in Libya, and 376,000 km^2 (17%) in Sudan. It is bounded by longitudes 18° and 34° from East to West and by latitude 14° and 33° from south to north. The 2011Egyptian annual withdrawal amounted for 1.5 Bm^3 /yr.

3.1.3. Non-conventional water resources

Reuse of drainage water in the Nile Delta has been adopted as an official policy since the late seventies. The policy calls for recycling agriculture drainage water by pumping it from main and branch drains and mixing it with fresh water in main and branch canals. There has been a decreasing trend in the amounts of water pumped into the sea with a significant increase in the amounts of drainage water reused recently as the reused quantity amounts to more than 7.0 Bm^3/yr in 2011(Omar, 2011; MWRI, 2005). The reuse of agricultural drainage water and of treated sewage water cannot be considered independent resources. However, they help augment the fresh water supply in certain regions. This recycling process of the previously used Nile fresh water improves the overall efficiency of the water distribution system (Ahmed and El-Kadi, 2013; MWRI, 2005).

Treated wastewater reuse: Egypt has adopted a policy of wastewater reclamation and reuse in irrigated agricultural land to alleviate the pressure imposed by increasing demands on freshwater resources. It is becoming part of integrated water resources management policy. The Egyptian water strategy comprises the treatment and reuse of treated wastewater. Treatment of domestic wastewater is either primary or secondary. Currently, Egypt produces over 5.5 Bm^3/yr. of that amount, about 2.97 Bm^3/yr is treated, but only 0.7 Bm^3/yr is utilized for agriculture (0.26 Bm^3/yr is undergoing secondary treatment and 0.44 Bm^3/yr undergoing primary treatment) (Abdelwahab and Omar, 2011; MWRI water strategy for 2050).

Desalination: Seawater obviously is available in unlimited quantities in coastal areas. It is expected that desalination plants for drinking water and industrial use in coastal areas will be developed as the demands grow. The total amount of desalinated water in Egypt in 2012 was estimated at 60 Mm^3/yr (Moawad, 2012; MWRI water strategy for 2050).

3.1.4. Water Uses

Egypt's water demands rapidly increase due to the increase in population and the improvement of living standards as well as to achieve the government policies to reclaim new lands and to encourage industrial development. The major water consumers are agricultural, domestic, and industrial user. Water is also extremely important for energy production, navigation, tourism and recreation, fisheries and the preservation of valuable nature areas. In the following sections a description of the water uses in Egypt is illustrated.

Irrigated Agriculture

The agricultural sector is the largest user, and consumer, of water in Egypt, with its share approaching 85% of the total demand for water (MWRI, 2005). Therefore, land and water policies have been focused on agriculture. The agriculture land base consists of old land in the Nile Valley and Delta, rain fed areas, several oases, and lands reclaimed from the desert. The total area of irrigated land in 2011 was 8.6 million feddans with a present demand of 60.9 Bm^3/yr (CAPMAS, 2012). This makes the average water consumption per feddan about 7500 m^3/ feddan/yr.

Industry

Industry is a growing sector in the national economy of Egypt. Further industrial development is expected to play a major role in the socio-economic development of the country, providing employment for a large part of the growing population. It is estimated that the water requirement for the industrial sector during the year 2011 was 7.5 BCM per year (most of which returns back to the system through agriculture drains and sanitary sewer system); making the net industrial water demand about 1.2 Bm^3/yr in 2011 (CAPMAS, 2012).

Domestic Use

Domestic water requirements include water supply for major urban and rural villages. A part of that water comes from the Nile system, either through canals or direct intakes on the river; the other part comes from groundwater sources or desalination plants. The total municipal water use is estimated to be 8.9 BM^3/yr in 2011 (HCWW, 2013; EWRA, 2011). A portion of that water is actually consumed and the rest returns back to the system, either through the sewage collection system or by seepage to the groundwater. There are regions like Alexandria, Suez Canal, and desert areas where that discharge cannot be recovered.

Navigation

The river Nile and part of the irrigation network are used for navigation. The present policy is that there is no exclusive release for navigation. There is, however, a guaranteed minimum release (75 Mm^3/day) from the HAD, which is also required for some drinking water intakes along the Nile.

Energy (Hydropower):

The total existing hydropower capacity is about 2.81 GW, producing about 24% of the national electricity demand (CAPMAS, 2012; MOEE, 2011). This capacity is gradually growing. Water has not been released from the High Aswan Dam exclusively for the generation of hydropower since 1990. The production of hydropower can be considered to be a by-product of the releases for irrigation, municipal, and industrial water uses. There is no water loss in the hydropower generation, contrary to the thermal power stations where large amounts of cooling water are lost by evaporation.

Water Balance:

Since 1997, Egypt fell below the international standard of water scarcity of water scarcity 1,000 m^3/person/year. The 2011 per capita share was estimated at 700 m^3/person/year. This is expected to decrease year after year due to the limited water resources in Egypt and the demand increase of all users. By considering the expected population growth, this value is estimated to become 350 m^3/person/year in 2040 without even accounting for climate change consequences that may drive the value even lower (Value predicted based on constant renewable water resources and a population increase of 22 % per year). This will likely result in relying on more water reuse year after year potting the society at the higher pollution risk and increasing water cost by pumping water over and over again. Table 3 summarizes the 2011 water balance of Egypt (MWRI, 2005; CAPMAS, 2012, HCWW, 2013).

Despite the balance between water resources and water uses, there is an evident imbalance between supply (renewable water resources) and demand (water withdrawals). It shows that over 21% of the water demand is being met by reused/ reclaimed agricultural drainage and treated wastewater of questionable quality. This comes at the cost of water quality issues and energy cost by re-pumping water particles over and over again for reuse purposes.

Table 3. Water Balance in Egypt (2011)

Water Resources (2011) Bm^3/yr		Water Demands (2011) Bm^3/yr	
River Nile	55.5	[1]Irrigated Agriculture	40.4
Rain Harvesting	1.3	[2]Domestic	1.9
Desalination	0.15	[3]Industry	1.4
Non-renewable groundwater	2.4	Evaporation downstream Lake Nasser	3.0
		Drainage water to Mediterranean Sea	12.45
		Environmental uses	0.2
Total available water	**59.35**	**Total demand**	**59.35**

[1] Actual withdrawal for irrigation amounts for 65 Bm^3/yr
[2] Actual domestic water withdrawals is estimated at 9 Bm^3/yr
[3] Actual Industrial water withdrawals amounts for 7.4 Bm^3/yr
*Sources of information (MWRI water strategy for 2050; CAPMAS, 2012; HCWW, 2012, estimates made by MWRI, 2005; CEDARE, 2011; EWRA, 2011)

3.2. Water Supply

Drinking Water Supply and Sanitation (WSS) in Egypt has been reformed since 2004 by establishing the HCWW by Presidential Decree no. 135/2004 and the Egyptian Water Regulatory Agency (EWRA) by Presidential Decree no. 136/2004, and by transforming Egypt municipalities into subsidiary companies of the HCWW, reaching 25 subsidiary companies in 2011. In 2012, another enhancement in the governance of the WSS was achieved by inaugurating the Ministry of Drinking Water and Sanitation Facilities (MDWSF) by Presidential Decree 178/2012. By this inauguration, HCWW and EWRA has become part of the MDWSF.

In terms of water supply, achievements include an increase of piped water supply to 99% in urban and rural areas (HCWW, 2013; EWRA, 2011) in 2011. Currently, the Sources of the water supply are the River Nile, groundwater, and desalinated sea water. Figure 4 shows the contribution of each source.

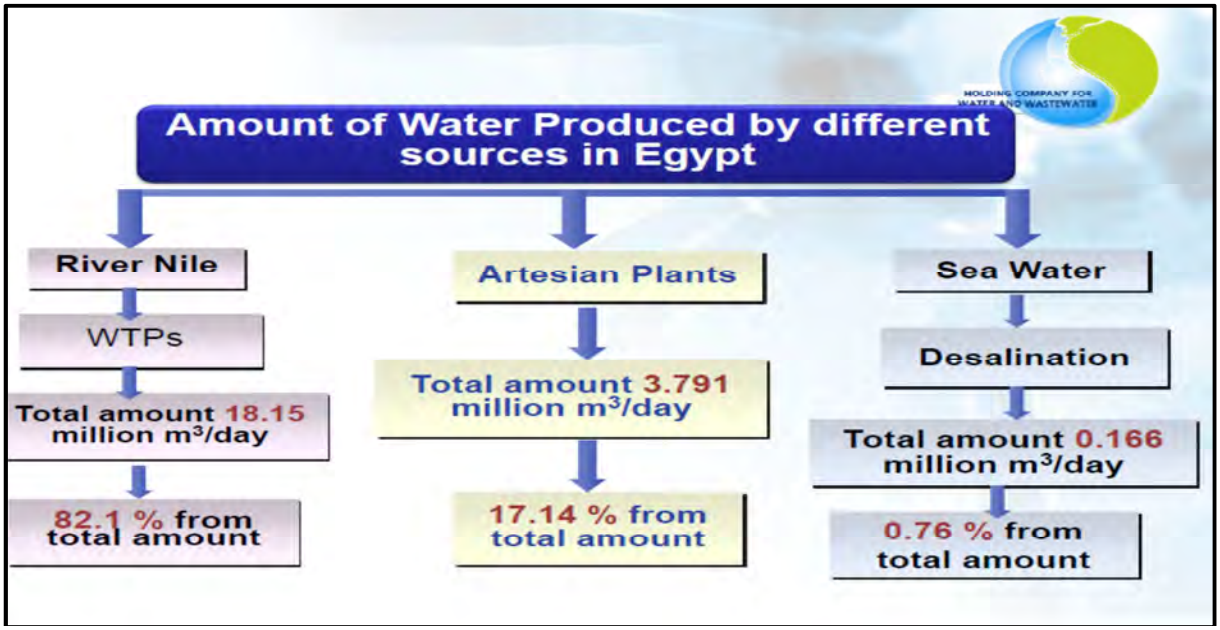


Figure 4: Contribution of water supply sources in Egypt (2011)

The per capita consumption in Egypt has a wide range spanning 230 to 756 l/c/d, with a country-wide average value of 300 l/c/d. The water transmission and distribution losses amounted for 31% of the produced amount of water in 2011 (HCWW, 2013; EWRA, 2011). This is estimated to be partially due to pipe leakage and partially due to unaccounted for water users as it is calculated by subtracting amount of water sold from amount of water produced (EWRA, 2011).

Table 4: Water supply status in Egypt (EWRA, 2011)

Item	Year 2011/2012
*No. of Subsidiary Companies	25
*Number of Employees	27 per 1000 connection
Served Population (million)	83.4
Water supply coverage (%)	99
No. of house connection (million)	12.7
Network Length (km)	146,000
Design Capacity For Water plants (Mm^3 per day)	33.1
Average produced water (Mm^3 per day)	24.4
No. of Water Treatment Plants	2593

*Value is for both water supply and sanitation

The governance, finance, and operation and maintenance of water supply and sanitation facilities are being grouped with no clear separation between water facilities and wastewater facilities.

Investments in WSS for Egypt mainly comes from government funding and international donors like the world bank, USAID, German fund, Swiss fund, and the likes. More recently public private partnership (PPP) started to play a small role in capital investment. Operation and maintenance budgets are subsidized by the government with a cost recovery reaching 66% in 2011 (EWRA, 2011).

Investments in WSS: Prior to the revolution, the combined annual budget of the two bodies procuring new water and wastewater infrastructure – the National Organisation for Potable Water and Sanitary Drainage (NOPWASD) and the Cairo and Alexandria Potable Water Organisation (CAPWO) – was in the region of EGP14 billion ($2.3 billion) in 2010. This dropped sharply to EGP8.8 billion ($1.4billion) in 2011 and EGP8.9

billion ($1.3billion) in 2012 – a significant setback to the country's ambitious building plans.Water and wastewater planners have now had to turn their eyes to less capital intensive projects due to the restrictions in yearly budgets. The Holding Company for Water and Wastewater has also had to adjust its master plan for extending water and wastewater coverage to reflect the fact that new capacity building is likely to be delayed in the short term (CAPMAS, 2012; GWI, 2012).

The National Master Plan for Water Supply and Sanitation conservatively estimates the investment needed for the 30 years after 2007 at about Euro 20 billion, out of which almost two thirds will be required for sanitation (NSWSS, 2009).

In order to set strategic targets for the future years, the HCWW, with the financial support of the EU, launched a program to update Regional Master Plans for all Egyptian governorates. Master plans, completed in 2009, not only offer a snapshot of the current situation of the provision of water and sanitation services, but through a process of technical, economic, social and environmental analysis, they provide a twofold investment plan to satisfy water and sanitation needs of the population in the medium (2007-2012) and long-term (2012-2037). In this exercise, the HCWW coordinated and validated the work of several Egyptian consultants hired for the execution of 26 Regional Master Plans. Subsequently Regional Master Plans have been compiled in order to develop a national strategy for water and sanitation. National priorities for capital investments have been defined building upon the outcomes of the Regional Master Plans. As a result, the HCWW has now a detailed capital investment program for the short, medium and long term. The National Master Plan for Water Supply and Sanitation estimates the investment needs for the 30 years after 2007 at about Euro 20 billion, out of which almost two thirds will be required for sanitation. The Master plans target to cover the sanitation in the urban areas by 2017 and in rural areas by 2022.

Egypt has already achieved the Millennium Development Goals (MDGs) with respect to water supply. The government is taking into consideration the MDGs as targets for improvements.

The JMP prepared a list of core questions on drinking-water and sanitation for household surveys for use in comprehensive surveys that include questions on drinking-water and sanitation. If national and sub national household surveys use the questions and response categories in this guide, this will help to improve survey comparability over time and harmonize them with international monitoring programmes, including the JMP. These harmonized questions are derived from an in-depth study of several international survey instruments. The questions were developed by the JMP in collaboration with experts from three international survey programmes – the Demographic and Health Survey (DHS), the Multiple Indicator Cluster Survey (MICS) and the World Health Survey (WHS) – as well with selected members of the JMP Technical Advisory Group (TAG). The DHS, MICS and WHS have adopted these harmonized questions to solve the comparability problems that previously existed across the different surveys (Appendix 14). These set of standard questions targets categorizing and quantifying water supply coverage into improved access (piped water into dwelling, plot or yard; public tap/standpipe; tube well/borehole; protected dug well; protected spring; rainwater collection; and bottled water only when the household uses water from an improved source for cooking and personal hygiene), and unimproved access (unprotected dug well; unprotected spring; cart with small tank/drum; bottled water from unimproved sources; tanker-truck; and surface water (river, dam, lake, pond, stream, canal, irrigation channels).

Table 5 displays a comparison between Egyptian reported water coverage values and that of the MDGs for the year 2011.

Table 5. A comparison between water supply coverage reported by the Egyptian government and JMP

Indicator	Access to improved water supply	2011	Comments
EWRI	Number of households provided with uninterrupted water supply / total number of households	Urban: 100% Rural: 99% Total: 99%	Values are reported based on 83.4 Millions
Joint Monitoring Program, JMP	Number of people having piped water into dwelling, into yard, public tap or standpipe, tubewell or borehole, dug well, protected spring & rainwater / total number of people	Urban: 100% Rural: 99% Total: 99%	Values are reported based on 85.537 Millions

3.3. Sanitation

Sanitation systems including collection, transport, treatment, effluent reuse and disposal works have been constructed in parallel with water supply networks with the major objective of protecting public health and the environment, providing a supplemental renewable source of water, and hence, freeing the over-mined groundwater aquifers.

Egypt has managed to eliminate open defecation in rural areas and in general a relatively high level of investment in infrastructure is being secured. For Sanitation, great achievements have been accomplished but not at the same rate of water supply. Average coverage in 2011 was about 59.7 % with 99% and 30 % coverage in the urban and rural areas, respectively. Table 5 summarizes the status of the sanitation sector in Egypt.

Table 6: Sanitation sector status in Egypt (2011)

Item	Year 2011/2012
*No. of Subsidiary Companies	24
*Number of Employees	27 per 1000 connection
Design Capacity of wastewater treatment Plants (Mm^3 per day)	12.6
Actual amount of treated wastewater (Mm^3 per day)	9.8
Number of wastewater treatment Plants	378
Network Length (km)	40,800 km

*Value is for both water supply and sanitation

As mentioned earlier; the governance, finance, and operation and maintenance of water supply and sanitation facilities are being grouped with no clear separation between water facilities and wastewater facilities. As such, investments for WSS are reported in Section 3.2. Operation and maintenance budgets are subsidized by the government with a cost recovery reaching 56% in 2011 (EWRA, 2011).

Charity organizations started to play a key role in funding sanitation projects. However, these efforts are not well organized to maximize benefits and preserve public health. The MDGs in terms of urban sanitation has already been achieved. However, it's unlikely; especially with the current reduction in capital budget; that the country will achieve the MDGs targets for rural sanitation.

Definitions of WSS coverages in Egypt are similar to the UNICEF JMP definition for water supply but different for sanitation as described in Sections 7 and 8. Table 7 presents a comparison between sanitation coverage reported by the EWRA and JMP values (Appendix 14). JMP classifies coverage, based on a set of harmonized questions utilized in a standard survey as per Appendix 14, into improved sanitation

(flush/pour flush to: piped sewer system, septic tank, pit latrine, and unknown place/not known where; VIP latrine; pit latrine with slab; and composting toilet), and unimproved sanitation (flush/pour flush to: elsewhere; pit latrine without slab/open pit; bucket; hanging toilet/hanging latrine; and no facilities or bush or field).

The difference in coverage arises from the Egyptian government counting only piped sewer connections to wastewater treatment plants.

Table 7. A comparison between sanitary coverage reported by the Egyptian government and JMP

Indicator	Access to improved sanitation	2011	Comments
EWRA	Number of households with improved access to sanitation / total number of households	Urban: 99% Rural: 30% Total: 59.67%	Values are reported based on 83.4 Millions
Joint Monitoring Program, JMP	Number of people having flush toilet, piped sewer system, flush to pit latrine, ventilated improved pit latrine, pit latrine with slab & composting toilet / total number of people	Urban: 97% Rural: 93% Total: 95%	Values are reported based on 85.537 Millions

4. Principal Issues in Water Sector

1) Trans-boundary issues: The Nile water is shared by 11 countries. They all aim to develop their own economies and improve the wellbeing of their people. The Nile Basin Initiative (NBI) was established in 1999 to improve the cooperation between the Nile riparian countries and plan the developments in the basin in a harmonized way. Despite the successes achieved by the NBI, full cooperation between the Nile riparian countries still needs more time to materialize. Egypt, being the last country in the downstream, is in a difficult situation as upstream developments can reduce the already limited available amount of water that it receives. The water dependency ratio in Egypt is above 97%, making the continuity of River Nile water critical for Egypt's survival. This puts a great pressure on the decision maker as to how to tackle this issue with a win-win resolution.

2) Limited water resources: As the population continues to grow steadily and development efforts are intensifying in order to produce food and raise standards of living, it is expected that water demand will continue to increase. This increase cannot be met by an increase in water resources. In fact, water resources can be reduced if issues such as climate change negative impacts and deterioration of water quality are not properly handled. This is also a challenge that has to be resolved by water sector in Egypt. As per Table 3, in 2012 Egypt was reusing 21% of its water resources. This value is expected to increase. As such, the National Water Resources Plan 2017 has focused on Integrated Water Resources Management (IWRM) approach to handle this problem by: decreasing the agricultural water consumption per feddan by 27% by 2017, increasing drainage water reuse to 11.4 Bm^3/yr, and increasing Groundwater recharge/withdrawal from to 8.4 Bm^3/yr by 2017. These are hard to achieve and still the question of what's after 2017 remains a challenge. More robust approaches have to be implemented in order to sustain enough water for Egypt in the future.

3) Water quality deterioration: another factor contributing to intensifying Egypt's water challenges is that environmental pollution is causing serious water quality deterioration, thus affecting public health and impairing the safe use of significant water resources for many purposes. The 21 % that are currently reclaimed/recycled is not of the best quality for use. More efforts have to be incorporated to prevent the illegal discharge of industrial waste in agricultural drains and to River Nile.

4) Climate change impacts on the Nile basin: there is a potential for a very significant reduction in Egypt's water supplies due to the negative impacts of climate change on the precipitation and temperature in the Nile basin. Across many studies, median or average results suggest a decrease in flow of the Nile. While it is possible that the flow of the Nile can increase under climate change, prudent planning should incorporate the risks of lower flows of the Nile. These projections of decreased flow come on top of projections of higher population and economic growth for Egypt, both of which could result in increased demand for water (Bellamy and Genena, 2013 UNFCCC, 2010; MWRI, 2005).

5) Climate change induced sea level rise may have significant impacts on the delta including altering ground water quality and soil salinization. Climate change induced sea level rise and consequent inundation and salination of surface and groundwater threaten Egypt's coastal areas. Sea level is likely to continue rising; the uncertainty is only about at what rate (i.e. how fast). This also could have a negative impact on the groundwater and existing desalination plants in addition to the loss of fertile agriculture lands. Direct and indirect impacts are expected to lead to the immigration of 6 to 7 million people from the Nile Delta. (UNFCCC, 2010; Nicolls et al., 1999).

6) Excessive subsidization: A great percentage of the development, operation and maintenance costs of water services in Egypt are funded by the government. These water services include the production, treatment, and distribution of water to various sectors which include irrigation, municipal, industrial, navigation, and hydropower. The comparably high public water expenditure for these sectors has led to an unsustainable demand for water, and promoted inefficient and inequitable dependency by water users on the government for funding water services and also, in most cases, to inefficient use of water.

Although there have been an enhancement in the WSS sector, water for agriculture in the old lands is still free of charge, causing a dilemma between sustainability of funding and social aspects.

7) Inappropriate governance and institutional Arrangements: Despite the recent efforts of the government to reform the water management system in Egypt, the system still suffer from the typical symptoms of inefficient management like duplication of efforts, centralization, uneconomical spending, wastage of skillful human resources, non-transparency and corruption. All of that leads to inappropriate decision making which has unfavorable impacts on the management of water in Egypt.

8) Fragmentation of agricultural landholdings: The agricultural landholdings in Egypt are fragmented, with the average size of farm units being less than 2.5 feddans down from 5 feddans in the 1960s. The unavailability of affordable housing in Egypt and the heritage rules will unfortunately decrease this share over and over again by time. Land fragmentation and the conversion of agriculture land to domestic and mini-industrial uses add to the water quality problems by imposing additional pollution loads to ground water and surface water from non-agricultural uses and from buildings with no sanitation systems.

9) Low sanitation coverage in rural Egypt: Rural Egypt constitute about 57% of the population (CAPMAS, 2012); yet only less than 30 % of this population is having access to improved sanitation; posing a great risk to public health and underground water resources.

10) Suboptimal Irrigation System: The irrigation system in Egypt suffers from: Unequal water distribution between head and tail-end farmers; poor maintenance of canals and mesqas; low yields; and low field application efficiencies. Decreasing evaporation losses will save some valuable amount of water and improving field efficiency might not impact the overall system efficiency but will provide better quality water than agricultural drainage water by reducing agricultural drainage and will save on the energy required for re-pumping the reduced amount of agricultural drainage water. This reuse of drainage water impact the soil quality and reduce the long term soil fertility.

11) Poor water quality in fish farms: By law fish farms utilize agricultural drainage water for fish breeding. It's not allowed to use fresh water in fish aquaculture without being used in irrigation first. The problem arises from the poor water quality of agricultural drains due to the discharge of untreated or partially treated domestic and industrial wastewater in these drains prior to being used in fish farming; resulting in a very low quality fish product that poses potential risk to frequent users and that do not add much to GDP because it cannot be exported despite being in abundance due to the poor fish quality.

5. Water Sector Institutional Framework

5.1. Water Resources

The water resources sector management in Egypt is centralized and is set to be managed by the Ministry of Water Resources and Irrigation (MWRI). The ministry website can be accessed at: http://www.mwri.gov.eg/. The main mandate of the MWRI is as follows:

- Formulate the water policies necessary for securing coverage of the water requirements for agriculture, industry, drinking, navigation and power sectors as well as other water requirements.
- Maintain all the available water resources, rationalize its use, maximize its revenues and increase its efficiency by using state-of-the-art technologies in managing water of the Nile River, the groundwater reservoirs, rainfall, torrents and drainage water that is usable according to specific standards.
- Control distribution of irrigation water; establish, operate and maintain grand barrages, and reservoirs and industrial works along the Nile River along with its branches, rayahat, canals, and irrigation and drainage networks. A good description of the hydraulic structures, irrigation and drainage systems in Egypt can be found in details in the NWRP for 2017 (MWRI, 2005) as summarized in Figure 5a.
- Improve and develop irrigation methods for the optimization of the available water resources.
- Maintain water quality and protect water from pollution.
- Increase Egypt's share from the Nile water by cooperation and coordination with the Nile basin countries to establish joint projects to polarize and make use of the lost water.

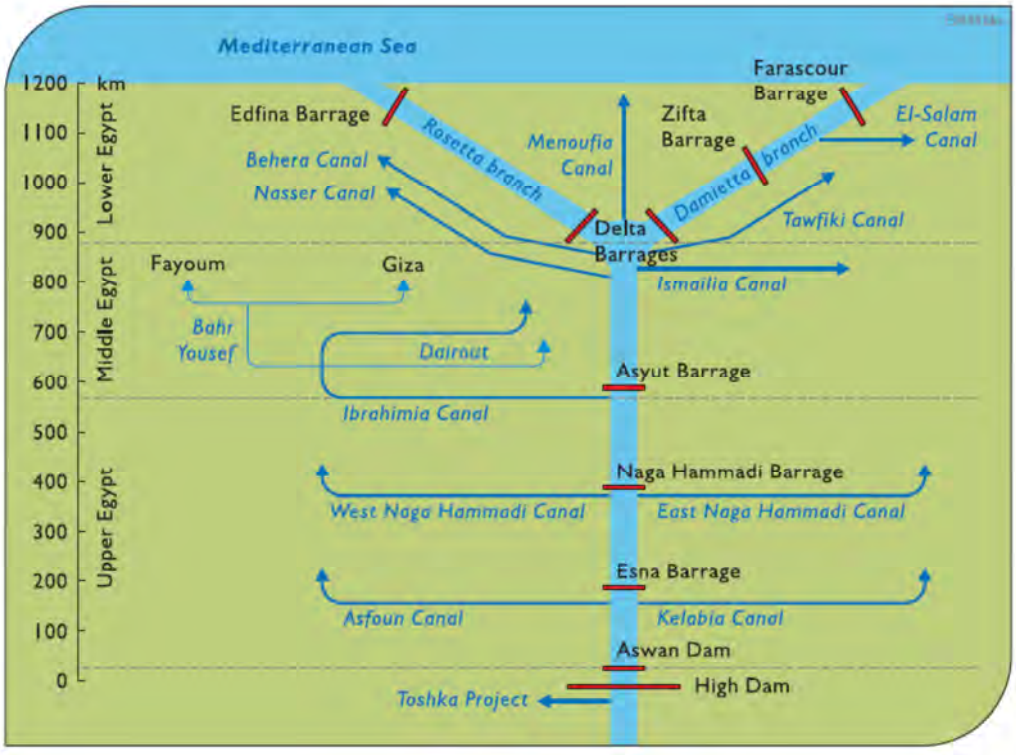


Figure 5a. Schematic diagram of the major control structures of River Nile in Egypt (Adapted from NWRP, 2005)

The ministry of water resources and Irrigation has a central organization in and around Cairo. The ministry has strategic and operational tasks. The operational tasks include both national activities (such as the implementation and operation of the Nile related infrastructure, the irrigation and drainage canals and the coastal lakes) and activities at district level.

The central organization of the Ministry includes various departments and sectors (Figures5b, 5c, and 5d). From the point of view of NWRP the most important are:

- Planning sector
- Nile water sector
- Irrigation department, including
  - Irrigation sector
  - Groundwater sector
  - Horizontal expansion projects sector
  - Irrigation improvement sector
  - Nile protection sector
- Egyptian public authority for high dam and Aswan reservoir
- Egyptian public authority for drainage projects (EPADP)
- Mechanical and electrical department (pumping stations)
- Water quality management unit (established during preparation of the NWRP)
- National water research Centre (NWRC)

MWRI distinguishes 22 irrigation directorates, subdivided into 62 inspectorates and about 206 districts. An inspectorate covers about 4 districts. The area of a district is between 20,000 and 60,000 feddan (about 40,000 – 100,000 farmers). Other organization units used in the management of irrigation are:

- Feeder canal level (between 10,000 – 100,000 feddan /15,000 – 150,000 farmers)
- Branch canal level (1,000 – 12,000 feddan/ 1,000 – 15,000 farmers)
- Mesqa level (between 10 – 100 feddan /less than 100 farmers)

For better decentralized management, integrated directorates have been formed in pilot governorates (about 10 are formed serving over 2.5 million feddans). The integrated directorate groups the irrigation, drainage, groundwater, and agriculture engineers under one management unit in order to better implement IWRM of the each directorate water resources.

An important department within the MWRI is the telemetry sector. The telemetry sector operates over 100 data-logger based and non data-logger based stations in River Nile (Appendix 15) to monitor inflows and outflows of the Integrated Water Management Districts (IWMDs), communicate with the HAD operators the required release, and monitor pump stations parameters. Data sensors and loggers are available at locations of irrigation structures and pumping stations. At irrigation structures, the system provided real or near real time information on water levels and flows. At the pumping stations, in addition to monitoring water level data, the system monitored changes in pump status, operating hours, and flow. Some data loggers also monitor water quality parameters (pH, conductivity, and dissolved oxygen) at some sites.

Participatory irrigation management has been practiced in Egypt for the past 2 decades. Water Users' Associations (WUA) have been established for increasing water use efficiency, through the involvement of all stakeholders, as much as possible, in the various management activities. A WUA join a group of farmers, all served by a common source of water, in order to participate in the allocation, distribution, and management of water.

WUAs are legal entities governed by the Law 213 in 1994, as specialized associations performing functions related to water management on mesqa level. The ministerial decree No. 14900 in 1995, issued by the Minister of Water Resources and Irrigation, reflects their functions, rights and duties in water management activities.

In general for every WUA, The board assembly, as well as the head of the mesqa is elected by the general meeting of the founders (i.e. members or farmers). Water users associations are empowered to act on

behalf of their members in their relations with local water management districts and local administrative entities, to solve problems of water supply, to conclude contracts for construction, repair, and maintain the irrigation schemes and facilities, as well as other contracts and transactions allowed by the existing legislations.

Water users associations have managerial, financial, and technical autonomy. They make their own budget and set the tariff for irrigation. They operate as independent legal entities, starting from the date of their registration. Hundreds of WUAs are now practicing participatory management with different levels of success.

Figure 5a. Organization chart of the MWRI in Egypt

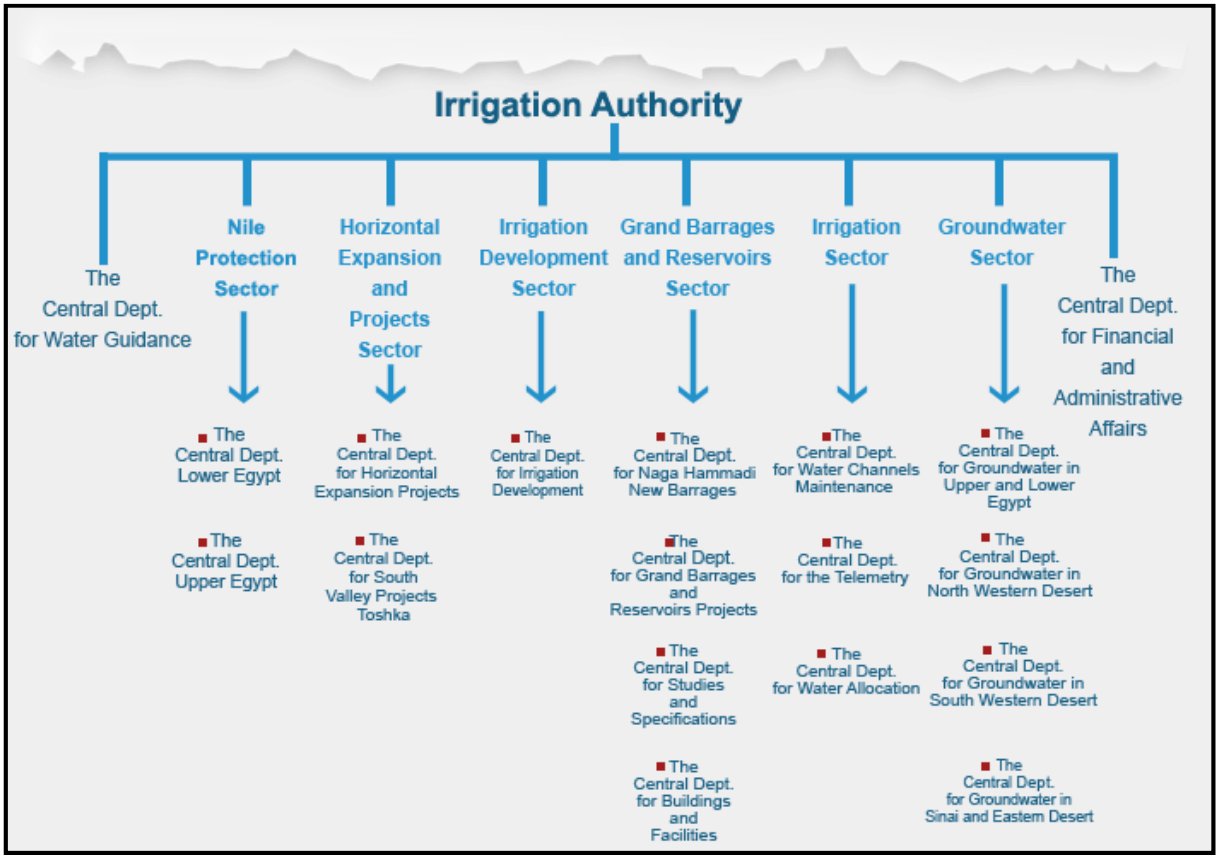


Figure 5b. Organization chart of the irrigation authority of MWRI

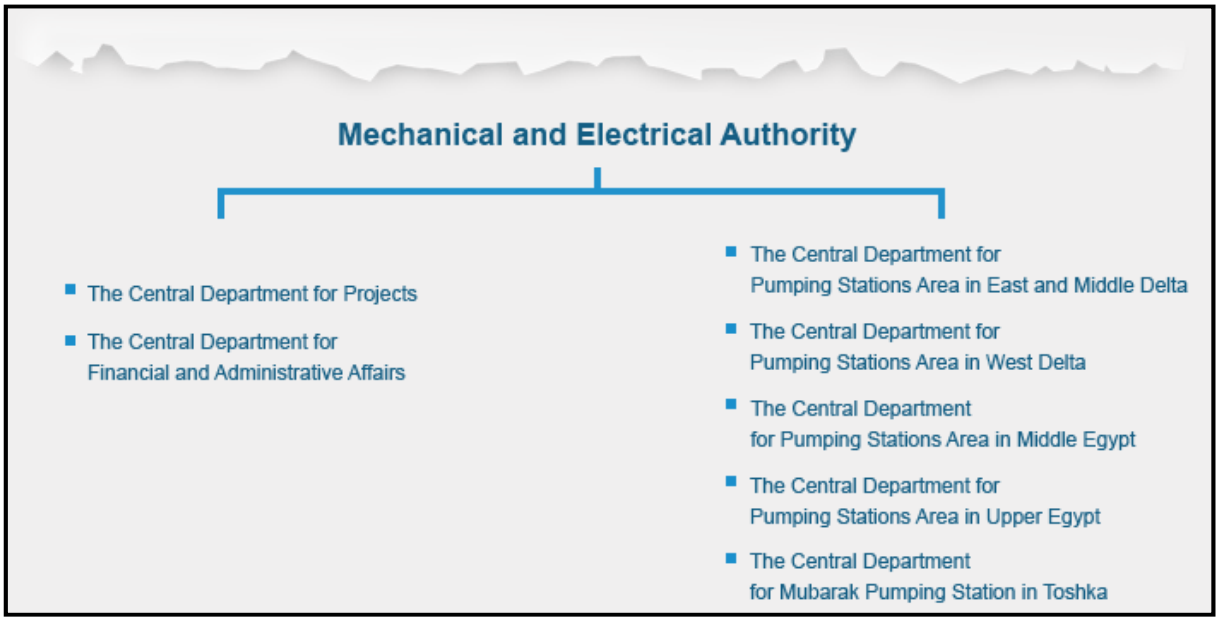


Figure 5c. Organization chart of the mechanical and electricity authority of MWRI

IWRM and System financing:

The water resources management organizational matrix and infrastructure has been explicitly part of the NWRP strategy (MWRI, 2005) with the concept of IWRM being its backbone. IWRM has been practiced in response to the growing pressure on Egypt's water resources as a result of: growing population and socio-economic developments, water shortages, and deteriorating water quality. The national plan provides a

comprehensive water policy planning, addressing the interaction between the different sub-sectors and establishing priorities, accounting for institutional requirements, dealing with capacity building, and incorporating environmental and socioeconomic aspects. The main aspects include:

- Economic development
  - The development and use of the available water resources in general should contribute to the national economic growth. For the different economic sectors the aim is to use the water resources in an optimum way, enabling an increase in production (industry, agriculture, aquaculture) and an improvement of the conditions for other water using sectors (such as navigation and tourism). Some important water related indicators that describe to what extent these policy objectives will be achieved are: For agriculture (increase in irrigation area, increase in production value in agriculture, crop intensity); For fisheries (production value of fisheries); for tourism (navigation bottlenecks in the Nile)
- Social objectives
  - Major social objectives where water plays a direct or indirect role are related to access to safe drinking water, the increase in employment, equity in water distribution and farmers income, and some minimum level of food self-sufficiency.
  - Another major government objective is to create more living space in the desert areas, outside of the heavily populated Nile Valley and Delta.
  - Some important water-related indicators that describe to what extent these policy objectives will be achieved are: population living in desert area; employment income and equity; employment in agriculture; average income of farmers; equity of water distribution in agriculture; drinking water and sanitation (coverage of drinking water supply systems, and coverage of sanitation systems); Self-sufficiency in food production as represented by the percentage of self-sufficiency in cereals.
- Meeting water needs
  - Incorporating the challenges of population growth, industrial growth and developments outside the old lands (horizontal expansion in the Nile fringes and desert areas, and development of New Industrial cities in desert areas), the demand for water of good quality is increasing. Since the potential for development of new water resources is limited (mainly limited to groundwater development in the Western Desert), water is becoming an increasingly scarce commodity. This urges a more efficient use of water. It also urges attention for the sustainability of the water resources system in areas where this resource is not replenished.
  - Important indicators that describe are: Water resources development (available Nile water, abstraction of deep groundwater, Water use efficiency of Nile system, outflow to areas outside the Nile system); Water use in agriculture (supply-demand ratio, water availability per feddan); Public water supply (Unaccounted-for losses, supply-demand ratio).
- Protecting health and environment
  - Poor water quality has a direct impact on health and environment conditions. Reduction in pollution loads entering the water system will improve the water-related public health conditions.
  - Improve the sustainable use of groundwater resources and contribute to meeting the water quality requirements of the different functions of the water system.
  - Important indicators are: Pollution and health (violation of water quality standards, water quality of shallow groundwater); Ecology and sustainability (use of non-renewable groundwater, ecological condition coastal lakes).
- Governance and Financial Sustainability

- The Government of Egypt aims to promote sustainable growth through enhanced private sector involvement in production and in public services. The assumption underlying this aim is that less government involvement in production and public services allows those to function with greater economic efficiency. Likewise, the water sector's economic efficiency is expected to increase through attributing a greater role to water users in the management of Egypt's waters. Or in other words: the same (or higher) levels of service and production would be achieved at less cost.
- The financial objectives of the government are to reduce the financial burden for investments, operation and maintenance of the water-related infrastructure. The government aims to recover part of the cost involved in these activities. Cost recovery and the use of other financial incentives are included as strategy components.

In brief, institutional and legislative capabilities exist but dynamic improvements are required to cope with the rising challenges. The water sector needs to be more geared towards a more effective and efficient collaborative implementation based on a holistic IWRM. The socioeconomic and environmental aspects of water resources management have been addressed in the National MWRI strategy for 2017. In addition, important elements like inter-agency networking, private-public participation, and climate change have to be more integrated in future plans.

In terms of funding, Egypt relies mostly on self-funding for execution of its important water related projects with aids playing a significant role but not the main role in recent days. Inadequate funding after 2010 due to other competing budget activities is challenging the continuation and the implementation of the National plan.

5.2. Water Resources Related Organizations

In addition to the MWRI with its subordinates, the governance of the water sector has been shared with the following national agencies:

1. **Ministry of Agriculture and Land Reclamation (MALR):** The ministry mission is to improve food security and increase national agricultural production through maximizing the net return per unit of water (maximum crop per drop concept) and to maximize crop productivity. The ministry information can be accessed at: http://agr-egypt.gov.eg. Figure 6 presents the organogram of the MALR.

   MALR is taking effective and aggressive measure for more efficient use of irrigation water through the following: making improvements to the quaternary or Marwas canals by converting them to low pressure pipelines; laser land leveling and soil amendments to improve on-farm lands; forming new cooperative water association and Marwas committee to achieve participatory management in most of the old lands; and providing new programs for crop selection and optimization of rice cultivation schemes to reduce water usage.

Minister

Main Sectors

Financial Affairs and Administration Development	Animal Wealth Development	Land Reclamation	Agricultural Services	Agricultural Extension	Economic Affairs	Organization and Minister's Office Affairs
1. Financial Affairs 2. Administration Development	1. Animal Production 2. Agricultural Industrialization and Inputs	1.Horizontail Expansion 2. Settling	1.Agricultural Cooperation 2. Enginemen Affairs	1.Extension and Environment 2. Horticulture and Agricultural	1. Agricultural Economics 2. Agricultural Planning	1. Minister's Office Affairs 2. Information , Documentation and Decision

		3. New Land Development	3. Land Protection 4.Seed Protection 5. Seed Testing and Certification 6. Agricultural Quarantine	Corps 3. Soil and Water 4. Afforestation And Nurseries 5. Pest Control and Plant Protection	3. International Agricultural Cooperation 4. Data Processing	Support 3. Training 4. Agricultural Directorates Affairs

Figure 6. Main sectors and central administration of MALR

2. **Ministry of Housing, Utilities, and Urban Development (MHUUD):** The ministry has been historically and until 2004 the responsible government authority for the implementation, operation and maintenance with help from municipalities, of all projects related to water supply and sanitation collection works through mainly NOPWASD (now is transitioning out of the MHUND) and New Urban Communities Authority; with the mandate to provide sufficient drinking water of good quality to the population and to treat the municipal wastewater in such a way that the discharge of the effluent does not pose and health or environmental risks. Information about the ministry can be accessed at: http://www.moh.gov.eg. Figure 7 shows the organization chart of the MHUUD with the subordinates that help in WSS sector shown in dotted boxes. After the initiation of HCWW and EWRI in 2004 and followed by the inauguration of the 3. Ministry of Drinking Water and Sanitation Facilities (MDWSF) in 2012, WSS governance has been restructured as described in Sections 5.3 and 5.4 of this report.

3. **Ministry of Drinking Water and Sanitation Facilities (MDWSF):** This ministry has just been established in 2012 with the target to group all WSS parties (originally under Prime Minister, MHUUD, municipalities) to be under one umbrella for better management and use of available resources. The experience is yet premature to judge and the MDWSF has been stalled in action since June 30th, 2014 due to the recent political changes in Egypt. Figure 8 depicts the organization chart of the newly formed ministry. Dotted lines denote supervisory links practiced as needed. Solid lines display organizational links.

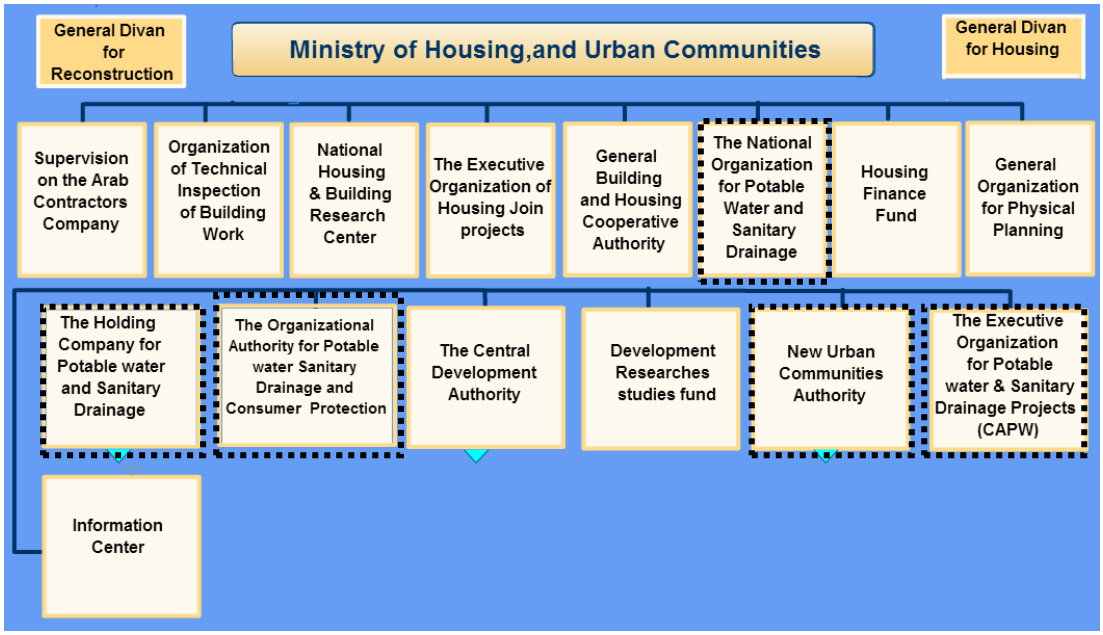


Figure 7. Simple organogram of MHUUD (subordinates related to WSS shown in dotted boxes)

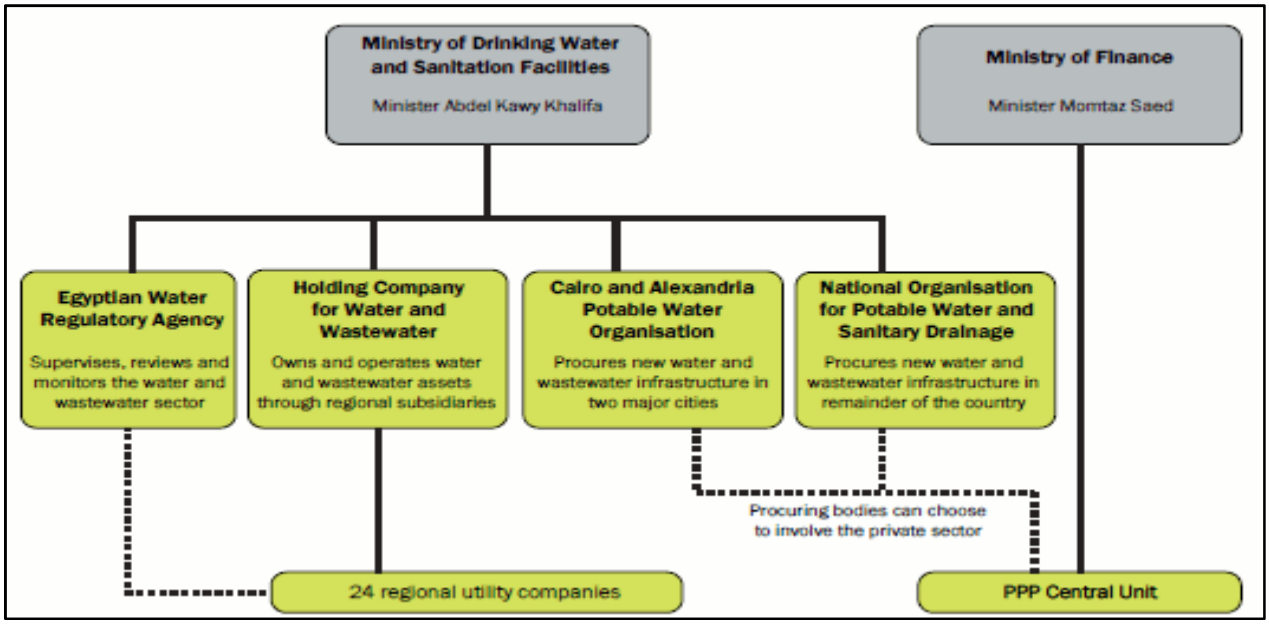


Figure 8. Simple organogram of the newly formed MDWSF

4. **Egyptian Environmental Affair Agency (EEAA)/Ministry of State for Environment Ministry of State for Environmental Affairs (MSEA): EEAA undertakes** policy formulation and plan preparation for the protection of the environment, water quality monitoring (pollution loads from industry, wastewater from Nile ships and coastal monitoring), and definition of natural protectorates' such as Lake Bardawil, Lake Qarun and Wadi El-Rayan, all affected by water resources management. The mandates of the MSEA are:

   - Preparing draft legislation and decrees related to the fulfillment of its objectives
   - Preparing state of the environment studies and formulating the national plan for environmental protection and related projects
   - Setting the standards and conditions to which applicants for construction projects must adhere before working on the site and throughout operations

- Setting the rates and proportions required for the permissible limits of pollutants in the treated water discharge into sea water in the coastal areas
- Periodically collecting national and international data on the actual state of the environment and recording possible changes
- Setting the principles and procedures for mandatory Environmental Impact Assessment (EIA) of projects
- Preparing Environmental Contingency Plans and supervising their implementation
- Participating in the preparation and implementation of the national and international Environmental Monitoring Programs and employing data and information gained thereof
- Establishing Public Environmental Education Programs and assisting in their implementation
- Coordinating with other empowered authorities for the control and safe handling of dangerous substances
- Managing and supervising the natural reserves of Specially Protected Areas
- Following up the implementation stages of International Conventions concerned with the environment
- Suggesting an economic mechanism, which encourages the observation of pollution prevention procedures
- Implementing pilot projects for the preservation of natural resources and the protection of the environment against pollution
- Listing of national establishments and institutions, as well as experts qualified to participate in the preparation and implementation of environmental protection programs, and coordinating measures with the Ministry in charge of international Cooperation to ensure that projects funded by donor organizations and states are compatible with environmental safety
- Participating in the preparation of an integrated national plan for the coastal zone management of the Mediterranean and the Red Sea areas
- Participating in the preparation of a plan to prevent illegal entry into the country of dangerous and polluting substances and waste
- Preparing an annual report on the state of the environment to be submitted to the President and the Cabinet of Ministers
- Implementing the programs to support “technically and/ or financially” the already existed facilities to comply with Environmental standard and regulations
- Inspecting the treated liquid discharging into water bodies from industrial facilities, drinking water plants and waste water treatment plants

All pertinent ministry information can be accessed at: http://www.eeaa.gov.eg. Figure 9 presents the organogram of the MSEA.

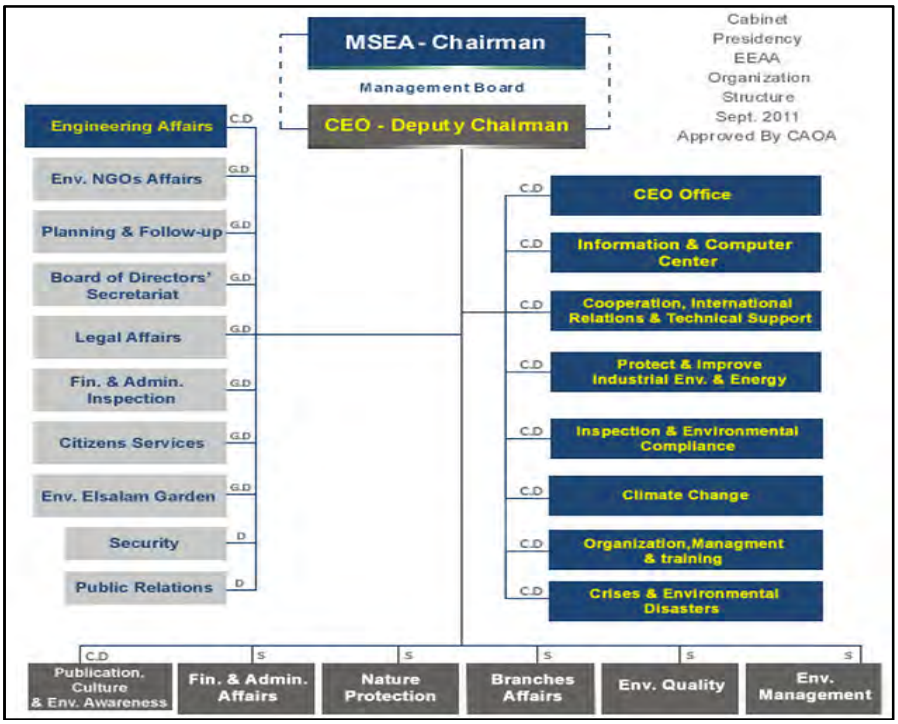


Figure 9. Simple organogram of the MSEA

5. **Ministry of Health and Population (MoHP):** the MoHP has the mandate for: preparing draft legislation and decrees related to its objectives; setting the rates and proportions required for the permissible limits of constituents in drinking water (surface water intakes), drainage water (industrial wastewater, sewage, and agriculture drainage); establishing and enforcing drinking water standards, monitoring and protecting surface water quality, inspecting water and wastewater treatment plants, and providing population control programmes. The ministry collects samples from River Nile, water and wastewater treatment plants, and at random locations in the distribution system to check water quality and to make sure that public health are not jeopardized. It also prepares annual report for water quality (drinking Water, water intakes, agriculture drainage, and treated wastewater) for all the governorates. In addition, annual reports are prepared for water quality monitoring of River Nile from Lake Naser to the end of the Rosetta and Damietta branches.

   Figure 10 depicts the organogram of the MoHP. The main department in charge of water related issues is the Central Administration for Environmental Affairs. Information about the MoHP can be accessed at: http://www.mohp.gov.eg.

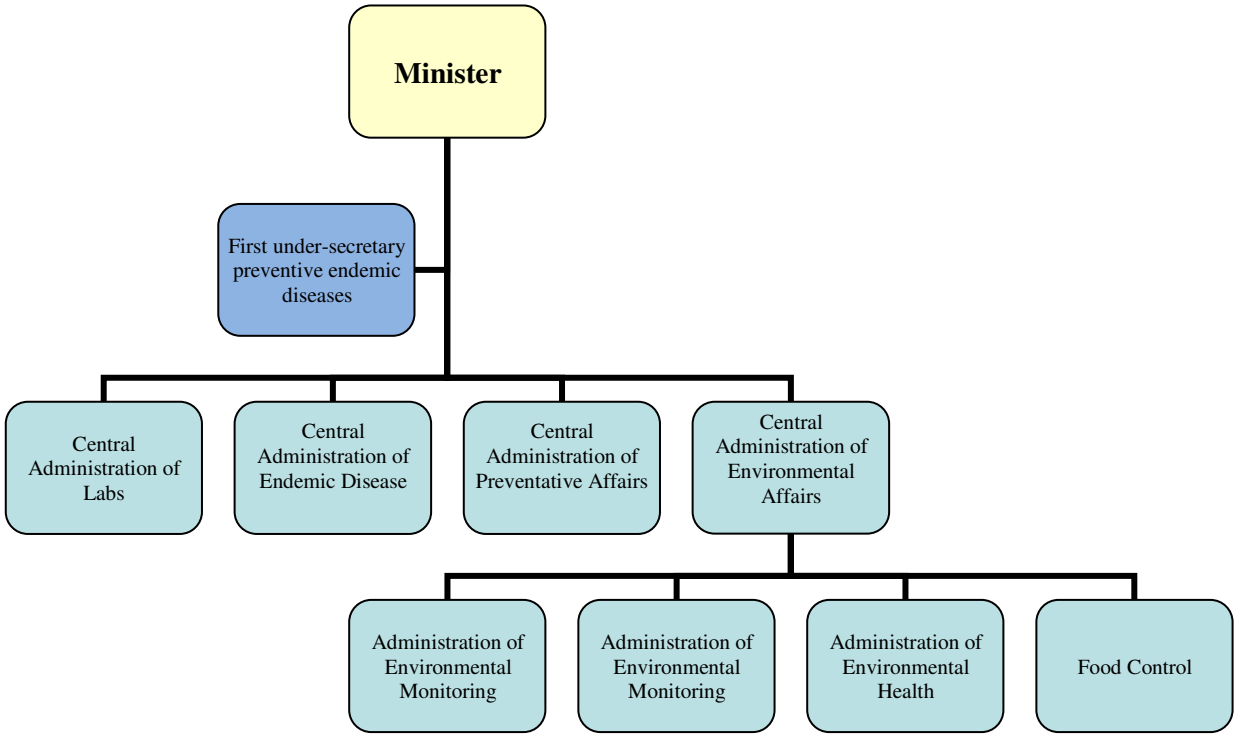


Figure 10. Simple organogram of the MoHP

6. **Ministry of Industry and Foreign Trade (MoIFT)**: Its mandates include: coordination between MWRI, HCWW, NOPWASD to ensure the availability and sustainability of water supply; protection of water resources from pollution through the implementation of cleaner technologies, and recycling of process and cooling water and treatment of industrial wastewater prior to discharge. Information about the MoIFT can be accessed at: http://www.mfti.gov.eg/english/.

7. **Ministry of Transportation (MoT) and River Transport Authority (RTA):** The main mandates of the MoT are: expanding navigation possibilities on the Nile and its branches; and maintaining minimum depth for tourist and transportation vessels on the Nile

8. **Ministry of Local Development (MoLD)**: It is responsible for sustainable development of rural areas and small cities, including water supply and sanitation

9. **Ministry of Energy and Electricity (MOEE)**: With respect to integrated water resources management, the ministry is responsible for the generation of hydropower at the High Aswan Dam and other hydropower stations along River Nile. Figure 11 depicts the organogram of the MOEE. All other information about the activities, goals, strategies and plans of the MOEE can be found at: www.moee.gov.eg.

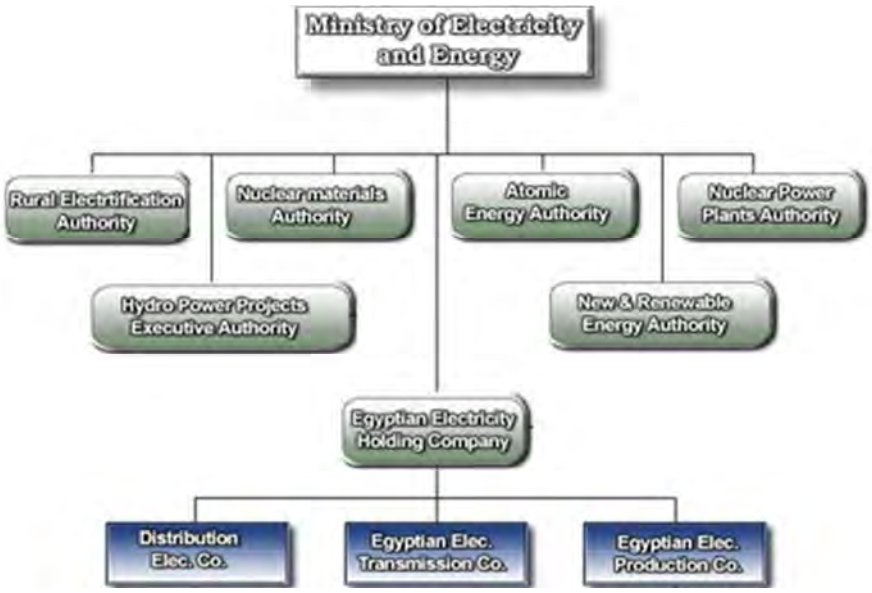


Figure 11. Simple organogram of the MOEE

10. **Ministry of Planning and International Cooperation (MoPIC)**: It prepares the annual and 5-year plans in cooperation with other ministries and governmental authorities and monitors their implementation. It is also involved in the prioritization of the allocation of investments. Information about the ministry can be accessed at: http://www.mop.gov.eg

11. **The Central Agency for Public Mobilization &Statistics (CAPMAS):** is considered, according to the presidential decree no. 2915/ 1964, the official source for providing, preparing and publishing statistical data , information and reports for all organizations, universities, research centers and international organizations that help in planning, developing and evaluating policies formulation and decision-making. Information about CAPMAS can be accessed at: www.capmas.gov.eg

12. **Egyptian Meteorological Authority (EMA)**: EMA also has regional centers for weather and seasonal forecasts and Climate Change and has approximately 200 meteorological stations to serve the ministry of Defense, Aviation and Agriculture. EMA has also a regional training center that is responsible for training staff in North Africa and it receives about 3000 trainees every year.

13. **Ministry of Finance (MoF)**: that provides budgets for water resources and WSS projects.

In addition to the abovementioned national ministries and agencies, the following are important international water related organizations:

1. **Nile Basin Initiative (NBI):** Cooperation among some of the Nile Basin countries began in the form of bilateral agreements at the beginning of the twentieth century, while regional cooperation commenced in 1967 by the formation of the Hydro-meteorological survey of the catchments of Lakes Victoria, Kyoga, and Albert (Hydro-Met Project), followed in 1992 by the TECCONILE project. Most recently, starting in 1999, the Nile Basin Initiative (NBI) represents the latest mode of regional cooperation among the Nile basin countries (UNEP, 2010). NBI is an inter-governmental organization dedicated to equitable and sustainable management and development of the shared water resources of the Nile Basin. NBI Member States include Burundi, Democratic Republic of Congo, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, Uganda, and recently South Sudan, with Eritrea as an observer. The following information is based on a Transboundary Organization survey of the NBI (Appendix 12), the NBI web site can be accessed at (http://www.nilebasin.org). The NBI was established on February 22, 1999 in Dar El-Salaam, by Ministers responsible for Water Affairs of each of the nine Member States.

The Nile Council of Ministers (Nile-COM) agreed on a Shared Vision which states: 'to achieve sustainable socio-economic development through the equitable utilization of and benefit from the common Nile Basin water resources' (NBI, 2013).

The **NBI** is a partnership initiated and led by the riparian states of the Nile River through the Council of Ministers of Water Affairs of the Nile Basin states (Nile Council of Ministers, or Nile-COM). The NBI seeks to develop the river in a cooperative manner, share substantial socioeconomic benefits, and promote regional peace and security. The NBI started with a participatory process of dialogue among the riparian countries that resulted in their agreeing on the shared vision and a Strategic Action Program to translate this vision into concrete activities and projects. Cooperation and interaction among the riparian states takes place on a number of levels within the NBI framework. It is to be noted that NBI is a transitional organization, eventually leading to the formation of a permanent Nile Basin commission legally defined by a Cooperative Framework Agreement (CFA).

The CFA is intended to establish a new legal and institutional framework reconciling the interests of the NBI States, while taking into consideration internationally-recognized principles concerning the uses of the waters of international rivers, as well as the rights under existing agreements. To date, the CFA has not entered into force. Six of the NBI States (Ethiopia, U.R of Tanzania, Uganda, Rwanda, Kenya, and Burundi) have signed a draft CFA, and both Ethiopia and Rwanda ratified it. Some of the pending issues regarding the cooperative framework agreement CFA (text of Entebbe 2007) are as follows: planned measures (Article 8), Water Security (Article 14b), and amendment of the framework or protocols (Article 34 a) (Salman, 2013).

2. **The Permanent Joint Technical Commission for Nile Waters (PJTC):** In November 1959, Sudan and Egypt signed an Agreement for the utilization of the shared waters of the Nile River. The 1959 Agreement was meant to regulate the River waters and control its flow into the Mediterranean Sea. The Agreement took into consideration the rights of other riparian countries in the Nile waters. Technical co-operation in various fields is performed under the umbrella of the PJTC. One of the important issues is to increase the Nile yield through the utilization of lost waters. The PJTC also cooperates with various International and Regional Organizations like WWC, IWRA, WMO, and International Hydrological Program and participate in most regional and international conferences and workshops dealing with international waters (UNEP, 2010). PJTC started its work through a head office in Khartoum and a branch office in Cairo. Regular meetings (four meetings per year) are held in Khartoum and Cairo by rotation. The chairmanship is by rotation every year, and so is the secretariat.

   The nature of the PJTC is technical, and permanent staff is appointed and the budget is shared by the two countries equally. Every year a budget is approved by PJTC Council to cover all the necessary activities. As part of the agreement, more than 130 gauging stations scattered along the Nile River and its tributaries in Sudan are being controlled by executive organs of the two countries, and the annual flows are being evaluated. The abstraction of Sudan and Egypt are monitored and should be within the stated shares in the 1959 agreement.

   In order to enable the Commission to exercise the functions enumerated in the above items, and in order to ensure the continuation of the Nile gauging and to keep observations on all its upper reaches, these duties are carried out under the technical supervision of the Commission by the engineers of the Sudan, and the engineers of Egypt in the Sudan, Egypt, and Uganda. The PJTC is also very active in co-operating with other riparian countries of the Nile Basin. It had played a major role in establishing the hydrometeorological survey Project (HYDROMET) in 1967. This project was financed mainly by UNDP and the executive agency was WMO with headquarters at Entebbe, Uganda. PJTC seconded staff members to that project on regular basis and contributed to its budget considerably when the finance from UNDP was terminated. The major findings of the Hydromet Survey Project was the development of three mathematical models: a catchment model including all the hydrological and meteorological

data being collected; a reservoir model including all the lakes in the Equatorial Plateau (Victoria, Kyoga, Albert lakes); and a routing model to represent the changes in levels due to changes in flows along the channel. In 1992 the two countries of PJTC were the first to sign an agreement for establishing TECCONILE (Technical Committee for Co-operation for Integrated Development and Environmental Protection of the Nile Waters) as a successor to HYDROMET Survey Project. TECCONILE was a step towards including more Basin members to consider a comprehensive development of the Nile water resources. An action plan was approved by the Ministers for Water Resources from Six Nile Basin countries. This action plan included various activities of interest to most riparian countries. One important project named D3 deals with the Establishment of a framework for cooperation. A panel of experts constituted from technical and legal professionals (three from each country) worked for almost a year to propose the best acceptable framework for the Nile Basin. UNDP financed that activity.

3. **Joint Authority for Study Development of the Nubian Sandstone Aquifer System (NSAS)** - that coordinates the activities of the NSAS to make sure that the transboundary resource is sustainably managed. Libya hosts the headquarters of the organization. Egypt has a local office that cooperate activities with the headquarters and other offices. Information about NSAS can be accessed at: www.nsasja.org

Egypt has formulated a number of laws and regulation over the years in order to properly govern its water resources and to save the environment and public health. These are summarized in Table 8. The governing authority for each activity can be more than one. The table describes the governing authority according to their level of involvement with Level 1 being the most involved and the level of involvement decreases by increasing the level number.

Table 8. Egyptian Laws and Regulations and their Governing Authorities

Activity	Governing Laws/Regulations	Governing Authority
Water allocations	• Law 12 for year 1982 for irrigation and drainage	Level 1: MWRI Level 2: MALR, MHUUD, MDWSF, MoIFT, MoT, MoLDandMoEestimate their requirements and apply to the MWRI to coordinate the respective water allocations
Water quality and National drinking water standards	• Law 48 for year 1982 Concerning the Protection of the River Nile and Waterways from Pollution", implemented by Decree 8/1982 and modified in Decree 92/2013 • Decree 458/2007 for drinking water standards • Law 4/ 1994 updated by Law 9/2009 for the Environment • Decree 171/2005 Egyptian code for reused treated wastewater • Law 27/1978 for drinking water resources • Law 93 for the year 1962 for the discharge to open streams and its modifications for the years 1962, 1982, and 1989 • Presidential Decree 2703/1966	Level 1: MWRI for protecting River Nile, MoHP for public health protection, MSEA for protecting the environment from industrial and domestic wastes Level 2: MHUND, MDWSF, MoLD for self quality control Level 3: National water research centers, universities, and NGO for quality checks
Municipal Water supply and Sanitation	• Decree 458/2007 for drinking water standards • Law 4/ 1994 updated by Law 9/2009 for the	Level 1: MDWSF, MHUND, MoLD for providing the service meeting the guidelines

Activity	Governing Laws/Regulations	Governing Authority
	Environment • Decree 171/2005 Egyptian code for reused treated wastewater • Law 27/1978 for drinking water resources • Law 93 for the year 1962 for the discharge to open streams and its modifications for the years 1962, 1982, and 1989	Level 2: MoHP, MSEA, MWRI to conduct quality check points on the system Level 3: National water research centers, universities and NGO for quality checks
Industrial effluent standards	• Law 4/ 1994 updated by Law 9/2009 for the Environment • Decree 171/2005 Egyptian code for reused treated wastewater • Law 93 for the year 1962 for the discharge to open streams and its modifications for the years 1962, 1982, 1989, and Decree 44/2000	Level 1: MWRI for protecting River Nile, MSEA, and MoH for public health protection Level 2: National water research centers, universities and NGOs for quality checks
Irrigation and drainage and framers participation	• Law 213 for the year 1994 for farmer participation and cost sharing • Law 12 for year 1982 for irrigation and drainage	Level 1: MWRI Level 2: MALR Level 3: casual national water research centers, universities and NGOs for quality checks

5.3. Rural Water Supply & Sanitation

In Egypt, there is no clear definition of urban and rural communities to be applied for planning, implementation, and management purposes.

The major organizations working in the field of rural water supply and sanitation (RWSS) in Egypt are the following (Figure 12):

- The newly formed MDWSF represented by:
  - EWRA that supervises, reviews, and monitors the water and wastewater sector. It is responsible for providing a yearly status report about the WSS sector in Egypt.
  - HCWW that owns and operates WSS assets through 25 regional companies. It also drafts the long term strategies and investment plans for the whole sector. It develops master plans and infrastructure investment action plans to help allocate funding for the WSS sector projects.
  - NOPWSD that was originally under the MHUND, which is responsible for the procurement of new WSS infrastructure in all governorates except Cairo and Alexandria
- MHUND, mainly represented by New Urban Communities Authority after migrating NOPWASD to the new MDWSF
- MoHP represented by the Central Administration for Environmental Affairs
- MWRI that allocates water sources for domestic applications
- MSEA with cooperation from EEAA
- MoLD represented by municipalities in the rural governorates of Egypt
- MoF that provides budgets for water resources and WSS projects
- CAPMAS to provide population census and forecasting information, necessary for WSS planning
- Other organizations include: projects run by universities, NGOs, and international organizations. The efforts of these organizations are not coordinated and are based on individual initiatives with little visibility and documented outputs.

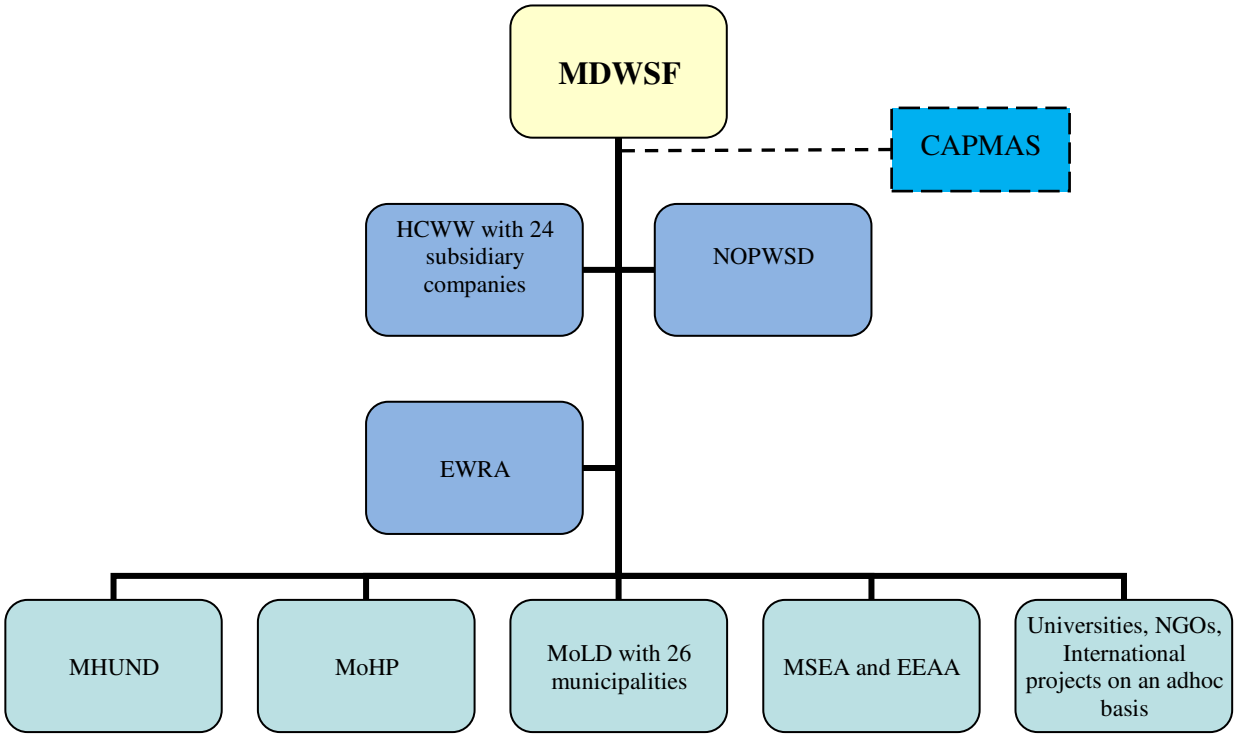


Figure 12. Organization chart for stakeholders in RWSS in Egypt (2012)

Note: In terms of governance MHUND, MoHP, MoLD, MSEA are not under MDWSF but MDWSF is the lead organization in RWSS

Strengths of RWSS institutions:

1. The MDWSF has been established and it groups all involved WSS partners from the different ministries under its own umbrella, which is expected to provide a more efficient service in rural communities.
2. All major water related organizations are under the mandate of one body, namely, the MDWSF which simplifies their reorientation.
3. Strong commitment towards improving WSS exists by raising the human and technical capacity of the subsidiary companies of the HCWW and providing training on design, operation, maintenance, leak detection, GIS, database management for most of the companies in rural Egypt.
4. Organizations responsible for water resources management, potable water and sanitation have been established.
5. The institutional framework already includes many actors with capabilities and on which it will be possible to rely on (e.g.: HCWW, MSEA, EWRA as portrayed in Figure 12).

Weakness of RWSS institutions:

1. Weak enforcement of existing laws
2. Segregating urban from rural governance is not very clear in many instances
3. Human capacities vary significantly between one subsidiary company to the other and between one governorate to the other.
4. Weak capacities to implement existing plans in rural WSS in terms of human resources, financing and clearly-defined institutional roles.
5. Financial sustainability as full cost recovery is not possible with the current economic struggle that Egypt is facing these days, putting additional financial stress on the WSS sector.

6. Migrating NOPWSD into MDWSF is still under implementation and the synergy needs to be evaluated with time.

5.4. Urban Water Supply & Sanitation (UWSS)

In Egypt, the following are the organization working in the field of Urban Water Supply & Sanitation (Figure 13):

- The newly formed MDWSF exemplified in:
  - EWRA that supervises, reviews, and monitors the water and wastewater sector. It is responsible to provide a yearly status report about the WSS sector in Egypt.
  - HCWW that owns and operates WSS assets through 25 regional companies. It also drafts the long term strategies and investment plans for the whole sector. It develops master plans and infrastructure investment action plans to help allocate funding for the WSS sector projects.
  - Cairo and Alexandria Potable Water Organization (CAPWO) that procures new WSS infrastructure in Cairo and Alexandria
  - NOPWSD that was originally under the MHUND, which is responsible to that procures new WSS infrastructure in all governorates except Cairo and Alexandria
- MHUND, mainly represented by New Urban Communities Authority after migrating NOPWASD to the new MDWSF.
- MoHP represented by the Central Administration for Environmental Affairs.
- MWRI that allocates water sources for domestic applications.
- MSEA with cooperation from EEAA.
- MoF that provides budgets for water resources and WSS projects.
- MoLD represented by municipalities in the urban governorates of Egypt.
- CAPMAS to provide population census and forecasting information, necessary for WSS planning
- Other organizations include: projects run by universities, NGOs, and international organizations. The efforts of these organizations are not well coordinated and are based on individual initiatives with limited visible and documented outputs. More coordination is needed with the HCWW to make these efforts part of the strategic objectives and action plans of the HCWW.

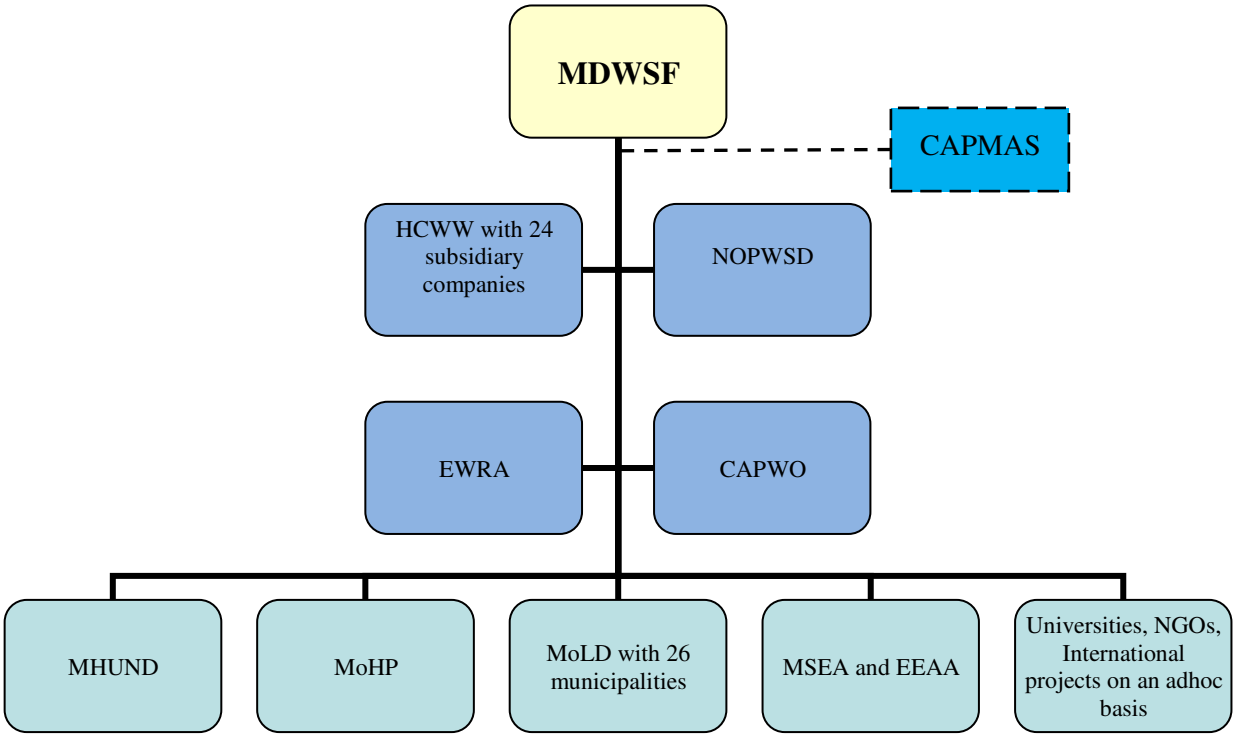


Figure 13. Organization chart for stakeholders in UWSS in Egypt (2012)

Note: In terms of governance MHUD, MoHP, MoLD, MSEA are not under MDWSF but MDWSF is the lead organization in RWSS

Strengths of UWSS institutions:

1. A ministry for WSS (MDWSF) has been established grouping all major WSS related organizations under the mandate of one body, namely, the MDWSF which simplifies their reorientation.
2. Strong commitment towards improving IWRM and WSS exists.
3. The institutional framework already includes many actors with capabilities and on which it is possible to rely.
4. Human resources are readily available. However there is a need for more capacity building.

Weakness of UWSS institutions:

1. Weak enforcement of existing laws.
2. Human capacities vary significantly between one subsidiary company to the other and between one governorate to the other.
3. Financial sustainability as full cost recovery is not possible with the current economic struggle that Egypt is facing these days, putting additional financial stress on the WSS sector.
4. Migrating NOPWSD and CAPWO into MDWSF is still under implementation and the synergy needs to be evaluated with time.

6. IWRM M&E

6.1. Institutions and Framework

***Global M&E Organizations*:**
While some global organizations such as Joint Monitoring Program (JMP) and FAO-AQUASTAT publish some information regarding water resources in Egypt; they are not really active in M&E of the country water resources and depend on limited surveys and sometimes on pre-published old data. Many senior Egyptian water sectors officials have serious reservations on these data. However, Egypt has maintained very good relations with FAO, World Bank (WB), AfDB, Islamic Bank, UNICEF-JMP, UNDP, and all other international organizations and NGOs. Numerous studies and surveys have been conducted with collected data that can feed IWRM and WSS M&E. Most of these reports are published in the official websites of these international organizations.

***Regional and Local M&E Organizations*:**
On the **regional level**, the Nile Basin Initiative (NBI) and the Joint Authority for the Nubian Sandstone Aquifer System (NSAS) are relatively active on the M&E of the shared transboundary surface and groundwater resources, respectively (NBI, 2013; NSAS, 2013). The two organizations cooperate with the transboundary countries to collect data and build models that reflect the status of the shared resources. Databases are available but need to be modified and updated more frequently as described below.

The following Egyptian ministries and agencies are active in IWRM M&E on the **national level**:

- MWRI, led by the NWRP unit
- MoHP
- MDWSF
- MHUUD
- MSEA
- MALR
- MoPIC
- MoF
- CAPMAS
- EMA

There is no national structured framework for M&E&R in Egypt. However, the NWRP unit of the MWRI chairs the coordination platform (CP) for M&E of the NWRP-2017 within the premises of the MWRI. Figure 13 depicts the NWRP coordination platform.

The NWRP-CP was formed to assist the various functional actors involved in NWRP implementation at central and non-central level with getting the planning and decision making process effectively on the ground, which is needed for the efficient and timely implementation of the NWRP.

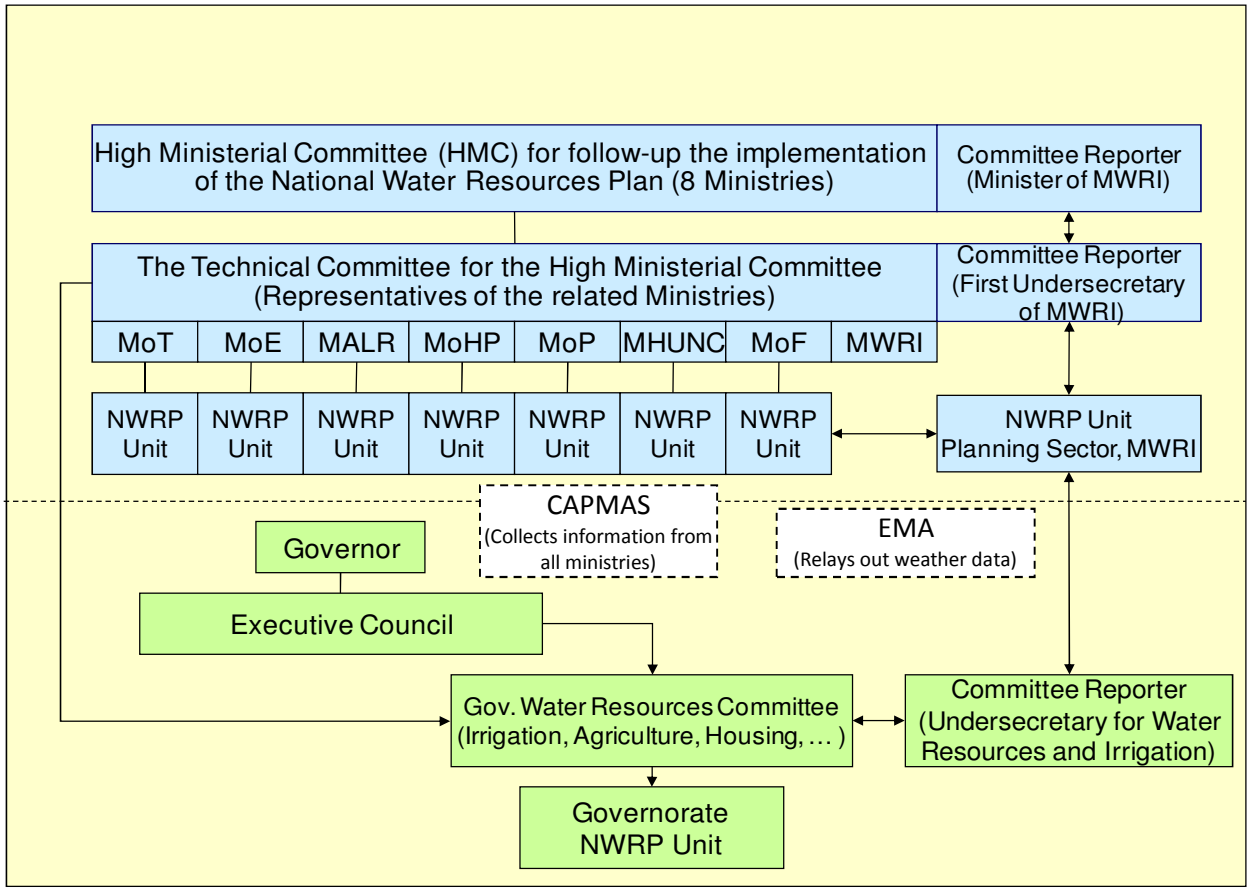


Figure 14. NWRP Coordination Platform (M&E institutional framework in IWRM in Egypt)

6.2. Basic Monitoring Networks

This section focuses on transboundary basins that have monitoring networks serving the country. The NBI, PJTC, and the NSAS are the international transboundary organizations that have some monitoring networks in Egypt.

For NBI, no data measurement is conducted by or in coordination with the NBI. Monitored information has not been used to resolve any conflicts between trasnboundary countries in the past. Monitoring is essentially performed by countries regarding all meteorological, water quantity, and water quality data. It has to be noted that some data, e.g., water quality data, may not be routinely monitored by all countries, and gaps may exist in some other data. In its meeting of July 2009 in Alexandria, Egypt, the Council of Ministers of Water Affairs of the Nile Basin Countries (Nile-COM) has agreed to a number of interim procedures for data and information sharing and exchanging (Appendix 13). However, the number of hydrometric stations in the Nile basin has been declining since the 1970's in many of the Equatorial Lakes basin countries, while it remained more or less constant in the Eastern Nile Basin, as shown in Table9 (NBI, 2012).

It is worth noting that some data sets have been acquired by NBI from countries and from public-domain data published by different countries guided by the Eastern Nile Council of Ministers (ENCOM). To support its multipurpose development objectives, the Eastern Nile Technical Regional Office (ENTRO) began an exercise in 2006 to create a One System Inventory (OSI) to support the planning of the Joint Multipurpose Program. The OSI is designed with the plan to make it a regional knowledge base across the three Eastern Nile countries, initially focused on three themes: water resources, socio-economic and environmental issues (rainfall, stream flow, weather data, water quality parameters, and socio-economic data).

Table 9. Monitoring Stations in the Nile basin (NBI, 2012)

	Hydrometric stations	
	Historic number, 1970s	Currently operational, 2011
Burundi	21	13
DR Congo	–	–
Egypt	300	300
Eritrea	–	–
Ethiopia	177	176
Kenya	216	63
Rwanda	27	16
South Sudan*	–	–
Sudan	43	36
Tanzania	34	14
Uganda	161	65
Source	WRPM 2011 and National DSS Specialists	

*Few data are yet available for South Sudan.

Principal strengths of NBI Office and Data:

- Establishment of NBI includes all 11 Nile basin countries, represented by an office in Egypt
- NBI has annual budget approved by the Council of Ministers. The annual budget varies according to the activities. All countries contribute to the approved budget, improving on collateral dialogue
- 5-year strategic planning is practiced, allowing for dynamic modifications in plans according to M&E results, if available
- There are historic data for trend analyses for many years. OSI inventory consists of hydrologic, environmental, and socio-economic data, and is coordinated with modeling and information management activities conducted under Eastern Nile Planning Model (ENPM) and the Nile Basin Water Resources Planning and Management Project, particularly the Nile Basin Decision Support System (NB-DSS) Component, which includes development of databases and analytical tools for the Eastern Nile and overall Nile basin.

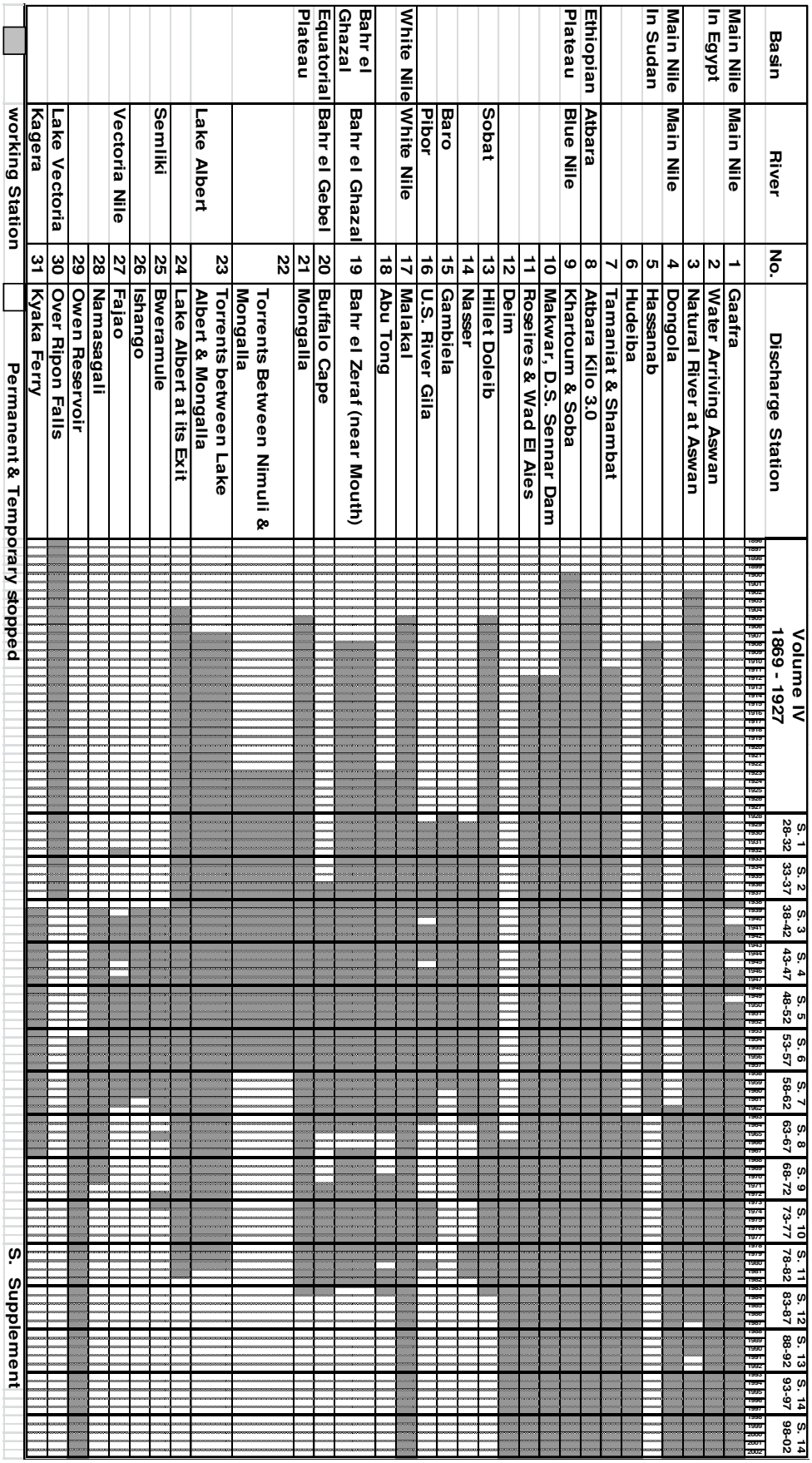
Weaknesses of NBI Office and Data:

- Data sharing agreement is neither mature not fully implemented
- There is enough data sharing between basin countries to allow for better management of the shared water resource. This hinders the full benefit of the NBI
- NB-DSS decision support system has been fully developed but still needs further enhancements to be of better use to managing the shared water resource

Other bilateral agreements like PJTC help Egypt, through cooperation with Sudan, to collect rainfall, river flow, and river stage data within the Nile basin in Sudan through the Central Directorate of Egyptian Irrigation Mission in Sudan. Data is sent on a weekly basis to the Nile Control Central Department in Cairo, Egypt, where measurements are cross-checked for consistency. The Nile Control Central Department was established in 1915 for the purpose of collection and analysis of the Nile Basin measurements that are sent to the department through the Irrigation missions in Sudan and Uganda. Data is compiled in annual sheets, where 5-day (flow and stage only), 10-day (flow and stage only), and monthly averages are calculated, as well as their minima and maxima. The product data are published as supplements to the Nile Basin Volumes (fifteen Volumes and sixty supplements) issued by the Nile Control Central Department every 5 years (Abdallah and Afifi, 2012). Table 10 shows the situation of stations reported in the Nile Basin

Volumes and supplements up to Supplement 14 in 2002. Figure 15 depicts the flow stations selected for statistical analysis in Volume III.

Table 10: Situation of stations reported in the Nile Basin Volumes and Supplements (up to supplement 14 in 2002).



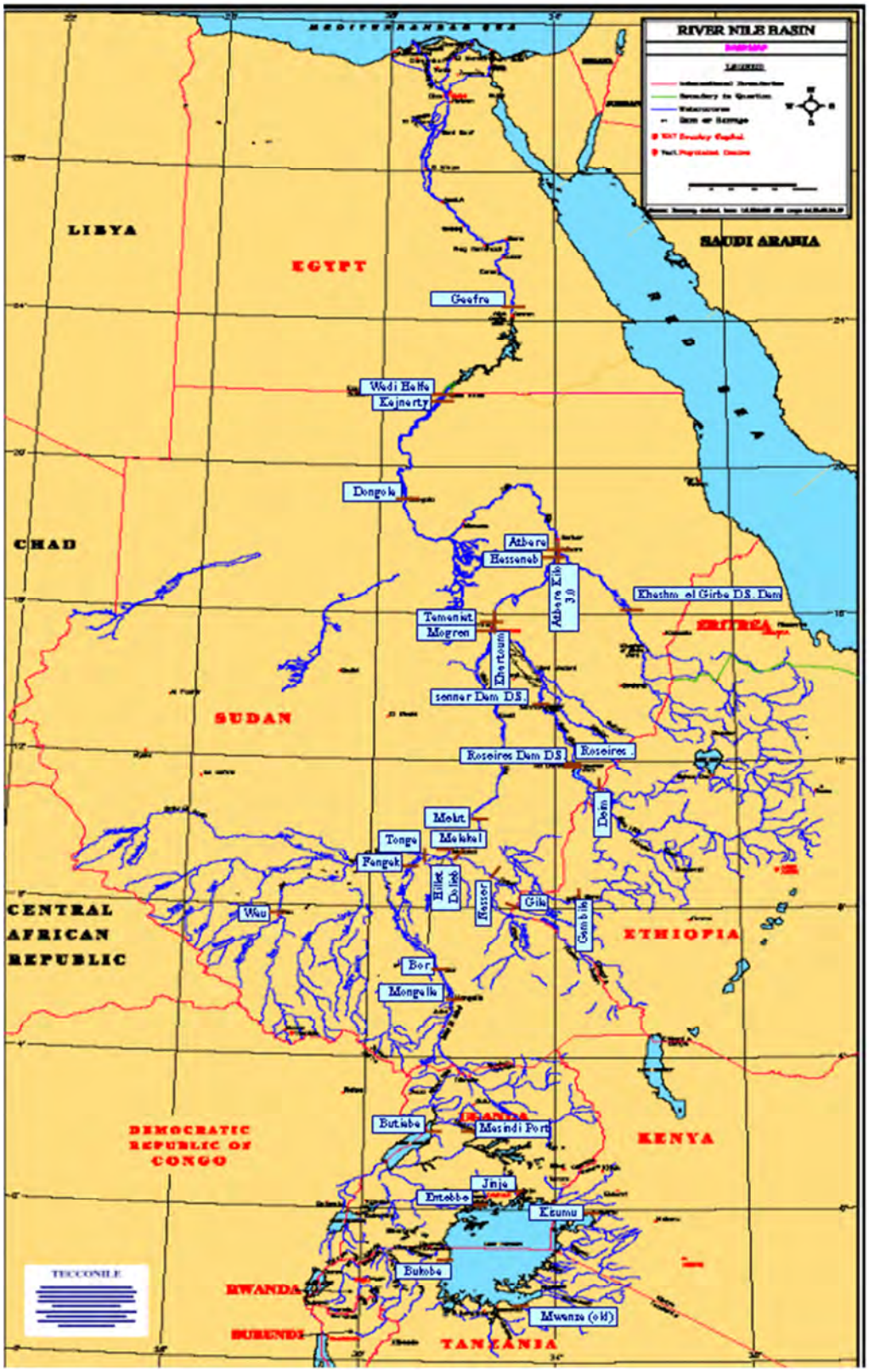


Figure 15: Selected Gauge Stations for Statistical Analysis, Nile Basin Vol. III.

- In addition to the Nile Basin Volumes and its Supplements, the Nile Control Central Department Publishes annual reports for hydrological features of the Nile River during the hydrological years as

well as Nile River flood forecasting studies and estimation of its yield. The Nile Control Central Department also contributes actively in the field of cooperation and sound management and development and use of water resources by providing data, information and support to many national and international entities.

On the other hand, with regards to the groundwater transboundary organization; Joint authority- NSAS, there exist basin monitoring networks consisting mainly of piezometric "water level" monitoring associated with water quality monitoring at times. Table 11 shows the resources, facilities and capabilities of NSAS monitoring network.

Table11. NSAS Monitoring Networks & their status (NSAS, 2013)

Personnel (Number and qualifications)	**Meteorological stations** (Number and description)	**Rainfall Monitoring Stations** (Number and description)	***GW Level Monitoring stations** (Number and description)	***GW quality monitoring stations** (Number and description)
• 13 highly experienced (PhD &Msc) • 12 geologists and hydrogeologists • 7 administrative skills	No information	No information	*74 wells for the national network (depth to water) with 14 in Egypt	*74 wells for the national network (TDS and conductivity) with 14 in Egypt

*74 are currently in operation. However there are sporadic historic data from over 1220 wells registered at the NSAS database

Principal strengths of NSAS Office and Data:

- Establishment of four national offices, represented by an office in the Research Institute for Groundwater in Egypt
- NSAS has annual budget approved by the Board of council. The annual budget varies according to the activities. The four countries contribute to the approved budget
- It operates under the umbrella of the MWRI in Egypt with good coordination with NWRP-CP
- All collected information in Egypt is assembled in an annual basis and is currently being fed to the regional NSAS-NARIS database (Madi, 2013)
- MWRI through its highly experienced personnel operates the wells in Egypt and thus provide reliable data
- There are historic data for trend analyses for many years

Weaknesses of NSAS Office and Data:

- In Egypt, only 14 wells out of 1220 are continually being monitored
- The data management system (NARIS, to be described later) has not been filled with information except up to 1998
- The data management system NARIS is still in its trial phase

In addition to the abovementioned basins monitoring network, the **MWRI telemetry unit** maintains a large network of measuring stations from Lake Nasser along the Egyptian River Nile down to the Mediterranean Sea (Appendix 15). All water level stations are now equipped with automatic data

acquisition system that send real time information to the Telemetry unit of the MWRI in Cairo. Flow values from rating curves are automatically calculated and displayed on a real time basis as well. Pumping stations data are being upgraded to fit within the automatic data acquisition system. Water quality parameters are sporadic and analyzers are not designed for automatic data acquisition yet.

The MWRI with its research collect periodic samples from River Nile, main canals, and agricultural drains and analyze them for temperature, pH, BOD_5, COD, TSS, turbidity, heavy metals, total coliform, fecal coliform, and pesticides.

Moreover, the **MoHP** operates 230 permanent measuring stations for water quality parameters along River Nile (El-Shafaey, 2013), its branches, and on major canal with special interest in drinking water intakes (MSEA, 2011). Measured parameters include: Temperature, pH, BOD_5, COD, TSS, Turbidity, heavy metals, total coliform, and fecal coliform and pesticides. Measurements are taken once a month by grab samples, analyzed at the MoHP labs, and shared by paper correspondence. Measurements are also taken from main agricultural canals and drains in Egypt. Yearly reports are being prepared by the MoHP and shared with MWRI and other stakeholders.

6.3. Data Analysis, Storage and dissemination

Table 12 summarizes data analysis, storage and dissemination in Egypt

Table 12.A summary table showing data analysis, storage and dissemination in Egypt

What is the quality and timeliness of data being collected in each basin?	• MWRI telemetry data is real time with full proof database management system • River water quality parameters are being collected, analyzed, and reported by professionals and therefore are thought of as good quality data. However, the data are not timely enough acknowledging the intrinsic daily and monthly variation of the measured water quality parameters. This applies to all data involved parties in water quality monitoring (MWRI, MSEA, and MoHP) • All peizometric data collected by the MWRI seems to be of adequate quality following international standards • Peizometric level/drawdown measurements seems to be timely • Groundwater water quality information is less timely
What indicators are being used?	• Surface waters: water level, flow rate, water quality parameters (pH, BOD_5, COD, TSS, Turbidity, heavy metals, total coliform, and fecal coliform). In addition sediment quality is also being periodically analyzed • Water quality performance indicators are neither timely, nor relevant in most of the times. More structured indicators that group priority contaminants (not just water quality parameters) at different times of the year are needed for better reporting on water quality. The MSEA can lead this effort • Ground waters: water level, drawdowns, water quality parameters (Salinity (or TDS), E-Conductivity, Sodium, Potassium, Calcium, Magnesium, Iron, Carbonate, Bicarbonate, Sulphate, Nitrate, Nitrogen Dioxide, Boron, Silicon Dioxide, pH, and total harness). No indicators are reported. • NWRP indicators are reported in Table 13 and Appendix 17.
What performance criteria are being used?	Each ministry operates internal performance criteria for data quality that are neither documented nor shared with data users. However, data quality checks and validation measures are being taken.

Is the data verified and are there quality checks on its collection?	Yes but with no clear methodology for data quality checks. It also varies from one ministry to the other
How is the data managed/collated, analyzed and prepared for dissemination? Is the data collected regionally or centrally before or after analysis?	• Data management/collation, analysis, and preparation for dissemination vary with the source of data/institution. • Procedures vary from simple computer computations to sophisticated special software applications. Outputs are in the form of reports, presentations, and circulars. • Dissemination is usually limited to concerned official organs/institutions and organizations with special materials prepared especially for the media and public. • All institutions disseminate information to CAPMAS to prepare the annual statistics year book that includes excerpts from collected data • MWRI, MoHP, EMA relay collected data to MSEA to help in preparing the annual State of Environment Report • NWRP performance indicators are being collected and calculated by each ministry/agency and shared with the NWRP-CP to be included in the NWRP database (already developed and will be inaugurated very soon) • Analysis is done at both regional and central levels with the more in-depth analysis done at the central level and vice versa. • CAPMAS headquarter, MSEA headquarter, and NWRP unit of MWRI in Cairo are the three main offices hubs that collects all data for storage, further quality checks, and preparation of annual/periodic status reports • Most of the information is still transferred by mail or email.
Is an MIS or DBMS available, functional and used? Provide comment on the strengths and weaknesses of data storage and management. Is the MIS or DBMS readily accessible at the basin/aquifer level?	• MIS or DBMS is available in some institutions but not universally. It is available at the shared basins levels as well. Where it is used, it is mostly functional. • NWRP has the NWRP database (just finished its development) that focuses in M&E&R of NWRP implementation. It is planned to develop links between other MWRI DBMS and models like (ASME, RIBASIM, and DELWAQ) to help in decision making. NWRP system receives the progress and impact data from dedicated units at the relevant ministries in Egypt (Figure 14). These units carry out the day to day work and in continuous contact with the NWRP at MWRI. The NWRP M&E system includes approximately 120 indicators to follow up the implementation of the 39 measures of the plan and 15 indicators to assess the impacts (Table 13 and Appendix 17). All involved stakeholders have agreed upon those indictors but then there were left to each responsible stakeholder to define how it can be measured.The indicators are updated every 3-6 month and they are collected in paper format. This will change shortly as there is an online system that will be launched and users will be able to access the system to update and view the data . • NSAS has the NARIS database functioning but only fed with historic records and still needs to be updated with new data sets (available at: http://www.nsasja.org) • All other departments utilize MS Excel for data storage
Is the information prepared in a user-friendly format and fed back to regional basin levels? How is the information	• Yes, the information is used to inform of and assess present status, diagnose problems, identify indicators, provoke action, form a base for planning and management, and assess performance. • Climatic data are transferred into rainfall, temperature, wind, etc. maps which are made available for utilization. • Water level and water quality monitoring results are mapped and utilized as needed.

used?	• Daily data are presented in tabular form for different users.
Has resource mapping been carried out and are inventories of resources available for each basin?	• Yes, mapping has been carried out in the past. However, it is not being updated except when a status report is demanded • Information that supports mapping of resources is available

Data storage and management strengths:

- More than one DBMS is available for Egypt: NWRP DBMS, MSEA DBMS, CAPMAS DBMS, among others. That means that the required personal and technical capacity for managing and operating such powerful databases not only on the central level but also on the non-central level is available
- Access to the data can be controlled like any sound database. Any of these databases can offer limited access for data viewing and editing according to need.
- Like any sound database the following strengths are inherent:
  - Data analysis can be done easily, quickly, and to high levels of differentiation and sophistication.
  - Outputs can be made in several forms and special attention can be paid to presentation.
  - Templates and special forms can be used to simplify data collection, documentation, standardization and analysis.
  - Different forms / levels of reports can be prepared.

Data storage and management weaknesses:

- Data analysis and manipulation requires high skills which are expensive and difficult to find.
- There is not a unified water sector DBMS that links all water related ministries and agencies. On the contrary, CAPMAS has its database that reports and saves only CAPMAS reported water indicators (e.g. agricultural water use, precipitation, etc..); MSEA has its database that stores and reports water indicators and quality parameters reported in the annual state of environment report (e.g. trends of contaminants in River Nile and coastal waters); MoHP stores data in excel files that are hard to locate and is in need to a more powerful database.
- The NWRP-CP is developing a database that will store and keep track of NWRP monitoring indicators. In its current status, it will not have historic data and it will only keep track on the NWRP M&E. Stretching it or developing a new database that builds on it can serve a unified M&E database and will alleviate the current weakness in the M&E system.

Table 13a. NWRP list of performance indicators for increasing water resources

Intervention #	Intervention	Measure #	Measures	Indicator #	Progress indicator (Output)	Units	Nature	Responsible/ Partner Agency	Department/ Sector	Source of Data
1.1	Add more conventional and non-conventional water resources to the country's water budget	1.1.1	Continue co-operation with Nile riparians	1.1.1.1	Ratification of the Legal and Institutional Framework	1. Preparation of the draft version (15%) 2. Consultation, Discussion and Revision (25%) 3. Agreement approval and ratification (35%) 4. Legal and Institutional Framework in place (25%	Institutional (Milestone Indicators)	MWRI	NWS	قطاع مياه النيل
				1.1.1.2	Annual Volume of Nile Water Available to Egypt	MM^3/YEAR	Outcome	MWRI	NWS	قطاع مياه النيل
		1.1.2	Develop groundwater in the Desert	1.1.2.1	# of operational wells	Number	Investment	MWRI	GWS	قطاع شبكة تحولية
				1.1.2.2	Annual Volume of abstracted deep groundwater	MM^3/YEAR	Investment	MWRI	GWS	قطاع شبكة تحولية
		1.1.3	Stimulate rainfall and flash floods harvesting	1.1.3.1	# of retention dams	Number	Investment	MWRI	GWS	قطاع شبكة تحولية
				1.1.3.2	# of ground reservoirs	Number	Investment	MWRI	GWS	قطاع شبكة تحولية
				1.1.3.3	Capacity of the rainfall and flash floods harvesting storage reservoirs	MM^3/YEAR	Investment	MWRI	GWS	قطاع شبكة تحولية
				1.1.3.4	Annual Volume of Water Harvested and utilized	MM^3/YEAR	Investment	MWRI	GWS	قطاع شبكة تحولية
		1.1.4	Increase seawater desalination (in the coastal areas)	1.1.4.1	Capacity of Desalination Plants in tourism areas	MM^3/YEAR	Investment	MoT	TDA	الشركة القابضة لمياه الشرب والصرف الصحي
				1.1.4.2	# of desalination plants in all governorates	Number	Investment	MHUUD	HCWW	الشركة القابضة لمياه الشرب والصرف الصحي
				1.1.4.3	Capacity of Desalination Plants in all governorates	MM^3/YEAR	Investment	MHUUD	HCWW	الشركة القابضة لمياه الشرب والصرف الصحي
				1.1.4.4	Annual Volume of Seawater desalinated	MM^3/YEAR	Investment	MHUUD	HCWW	الشركة القابضة لمياه الشرب والصرف الصحي
		1.1.5	Improve management and increase pumping of shallow groundwater	1.1.5.1	Total number of wells	Number	Management	MWRI	GWS	قطاع شبكة تحولية
				1.1.5.2	Total number of wells registered	Number	Management	MWRI	GWS	قطاع شبكة تحولية
				1.1.5.3	Total number of wells licensed	Number	Management	MWRI	GWS	قطاع شبكة تحولية
				1.1.5.4	# of observation wells in Nile Valley and Delta	Number	Management	MWRI	GWS	قطاع شبكة تحولية
				1.1.5.5	Annual Volume of shallow groundwater abstracted	BM^3/YEAR	Management	MWRI	GWS	معهد بحوث المياه الجوفية

Table 13b. NWRP list of performance indicators for water use efficiency

Intervention #	Intervention	Measure #	Measures	Indicator #	Progress indicator (Output)	Units	Nature	Responsible/ Partner Agency	Department/ Sector	Source of Data
2.1	Raise water use efficiency	2.1.1	Continue irrigation improvement programs (IIP/IIIMP)	2.1.1.1	Total areas with improved irrigation handed over to WUAs	1000 Feddans	Investment	MWRI	IIS	قطاع تطوير الري
		2.1.2	Expand on-farm improved water management	2.1.2.1	Area of agricultural lands with laser land leveling applied	1000 Feddans	Investment	MALR	EALIP	جهاز تحسين الأراضي
				2.1.2.2	Area of agricultural lands with improved marwas	1000 Feddans	Investment	MALR	EALIP	جهاز تحسين الأراضي
				2.1.2.3	Total area where on-farm improvement completed	M^3/Feddan	Management	MALR	EALIP	جهاز تحسين الأراضي
		2.1.3	Apply modern irrigation techniques in new lands and oases	2.1.3.1	Total area of violations	1000 Feddans	Management	MWRI	ID	قطاع الري
				2.1.3.2	Area of violations corrected	1000 Feddans	Management	MWRI	ID	قطاع الري
				2.1.3.3	Area of new lands applying modern irrigation	1000 Feddans	Management	MWRI	ID	قطاع الري
				2.1.3.4	Total irrigated lands in oases	1000 Feddans	Management	MWRI	GWS	قطاع المياه الجوفية
				2.1.3.5	Area of oasis lands applying modern irrigation	1000 Feddans	Management	MWRI	GWS	قطاع المياه الجوفية
		2.1.4	Promote drainage water reuse in selected areas and expand intermediate drainage	2.1.4.1	Volume of Reused Drainage Water in Main System	MM^3/YEAR	Management	MWRI	IS	معهد بحوث الصرف (المركز القومي لبحوث المياه)
		2.1.5	Promote growing salt-tolerant and short duration crops	2.1.5.1	Number of salt tolerant crops developed and cultivated	Number	Research	MALR	ARC	معهد بحوث المحاصيل
				2.1.5.2	Number of short duration crops developed and cultivated	Number	Research	MALR	ARC	معهد بحوث الهندسة الوراثية
				2.1.5.3	Area of agriculture land using salt tolerant crops	1000 Feddans	Management	MALR	ASS	قطاع الشئون الإقتصادية
				2.1.5.4	Area of salt affected soil	1000 Feddans	Management	MALR	ARC	معهد بحوث الأراضي والمياه والبيئة
				2.1.5.5	Area of agriculture land using short duration crops	1000 Feddans	Management	MALR	ASS	قطاع الشئون الإقتصادية
		2.1.6	Improve drinking water availability and reduce losses	2.1.6.1	# of installed functional water meters	Number	Investment	MHUUD	HCWW	الشركة القابضة لمياه الشرب والصرف الصحي
				2.1.6.2	% of unaccounted for water = [1-(Ratio of quantity of drinking water billed / quantity of drinking water produced)] * 100%	PERCENT	Investment	MHUUD	HCWW	الشركة القابضة لمياه الشرب والصرف الصحي
				2.1.6.3	Total installed capacity of drinking water treatment plants	MM^3 / DAY	Investment	MHUUD	HCWW	الشركة القابضة لمياه الشرب والصرف الصحي
				2.1.6.4	Actual annual volume of drinking water produced	MM^3 / Day	Investment	MHUUD	HCWW	الشركة القابضة لمياه الشرب والصرف الصحي
				2.1.6.5	% of safe drinking water coverage in rural areas	PERCENT	Investment	MHUUD	HCWW	الشركة القابضة لمياه الشرب والصرف الصحي
				2.1.6.6	% of safe drinking water coverage in urban areas	PERCENT	Investment	MHUUD	HCWW	الشركة القابضة لمياه الشرب والصرف الصحي
		2.1.7	Promote water saving technologies and practices in industry	2.1.7.1	New norms of standard water consumption for various industries issued	1. Proposed options and planning alternatives prepared (15%) 2. Discussion rounds organised and consensus built (35%) 3. Endorsement of agreed criteria and bases (25%) 4. Water consumption norms and standards applied (25%)	Management (Milestone Indicators)	MoIFT	IDA	الهيئة المصرية للتنمية الصناعية
				2.1.7.2	Total number of industrial units	Number	Investment	MoIFT	IDA	الهيئة المصرية للتنمية الصناعية
				2.1.7.3	# of industrial units applying water saving techniques	Number	Investment	MoIFT	EFI	اتحاد الصناعات المصرية جهاز شئون البيئة

Table 13c. NWRP list of other key performance indicators

Measure / Indicator	Target in 2017	Achieved up to 2010
Develop groundwater in the Desert [MWRI]		
Annual Volume of abstracted deep groundwater (Mm3/yr)	4000	2200
Continue irrigation improvement programs (IIP/IIIMP) [MWRI]		
Total areas with improved irrigation (1000 fed.)	1780	339
Expand on-farm improved water management [MALR]		
Area of agricultural lands with laser land leveling applied (1000 fed.)	3300	550
Promote drainage water reuse in selected areas and expand intermediate drainage reuse [MWRI]		
Volume of Reused Drainage Water in Delta (Mm3/yr)	8000	6400
Improve drinking water availability and reduce losses [MHUUD]		
Number of installed functional water meters (1000)	1380	980
Total amount of produced drinking water (Mm3/yr)	13000	8760
Safe drinking water coverage in urban areas (%)	100	100
Safe drinking water coverage in rural areas (%)	100	99
Improve agricultural drainage conditions [MWRI]		
Area served with functional open drains (1000 fed.)	8290	8190
Area of agricultural land provided with functional Sub-surface drainage (1000 fed.)	6400	5857

7. Rural Water Supply & Sanitation M&E

The WSS M&E system in Egypt is centralized. There is no segregation between Rural M&E and Urban M&E. As such, for the specific case of Egypt, one section will be included to report rural and urban WSS M&E to avoid unnecessary redundancy.

8. Urban Water Supply & Sanitation M&E

8.1. Institutions and Monitoring Networks

The following institutions collect data on rural and urban water supply and sanitation (WSS) as the two are not segregated in Egypt:

- The newly formed MDWSF exemplified in:
  - HCWW that owns and operates WSS assets through 25 regional companies. It collects daily water quantity and quality data from WTPs, WWTPs, random samples from the water transmission and distribution systems, and pump stations. Samples are analyzed in the subsidiary companies branch labs and in the certified central laboratory in Cairo.
  - CAPWO for monitoring the water quality in Cairo and Alexandria
  - EWRA that supervises, reviews, and monitors the water and wastewater sector. It monitors on a random check basis to ensure adherence to standards and regulations.

- MHUND, mainly represented by New Urban Communities Authority after migrating NOPWASD to the new MDWSF. It monitors on a random check basis to ensure adherence to standards and regulations.
- MoHP represented by the Central Administration for Environmental Affairs. This is the main body responsible for public safety in Egypt. It monitors water quality on a periodic check basis at locations selected at points of high contamination risk to ensure adherence to standards and regulations. It collects samples from WTPs, and from the water transmission and distribution systems in Egypt. Samples are also taken from main canals and at close locations to water intakes. The samples are analyzed in the MoHP laboratories.
- EEAA and its branches through their inspection plans collect samples from liquid industrial discharges, WTPs and WWTPs and analysis them in their Labs to ensure adherence to standards and regulations.

Despite the fact that there is not a structured M&E framework for the WSS sector, M&E activities are assigned to special departments/units within the different ministries/agencies.

Nearly 50% of the population is being served by secondary/tertiary wastewater treatment plants in Egypt. The remaining 50%of both rural and urban population uses septic tanks and on-site decentralized systems that are not controlled by the Ministry, or are subject to unimproved sanitation systems. These onsite disposal systems are not monitored (except infrequently by researchers). Collected data are not analyzed nor utilized by the institutions in charge. Collected data are not exchanged between institutions in charge. Collected data are usually infrequent /discontinuous, fragmented, inaccurate, and not updated. Hence, they are of limited use.

However, MDG indicators that relates to WSS are being estimated based on collecting information on access to water and sanitation, population estimates; as releases by CAPMAS in annual the statistics year book. Formal water quality measurements are also being conducted routinely for the 50% treated in wastewater treatment plants.

8.2. Indicators & Sampling for Data Collection

The MoHP, MDWSF, MSEA are the major players in sampling and data collection for WSS. The major (rural and urban) WSS parameters monitored are:

- Network components data (pipes, pumps, etc.).
- Volume of treated potable water

- Length of pipelines
- Pumping stations electricity usage
- Drinking water quality parameters
- Influent and treated effluent quality leading to treatment plant performance evaluation.
- Wastewater quantities generated on basis of sources.
- Wastewater treatment plants and capacities.
- Wastewater volumes treated / reused / discharged.

This data is used for pricing and collecting revenue from WSS system operation and maintenance. Table 14 gives an overview on the data collection.

Table14. Indicators & Sampling for urban/rural WSS Data Collection

Question	Response	Comments
For what purpose is the data being collected?	• Data are collected mainly for purpose of operation and maintenance of WSS networks by the HCWW; e.g. checking networks pressures and water losses, metering water users for the sake billing, and checking quality of water, and flow rates of treated effluents for reuse or disposal purposes. However, this data is used to prepare the annual WSS report by EWRA and the annual state of environment report by MSEA. • MoHP also collects daily samples from WTPs, desalination plants, distribution network for quality control purposes, and some data are used for reporting by MSEA in its annual report and for the MoHP annual water quality report. MoHP also collects data on sanitation for samples collected from the discharge points of WWTPs to agriculture drains for quality control purposes.	• Data collected by HCWW is stored in the HCWW database (MARS) and in the 24 subsidiary companies computers. • Data collected by the MoHP is stored in Microsoft Excel spreadsheets within the Central Administration for Environmental Affairs • This data should be regularly fed to the M&E lead organization
Is the data being collected by direct observation (such as through household surveys) or through knowledge of delivery of services by projects (supply side)?	• Most of the water supply data is collected through HCWW operators in every subsidiary company zone and on every network. Periodic as well as random samples are being taken by the MoHP and MSEA for quality control. • All WTPs, WWTPs, desalination plants, pump stations are being sampled by operators on a regular basis. Data are typically analyzed at the subsidiary companies labs and at the central reference lab in Cairo. • Collection of data on sanitation is also conducted by WWTPs operators, lift stations operators for samples collected from lift stations, and on the discharge points to agriculture drains by MSEA. • Egyptian Armed forces collects water quality information for its armed bases and networks and conducts its own quality control measures. However, this data is not shared with anyone outside the army.	A point of strength that ensures good representation of service to reality
Which indicators are	Find below information about national indicators used	National indicators have to

Question	Response	Comments
being used? How do they compare to the indicators used by the JMP to measure progress towards the MDG?	and JMP indicators	include JMP indicators, as originally defined by JMP, to avoid confusion in the reported figures
What are the geographic area and/or population being surveyed?	• All zones covered by the 25 subsidiary companies of the HCWW • Urban cities are covered • Rural cities are less covered • All piped water supply are routinely monitored • All WTPs, WWTPs are being monitored routinely	
Comment on the survey design and the sample and its representativeness	No designs for surveys are made since water companies do not depend on surveys for data collection.	Surveys are needed for remote rural communities and at locations where onsite wastewater treatment is conducted in order to get more up-to-date information
Are there quality checks on the data collection? Is the data verified?	Yes, there are qualities checks as 5 of the HCWW labs are ISO 17025 certified. MoHP, MSEA, and EWRA collects random samples for quality control and verification of the data reported by the WSS main operator, the HCWW	More quality checks are needed. Validation of sampling procedures is not conducted as validation only takes place for the sampling analyses.
Is the local definition of coverage the same as that of the MDGs	**Yes, for drinking water** • JMP Improved Drinking Water Sources (Piped water into dwelling, plot or yard, Public tap/standpipe, Tube well/borehole, Protected dug well, Protected spring, Rainwater collection • JMP Unimproved Drinking Water Sources (Unprotected dug well, Unprotected spring Cart with small tank/drum, Bottled water, Tanker-truck, Surface water (river, dam, lake, pond, stream, canal, irrigation channels)) **No, for sanitation** • JMP improved Sanitation Facilities (Flush or pour – flush to: piped sewer system, septic tank, pit latrine; Ventilated improved pit latrine; Pit latrine with slab; Composting toilet) • JMP Unimproved Sanitation Facilities (Flush or pour–flush to elsewhere; Pit latrine without slab or open pit; Bucket; Hanging toilet or hanging Latrine; No facilities or bush or field) • Egypt improved sanitation includes only piped sewer system to WWTPs (sometimes defined as secondary WWTPs)	• JMP reported values for improved water supply access are 100% and 99% for urban and rural populations, respectively (2010 figures as per Appendix 14); matching Egyptian figures • JMP reported values for coverage of improved sanitation are 97% and 93% for urban and rural populations, respectively (2010 figures as per Appendix 14); not matching Egyptian published numbers (85% and 11% for urban and rural, respectively)

Question	Response	Comments
Are the coverage rates based on area, or population? If based on area, do they accurately reflect population? If based on population, is the total population up-to-date and accurate or have interpretations been made which are of doubtful quality?	• Coverage rates are based on population as provided by CAPMAS (i.e. numerator and denominators are timely but population figures are forecasts from last census) • For accessibility of water, the coverage is computed as the number of households connected/number of households in city or town in urban areas. • For consumption, the coverage is computed as the total volume of water consumed /population in urban area.	Revising coverage rates for accessibility of water is needed according to JMP
Is water quality tested and do the sample collection, indicators and water analysis give a realistic/accurate determination of water safety?	• Water quality analyses are not being monitored based on a preset sampling plan. • EWRA, HCWW, MSEA, MoHP collect and analyze samples as well as NGOs, universities, research centers for quality control purposes • MDWSF has up-to-date ISO certified laboratories. MSEA and MoHP also have certified laboratories • Collected data can provide a realistic determination of water safety	• Water quality sampling do not follow a pre-defined protocol (when to collect the sample, where from, how to collect, and how to store and handle until measurements • A more robust data sampling, analysis, and reporting system is needed for M&E purposes
Data segregated by gender	NO	NA

The HCWW and EWRA develop a set of performance indicators (71 are mentioned for HCWW in its Monitoring, Analysis and Reporting System DBMS (MARS): 36 for water and 35 for wastewater. However, EWRA working documents suggest that it has developed about 90 indicators to be implemented in the future). Table14 shows the main performance indicators for WSS in urban and rural areas and how they are calculated and where these indicators are supposed to go (ARUP, 2011). Table 15 depicts the definition of the key WSS performance indicators monitored by the HCWW and by MoHP.

Table15. Definition of key indicators for urban and rural WSS in Egypt as presented in MARS and by MoHP

Theme	Performance Indicator	Frequency	Institution
Accessibility to improved drinking water in urban and rural areas	Number of households with improved access to water or provided with potable water by government tanker trucks / total number of households	Annually	MDWSF
% of population served by piped water	Number of households with piped access to water / total number of households	Annually	MDWSF
Per Capita water consumption	Volume of wastewater (domestic and industrial)	Annually	MDWSF
Total amount of water provided	m^3 sold per year	Annually	MDWSF

Theme	Performance Indicator	Frequency	Institution
for domestic applications			
% water losses	Percent of water produced but unbilled	Annually	MDWSF
Coverage of improved sanitation	Number of households with improved access to sanitation / total number of households	Annually	MDWSF
Wastewater treated by WWTPs	m^3 treated per year	Annually	MDWSF
Other indicators	Progress in developing, implementing, and assessing performance against service standards (milestone indicator)	Annually	MDWSF
Other indicators	Percent of total costs recovered by targeted subsidiaries	Annually	MDWSF
Other indicators	Percent of O&M costs recovered by targeted subsidiaries*	Annually	MDWSF
Other indicators	Percent change in volume of unaccounted for water	Annually	MDWSF
Other indicators	Days sales in accounts receivable (aging)	Annually	MDWSF
Other indicators	Percent of collection from period's bills	Annually	MDWSF
Other indicators	Percent of collection from arrears	Annually	MDWSF
Other indicators	Progress in developing and implementing subsidiary business plans(milestone indicator)	Annually	MDWSF
Other indicators	Percent change in the volume of leakage	Annually	MDWSF
Other indicators	Percent change in chemical costs	Annually	MDWSF
Other indicators	Percent change in energy costs	Annually	MDWSF
Other indicators	Percent of samples meeting Egyptian water quality standards	Annually	MDWSF
Other indicators	Percent of samples meeting Egyptian effluent wastewater quality standards	Annually	MDWSF
Other indicators	Number of project-targeted subsidiaries producing quarterly financial and accounting statements	Annually	MDWSF
Other indicators	Percent of meters functioning in targeted areas	Annually	MDWSF
Other indicators	Percent of customers billed in targeted areas	Annually	MDWSF
Other indicators	Percent of the volume of water produced that is billed	Annually	MDWSF
Other indicators	Number of project-targeted subsidiaries producing quarterly MARS Reports	Annually	MDWSF
Other indicators	Quality of information generated by MARS*	Annually	MDWSF
Other indicators	Percent of annual R&R budget expended	Annually	MDWSF
Other indicators	Number of standard contracting documents completed	Annually	MDWSF
Other indicators	Percent of Agency Chairman receiving PM reports on a monthly basis	Annually	MDWSF
Other indicators	Percent of overall sector O&M financing which comes from customer tariffs	Annually	MDWSF
Other indicators	Percent of overall sector O&M financing which comes from subsidy	Annually	MDWSF
Other indicators	Percent of utilities submitting annual information returns	Annually	MDWSF
Other indicators	Percent of utilities submitting three year tariff studies	Annually	MDWSF
Other indicators	Number of plant operators who take a certification exam	Annually	MDWSF
Other indicators	Percent of plant operators taking the exam who are certified	Annually	MDWSF

Theme	Performance Indicator	Frequency	Institution
	(pass rate)		
Other indicators	Number of PPP transactions contracted	Annually	MDWSF
Other indicators	Value of private sector investment through PPPs	Annually	MDWSF
Other indicators	Number of people trained	Annually	MDWSF
Other indicators	Number of subsidiaries developing or updating HRD plans	Annually	MDWSF
Other indicators	Number of subsidiaries using an automated HR management system	Annually	MDWSF
Other indicators	Percentage of samples meeting Egyptian water quality standards for drinking water	Annually	MoHP
Other indicators	Percentage of samples meeting Egyptian water quality standards for surface water (intakes)	Annually	MoHP
Other indicators	Percentage of samples meeting Egyptian water quality standards for agriculture drains	Annually	MoHP
Other indicators	Percentage of samples meeting Egyptian water quality standards for treated wastewater	Annually	MoHP
Other indicators	Percentage of samples meeting Egyptian water quality standards for industrial discharges	Annually	MoHP

Assessment of M&E data collection approaches and methods on the national level:

- Data collection by HCWW, EWRI, MoHP, and MSEA is usually practiced all over urban and rural Egypt
- Approaches and methods for M&E data collection and analyses vary from one agency/ministry to the other. Every ministry/agency has acquired enough experience to carry the work properly among the years.
- HCWW operates a web-based Database Management System (DBMS); called MARS; that collects WSS information and water quality data for storage, performance indicators calculations, and providing annual reports.
- In summary, the WSS M&E system is relatively strong but there is a lot of room for improvements and cooperation between all ministries involved in data collection to formulate a national framework for M&E&R.

Points of Strength:

- Monitoring, evaluation, and reporting system has been established to link all the subsidiary companies of the HCWW, namely MARS; providing a comprehensive database on pre-approved set of water related indicators including those of the MDGs and on financial and other indicators as well.
- The RWSS indicators are being coordinated and included in the set of indicators monitored by the NSWRP 2017 coordination panel
- Collected data clearly and adequately represent the intended result and reflect no bias in most cases
- Collected data reflect consistent collection and analysis methods over time (data reliability)
- WSS data gathering is sufficiently current and available to be practical for use by management (data timeliness)
- Human and financial resources for M&E are available enough for a basic M&E system

Points of Weaknesses:

- An integrated framework for data collection identifying the data, indicators, who collects what among sectors, data flow and analysis methods, does not exist as such; minimizing the full potential of use in decision making.
- The available mechanisms in place to reduce the possibility for manipulation of data is not robust enough
- Although data validity is inherent of the current system most of the times, it is at times questionable. Data collection can be biased at times to hide problems of political consequences.
- There is still a need for more qualified personnel for data collection, analysis, and reporting. Financial availability needs to be increased through full-cost recovery for sustainability but this cannot be at the cost of the poor. Intelligent cost recovery models are needed to overcome these problems.

8.3. Data Storage & Analysis

Data collection, storage, and analysis:

As explained in Section 8.1, there is more than one institution working with data collection, storage, and analysis. Data collection, storage, and analysis methods vary with entities and locations (towns and cities). However, in general no automatic / on-line sampling is used.

In terms of data collection, all involved parties (MoHP, HCWW, EWRA, and MSEA) employ simple data gathering approaches/methods using simple, manual operations and via collecting grab samples from requested or periodic locations. The database has been designed in order to allow an easy data entry and with access to all subsidiary companies to HCWW. As a consequence, the data contained in the Regional WSS Master Plans have been transferred into the database.

MoHP and MSEA typically store collected information in paper sheets, scan these sheets to share with central offices, and archive the paper files. However, HCWW and EWRA utilize a web-based DBMS (termed MARS) for data entry. MARS can be accessed at: *www.mars.hcww.com.eg*. Figures 16 to 18 show some screenshots from the MARS interface.

MARS is GIS based (Figure 18), with employed models to calculate performance indicators (Table 14), analyze systems (water networks losses, wastewater networks, wastewater treatment plants, cost recovery, etc..). The quality of analysis and storage is good. Access of information is easy. However, data is not gender disaggregated. In addition, the HCWW uses up-to-date hydraulic analysis software (water CAD and sewer CAD) that can help in providing important information for WSS management.

Figure 16. Screenshot from MARS DBMS

Figure 17. Screenshot from MARS DBMS, showing some of the measured water quality parameters

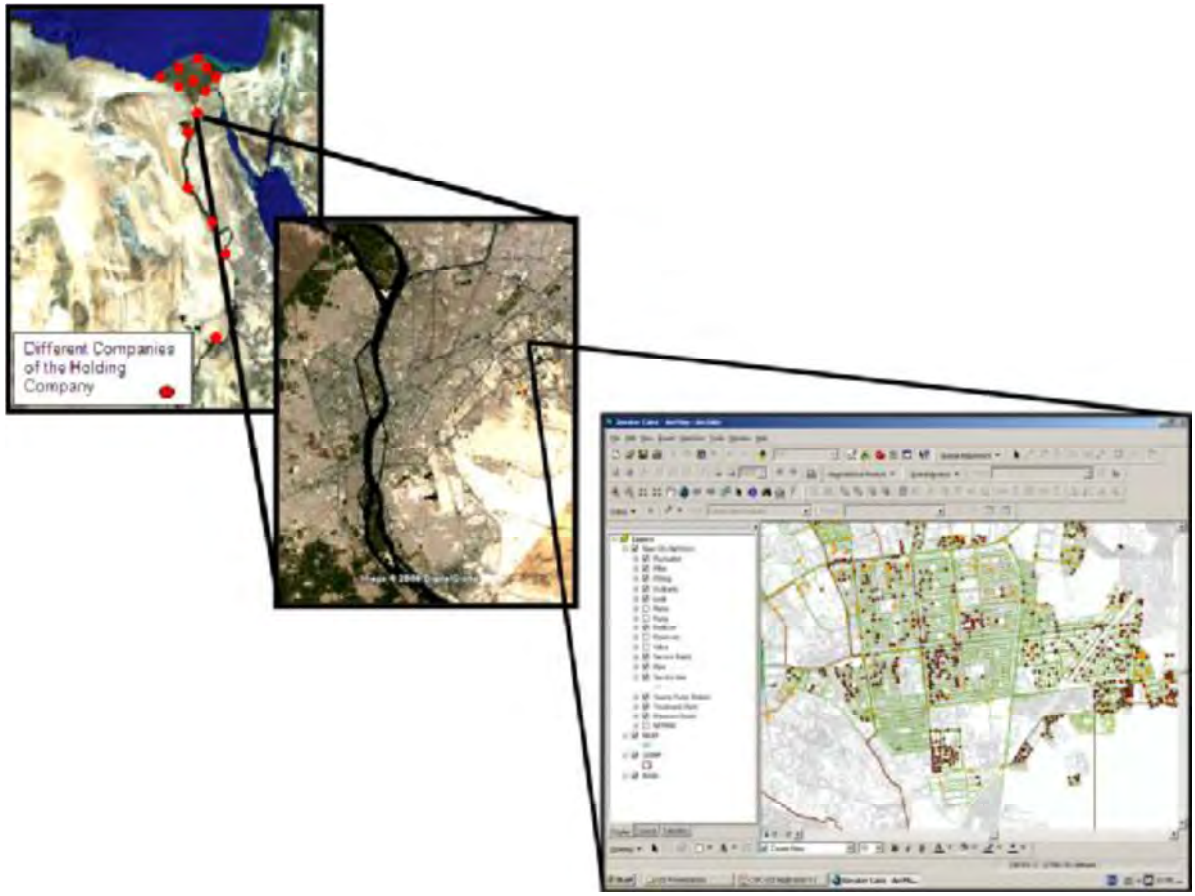


Figure 18. Screenshot showing the GIS capability of MARS

Data management chain:

MoHP and MSEA:
Data are recorded and stored in special forms at sites and labs. They are submitted to the main office of each governorate to be digitized and emailed to the central office in Cairo for analysis. Digitized data analysis is carried out using simple programs (Excel). The processed data is used to form an annual report to be communicated to the Prime Minster office. Some information is sent to CAPMAS to be included in the annual yearbook (e.g. CAPMAS, 2012). In addition MSEA share some water quality information with MSEA to be included in the annual State of Environment Report (Appendices 6 and 7). Violations are dealt with immediately in cooperation with the HCWW. MoHP and MSEA data management chain can be summarized as in Figure 19.

HCWW and EWRA:
Data are recorded and stored in special forms at sites and labs. They are keyed in directly to MARS using the computer infrastructure of the HCWW subsidiary branches and labs. MARS is programmed to carry out data analysis and to calculate over 90 performance indicators. However, data presentation is lumped for the subsidiary company as a whole with no option to view more disaggregated data. The processed data is used to form an annual report by EWRA (e.g. Appendix 16) to be communicated to the Prime Minster office. Some information is sent to CAPMAS to be included in the annual yearbook (e.g. CAPMAS, 2012). In addition MSEA share some water quality information with MSEA to be included in the annual State of Environment Report (Appendices 6 and 7).

Calculated performance indicators by MoHP, MSEA, HCWW, and EWRA as per Table 14 are communicated to the NWRP-CP to continue monitoring the NWRP. A summary of HCWW/EWRA data management chain is presented in Figure 20.

Monitoring can be considered as a chain of activities in an information system and with the chain closed with the management and control action of the decision maker. Building an accountable information system requires the activities in the chain to be implemented. An "x" is shown beside links that are not found in the WSS data chain in Egypt. It is evident that the chain does not constitute a closed loop.

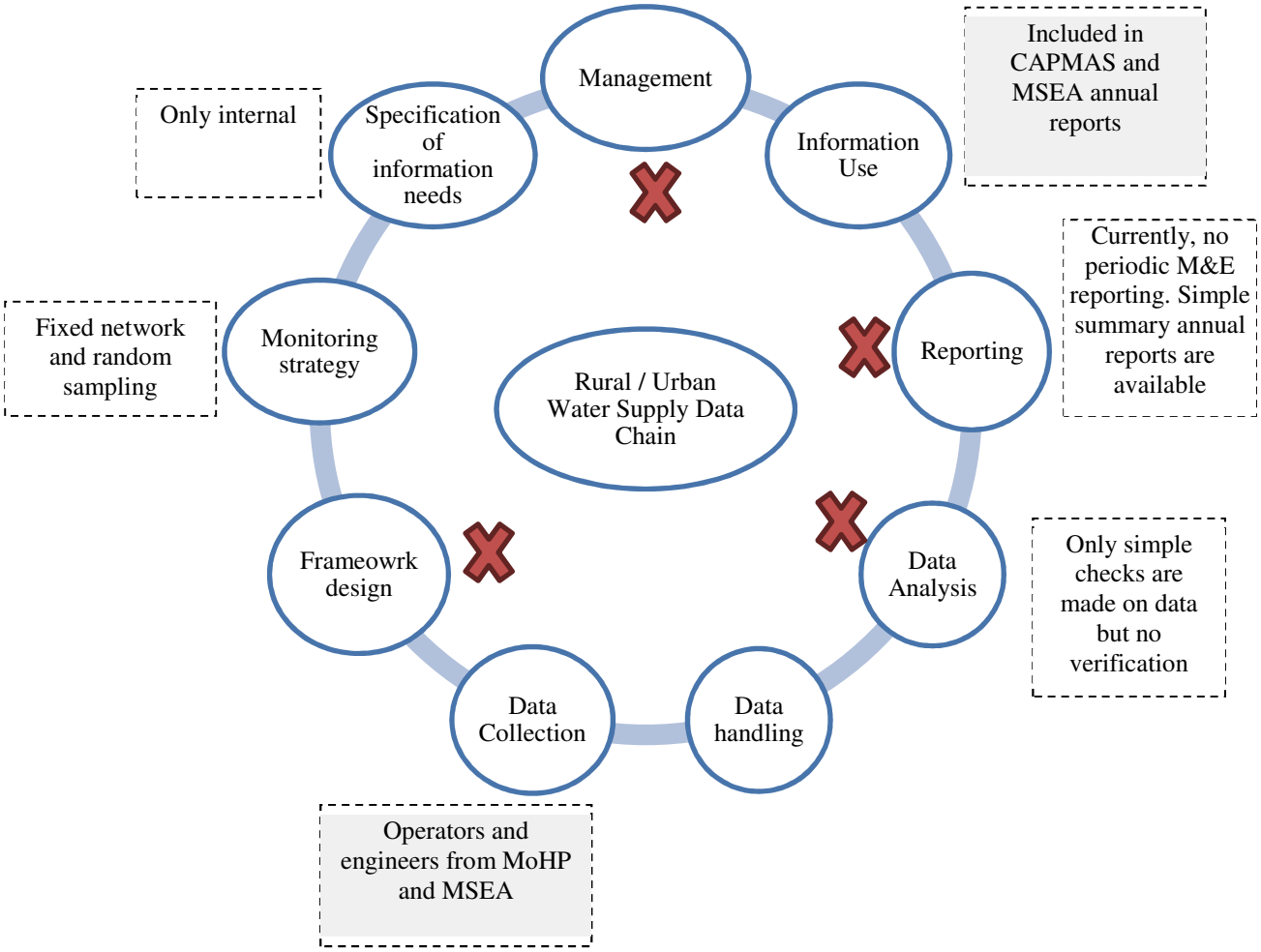


Figure 19. Data management chain of activities for urban & rural WSS for data collected by MoHP and MSEA

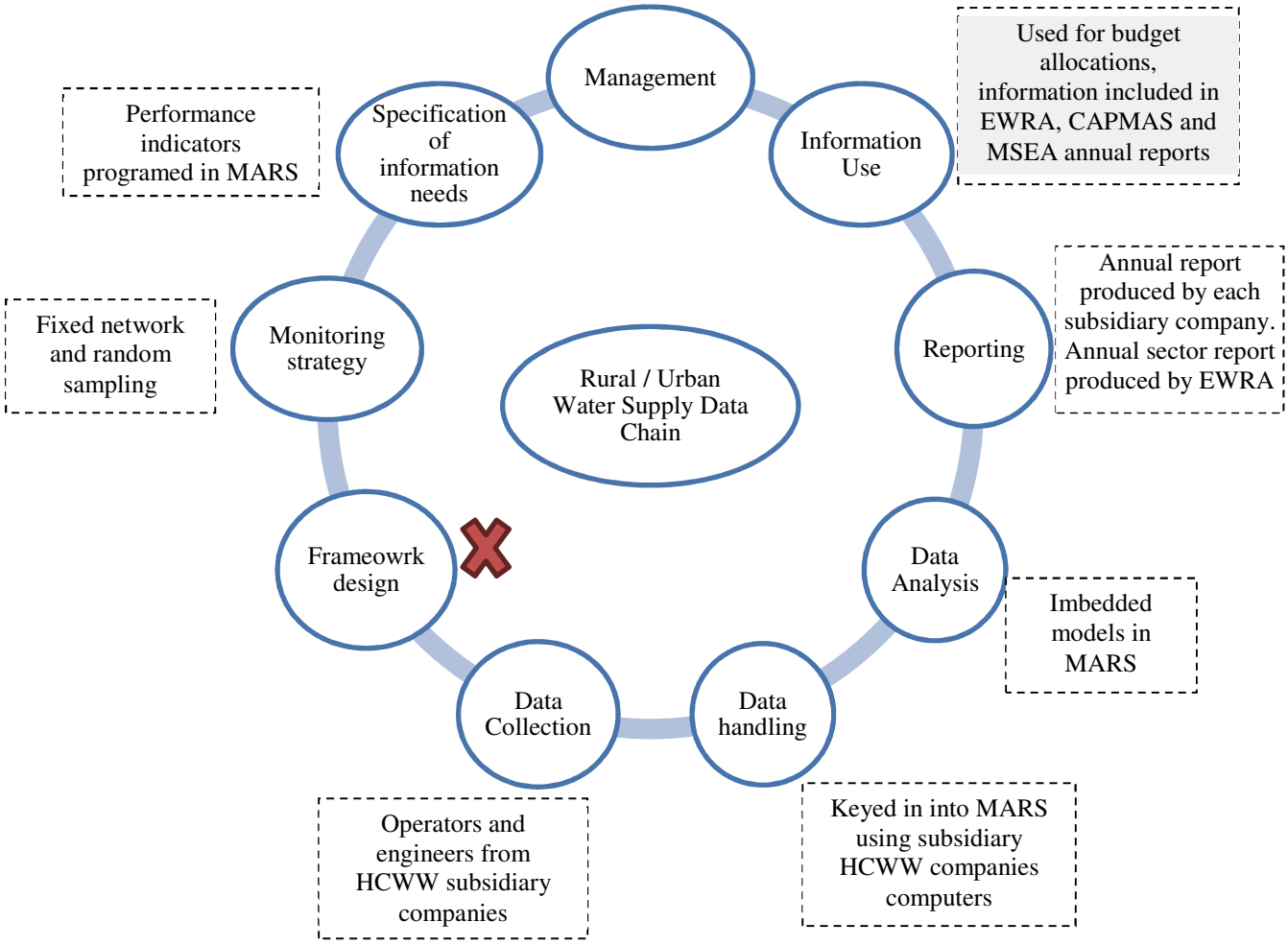


Figure 20. Data management chain of activities for urban & rural WSS for data collected by HCWW/EWRA

8.4. Information Dissemination & Use

Egypt has maintained excellent relations with international donors and organizations. WSS data produced in Egypt are used by global organizations, which produce monitoring indicators for urban and rural water supply such as UNICEF JMP (Appendix 14).

***Information flow*:**

- Collected data and calculated performance indicators are used mainly for:
  - Billing citizens
  - Calculating cost recovery and budgeting for the following year
  - Producing EWRA annual WSS report (Appendix 16)
  - Producing MSEA state of environment report (Appendices 6 and 7)

- Feeding CAPMAS with necessary information to help in developing the annual yearbook (Appendix 5)
- Help in monitoring and evaluating the NWRP

- Collected information and performance indicators may be used for assessment and planning purposes by the HCWW, and NWRP
- Data/information is processed as described in Section 8.3. Publications are in the form of performance reports, follow-up/progress reports, technical articles, or presentations upon request for official purposes. At times, data/information is published on the company's website.

9. M&E Subsystems

9.1. Environment

M&E systems and capacities of related organizations:
There are three major related organizations that protect the Environment in Egypt: (1) MSEA, (2) MoHP, and (3) MWRI.

The main **mandate of the MSEA** or, Egyptian Environmental Affairs Agency (EEAA) as mostly referred to in Egypt, is to protect Egypt's environmental ecosystem including: air, water, soil, and protectorates from any adverse anthropogenic environmental impacts. It has a mandate to monitor all indicators / parameters related to industrial discharges and to monitor the water quality of receiving water bodies. Section 5.2 lists the man mandates and activities conducted by the MSEA.

MWRI has the mandate to protect River Nile, groundwater resources, irrigation canals, and Lake Nasser. It operates a water quality network in River Nile, Lake Nasser, and irrigation canals. The groundwater research center operates over 200 fixed groundwater monitoring wells. Results are being assembled in annual reports that are shared with the Cabinet of ministers.

MoHP undertakes M&E in order to protect public health. The main focus is on potable water quality, River Nile quality, and the water quality of selected agricultural canals and agriculture drains that has direct/indirect influence on WTPs. MoHP also calculates and reports performance indicators as per Table 14.

Currently, the three involved organizations have well positioned systems and capacities for M&E&R. MSEA and MWRI are more advanced in terms of technical and infrastructural capabilities of the DBMSs and the skill of the involved employees than the MoHP. The MSEA is the most advanced in terms of good reporting mechanisms (e.g. in Appendices 6 and 7). GIS tools and DBMs are being used extensively by MSEA and MWRI. Opportunities exist for generating and sharing data between the two ministries. MSEA coordinates its reporting with MWRI and MoHP through the Higher Ministerial Committee for Water that involves all water related ministries in Egypt including MESA, MWRI, and MoHP.

9.2. Physical Surveys

The following data sources that are generated by physical surveys can be useful to the water sector:

- Agricultural farm surveys to determine water demands, productivities, incomes, labor force, power consumptions, fertilizers, pesticides, etc… to determine / monitor / evaluate used water sources, agricultural water consumptions, crop yield, etc...
- Industry, tourism, oil and gas production and manufacturing, and other sectors: sources, quantities of water used and wastewater volumes generated their variations, treatment technologies used, etc.
- Domestic water and wastewater surveys including:
    - House surveys to determine / monitor number of connections and water use rates
    - House surveys to determine / monitor / evaluate water quality and variations
    - House surveys to determine / monitor / evaluate user satisfaction levels and complaints
    - Commercial and industrial connections to determine / monitor number of connections and water use rates
    - Supply sources to monitor / evaluate global demand rates

- Surveys on treatment plants to determine / monitor / evaluate performance and quality changes
- Network surveys to determine / monitor / evaluate pressure distributions and variations
- Network surveys to determine / monitor / evaluate state of components
- Billing records to determine / monitor / evaluate user compliance and net returns, etc.
- Expenses (capital, operation and maintenance) on monthly and yearly basis
- Maintenance records to determine / monitor / evaluate distribution of failures, causes, solutions, etc.
- Workforce records to determine / monitor / evaluate work quality, performance, training needs, etc.

The above surveys can be supplemented with other related surveys such as population, climate, environment, economy, legislation to ensure a comprehensive database.

Most of the collected information via surveys can aid in providing M&E data or anecdotes to support available data as follows:

- It can be used at different levels and by different stakeholders. At the organization's (subsectoral) level, data can be used to assess and improve performance and to make strategies and action plans. This same practice is done on the sectoral and then national levels.
- To be of best use, M&E data: 1) must be identified centrally but with the participation of all parties concerned, 2) collected and analyzed using the same "agreed to" approaches and methods, 3) be verifiable, 4) collected and analyzed at a decentralized level (by subsectors or even lower levels), 5) be streamlined to flow from bottom up and conversely, 6) be overseen by an authority that can check the validity and ensure and build the capabilities needed for good M&E, and 7) have independent organs checking the performance of the national M&E system. There are opportunities to organize surveys to provide specific M&E information in such an organized way.

9.3. Census & Socio-economic Surveys

In Egypt, the last census was conducted in 2006. Census is being conducted once every 10 years. Census results are being monitored by CAPMAS. It produces a yearly statistics book (Appendix 5) that has separate sections on population, water, agriculture, economy, etc... Census data is clearly being used in IWRM and WSS M&E.

CAPMAS is the official source for providing, preparing, and publishing statistical data, information and reports for all organizations, ministries, universities, research centers, and international organizations.

Census data are available for all communities. They are relevant to sector M&E as water sector is a service sector to all other sectors whose water demands depend heavily and directly most of the time on population served. This is especially the case for WSS. Because census is conducted every 10 years, interpretations have to be made to feed WSS M&E with census information. These interpretations are generally good (CAPMAS, 2012).

Socioeconomic surveys are still in a pre-mature phase in the field of WSS so their significance or relevance cannot be evaluated. The boundaries that cover the census are the same as those covering the WSS M&E as there is a good coordination between CAPMAS and MDWSF.

9.4. Meteorological Surveys

The Egyptian Meteorological Authority (EMA) is the national organization that leads the meteorological surveys through operating more than 200 meteorological stations all over Egypt. EMA has over 100 years of data about meteorological parameters such as temperature, wind speed, wind direction, relative humidity, barometric pressure, sunshine duration, radiation, rainfall, and air quality (EMA, 2013). The World Meteorological Organization (WMO) established several Regional Climate Centers (RCC). In cooperation between Egypt, Libya, Tunisia, Algeria, Morocco and under WMO region I (WMO RA I) EMA is hosting the North African Virtual Climate Change Center (NA_RCC) for training and co-leading the Long Range Forecast (LRF) as per Appendix 8.

EMA provides services to different sectors in Egypt such as: Civil Aviation, Marine, Military Forces, Tourism, Water resources and irrigation, Agriculture, Environment and Urbanization. Through the cooperation between the EMA and MWRI, EMA is running several stations for measuring the evaporation at Lake Naser.

Recently, EMA renew the traditional meteorological stations to Automatic Weather Systems (AWOS); AWOS provide meteorological observations to users in real-time basis by gathering data from a network of automatic weather stations through various communication channels. In terms of data validation and quality, EMA uses the World Meteorological Organization (WMO) data quality control procedures. In addition, the planning and monitoring department of EMA assesses the performance of the services offered by EMA sections. This assessment is based on users' satisfaction and that EMA users included: Aviation Authority, Navigation Authority, Army, MWRI, and MALR .

In terms of reporting, EMA produces daily weather reports for all Egyptian governorates and daily marine forecast reports (Appendix 8), monthly air quality reports (Appendix 8), Long Range Forecast report (Seasonal Forecast), (10 days and daily forecast) report for agro-meteorology and trend report once every 30 years (Appendix 8). All reports can be accessed on EMA website (nwp.gov.eg).

In addition to the EMA, the MSEA and MWRI have operational weather stations but data are not typically shared with EMA. The data collected are utilized by the water sector. As an example, climate affects demand rates in both agricultural sector and domestic sector markedly. Collected temperature and rainfall information are essential to water resources studies and climate change impact studies.

9.5. Agriculture

The MALR is the government agency responsible for monitoring any information related to the agriculture sector. MALR organogram is presented in Figure 6. MALR records performance indicators about: **Cropping Pattern** (e.g.: Total Area of Field& Vegetable Crops (In Old & New Lands), Total of Cropped Area, Total Area of Winter Crops, Total Area of Summer Crops, Total Area of Nile Crops, etc...); **Area, Yield and Production** (e.g.: Area, Yield and Production of Summer Field Crops, Area, Yield and Production of Nile Field Crops, etc…); **Average Cost of Production** (average cost of production per feddan for field crops inside the valley, average cost of production per feddan for vegetable crops inside the valley); and **Average Net Return** (average of net return per feddan for field crops inside the valley, average net return per feddan for vegetable crops inside the valley).

MALR's Economic affairs section conducts data gathering, processing, and reporting and produces an annual report as per Appendix 9. The Agriculture Research Center (ARC), universities, other research centers, and NGOs also play a role in gathering and processing M&E agricultural information; however, these information are scattered in unorganized publications that do not serve the purpose of periodic reporting.

In terms of data quality and validation methods, there is not a structured methodology for quality checks: MARL has enough staff to survey and collect field data (MALR, 2013). In addition, the production data of

each crop is also collected from what the agriculture cooperatives receive from farmers and quality checks are conducted for data verification (MALR, 2013).

In terms of existing M&E systems in MALR, each project has it is own M&E system with indicators that suit its objective(s) (MALR, 2013). In addition to this, MALR has an M&E unit in the Agriculture Research Center (ARC) that is responsible for M&E at the ministry level. This unit has 20 members of staff. The unit staff has been trained by FAO. However, this system is still under implementation. Upon completion, availability of dynamic information about crop water use, crop yield, and cropping pattern is important for agricultural water use allocation, studying the impact of climate change on water use and crop yield, and help decision makers in prioritizing water use allocations in general.

9.6. Universities & Research Institutions

Almost all major universities and technical institutions in Egypt are working in the water sector. There are over 60 major public and private universities and research institutes: (e.g.: Cairo University, Ain Shams University, Alexandria University, agriculture research center, national research center,…etc…). Appendix 11 shows a list of Egyptian Public, Private Universities and Egyptian Research Institutes.

Generally, these institutions utilize M&E data. For example, researchers obtain long-term data about climate variables, cropping pattern, water use to study the impact of climate change on irrigation and agriculture. In some instances, they provide data through projects which rely on monitoring of parameters of use to the water sector, e.g., monitoring changes in water quality of basins or in sections of cities, etc.

The water sector can better relate, serve, and draw upon academic, technical and other institutions through joint programmes where the research needs of the sector are identified then researched by these institutions. Good communication sealed with sound cooperation agreements to conduct result-based research is essential for success. A catalyst that speeds and ensures sustainability of the research is funding by the water sector.

9.7. Transboundary Water

Egypt relies mainly on River Nile, a transboundary basin. In addition, Egypt groundwater resources are closely linked to the NSAS.

The Nile River has been the subject of numerous treaties and agreements across the years.. Today, the distribution of Nile water is governed by the Nile Waters Treaty - a bilateral agreement between Egypt and Sudan that was signed in November 1959. More recently, countries of the Nile Basin have been engaged in regional cooperative activities, like the Nile Basin Initiative (NBI) as explained in Section 5.2.

As for the NBI, there is historic data for trend analyses for many years that were acquired from many sources over the years. OSI inventory consists of hydrologic, environmental, and socio-economic data. However, data sharing agreement is neither mature not fully implemented. There is a history of mistrust between basin countries, limiting openness in data sharing. As such, beside the information collected by the Egyptian MWRI to server NBI, no transboundary collected data is of use to Egypt's M&E activities in the current time.

On the other hand, the Joint Authority for Study Development of the Nubian Sandstone Aquifer System (NSAS) coordinates the activities of the NSAS to make sure that the transboundary resource is sustainably managed, including M&E activities. Basic water quality and water level monitoring systems have been established. Accurate withdrawal figures are not available. Modeling efforts are used to estimate withdrawals. Illegal mining is a key issue.

The following information is being shared between NSAS riparian countries?

- Basic water quality and water level data is being shared between riparian countries with quantity estimates at times.
- The quality of the data shared is good and so is its timeliness.
- Many of the wells lying within the transboundary systems are monitored by the MWRI so they are part of the national water sector M&E system.

The monitored data can be integrated into the water sector's M&E system simply by classifying the transboundary basin among the national water sources and ensuring that the same indicators used by the national M&E system are applied to the transboundary systems. The M&E systems must be compatible with the national M&E and upgraded to its level if needed. The upgrading within the country may be done by the water sector. M&E networks used should be unified (no duplication) and whosever transboundary monitoring system is better should be used.

9.8. Climate change

Egypt is at risk from climate change, partly because of current severe water scarcity, high temperatures, and its generally low elevation with respect to the Mediterranean Sea level. However, climate change impacts have much inherent uncertainty that needs to be addressed wisely seeking "no regret" adaptation measures (UNFCCC, 2010; MWRI, 2005).

In general, there are no practical measures being undertaken to monitor the impact of climate change on domestic and transboundary water resources and WSS. Many ministries, universities, research centers conduct studies to assess the impact of climate change on certain regions of Egypt with some relevance to the water sector. This includes modeling efforts and scenario analyses. The MSEA is main player in this area, followed by EMA, MWRI, ARC, among others.

The Egyptian NWRP for the year 2017 explicitly addressed climate change impacts and adaptation (MWRI, 2005). The MSEA dedicates a full reporting chapter about climate change in its annual state of environment report (Appendices 6 and 7). It collects data from EMA and MWRI to help in producing its annual report.

In addition to the State of Environment Report that reports on Climate Change, Egypt prepares (MSEA) National Communication Reports to United Nations Framework Convention on Climate Change (UNFCCC) to meet its obligations under Kyoto protocol. These reports are prepared every 2-3 years, upon funding availability, and describe the national actions and efforts that have been done in response to climate change and the needs for technical and financial support.

An important initiative in the climate change studies that will lead to a draft national policy is the three-year Climate Change Risk Management Programme (CCRMP), which is a national cross-cutting programme implemented across multiple ministries (MSEA, MALR, and MWRI in collaboration with six UN Agencies; UNDP, UNEP, UNESCO, FAO, IFAD and UNIDO). The CCRMP initiated in 2008 and just terminated in 2013 addressed both climate change adaptation and mitigation issues in Egypt. On the climate change mitigation side, the programme provided tools to assist in the formulation of policies to help mitigate Egypt's contribution to Green House Gases emissions. This can be achieved through the provision of an enabling environment and incentive schemes to promote financing of renewable energy and energy efficiency initiatives as well as utilizing Clean Development Mechanisms (CDM). On the other hand, the adaptation side of the programme paved the road for providing tools to make strategic decisions to strengthen institutional capacity to develop and implement national strategies in the areas of water resources, agriculture, and other climate change vulnerable sectors (Bellamy and Genena, 2013).

10. M&E Issues, Conclusions and Recommendations

10.1. Issues

The main issues confronting the development of effective water sector M&E systems can be summarized as follows:

At the institutional level:

- Lack of specific strategies, polices, and action plans that explicitly address M&E of natural resources;
- A national framework on M&E does not exist so the nature of data collected and levels of analysis and outputs are not comparable. Hence, data collected is of limited use;
- The dispersion of information is mainly within a single institution, especially for WSS;

At the human level:

- More skills need to be acquired in managing databases (DB) and DBMSs in the new technologies of information and communication and monitoring and evaluation;
- The culture of sharing information is limited;

Technical and financial sustainability:

- More financial resources have to be allocated to proper data collection, analyses, and reporting;
- There is limited data communication and data access platforms between institutions/ ministries, which limits the optimal use and exchange of data;

10.2. Conclusions and Recommendations

In terms of the rapid assessment undergone for the Egyptian water sector M&E&R; the following conclusions can be stated;

- A unified national IWRM and WSS M&E&R system does not exist. However, institutional responsibilities/mandates do include M&E&R procedures.
- The M&E&R mechanisms and database are not coherent and the efforts are not well coordinated.
- Implementation of the M&E&R procedures differ from one institution/ministry to the other.
- The formation of the NWRP-CP with the headquarter in the MWWRI (main water resources organization) with focal points in all related organizations (MoHP, MDWSF, MHUUD, MSEA, MALR, MoF). This panel follows up the implementation of the NWRP and dynamically monitors the progress of the NWRP, based on 120 indicators to follow up the implementation of the 39 measures of the plan and 15 indicators to assess the impacts. The gained experiences and acquired skills can be the corner stone for the formation of the unified IWRM and WSS M&E&R system in Egypt nationwide.
- In terms of WSS, Egypt has recently grouped all WSS stakeholders under the management of the newly formed MDWSF to better coordinate, plan, budget, and finance new projects and operation and maintenance activities in the WSS sector. Egypt has already achieved the MDGs for water supply and has planned to keep up with the increased demand of population for water supply. However, rural sanitation is still at 12% and the overall country coverage for sanitation is currently below 50%, making it difficult to achieve the MDGs for coverage of rural sanitation. Cost recovery has been enhanced in recent years and thus will help to better manage existing infrastructure.
- In terms of M&E&R, Egypt is in better position than other N-AMCOW countries in terms of database infrastructure, technical, and human capacity. There is a synergy in data collection and annual reports

are already being produced (State of Environment Report by MSEA, WSS annual report by EWRA, MoHP annual water quality monitoring and evaluation report Statistics Year Book by CAPMAS), containing many of the proposed water related indicators and can be made use of in preparing an annual water sector rapid assessment report.

- It is logical that the NWRP-CP stretch their mandate to include an annual state of water rapid assessment report, making use of the existing database and capacity used for the M&E&R of the NWRP.
- Water quality performance indicators are neither timely, nor relevant in most of the times. More structured indicators that group priority contaminants at different times of the year are needed for better reporting on water quality. The MSEA can lead this effort.
- It is advisable that MDWSF harmonize methodologies of defining water and sanitation indicators with JMP definitions as an addition to existing definitions to be able to compare indicators on a similar basis.
- Enhance funding and institutional resources for implementing and enforcing the policy of integrated water resources management including M&E.
- Implement a sector wide M&E plan with respect to water supply & Sanitation that builds up on existing MARS DBMS and produced annual report but to include more disaggregated data and information to help decision making and budget prioritization in the sector.
- Increase budgetary allocations for monitoring programs especially in rural areas.
- Facilitate transparency in the communication and sharing of water and sanitation information amongst related institutions.
- Engage in regional & global monitoring initiatives.

11. AMCOW Pan African Water and Sanitation Monitoring, Evaluation and Reporting Indicators Values

Country Background Information Sheet

Country Name: **Egypt**

Items	Information
1. Population trends for the last 4 years, and GDP.	

Years	2000	2008	2009	2010	2011
Urban pop.	27,123,000	32,353,000	33,083,000	33,833,000	34,516,000
Rural pop.	36,728,000	42,876,000	43,842,000	44,895,000	45,894,000
*Total pop.	63,860,000	75,229,000	76,925,000	78,728,000	80,410,000
GDP (10^6 LE)	855,302	994,055	1,150,620	1,309,905	855,302

*Last census was conducted in 2006. (2012 Statistical year book, CAPMAS)

2. Basis of the existing water sector Policy/ Reform and potential policy targets.	Important issues addressed in the existing Water Sector Reform? -Bridging water supply / demand deficit. - Seawater intrusion and water quality deterioration. -Improving domestic water supply and sanitation access. -Review and redirection of irrigated agricultural policies. -Increase water use efficiency. - Institutional capacity building. - Integrated water resources management. - Low Water Tariffs and Poor Recovery Rates
3. Knowledge of international and African Milestones on Water and Sanitation.	Which are the ones well known and used in the county? Specify how it is used. - Agenda 21-Rio principles: as a general guide for sustainable use of water for development. - The Dublin principles: as a general guide for sustainable use of water for development. - UN Millennium Development Goals (MDGs): as a measure of progress towards achieving MDGs. - African Water Vision 2025: as a base for updating plans and as a measure of progress. -Sharm-el-Sheikh Declaration: as a base for updating plans to accelerate meeting water supply and sanitation goals.
4. Trend of the 3 latest reviews in national water Policy and Reforms.	

Years	2008	2009	2010	2011
Drivers of the Reviews	-Reducing increasing water deficits	-Reducing increasing water deficits	-Reducing increasing water deficits	-Reducing increasing water deficits
	-Decreasing water quality decline	-Decreasing water quality decline	-Decreasing water quality decline	-Decreasing water quality decline
	-Improving service levels	-Improving service levels	-Improving service levels	-Improving service levels
	-Increasing agricultural area with the same water use	-Increasing agricultural area with the same water use	-Increasing agricultural area with the same water use	-Increasing agricultural area with the same water use
	-Optimize water allocation to different sectors	-Optimize water allocation to different sectors	-Optimize water allocation to different sectors	-Optimize water allocation to different sectors
Targeted Impacts and effectiveness	-Decreasing deficits	-Decreasing deficits	-Decreasing deficits	-Decreasing deficits
	-Improving quality	-Improving quality	-Improving quality	-Improving quality

		-Improving services	-Improving services	-Improving services	-Improving services
5. Comments on the national water sector regarding the strengths, weaknesses, opportunities, threats and outstanding problems.	- Strengths: a) a national water strategy exists, b) a ministry for water resources has been established, c) strong official commitment to the water sector, d) specialized institutions for water supply and distribution exist, e) skilled workforce exists, f) financing is available with many major projects under execution, g) rising water awareness, h) favorable political climate -Weaknesses: a) weak governance and institutional capacities, b) lack of data and information for water quality, c) decentralization efforts is lagging, d) inefficient communications with water resources transboundary countries -Opportunities: a) NWRP monitoring and evaluation will provide necessary information for better planning and management of the water sector in Egypt, b) HCWW achieved great success in operation and management of WSS in Egypt, c) establishing the new ministry of infrastructure will help better manage WSS and provide required resources to provide safe drinking water and sanitation to urban and rural Egypt - Threats: a) water scarcity and quality degradation, b) multiplicity of transboundary basins, c) climate change and desertification, d)political instability, e)food sufficiency syndrome Outstanding problems: a) continuing deficit, b) low standard of service, c) inefficiency of utilization, d) water pricing and financing, e) Conflict over Egypt's share of Nile basin			

Country Water and Sanitation Performances Evaluation Sheet

Country Name: **Egypt**

Performance Category	Country Information
1.1.Water and Energy *Target:* Increase hydropower utilization by 10% from 2000 to 2015.	▪Specific actions taken so far for the milestone: According to the 2007 / 2012 government plan, capacities of 82 megawatt are added to the system, of which 64 megawatt is added within the Plan's first year 2007/2008. ▪Achievement:

Years (i)	2000	2008	2009	2010	2011
-Economically feasible hydropower Potential **(P)**	5.1	5.1	5.1	5.1	5.1
-Installed hydropower capacity (**C**)	2.81	2.875	2.875	2.875	2.892
-Hydropower utilization ***(HpuI = C/P)***	0.55	0.56	0.56	0.56	0.57
Rate of increase $R_iHpuI(\%) = (Hpul_i - Hpul_{2000})/Hpul_{2000}$	**0.00%**	**2.31%**	**2.31%**	**2.31%**	**2.92%**

▪Sources of verification:
- National water Resources Plan (2005) - Government Plan 2007/2012

▪Specific comments:
- This target was announced in a continent wide political declaration but apparently it cannot be applied on each country level since most countries cannot realise it due to lack of resources. Accordingly, comparison between countries within this target might not be realistic.

1.2.Water and Agriculture

Targets:
-Increase water productivity Rain fed agriculture & Irrigation by 30% from 2000 to 2015.

And
-Increase the size of irrigated areas by 50% from 2000 to 2015

▪Specific actions taken so far for the milestone:
- Implementation of the irrigated land horizontal expansion plan. Target is to increase the irrigated land to about 11 million feddans by 2017.

▪Achievement on water productivity:

Years (i)	2000	2008	2009	2010	2011
-Agricultural GDP (109 LE) **(A)**	60	103.30	106.57	110.28	113.28
-Total Agri. Water withdrawal (10^9 m^3)**(B)**	57.8	60	60	61	60.9
--Water Return to Environment **(C)**	18.5	17.15	25.44	23.21	22.90
Water productivity (LE/m^3) Wp=A/(B-C)	1.53	2.41	3.08	2.92	2.98
Rate of increase $R_iWp(\%) = (Wp_i - Wp_{2000})/Wp_{2000}$	**0%**	**58%**	**102%**	**91%**	**95%**

▪Achievement on irrigated areas:

Years (i)	2000	2008	2009	2010	2011
-Irrigated areas**(IA)**	7836000	8432186	8783214	8741122	8619424
Rate of increase $R_iIA(\%) = (IA_i - IA_{2000})/IA_{2000}$	**0.00%**	**7.61%**	**12.09%**	**11.55%**	**10.00%**

▪Sources of verification and Specific comments:
- Central Agency for Public Mobilization and Statistics (CAPMAS) publications

▪Specific comments:
- This target was announced in a continent wide political declaration but apparently it cannot be applied on each country level since most countries cannot realise it due to lack of resources. Accordingly, comparison between countries within this target might not be realistic.

1.3.Water for multiple Uses

Target:
Increase the Water Demand Satisfaction Index ***(WDSI)*** by 10% from 2000 to 2015.

Specific actions taken so far for the milestone:
- Several actions have been taken to achieve this target but demand increases mask the impact of those actions.

▪Achievement:

Years (i)	2000	2008	2009	2010	2011
- Total all sectors Water Demand (A)	63.31	74.44	76.10	77.84	79.60
-Total all sectors water supply (B)	60.46	70.23	70.03	74	73.8
- WDSI =B/A	**0.96**	**0.94**	**0.92**	**0.95**	**0.93**
Rate of increase $R_iWDSI(\%) = (WDSI_i - WDSI_{2000})/ WDSI_{2000}$	**0%**	**-1%**	**-4%**	**0%**	**-3%**

Performance Category	Country Information
	▪Sources of verification and Specific comments: -National water Resources Plan Report 2005 - CAPMAS publications
2.1.Basin and Transboundary water resources management *Target:* Develop a national Water Efficiency Plan by 2015.	▪Specific actions taken so far for the milestone: - Development of the National Water Resources Plan in 2005 ▪**Availability of Water Efficiency or IWRM Plan and Year of Adoption:** - The National Water Resources Plan (NWRP) for Egypt 2017 published in 2005. **Elements of the policy and legal environment:** -The main aim of the NWRP is to provide direction and guidelines to all ministries, agencies and institutes working in Egypt's water sector in one form or another, in order to achieve its particular objectives related to water. NWRP objectives are: (1) the supply of drinking water for domestic uses and the provision of sanitation services, according to the government standards and targets, on a cost recovery basis but taking into account the right on basic requirements of all people (2) The supply of water for industrial purposes and the provision of sewage treatment facilities. (3) The supply of water for irrigation based on a participatory approach and cost-recovery of operation and maintenance (4) The protection of the water system from pollution, based on a polluter-pays principle and the restoration of water systems, in particular the ecological valuable areas Given the importance of water for the socio-economic development of the country, the Government of Egypt is taking all necessary means and measures to manage and develop the water resources of the country in a comprehensive and equitable manner. The NWRP has looked at Investments that are needed to safeguard the water resources and priorities have to be set, Infrastructural projects and improvements of the operation and maintenance of the system are required and the institutional changes that are needed to decentralise and integrate the various activities. Developments in the legal and regulatory environment have to support these changes. The NWRP has the following pillars (policies): (1) Developing additional new water resources (2) Making better use of existing water resources (3) Protecting health and environment Legal adjustments have been made to develop and implement the measures included in the National Water Resources Plan. Examples are adaptations of Law 48 (1982) to allow the application of the polluters-pay principle and Law 12 (1982) to establish a legal status for the Water boards. Legal adjustment may also be needed to be able to impose fees, issue permits or provide subsidies. On the transboundary aspect, the NWRP also focuses on the cooperation with the Nile basin countries on the development of additional water resources policy. This also monitored through the progress indicators of the NWRP. The MWRI has also the Permanent Joint Technical Commission (PJTC) for Nile Waters and the Joint Authority for studying and development of the Nubian Sandstone Aquifer System that help in managing the two transboundary basins. **Element of the institutional arrangements:** -The implementation of the NWRP which is based upon the Integrated Water Resources Management (IWRM) concepts that requires that the roles of the various Ministries are clearly set out, as well as the roles of the difference levels of government. Major institutional developments related to the water sector are decentralisation and privatisation. Steps have been taken into those directions but further implementation requires careful consideration and a strong support of a new institutional setting. The principle of appropriate responsible authority and functions being devolved to the lowest possible level is increasingly being regarded as best practice and most likely to result in a sustainable development. The roles of the different levels of government in relation to allocation of water and provision of permits and the powers of enforcement must be clearly set out. Clarity should also be provided on fiscal and budgetary arrangement and intergovernmental transfers and subsidy schemes. **Element of the financial structure:** - One of the principles adopted by the government in the NWRP is that water is a common good and that it cannot be owned by anybody. The basic human and ecological needs should always be satisfied. Agriculture and industry use water to develop commercial products. This means that water has an economic value for them. However, given the important social function of water for employment and income in agriculture and industry, water should not be treated as a normal economic good, ruled by the market mechanism of supply and demand. The social function of water should be taken into account at all times. Notwithstanding this social function, economic instruments can be used to recover the costs for

<table>
<tr><th>Performance Category</th><th>Country Information</th></tr>
<tr><td></td><td>providing the services involved in supplying the water. Examples are a service fee for agriculture, covering the costs of the operation and maintenance of the irrigation and drainage systems and a drinking water fee for the operation and maintenance costs for the treatment of the water and the distribution systems to the domestic users. In a similar way economic instruments can be used in pollution control. Based on the polluters-pay principle domestic and industrial polluters can be asked to pay a levy on the discharge of waste to the water system. The income generated in this way can be used again to subsidize treatment plants or the use of less polluting production processes.

<u>Management tools</u>:
The NWRP has an M&E system that includes approximately 120 indicators to follow up the implementation of the 39 measures of the plan and 15 indicators to assess the impacts. All involved stakeholders have agreed upon those indictors but then they were left to each responsible stakeholder to define how it can be measured. The indicators are updated every 3-6 month and they are collected in paper format. This will change shortly as there is an online system that will be launched and users will be able to access the system to update and view the data.

▪Sources of verification and Specific comments:
-National water Resources Plan Report 2005</td></tr>
<tr><td>2.2. not applicable</td><td>▪Specific actions taken so far for the milestone:</td></tr>
<tr><td>2.3. not applicable</td><td>- None</td></tr>
<tr><td>2.4.Rainwater

<u>Target:</u>
Increase the share of rainwater use in total municipal water consumption up to 10% by 2015.</td><td>▪Achievement:
<table>
<tr><th>Years (i)</th><th>2008</th><th>2009</th><th>2010</th><th>2011</th></tr>
<tr><td>-Total municipal water supply (A)</td><td>606</td><td>8.5</td><td>9.55</td><td>9.7</td></tr>
<tr><td>- Rainwater use (B)</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>-Water use from other sources (C)</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>-Total municipal water consumption (%) (Twc = A+B+C)</td><td>6.6</td><td>8.5</td><td>9.55</td><td>9.7</td></tr>
<tr><td>Percentage of rainwater use pRu(%)=B/Twc</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
</table>
▪Sources of verification and Specific comments:
- CAPMAS publications
- Egyptian Water Regulatory Agency (EWRA) annual reports</td></tr>
<tr><td>3.1.Urban Water Supply</td><td>▪Specific actions taken so far for the milestone:
- Reform of the Sector started in 2004 resulting in a significant improvement in the services and coverage.</td></tr>
<tr><td>3.2.Urban Sanitation</td><td>▪Achievement in water supply:
<table>
<tr><th>Years (i)</th><th>1990</th><th>2008</th><th>2009</th><th>2010</th><th>2011</th></tr>
<tr><td>-Urban access (%)</td><td>-----</td><td>100</td><td>99.5</td><td>99</td><td>99</td></tr>
<tr><td>-Rural access (%)</td><td>-----</td><td>100</td><td>100</td><td>100</td><td>98</td></tr>
<tr><td>-Total access (%) (W)</td><td>82.6</td><td>100</td><td>99.75</td><td>99.5</td><td>98.5</td></tr>
<tr><td>Rate of Inaccessibility reduction for water IRwat (%) = (Wi-W1990)/(100-W1990)</td><td>0.00</td><td>1.00</td><td>0.99</td><td>0.97</td><td>0.91</td></tr>
</table></td></tr>
<tr><td>3.3.Rural Water Supply</td><td></td></tr>
<tr><td>3.4.Rural Sanitation and Hygiene</td><td></td></tr>
<tr><td><u>Target:</u>
Reduce by 50% from 1990 to 2015, the proportion of the population without improved drinking water source, and the proportion without improved sanitation facility (Urban/Rural /Total).</td><td>▪Achievement in improved sanitation:
<table>
<tr><th>Years (i)</th><th>1990</th><th>2008</th><th>2009</th><th>2010</th><th>2011</th></tr>
<tr><td>-Urban access (%)</td><td>-----</td><td>60</td><td>72.5</td><td>85</td><td>99</td></tr>
<tr><td>-Rural access (%)</td><td>-----</td><td>11</td><td>11</td><td>11</td><td>30</td></tr>
<tr><td>-Total access (%) (W)</td><td>45</td><td>36</td><td>42</td><td>48</td><td>59.67</td></tr>
<tr><td>Rate of Inaccessibility reduction for sanitation IRsan (%) = (Si-S1990)/(100-S1990)</td><td>0.00</td><td>-0.17</td><td>-0.06</td><td>0.05</td><td>0.27</td></tr>
</table>
*Sanitation coverage value was updated in 2011 to cover government supplied coverage as well as NGOs and local efforts. It is estimated that local and NGOs provide nearly 9% of the total coverage. This explains the rapid enhancement in coverage from 2010 to 2011.

▪Sources of verification and Specific comments:
- NWRP indicators
- The Holding Company for Water and Wastewater (HCWW) presentations</td></tr>
</table>

Performance Category	Country Information
	- HCWW & EWRA data - CAPMAS data
4.1.Adaptation to Climate Change *Target:* Develop and implement, at least 1 Climate Change Adaptation Strategy by 2015.	▪Specific actions taken so far for the milestone *(New initiatives to improve resilience):* - Egypt launched a program called Climate Change Risk Management (CCRM) in 2008. The program aimed at developing a two part strategy to help mitigate the effects of and adapt to climate change. The program is divided into four components, each equipped with relevant government institutions and UN partners, and tasked with the responsibility of implementing either mitigation or adaptation efforts. **▪Existence of a National Climate Change Adaptation Strategy and Year of adoption:** - The CCRM program has published its Climate Change Strategy in 2013. Part of the strategy deals with the adaptation in the water and irrigation sectors. **▪Existence of a Actions Plans on Water for Climate Change resilience:** - Action Plans are being formulated. **▪Existence of Programmes for implementing the Actions plans:** - None ▪Sources of verification: - CCRM program reports (http://www.eeaa.gov.eg/English/info/report_CCRMP.asp) ▪Specific comments: -In Egypt, an action plan exists for Climate Change mitigation. The mitigation action plan focuses on a number of areas including: 1- Environmental Pollution Control 2- Utilizing Nuclear Power and Renewable Energy 3- End-Use Energy Efficiency & Demand-Side Management
4.2. Water-related Hazards *Target:* Establish at least 1 Early warning System for disaster prevention at national level by 2015.	▪Specific actions taken so far for the milestone *(water disaster prevention initiatives)*: - An early warning system is established in Nuweiba City to warn against flash floods **▪Existence of Early Warning Disaster prevention System and Year of establishment:** - The Flash Flood Manager (FlaFloM) project began in 2007 and was completed in 2009. It was coordinated by the Egyptian Water Resources Research Institute (WRRI) and the Belgian consultant company SORESMA together with the Vrije Universiteit of Brussels (VUB). The main result of the project was an accurate flash flood early warning system which can provide the necessary lead-time for local authorities to take emergency actions to minimize the number of victims and limit damage to property. Elements on Knowledge of risks: - An ideal flash flood detection and early warning system would require water level, discharge and rainfall data collected through real-time field measurements and external forecasts. However, the FlaFloM project, as occurs in many arid flash flood prone areas, was confronted with data scarcity and insufficient knowledge in the flash flood driving forces. To overcome this bottleneck, the project developed rainfall intensity maps derived from two global satellite instruments: the weather research and forecasting model (WRF) and satellite estimates from the Tropical Rainfall Measuring Mission (TRMM). Elements on Monitoring, analysis and forecasting of the hazards: -The FlaFloM system consists of four modules: 1) a Data gathering module, 2) a Forecasting module, 3) a Decision support module and 4) a Warning module. Each module processes input data and sends the output to the following module. Forecasts have a lead time of up to 48 hours. Elements on Communication or dissemination of alerts and warnings: - The FlaFloM is able to send in time a flood warning to the decision-makers in the area In case of a flash flood emergency. Elements on Local capabilities to respond to the warnings received: -In the Nuweiba City where the FlaFloM early warning system was running, no casualties were reported during the 2010 flash floods. This could indicate good local capabilities to respond to the warnings received by the system. ▪Sources of verification and Specific comments: - http://www.euromedcp.eu/index.php?option=com_customproperties&view=show&task=tag&Itemid=1043&tagId=20&lang=en - http://library.witpress.com/pages/PaperInfo.asp?PaperID=21031 - http://www.preventionweb.net/english/professional/news/v.php?id=12519 - http://www.innovyze.com/news/case_studies/sinai_peninsula.aspx
5.1. Institutional arrangements5.2.	▪Specific actions taken so far for the milestone: - Establishment of the Institutional Reform Unit (IRU) at MWRI in 2002

Performance Category	Country Information
Ethics, transparency, empowerment5.3. Public and private roles5.4. Right to water5.5. Regulatory approaches *Target:* Institute/update, by 2015, water sector policy reforms that reflect good governance principles of: (i) partnership commitment; (ii) ethics - transparency, equity and fairness; (iii) responsibility and accountability; (iv) inclusiveness, participation, predictability and responsiveness; and (v) coherence.	- Water and Wastewater sector reform in 2004 - Development of the National Water Resources Plan in 2005 ▪**Existence of Water sector policy that reflects good governance principles, and Year of latest update:** - See section 2.1 above. Elements on Partnership and commitment: In May 2005, the Institutional Reform Unit (IRU) prepared the guiding document "Vision and Strategy for MWRI Institutional Reform", which reiterated the challenges in the water sector that call for new approaches to water management in Egypt. Whereas the IRU Vision and Strategy recognised that efficiency gains and equity improvements could be made through the application of information systems, technology and communication, it stressed that 21st century water management also requires fundamental institutional reform, i.e. a change in the distribution of responsibility and authority among stakeholders. As with the NWRP, the Vision and Strategy maintained that the modern water resources management challenges could mainly be met by "a greater involvement of water end-users and an increasingly multi-sector approach to water resources planning and control". The Strategy as developed was guided by a number of principles such as decentralisation, participation and inter-ministerial coordination which can be applied in different degrees and combinations to Egypt's water management system. Elements on Ethics - transparency, equity and fairness: Within the Vision and Strategy for MWRI Institutional Reform described above, the concept of participation includes enhancing of the openness, accountability and transparency of transactions. However, it is recognised that this process requires time to be fully developed. Elements on Responsibility and accountability: A transfer of responsibilities to end-user organisations (see section below) necessarily requires the corresponding adaptation of the roles, responsibilities and mode of operation of the government agencies at local, district and governorate levels, as is reflected in the shared vision of decentralisation, the horizontal integration of MWRI administrations and multi-sector cooperation for the implementation of IWRM. Equally shared is the vision that adaptations to the legal framework are required in order to achieve the reforms, particularly to enable the effective functioning of the water users' organisations as partners in water management. The IRU's Vision and Strategy sets out the following requirements: - The proposed reorganization of MWRI entities at the District and General Directorate levels can be established by Ministerial decrees. - The changes at the regional and national level will require the approval of Central Authority of Organization and Administration - A Presidential Decree is required for the reorganization of the Ministry. - Three draft amendments to Law 12/1984 are both necessary and sufficient to constitute the Directorate Boards, District Boards, and Branch Canal Boards as corporate entities. The executive regulations of the amended Law 12 will be critical for setting out: 1 the legal rights and responsibilities of water boards 2 the framework for water board membership, governance, management, accounting, financial management, and setting of charges and penalties 3 the framework of transfer agreements, including levels of management transfer, preconditions for "graduation" to each level, and mechanisms and procedures for MWRI monitoring and regulation Elements on Inclusiveness, participation, predictability and responsiveness: Within the Vision and Strategy for MWRI Institutional Reform described above, the following two-phased reform process was proposed: First stage: a) Formation of water users' organizations (WUOs) at branch canal, district, and directorate levels to propose water distribution plans and participate in O&M activities, resolve internal conflicts, and assume responsibility for selected O&M costs b) Horizontal integration of MWRI administrations at district, directorate, and regional levels c) Increased private sector participation in O&M d) Formation of the National Water Council Second stage: a) Transfer of O&M management and financial responsibilities to WUOs

Performance Category	Country Information
	b) Restructuring of MWRI local administrations into Regional Water Management Authorities of the public service authority type, with inter-ministerial boards of directors c) Increased private sector participation in financing and operation of large I&D works. The above focuses on the end-user participation which remains firmly at the foundation of the policies for reform, with the shared vision of the gradual – or phased – transfer of responsibilities, authority and control to water users' organisations at mesqa, branch canal, and governorate level. Elements on Coherence: - See section 2.1 above. ▪Sources of verification and Specific comments: -National water Resources Plan Report 2005 - NWRP Technical Report No. 70 Strengthening the Participatory Approach in Irrigation Management
6.1.Financing Local Authorities *Targets:* -Allocate immediately at least 0.5 % of GDP to sanitation & hygiene. and -Allocate immediately 5% of national budget for water & sanitation.	▪Specific actions taken so far for the milestone: - First target was almost achieved in 2009. ▪Achievement for GDP allocation: **Years (i)** | **2008** | **2009** | **2010** | **2011** - GDP (A_1) 10^6 LE | 855302 | 994055 | 1150620 | 1309905 - Sanitation and Hygiene Budget (B_1) | 3600 | 4800 | 4300 | 2900 **Percentage of GDP to Sanitation and Hygiene gdpSH (%) = B1/A1** | **0.42%** | **0.48%** | **0.37%** | **0.22%** ▪Achievement for national budget allocation: **Years (i)** | **2008** | **2009** | **2010** | **2011** - Total National Budget (A_2) - Millions | 855302 | 994055 | 1150620 | 1309905 - Water and Sanitation Budget (B2) - Millions | 12100 | 15500 | 13800 | 8800 **Percentage of national Budget to Water and Sanitation BdgWS (%) = B2/A2** | **1.41%** | **1.56%** | **1.20%** | **0.67%** ▪Sources of verification and Specific comments: - CAPMAS publications
6.2.Pricing Strategies	▪Specific actions taken so far for the milestone: Tariff system is already in place.
6.3.Pro-poor financing Strategies *Target:* Set by 2015, water tariff system that addresses cross-subsidy and the need of poor.	▪Describe the Water Tariff Structure: ✓ *Lifeline Water (l/ca/day):* | *66* ✓ *Minimum salary of the population (local currency-llcc-):* | *710 LE / month* ✓ *Rate (USD or EURO/local currency):* | *1 USD for 6.8 LE (March 2013)* Water Tariff Structure: ***Consumption categories (m^3)*** | ***Rate (local currency)*** ***< 10 m^3*** | ***0.23 LE/ m^3*** ***0 m^3*** to 20 m^3 | ***0.3 LE/ m^3*** ***0 m^3*** to 30 m^3 | ***0.43 LE/ m^3*** ***0 m^3*** to 40 m^3 | ***0.45 LE/ m^3*** ***> 40 m^3*** | ***0.5 LE/ m^3*** Adjustments for cross-subsidy: ***Adjustments*** | ***Rate*** Industrial | ***2.3 LE/ m^3*** Commercial | ***0.95 LE/ m^3*** Regional Adjustment | ***NA*** Other? Hotels | ***2.3 LE/ m^3*** Tariff for rural areas if any: - NA ▪Describe the sanitation services pricing if there is any: - Tariff is 40% of the domestic use water tariff and 75% of the water tariff for other uses ▪Sources of verification and Specific comments:

<table>
<tr><th>Performance Category</th><th>Country Information</th></tr>
<tr><td></td><td>- HCWW data</td></tr>
<tr><td>7.1.Education and capacity development

<u>Target:</u>
To be identified.</td><td>▪Not be reported.</td></tr>
<tr><td>7.2.Information

<u>Target:</u>
Enhance by 2016, the national water and sanitation Monitoring, Evaluation and Reporting (M&E, &R) Systems in a way to be in line with the pan African M&E.</td><td>- The Monitoring Analysis and Reporting System (MARS) is used for the monitoring and Evaluation of the performance of the companies that are under the HCWW. The system at the beginning was used to collect the laboratory results of the water samples and was extended with time to be an online system that covers the following aspects:
1. Water quality parameters
2. Performance Indicators
3. Financial and Economic Analyses
Based upon the system results and reports, recommendations are made to improve the services provided by HCWW.

<u>Recent updates in the M&E System:</u>
<table>
<tr><th>Items</th><th>Year 1</th><th>Year 2</th><th>Year 3</th><th>2011</th></tr>
<tr><td>-New Elements incorporated</td><td colspan="4">System is already established</td></tr>
<tr><td>-Drivers</td><td colspan="4">System is already established</td></tr>
</table>
<u>Elements of the pan African M&E incorporated:</u>
- Not yet but is part of the Monitoring and Evaluation of for Water in North Africa (MEWINA) project.
▪Sources of verification and Specific comments:
- MEWINA project reports</td></tr>
<tr><td>7.3.Water and Technologies

<u>Target:</u>
To be identified.</td><td>▪Not be reported.</td></tr>
<tr><td>7.4.Professional Networks/ Associations
<u>Target:</u>
To be identified.</td><td>▪Not be reported.</td></tr>
</table>

<u>Observations on the Evaluation and other general comments</u>

- Some of the targets seem to be unrealistic when compared with what is achieved by the countries. It would be good to try to link those targets with other factors such as population, irrigation network efficiency, sea level rise and economic aspects to reach a realistic vision.

- For hydropower generation, 'Run of the River" hydropower generation systems can a better option than dams as they are closer to people with Low costs and quick construction. Therefore, this option needs to be promoted.

12. Data Collection Methodology

12.1. Data Collection Methodology

The time frame of the project is very limited for collecting all required data. As such, in order to speed up the data collection phase, Misr Consult has adopted the following methodology for data collection:

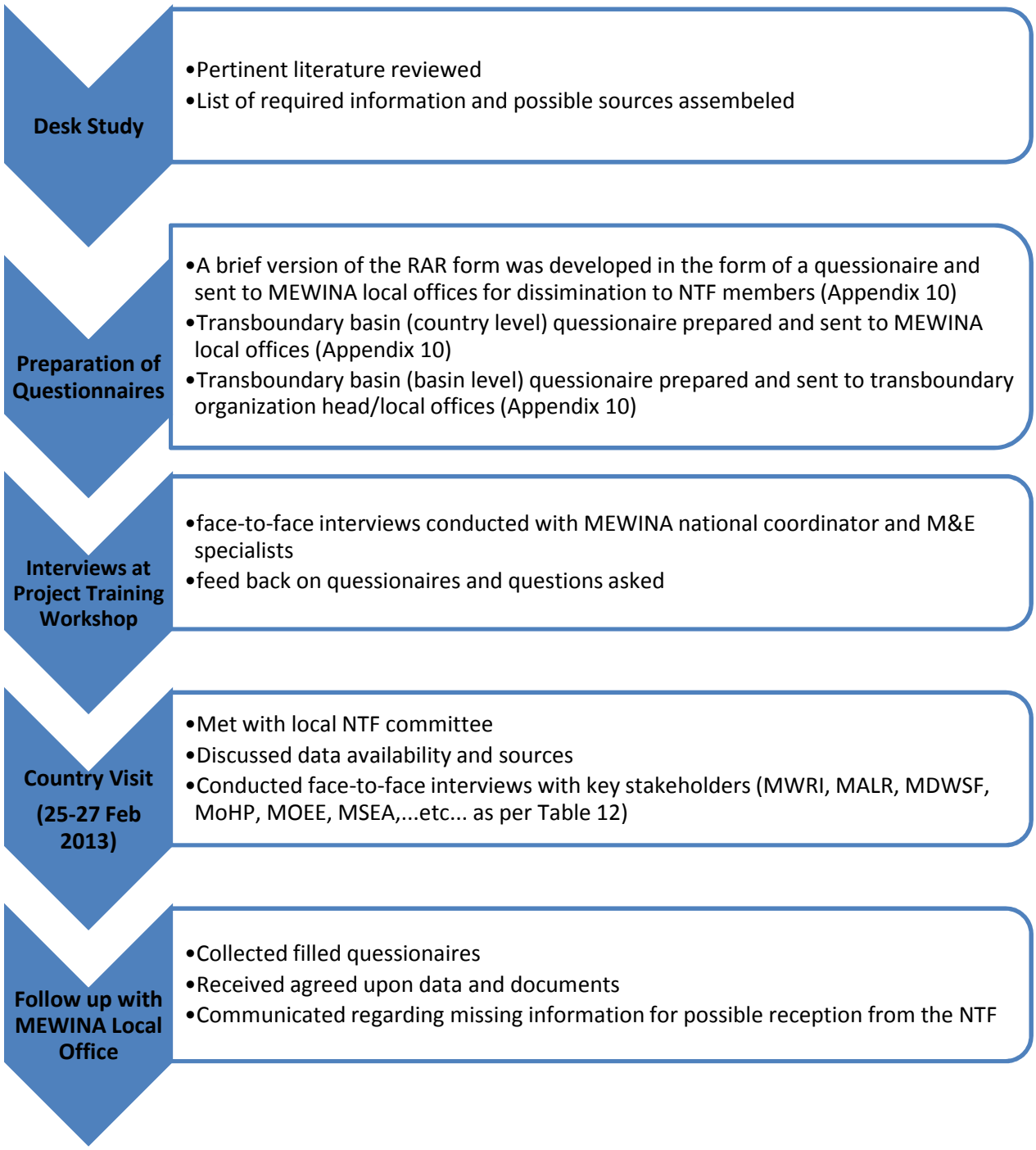


Figure 21. Data collection methodology

12.2. List of Stakeholders Interviewed

Table 16. A List of stakeholders interviewed during the Egypt country visit

Interviewed Organization	Persons Interviewed	Contact Information	Position
MWRI	Eng. Amr Gabr El Kadi	Email:amreelkady@yahoo.com amreelkady1969@yahoo.com Phone: 35449492 Fax:35449491	Monitoring and evaluation project coordinator
MWRI – NWRP project	Eng. Walid Aly Hakiki	Email:walidhakiki@yahoo.com Phone:35449492 Fax:35449491	Deputy director of national water resources plan project
CAPMAS	Ms. Eman Saleh	Email:emansaleh11@yahoo.com Phone: 01119574013 Fax: 24024099	Director of the Center for Research and Population Studies
HCWW	Dr. Ahmed Moawad	Email:ahmed.moawad@hcww.com.eg ahkamal_moawad@yahoo.com Phone:24583590 Fax: 24583598	Manager of planning and technical support department
MoHP	Dr. Olivia Hussein El Shafey	Email: olivia_elshafey@hotmail.com Phone: 33119694 Fax: 37110567	Director of Water and Sanitation Directorate for the environmental health - the quality of the water sector
National Center for Planning State Land Use (NCPSLU)	Dr. Amany Abd El Meguid Ibrahim	Email: dr.amany2009@hotmail.com Phone: 22632231-22631298 Fax: 22632213	Managing Director of NCPSLU
MALR	Dr. Mohamed Samir Mohamed Abo Soliman	Email: M_abosoliman@yahoo.com Phone: 37619753 Fax: 37619756	Head director of Field Development Projects department
MoIFT	Eng. Hoda William Ayoub	Email: environment.ida@gmail.com Phone: 26130134/135 Fax: 26130129/136	General Director of the General Administration of Environmental Protection - Industrial Development Authority
MSEA	Dr. Eklass Gamal Eldin	Email: Eklassg@hotmail.com Phone: 25256452 Fax: 25246394	Head of water quality department
MoEE	Eng. Ahlamy Ahmed Ebrahim Sayed Ahmed	Email: ahlamyebrahim@gmail.com Phone: 22907621 Fax: 22903986	Head of the Civil, survey and environmental research sector - the executive authority of the hydroelectric power stations
EMA	Dr. Ashraf Saber Saki	Email: ashzakey@gmail.com Phone: 26820790 Fax:26849857	General director of scientific research department

13. Assessment of Collected Data

A national framework on M&E does not exist so the nature of data collected and levels of analysis and outputs are not complete. However, providing this RAR will help raise awareness on the importance of data collection, annual estimation of performance indicators and their use in formulating strategic plans polices, and action plans. The efforts of the existing NWRP-CP can be made use of to stretch their mandate to include providing RARs for the water sector. They do collect many of the required information to achieve this task. More important, they have developed strong relationships and linkage between all water related stakeholders that will facilitate data sharing and aid in providing a nationwide annual water status report.

Collected data can be categorized as follows:

- Governance information, including organograms, strategies, policies, action plans, memoranda of understanding, etc…
- Data on budgets, financial plans, and infrastructure financing, etc…
- Data on water resources (withdrawals and sectorial water use)
- Water supply and sanitation coverage
- Water quality information
- Census and demographics data
- Meteorological data, e.g. rainfall

In countries where data is collected by more than one source with neither coordination nor agreement on the definition of indicators and method of collecting data, any concerns over data consistency and quality should be resolved through discussion with the data collectors. However, because this round is the first round of producing the RAR, not all data were available during this first round of collection. In Egypt, the governance data were more available than the financial and technical performance data; these come from the utilities' technical departments and were not readily available at times. The culture of data sharing is still facing difficulties in Egypt as most government officials are concerned about potential liabilities resulting from reviewing collected data and performance indicators by independent parties or officials other than their immediate senior officials. In practice, however, during subsequent and follow-up data collection efforts these issues are expected to get resolved, especially with the full endorsement of the project from the government of Egypt.

The following table summarizes the Consultant assessment of the collected data:

Data Category	Data Sources	Examples of Collected Data	Validation
Governance information, including organograms, strategies, policies, action plans, memoranda of understanding, etc…	MWRI, MoHP, MDWSF, MHUUD, MSEA, MALR, MoPIC, MoF, CAPMAS, EMA	Organograms NWRP (2017)	Organograms submitted, copies of laws, strategies, and agreements submitted
Data on budgets, financial plans, and infrastructure financing, etc…	CAPMAS, international databases like CIA	Annual GDP, agricultural sector GDP	CAPMAS 2012 year book submitted
Data on water resources (withdrawals and sectorial water use)	CAPMAS, MWRI, NWRP, MSEA annual report, literature and	Annual withdrawals, domestic water uses, agricultural water uses	CAPMAS 2012 year book submitted NWRP submitted

Data Category	Data Sources	Examples of Collected Data	Validation
	international databases		Other sources of verification: UNDP reports, published manuscripts as per the references, International databases like FAQ-AQUASTAT and WB were accessed
Water supply and sanitation coverage	MDWSF	Number of households with piped access to water / total number of households Number of households provided with potable water by government tanker trucks / total number of households Cost recovery figures	EWRA annual reports submitted (Appendix 15)
Water quality information	MoHP, MWRI, MSEA	BOD_5, TDS, Alkalinity, coliform counts, etc.…	Sample MoHP annual report submitted (Appendix 16) Sample annual state of environment report submitted (Appendix 6 and 7)
Census and demographics data	CAPMAS	Population count, financial statistics, agricultural statistics, water and environment statistics, …etc.	Last census in 2006. 2012 Statistics year book submitted

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