Libya 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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Mobilising Resources for Water in Africa

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Executive Summary

This report was prepared as part of the project titled "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 per 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 Libya. The aim of the report is to analyze gaps and to identify strategic objectives to improve Libya's institutional capabilities to achieve effective 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 Libya in order to gather the requested information. This was followed by a field visit to Tripoli 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.

One of the critical problems that hinder the sustainable development in Libya is the lack of renewable water resources. Over-exploitation of fossil groundwater resources to meet irrigation demands has already affected the northern aquifers. The following were found to be the principle issues in the water sector: Water Scarcity and Excessive Groundwater Mining, Inadequacy of Institutional Framework, Uneven Distribution of population and the Intensive Agricultural Activities in the Coastal Plains, Seawater Intrusion and Water Quality Deterioration, Uncontrolled Mining of Groundwater, Poor Crop Yields, Fragmentation of Agricultural Land Holdings, and Low Water Tariffs and Poor Recovery Rates.

The diagnostic outcomes indicate that Libya has already realized the millennium development goals (MDGs) and targets. However, Libya defines water coverage differently from the UNICEF JMP definition. While most urban centers had enjoyed central sanitation systems, many rural and remote areas relied on simple "natural" on-site systems.

In terms of M&E, it can be stated that: a unified national Water and Sanitation M&E&R system does not exist. However, institutional responsibilities/mandates do include some 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 by all institutions is weak. The water sector database is fragmented, not up-to-date, with little analysis and reporting on any level. Some organizations have good data, however, namely, the Manmade River Execution and Management Authority and, the General Water Authority (GWA). All organizations concerned are well aware of the need for M&E&R on a nationally coordinated level. Efforts are led by the Ministry of Water Resources (established in November 2012) to establish such networks . Implementation of projects like this project will certainly accelerate these efforts and set a unified standard for both Libyan and Pan African networks and reporting.

The GWA is well structured to be the hub for any nationwide M&E activity. It is one of the oldest institutions around. It hosts the Hydro Manager DMS and a GIS lab. It currently stores all information related to the MmRP, some information from the GCWD, and sporadic information from the transboundary aquifers. This can be used as the hub for a special M&E organ in Libya.

Finally, the assessments and proposals presented in this report have been based on information and data collected by the authors, 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 limit the validity and applicability of these findings.

Table of Contents

List of Tables

List of Figures

List of Appendices

List of Acronyms

AEMMmRP	Authority for Execution and Management of the Man-made River Project
AMCOW	African Ministerial Council on Water
DBMS	Database Management System
EGA	Environment General Authority
GAI	General Authority of Information
GCWD	General Company for Water Desalination
GCWW	General Company for Water and Wastewater
GDP	Gross Domestic Product
GIS	Geographic Information System
GWA	General Water Authority
HDI	Human Development Index
HIB	Housing and Infrastructure Board
IWRM	Integrated Water Resources Management
JMP	Joint Monitoring Program
LYD	Libyan Dinar
M&E	Monitoring and Evaluation
M&E&R	Monitoring and Evaluation and Reporting
m^3/yr	Meter cube per year
MDGs	Millennium Development Goals
MEWINA	Monitoring & Evaluation for Water In North Africa
MIS	Management Information System
mm/yr	Millimeter per year
Mm^3/yr	Million cubic meters per year
MmRP	Man-made River Project
MOAAMW	Ministry of Agriculture, Animal, and Marine Wealth
MOEE	Ministry of Energy and Electricity
MOHU	Ministry of Housing and Utilities
MWRs	Ministry of Water Resources
NSAS	Nubian Sandstone Aquifer System
NSIWRM	National Strategy for Integrated Water Resources Management
NWSAS	North-Western Sahara Aquifer System
ODAC	Organization for Development of Administrative Centers

RAR	Rapid Assessment Report
RWSS	Rural Water Supply and Sanitation
UNDP	United Nations Development Program
UNESCO	United Nations Education, Science and Culture Organization
UWSS	Urban Water Supply and Sanitation
WPI	Water Poverty Index
WRM	Water Resources Management
WSI	Water Stress Index
WSS	Water Supply and Sanitation
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

1. Country Background

1.1. Geography

Libya is a North African country with a surface area of over 1,667,000 km^2, forming a great part of the Sahara desert. Libya is the fourth largest state in Africa. It lies between latitudes 33° 10'N and 8° 45'N and longitude 9° 58'E and 25° E. Its land boundaries span about 4,348 km, bordering Algeria (982 km), Chad (1,055 km), Egypt (1,115 km), Niger (354 km), Sudan (383 km), and Tunisia (459 km) as shown in Figure 1. It enjoys a Mediterranean coast of about 1,800 km (National Strategy for Sustainable Development, 2008).

Figure 1. Libya Location showing border countries

In general, Libya has a flat surface area gently sloping northward. A few mountains of low to medium altitude mark the north-western and north-eastern as well as the central and southern parts of the country. Only 2% of the surface area is considered suitable for agricultural activities, the rest is either gravelly or sand dune desert, salt marshes (sabkhas) or mountains. Irrigated agriculture is currently estimated at 350,000 – 400,000 hectares (State of Water Report by General Water Authority (GWA), 2006), while dry farming occupies an area of 1.4 million hectares.

1.2. CLIMATE

The climate varies widely from north to south, influenced by the Mediterranean Sea and the Sahara desert. The following climatic zones characterize the main climate of Libya: Mediterranean - subtropical, limited to a small area in the Jabal Akhdar (NE); Semi-Mediterranean, covering a small strip along the Mediterranean coast (NW and NE); Steppe, covering the southern slopes of Jabal Nafusa and Jabal Akhdar; and Desert, covering the greater part of the country southward (National Strategy for Sustainable Development, 2008;). The temperature varies in all climatic zones. In summer, the temperature can exceed 40°C, but in winter it can fall below zero. On rare occasions, snow has fallen on the northern hills and mountains. Inland, the temperature rises as the rainfall and humidity decrease. Rain falls between October and March, but occasionally also in April and May. December and January are the wettest months. The amount of rain varies from one place to another; it reaches 350 mm/ year along Jabal Nafusah and the western coast, and even sometimes 500 mm annually on Jabal al-Akhdar, and

decreases rapidly with the distance inland to 10 mm/year in the southern half of the country, averaging about 56 mm/yr in the whole country (Climate department of Libyan National Meteorological Center, 2009). Figure 2 depicts the rainfall distribution over Libya.

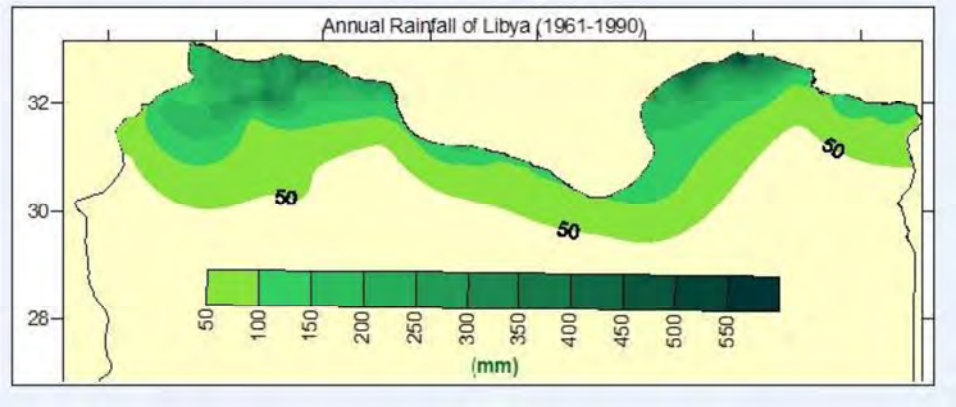

Figure 2. Annual rainfall distribution over Libya. Source: Climate department of Libyan National Meteorological Center, 2009.

1.3. POPULATION

According to the last census (2006), the Libyan population was 5.32 million in 2006; of which 50.6% are males and 49.4% are females (Libya Yearly Statistics Book, 2007). Sixty seven percent of the population is over 15 years old. The estimated population in 2012 is 6.279). This includes Libyans and non-Libyans. Non-Libyans account for about 6.5% of the population (2007 Statistics year book).

Geographically, the Libyan population is concentrated along the coastal belt and in a few inland cities and oases. In fact, over 50% of the total population live in the Gefara plain and Jabal Nafusa, making the population density over 120 persons/km^2. In the central and southern parts of the country, the population density is below 1 person/km^2. Key statistical indicators of Libya's economy and water stress are presented in Table 1.

Table 1. Basic statistics for Libya

Index	GDP [1] (2012)[2]		HDI (2011)[3]	WSI (2012)[4]	WPI (2012)
	Total	Per capita			
Value	$35.6 billion[1]	$5,700	0.76 Rank = 64	Extreme stress Rank = 4	No data

[1]GDP: $38.98 billion (2011) $43.49 billion (2010) and $38.41 billion (2009)

[2]Source: MEWINA Libya, 2013

[3]Source: UNDP, 2013

[4]Source: Maplecroft, 2012

2. National Water Development Strategies and Policies

Until 1998, there was not a clear strategy related to the water sector. In view of the growing water scarcity problem, it was deemed necessary to review the water situation and draw up a long-term policy to overcome this and other evolving problems. A national committee was formed by a decree of the General People's Committee (Council of Ministers), No. 196 of 1996. This Committee, which consisted of 14 members representing all water-related sectors, formulated the first 25 year National Strategy for Integrated Water Resources Management (2000 – 2025) (NSIWRM) and annual sector plans. Its ultimate objectives were to stop continuing water deficits and quality deterioration and set a base for sustainable development which maintains present living standards while securing the same rights for future generations (Appendix 1).

This strategy, although officially adopted in 2006, has not been operationalized yet. However, it has been followed by the water sector organs as a general basis/guide for action plans. Many of its recommendations have been implemented.

Implementation of the NSIWRM workplan has led to the establishment of the National Program for Water Supply and Sanitation (NPWSS) that is an ongoing effort with the intention to provide access to safe water supply and sanitation (WSS) to all Libyans.

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 (National Strategy for Sustainable Development, 2008). It is also worth noting that polices in Libya do not explicitly address poverty reduction or gender equity.

Other elements of the policy and legal environment:

- Water Law (2)/1982 and Environment Protection and Enhancement Law (15)/2003 are in place along with several decrees.
- The National Strategy for Sustainable Development that was drafted in 2008.
- Water pollution control and water quality standards are in place.
- Regional and international guidelines and targets are considered in policy formulation and execution (e.g.: WHO drinking water guidelines and MDGs).
- All water concerned ministries are in the process of preparing sectorial strategies which must include action plans rather than annual plans.

3. Water Sector Overview

3.1. Water Resources and Their Uses

3.1.1. Surface Water

Surface water resources in Libya are very limited and contribute less than 3% of the current water resources in use. This is due to the fact that Libya has no perennial rivers, with surface runoff limited to short winter floods following intense rain events. The total runoff is estimated to be 385 Mm^3/yr; of which 200 Mm^3/yr comes from both the Gefarah plain and the Jabal al-Akhdar. Surface runoff from the northern part of the Jabal alAkhdar is estimated to be 30 Mm^3/year and 50 Mm^3/year on the southern part . The maximum runoff for the Jabal Nefusa-Hamada Hamra is estimated to be 100 Mm^3/year from the northern part of the Nefusa mountain and 20 Mm^3/year on its south-eastern part (NSIWRM, 1999). Heavy rainfall events, though not very frequent, can produce major floods in the winter months of October to February. They play a major role in the replenishment of the Quaternary and Tertiary aquifers in northern Libya, and in maintaining the flow of several small- and medium-sized springs.

Libya has constructed 18 major dams to harvest rainwater and for soil conservation with a total capacity of 389.9 Mm^3 and an average annual storage capacity of 61 Mm^3 (GWA Dams Brochure, 2012). Water stored behind these major dams is used for agricultural water supply, industrial projects, and, in a few cases, for domestic use. Table 2 lists these dams with their respective storage capacity.

Table 2. Constructed dams in Libya (GWA Dams Brochure, 2012)

No.	Dam Name	Design Capacity (Mm^3)	Average Annual Storage (Mm^3)
1	Wadi El-Magineen	58	10
2	Wadi Kaam	111	13
3	Wadi Ghan	30	11
4	Wadi Zaaret	8.6	4.5
6	Wadi Quattara	135	12
7	Supplementary Wadi Quattara	1.5	0.5
8	Wadi Mourkos	0.15	0.15
9	Wadi Ben Gawad	0.34	0.3
10	Wadi Zaza	2	0.8
11	Wadi Darna	1.15	1
12	Wadi Abou Mansour	22.3	2
13	Wadi Tabrit	1.6	0.5
14	Wadi Alzakar	1.6	0.5
15	Wadi Giaaref	2.4	0.3

No.	Dam Name	Design Capacity (Mm^3)	Average Annual Storage (Mm^3)
16	Wadi Elzahaweya	2.8	0.7
17	Wadi Elzayd	2.6	0.5
18	Wadi Zafer	3.65	0.2
Total		389.89	61.35

Some 20 more dams are planned for construction during the coming years, which will raise the total storage by about 136.6 Mm^3 and the average annual storage by 45 Mm^3 (GWA Dams Brochure, 2012).

Libya also has a large number of natural springs, many of which are of good quality water. Their discharge varies from less than 1 liter per second (l/s) to over 10 l/s. A few springs are, however, of much higher discharge; namely, Ayn Zayana, Ayn Kaam, Ayn Dabbousia and Ayn Tawargha. (State of Water Report by GWA, 2006; National Strategy for Sustainable Development, 2008). Flow rates of the main springs are shown in Table 3.

Table 3. Water flow rate of Main Springs in Libya

Jabal al-Akhdar				Gefarah plain and Nafusah / al-Hamada			
No.	**Location**	**Flow L/sec**	**TDS, mg/L**	**No.**	**Location**	**Flow L/sec**	**TDS, mg/L**
1.	Ras-halal	9.8	700	1.	Rabta	8	1440
2.	Derna	5	800				
3.	Ras-halal	5.8	670	2.	Rabta	6	1200
4.	Sousa	5	805				
5.	Derna	100-150	500	3.	Gheraan	5-7	900
6.	Derna	60	520				
7.	Ghoba	170-230	600	4.	Gheraan	7	2500
8.	Shaat	6	450				
9.	Wadi-nagha	9-24	700	5.	Gheraan	5-7	950
10.	Wadi-nagha	15	-				
11.	Wadi-bshara	15	-	6.	Zarat	8	1300
12.	Wadi-aneal	5	-				
13.	Ghoba	4-15	-	7.	Trhouna	7	1100
14.	Wadi-bshara	20	-				
15.	Tobruk	12	7800	8.	Tawergha	2000	3000
16.	Wadi-bshara	18	-				
17.	Benghazi	5580	16000	9.	Wadi-ekaam	350	1400-2000
18.	Bada	5	-				
19.	Shaat	6	-	10.	Al-hesha	151	2000-3000
Total spring discharge			**6118.6 1/s**	**Total spring discharge**			**2549 1/s**

3.1.2. Groundwater

Being an arid zone country, Libya depends heavily on groundwater, which accounts for more than 97% of the water used. In the past, groundwater was easily extracted through large-diameter wells, dug using traditional tools, since water levels were very near to the surface. However, starting from

the early sixties and coinciding with the oil boom, groundwater extraction rates accelerated rapidly and the use of centrifugal and submersible pumps became necessary to cope with the falling water table. Groundwater resources are divided into two major categories: renewable and non-renewable.

The renewable groundwater resources are those retained in the northern aquifers of the Gefara plain, Jabal Akhdar and parts of the Hamada and central zone area. The total amount of renewable groundwater amounts for an average value of 600 - 650 Mm^3 /yr (State of Water Report by GWA, 2006)

The non-renewable groundwater resources are those belonging to the great sedimentary basins of the Kufra, Murzuk, Sarir, and the Hamada regions (Figure 3). These basins underlie the southern part of the country, which portrays severely arid conditions. Rare events of heavy showers producing local runoff do take place, especially in the Haruj Mountains in the center of the country, in the Tibesti Mountains in the south and in the Aweinat Mountains in the west. These events may cause local recharge, but it is of minor importance in comparison with total storage values and aquifer losses.

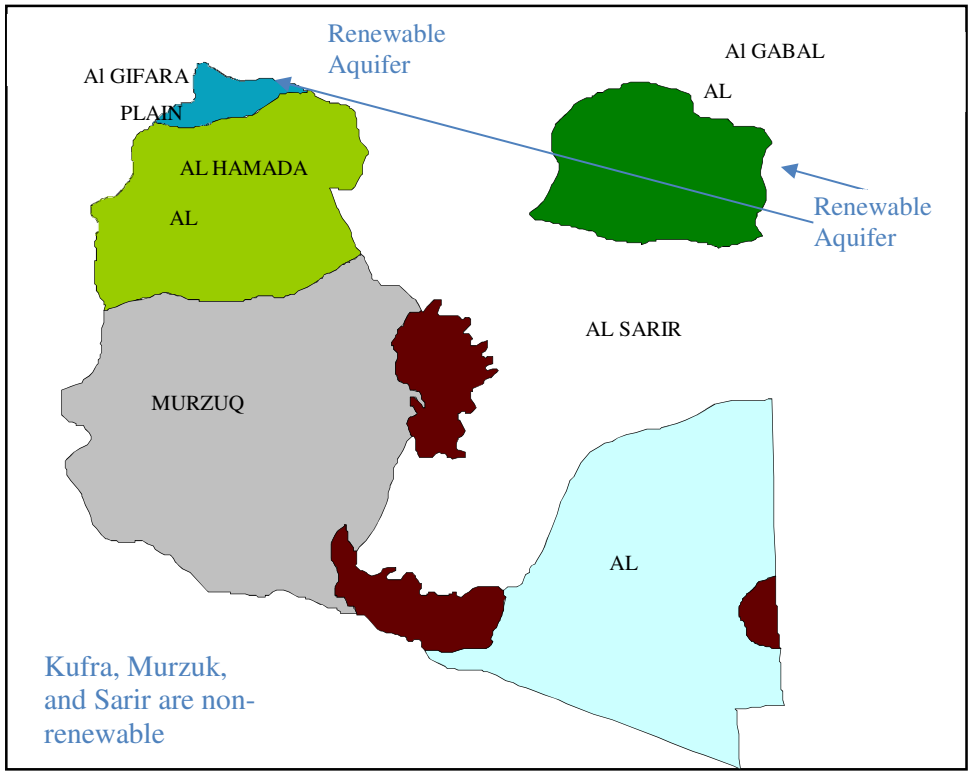

Figure 3. Libya groundwater basins

Most of the groundwater resources are part of two transboundary aquifers; the Nubian Sandstone Aquifer System (NSAS) and the North-Western Sahara Aquifer System (NWSAS).

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 2012 annual withdrawal amounted for 1500 Mm^3/yr.

The NWSAS covers a total area of over one million km²: 700,000 km² in Algeria (68%), 80,000 km² in Tunisia (8%), and 250,000 km² in Libya (24%). It contains sedimentary deposits which, from bottom to top, have two main levels of aquifers, the Intercalary Continental (IC) and the Terminal Complex (TC). The 2012 estimated groundwater withdrawal from the NWSAS is 500 Mm^3/yr (NWSAS Periodic Report, 2008).

3.1.3. Non-conventional water resources

Desalination is the main non-conventional water resource used in Libya. Due to freshwater shortage and despite the higher cost of desalinated water, Libya turned to desalination as a supplemental water resource as early as the sixties. Both thermal and membrane desalination technologies have been used ever since, making Libya one of the largest user of these two technologies in the Mediterranean region. These technologies were built to bridge the gap between water availability and municipal and industrial demands. The 2012 total desalinated water produced in Libya is estimated at 70Mm^3/yr (GCWD, 2012). A number of desalination projects are being tendered or under construction. Upon completion of these projects, it is anticipated that the production capacity of desalinated water in Libya will reach 86.5 Mm^3/yr (National Strategy for Sustainable Development, 2008).

Treated effluent is another important non-conventional water resource. Libya has constructed over 75 wastewater treatment plants; all of which were designed to produce effluents suitable for irrigation. Although the installed design capacities of these plants exceed 450,000 m^3/day (GCWW, 2013), the effluent quantities utilized for irrigation presently are very small due to technical and nontechnical problems. Overcoming these problems and construction of more wastewater treatment plants in line with the National Program for Water Supply and Sanitation objectives, will likely generate an estimated flow of 700,000 m^3/day.

3.1.4. Water Uses

Despite the scarcity of water resources, consumption is on the rise as a result of improving economic conditions, urbanization, and improving standards of living. Irrigated agriculture is expanding in the north as well as in the oases and along Wadis. At present it is estimated that nearly 335,000 hectares are under irrigation (National Strategy for Sustainable Development, 2008; NSIWRM, 1999). Their water requirements vary from less than 10,000 m^3/hectare to over 20,000 m^3/hectare; depending on the location, type of crop, and irrigation method. At the same time, domestic water use varies from less than 150 l/capita/day in small rural settlements to over 300 l/capita/day in major cities (GCWW, 2013).

Agricultural Use: Agriculture is and will continue to be the major water consumer. It represents about 85% of the current water demand (NSIWRM, 1999). The estimated 2012 agricultural water use is 4,850 million m^3/year (National Strategy for Sustainable Development, 2008; NSIWRM, 1999). The actual quantities of agriculture withdrawals are not known due to the poor measurement infrastructure and the uncontrolled mining of groundwater for agricultural purposes (MOAAMW, 2013).

Domestic Use: Nearly 89% of the population lives in urbanized communities (Statistics Year Book, 2007), varying in size from 5,000 to over 1,000,000 inhabitants. The citizens depend on municipal sources with house connections for their domestic water supply. A number of surveys have been conducted to determine the average water consumption per capita, and was found to range from 150 to 300 l/capita/day, depending on the size of the city, location, and age of the supply network (GWA, 2012). However, in rural areas people depend to a large extent on private water supply wells, rainwater reservoirs, and springs. The average per capita consumption falls between 100 and 150 l/capita/day in rural areas (GWA, 2012). The estimated domestic water consumption for 2012 is 700 Mm^3/yr (National Strategy for Sustainable Development, 2008; NSIWRM, 1999).

Industrial Use: In Libya, the industry sector consumes the least water of all sectors, with a current share of about 4% (GWA, 2012). A large number of industries depend on private sources for water supply, including desalination of seawater, as in the case of chemical, petrochemical, steel, textile and power generation industries. At present, total industrial water use is estimated at 280 million m^3 /yr (National Strategy for Sustainable Development, 2008; NSIWRM, 1999).

Water balance: Libya is heavily dependent on groundwater resources. Because most groundwater resources in Libya is fossil in nature, the sustainable groundwater abstraction should not exceed 3,650 Mm^3/yr (Renewable groundwater: 650 Mm^3/yr, fossil Gefara Plain: 25 Mm^3/yr, fossil Jabal Akhdar: 25 Mm^3/yr, fossil Kufra and Sarir: 1,300 Mm^3/yr, fossil Hamada: 150 Mm^3/yr, and fossil Murzuk: 1,500 Mm^3/yr) (NSIWRM, 1999). The total controlled surface water is estimated at 170 Mm^3/yr (National Strategy for Sustainable Development, 2008; NSIWRM, 1999), and the total 2012 desalination water is estimated at 70 Mm^3/yr (GCWD, 2012). This makes the 2012 estimated total available water resources for Libya 3,890 Mm^3/yr (Ground water: 3,650 Mm^3/yr + Surface water: 170 Mm^3/yr + Desalination: 70 Mm^3/yr = 3, 890 Mm^3/yr). Based on data available, the total 2012 water uses is estimated at 5,830 Mm^3/yr (83% for agriculture, 12% for the domestic sector, and 5% for the industrial sector) (National Strategy for Sustainable Development, 2008; NSIWRM, 1999). Table 4 summarizes the water budget for Libya in 2012.The imbalance between supply and demand amounted for 1,940 Mm^3/yr (48% of the total supply). It is anticipated that unlicensed wells (MEWINA Libya, 2013; MOAAMW, 2013), green water, wastewater reuse, and data inaccuracy contribute to the balance. Rainfed agriculture abstraction was estimated at 2,350 Mm^3/yr (AWC, 2013).

Table 4. Water budget in Libya in 2012

Water Resources	Quantity (Mm^3/yr)	Sector	Water consumption (Mm^3/yr)
Groundwater (Gefara plain, Jabal Akhdar, Kufra, Murzuk, Sarir, Hamada)	3,650 (3,000 Non-Renewable, 650 Renewable)	Agriculture	4,850 (83%)
Surface water (Dams, springs)	170	Industry	280 (5%)
Desalination	70	Domestic	700 (12%)
Green water estimate	2,350		
Total	**6,240**	**Total**	**5,830**

It is worth noting that Libya is subdivided into five water zones, representing the major groundwater basins or aquifer systems (Figure 2). The uneven distribution of population and the intensive agricultural activities in the coastal plains make the gap between supply and demand much wider in the Gefara and Jabal Akhdar plains. The "Man-made River Project" (MmRP) transports water from the well fields in Sarir and Murzuk basins to the coastal cities of Tripoli and Benghazi to reduce / fill the gap in the water balance in the Northern regions.

3.2. Water Supply

In Libya, water for irrigation is mainly obtained from groundwater through drilled wells, ranging in depth from less than 100 m to over 1000 m. Apart from public supply wells associated with government production and settlement projects, all wells are privately owned. In the so-called "settlement projects" each well serves a number of farms through an integrated irrigation network.

Domestic water supply networks are supplied from groundwater wells (owned and operated by the General Company for Water and Wastewater (GCWW)), water transported from the MmRP, or desalinated water from GCWD plants. Water is usually chlorinated prior to its distribution. As per GCWW, the total volume of produced water per year in 2012 was 1,726,000 m^3/day; amounting for 630 Mm^3/yr. The level of WSS services in Libya is among Africa's and the Arab states' highest thanks to the country's commitment to continuous upgrading of the WSS sector. According to the Arab Water Council/CEDARE report on Water Supply and Sanitation Coverage in the Arab States (2008), the fraction of Libya's population having access to improved water rose from 45% in 1990 to 84% in 2005. The WHO/UNICEF Joint Program for WSS (2008), reported fractions of 54.2, 54.9, and 54.4% urban, rural, of the total population connected to public networks with those supplied from private wells accounting for 35.8, 26.9, and 33.5 %, respectively. Assuming that well water is protected and, hence, safe to drink, the total coverage for urban, rural and total population is 90, 81.8, and 87.9 %, respectively.

National census (2006) and Ministry of Health data (2010) indicate that 89 % of Libya's population is urban. Over 82% of the total population obtains water from public or private water sources. The rest are supplied by other means (rainwater, transported water, etc.). They report an access to safe drinking water of over 97%. According to these two sources and to data reported to MEWNA – Libya Project (2013) by the GCWW, about 65% of the potable water is supplied by public networks, 17% by private sources, 16% is harvested rainwater, and 2% is supplied transported by vehicles.

Based on the national and international data reported above, it can be concluded that Libya has exceeded the MDGs. It is worth stressing that the present fraction with access to safe water supply and sanitation will increase as Libya completes implementation of its ongoing comprehensive National Program for Water Supply and Sanitation extending coverage to newly urbanized "smaller" communities and settlements.

Leakage and unaccounted for water losses are expected to be high. Although no field studies have been conducted to estimate these losses, experts put them at 35-50% in old networks of Tripoli and other major cities (MEWINA Libya, 2013).

All water supply projects are being financed by the government. There is no separation between the rural and urban water administration. The GCWW operates and manages all domestic water supply systems. It is clear that Libya is fully committed to realize the targets of the MDGs and that of Africa 2025.

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 subnational 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 2). These sets of standard questions targets categorizing and quantifying water supply coverage into improved access (piped water into dwelling, plot or yard; public tap/standpipe;

tubewell/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).

In terms of governance, long and short-term plans are being prepared to help meet demand, enhance water quality, reduce sea water intrusion, increase desalination use for domestic purposes, and reduce the per capita consumption to 250 l/c/d by reducing water losses (GCWW, 2012). Table 5 displays a comparison between Libyan reported water coverage values and that of the MDGs for the year 2011. Unfortunately, due to the long years of isolation of Libya, there is no data available in the JMP to compare with local data. However, the local and JMP definitions of the MDGs are presented for comparison.

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

Indicator	Access to improved water supply	2011	Comments
GCWW, Libya	Number of households provided with uninterrupted water supply from piped networks, truck tankers, bottled water, or rain harvesting / total number of households	Urban: 94% Rural: 84% Total: 92%	Values are reported based on 6,270,000 inhabitants
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 and rainwater / total number of people	No data	

3.3. Sanitation

Water 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. A total of over 6000 kilometers of sewage collection/transport pipelines and more than 70 waste water treatment plants (WWTPs) have been constructed since 1971 and a larger number is under construction or under contracting presently to serve over 400 urban and semi-urban communities (GCWW, 2012).

WWTPs have been designed to produce effluents suitable for agricultural irrigation. To meet effluent criteria, WWTPs had to include secondary (biological) treatment followed by filtration (granular media or micro), disinfection, and storage. Practically all WWTPs in large cities utilize modifications of the activated sludge treatment technologies. Oxidation ponds and on-site package plant systems have been employed in rural/remote locations while a large number of individual residences in unsewered areas employ septic tank systems.

Existing WWTPs are facing operational problems with only 19 plants operating satisfactorily at present with an output estimated at 200,000 m^3/day (GCWW, 2013). These problems include operation and maintenance problems and scheduling of completion and synchronization of different wastewater system components (collection, treatment, and disposal/reuse).

Access to sanitation is estimated by the same sources cited above at 99% with 45% served by centralized public networks and 54% served by on-site sanitation systems. According to the UNDP Arab Human Development Report (2009), access to safe sanitation rose from 97% in 1990 to 98% in 2004. The

AWC/CEDARE report (2009) gave fractions of 85 % and 97 % in 1990 and 2005, respectively. The GCWW and Census Bureau of Libya estimate the rural and urban populations served by centralized networks at 45% with 54% served by on-site systems (septic tanks).

Access to improved sanitation in urban and rural areas of Libya has improved steadily in the last four decades. According to the UNDP Arab Human Development Report (2009) and the World Bank (2012), percentage of population with access to improved sanitation in Libya is 97%.Table 6 presents a comparison between sanitation coverage reported by the Libyan government and JMP values (Appendix 2). JMP classifies coverage, based on a set of harmonized questions utilised in a standard survey as per Appendix 2, 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).

Construction of sewerage works has been financed by public funds as have their operation and maintenance. Like water supply, sewerage services costs have been recovered partially through tariffs. The agencies directly involved in managing sanitation water services are the GCWW with its branches. Upon rehabilitating existing WWTPs and constructing contracted WWTPs, all Libyans should have access to proper sanitation systems through secondary or tertiary WWTPs. Contracts have been awarded or prepared for tendering before the Libyan revolution but projects got delayed due to the political imbalance.

Table 6. A comparison between sanitation coverage reported by the Libyan government and JMP

Indicator	Access to improved sanitation	2011	Comments
GCWW, Libya	Number of households having flush toilets that are connected to piped sewer systems or septic tanks / total number of households	Urban: 99% Rural: 97% Total: 98.8%	Values are reported based on 6,270,000 inhabitants
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 and composting toilet / total number of people	Urban: 97% Rural: 96% Total: 97%	Values are reported based on 6,423,000 inhabitants

4. Principal Issues in Water Sector

1) Water Scarcity and Excessive Groundwater Mining: Because most groundwater resources in Libya are fossil in nature, the safe groundwater abstraction should not exceed 3,650 million m^3/yr (Renewable groundwater: 650 Mm^3/yr, fossil Gefara Plain: 25 Mm^3/yr, fossil Jabal Akhdar: 25 Mm^3/yr, fossil Kufra and Sarir: 1,300 Mm^3/yr, fossil Hamada: 150 Mm^3/yr, and fossil Murzuk: 1,500 Mm^3/yr). The total controlled surface water is estimated at 170 Mm^3/yr (GWA, 2012), and the total desalination water is estimated at 70 Mm^3/yr (GCDW, 2012). This makes the 2012 estimated total available water resources for Libya 3,890 Mm^3/yr. Based on data available, the total water uses is estimated at 5,830 Mm^3/yr (83% for agriculture, 12% for the domestic sector, and 5% for the industrial sector). The imbalance between supply and demand amounted for 1,940 Mm^3/yr (48% of the total supply in 2012). It is anticipated that unlicensed wells, unaccounted for rainfed agriculture, wastewater reuse, and data inaccuracy contribute to the balance. This imbalance is expected to grow wider in the future.

2) Inadequacy of Institutional Framework: In the past 40 years, Libya was plagued with administrative instability, i.e., continuously changing the mandates of ministries every few years. The water sector was an exception, however, as it was administered by the GWA for many years. In 2012, the Ministry of Water Resources (MWRs) was established. Its domain included overseeing of the GWA, the General Company for Water and Wastewater, the General Company for Water Desalination (previously overseen by the Ministry of Electricity), and the Authority for Execution and Management of the Manmade River Project (AEMMmRP). As is the case in many other developing countries, there is no well-defined mandate for sectors concerned with water and no well-structured interaction methodology to properly govern the water sector in Libya. Therefore, Libya needs to upgrade its institutional frameworks and capacities. There is room for development in the areas of human resources, capacity building, and awareness raising.

3) Uneven Distribution of population and the Intensive Agricultural Activities in the Coastal Plains: Libya's coastal area is characterized by high population densities and intensive commercial, industrial and agricultural activities causing the gap between water supply and demand much wider in the Gefara and Jabal Akhdar plains. The imbalance between supply and demand is expected to grow much wider in the future, especially for the northern basins. The immediate remedies already considered include interbasin water transfer, desalination, and treated wastewater effluent reuse. Other complementary solutions cover legislative measures, charges and public awareness.

4) Seawater Intrusion and Water Quality Deterioration: The seawater interface has advanced close to 2 km inlands in some coastal areas in the Gefara Plain, and salinity levels have increased significantly from 150 ppm to over 5000 ppm in some locations during the period from 1950 to 1990 (GWA State of the Water Report, 2006). Salinity levels continue to increase at a rate of 15-20 ppm per year in some locations (GWA State of the Water Report, 2006).

5) Uncontrolled Mining of Groundwater: The uncontrolled mining of groundwater for agricultural purposes has added to the water imbalance and to increasing the salinity levels of the fossil groundwater resources of Libya.

6) Poor Crop Yields: The increase in the irrigation "ground" water salinity levels over the years in many places in Libya has led to soil salinization. As a result, irrigation water demand increased and crop yields decreased (State of Water Report by GWA, 2006).

7) Fragmentation of Agricultural Land Holdings: During the last four decades (1970-2010), Libya's official policy had been focused on land reform. All Italian-owned farms (about 38,000 hectares) had been confiscated and redistributed to Libyans in smaller plots. In 1971, the government

declared all uncultivated land shall be state property, a measure aimed mainly at breaking certain powerful conservative tribal groups who had laid claim to large tracts of land. Another law passed in 1977 placed further restriction on tribal systems of land ownership, emphasizing actual use as the deciding factor in determining land ownership. Since 1977 an individual family has been allotted only enough land to satisfy its own requirements. This policy was designed to prevent the development of large-scale private sector farms and to end the practice of using fertile "tribal" lands for grazing rather than cultivation.

Further agricultural land fragmentation resulted from application of rules of inheritance which led to dividing land continuously among the many inheritors upon the death of "father" the original owner. Areas of about 90% of all farms in Libya are less than 20 hectares, i.e., too small to make efficient use of water. Fragmentation of agricultural land holdings was especially severe in the long-settled Jifarah Plain, which has been Libya's single most productive agricultural region.

8) Low Water Tariffs and Poor Recovery Rates: The right of all citizens to safe drinking water is granted by Libyan legislation. A water tariff structure exists. By Law, municipal water must be metered and an ascending tariff is charged. However, the tariff is not intended to recover the investment cost for the water supply system, but rather to minimize wastage and to partly compensate for O&M (e.g.: desalinated water is sold for 0.25 LYD(0.2 US$) per m^3 whereas its average cost is 0.86 LYD (.76 US$) per m^3 (2012 US $). The billing system is irregular and sometimes non-existent, which implies that water will continue to be a free commodity provided by the State. No charges have been imposed for irrigation water in the past except in public agricultural projects supplied by the Authority for Execution and Management of the Man-made River. At present, farmers are only charged the cost of energy used for the production of water, and that energy is also subsidized.

Furthermore, private uses for all purposes from wells are not subject to tariffs. Although the construction cost of the MmRP has been recovered through taxes, the O&M of the MmRP system is not fully recovered and tariffs need to be restructured.

5. Water Sector Institutional Framework

5.1. Water Resources

The water sector management in Libya is centralized and is set to be managed by the Ministry of Water Resources (MWR) that was established on November, 2012. The MWR will consolidate the following governmental bodies under its umbrella as shown in Figure 4:

- The General Water Authority (GWA) – الهيئة العامة للمياه
- The Authority for Execution and Management of the Manmade River Project (AEMMmRP) – جهاز تنفيذ وإدارة مشروع النهر الصناعي
- The General Company for Water and Wastewater (GCWW)الشركة العامة للمياه والصرف الصحي
- The General Company for Water Desalination (GCWD) - الشركة العامة للتحلية
- The Water Research Institute -مركز بحوث المياه
- Water Information and Documentation Center (to be established).
- The Joint Authority for Study Development of the Nubian Sandstone Aquifer System (NSAS) - الهيئة المشتركة لدراسة الحوض الرملي النوبي
- The North-Western Sahara Aquifer System (NWSAS) - حوض شمال غرب الصحراء

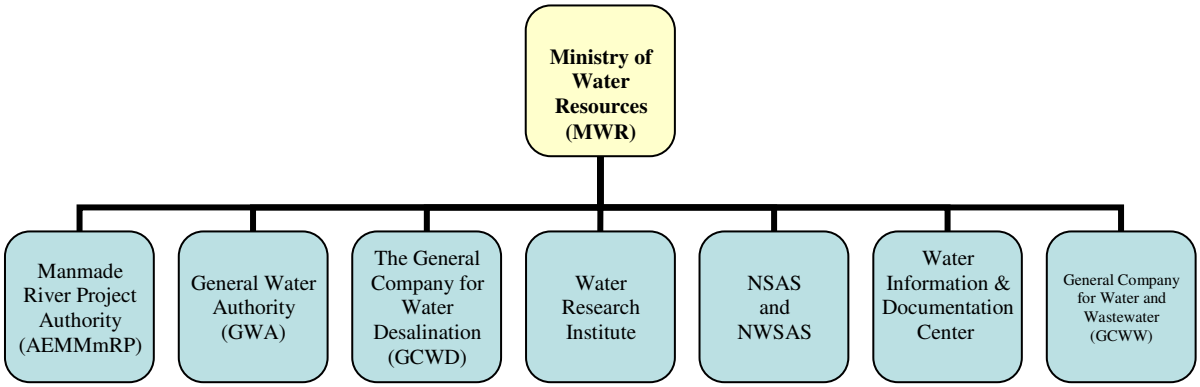

Figure 4. Simple organization chart of the newly formed Ministry of Water Resources in Libya

The General Water Authority (GWA):

The main government agency dealing with water resources and management has been the GWA. The GWA was first established as an independent government body on 12/2/1972 according to Law 26, 1972. The GWA has become a part of the MWR upon its establishment in 2012. The organization chart of the MWR is still under preparation. The mandate of the GWA is as follows:

- Developing water resources strategies
- Prioritizing water abstractions and allocations among the different sectors (agricultural, industrial, and domestic)
- Conducting basic and applied research on water management, water saving techniques, integrated water resources management, and developing alternative water resources

- Assuring sustainable use of the available water resources
- Communicating and organizing water uses with all ministries and water stakeholders
- Drafting water resources guidelines, action plans, laws, and regulations
- Supervising the construction of water resources projects

Clearly, the GWA's responsibilities are very broad and numerous combining planning, execution, supervision, and regulation. The nature of these responsibilities has overtaxed the GWA and made it less effective in addressing all of these responsibilities simultaneously. Accountability was also a problem in cases where the GWA played the roles of planner / executer and regulator / controller. Finally, burdened with these numerous and diverse responsibilities, the GWA priorities were not always adhered to and valuable time and endless efforts were dedicated to low-priorities issues.

The Authority for Execution and Management of the Manmade River Project (AEMMmRP):
To provide long term solutions to its serious water shortages, Libya has constructed the Manmade River Project (MmRP), the world's largest pre-stressed concrete pipe project. The Project, since its conception in 1984, has grown to include hundreds of wells, almost 4,000 km of mainly 4 meter diameter conveyance pipes, reservoirs, monitoring and control structures. Eventually over 6 Mm^3 of water will be conveyed daily from well fields deep in the Sahara desert to the population centers that are concentrated on the northern coastal strip. The MmRP project has five phases (Figure 5) as follows:

1) Sarir-Sirt,Tazerbo Benghazi System SSTB (completed).
2) Jabal Hasaouna-Jefar System (completed).
3) Gadabiya/Sedada System (completed).
4) The Gedammes/Zwara System (in tendering phase).
5) Kufra/Tazerbo System (not tendered yet).

Figure 5: Man-Made River Project Phases

The system includes hundreds of wells, thousands of kilometers of pipelines, and pumping stations. The large scale of the project had mandated the formation of a dedicated organization (AEMMmRP) to operate and manage the system elements and to carry out research and continuous monitoring to make sure that the abstraction of water from such deep fossil aquifers is sustainable.

The General Company for Water and Wastewater (GCWW):

The GCWW was re-established in 2008 as a semi-independent body under the supervision and direction of the Ministry of Housing and Utilities (MoHU). Its mandate included provision of Libya's cities and towns with potable water and management of the wastewater produced. In this regard, the mandate included managing the operation and maintenance of all WSS infrastructure including water pipelines, wastewater pipelines, and water and wastewater treatment plants. This mandate was expanded to include the construction of WSS infrastructures and water and wastewater treatment plants. This latter mandate is shared between the MOHU and the GCWW although it is "traditionally" not within the GCWW's responsibilities.

With the formation of the Ministry of Water Resources, supervision and direction of the GCWW has been transferred from the MoHU to the MoWR. The GCWW's role as a supplier of supplemental treated effluents has been marginal as the fraction of effluents subject to treatment is very small and unsuitable for reuse. Moreover, land to be irrigated with treated effluents is not available and private farmers prefer using well water to treated effluents.

The General Company for Water Desalination (GCWD):

The GCWD was established in 2007. It was charged with the execution of plans and programs in the field of water desalination including construction, operation and maintenance of desalination plants of brackish and seawater. The company's mandate gave it the right to sell the water it produced; a practice which it has applied continuously. Historically, the GCWD has been operating under the Ministry of Energy and Electricity. However, upon the formation of the MWR, the GCWD has been managed under the umbrella of the MWR. This will create a more logical coordination framework with other players in the water sector. The company's contribution to the national water supplies has been limited to domestic uses with the General Company for Water and Wastewater as the major client.

IWRM and System Financing:

The water resources management organizational matrix and infrastructure is still in its inception phase after forming the MWR in November 2012. Historically, the GWA was the government body responsible for integrated water resources management and will probably continue to do so under the umbrella of the MWR. The water governance system in Libya has been central with the GWA approving every water-related project before its being tendered.

Libya has taken concrete steps towards addressing its water challenges. Large scale water projects provided water to practically all of Libya's settlements and agricultural projects. These efforts are epitomized by the MRP, one of the world's largest water transport schemes, intended to transport over 6 Mm^3 of water daily from the vast reservoirs in the south to the coastal townships and agricultural areas. Presently, water resources management practices are predominantly centralized with focus on supply-management, but with a high degree of integration and horizontal coordination with other water sector agencies. All water projects based on the development of groundwater resources including those of MmRP and municipal well fields have to be approved by the GWA. The GWA has been approving projects on the basis of new or existing studies and modeling results (MEWINA Libya 2013; Abufayed and Elkebir, 2010). 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 integrated water management approach. This integrated approach was spelled out clearly in the country's first National Strategy for Integrated Water Resources Management (NSIWRM) formulated in 2000 and approved for implementation in 2006. The socioeconomic and environmental aspects of water resources management have to be addressed. In addition, important elements like inter-agency

networking, private-public participation, and climate change have to be integrated in a well-planned IWRM strategy.

In terms of funding, Libya relies mostly on self-funding for execution of its important water related projects. Libya is an oil rich country and provided that there is a political will for implementing a well-developed IWRM plan, the funding can be made available and is therefore sustainable.

5.2. Water Resources Related Organizations

Historically the GWA, the AEMMmRP, the GCWW and the GCWD were independent governmental bodies and were categorized under "Water Resources Related Organizations". Since the inception of the MWR in November 2012, they can no longer be categorized as such. In addition to the MWR with its subordinates, the governance of the water sector has been shared by the following agencies and as depicted by Figure 6:

1) **The National Center for Standards (NCS)** which sets water supply and sanitation (WSS) standards and criteria;
2) **The Environmental General Authority (EGA)**, a semi-autonomous organ that belongs to the Prime Minster office directly. It has the mandate to set the maximum contaminant levels for drinking water and effluent reuse criteria. It also approves projects based on environmental impact assessments, drafts national environmental strategies and action plans, raise awareness of environmental problems, and monitors water quality;
3) **The Ministry of Housing and Utilities (MOHU)** that executes water supply and sanitation (WSS) plans through its subordinate the Housing and Infrastructures Board (HIB), a semi-independent authority, which executes new housing projects along with all the infrastructures projects associated with these projects (WSS, electricity, gas, etc.);
4) **Organization for Development of Administrative Centers (ODAC)** that executes new public (housing, educational, health, etc.) projects along with all associated infrastructures ;
5) **National Center for Meteorology (NCM**), a semi-autonomous organ of the Ministry of Transportation that monitors weather parameters including rainfall, temperature, humidity, wind speed and direction;
6) **The Ministry of Agriculture, Animal, and Marine Wealth (MOAAMW)**, which oversees agricultural activities nationally. Its activities include agriculture land use projections for Libya's district and corresponding water requirements and coordination with the MWR to negotiate water shares.
7) **The 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 head-quarter of the organization. This office coordinates its activities very closely with the MWR through the GWA.
8) **The North-Western Sahara Aquifer System (NWSAS)** - that coordinates the activities of the NWSAS to make sure that the transboundary resource is sustainably managed. This office coordinates its activities very closely with the MWR through the GWA via the NWSAS Libyan focal point who resides in the premises of the GWA.
9) **The Ministry of Energy and Electricity (MOEE)**, which has historically managed the GCWD as desalination has been linked with power production. The MOEE still manages all power stations employing thermal desalination plants while the GCWD oversees other non-thermal and non-power desalination plants.

10) **The General Authority for Information (GAI) of the Ministries council** that carries out national censuses and population forecasting and is host to all national data and information which is submitted to it officially by the different government agencies and ministries. The GAI publishes annual statistics reports that summarize the state of growth of population and sectors along with national development indicators which are in line with regional and international indicators.

The water laws and regulations in Libya are listed in Table 7 along with their governing authorities. Table 7 displays the key laws and guidelines regulating: water allocations, water quality, municipal water supply and sanitation, industrial effluent discharges, and irrigation and drainage.

Table 7. Libyan Water Laws and Regulations and their Governing Authorities

Activity	Governing Laws/Regulations	Governing Authority
Water allocations	• Law 3 year 1982 on Regulating the Utilization of Water Resources • General People's Committee Memo no. 612 / year 1993 on Manmade River water allocations • Law 15 year 2003 On Environmental Protection and Enhancement	Level 1: MWR, AEMMmRP Level 2: MOAAMW, GCWW, HIB, MOEE estimate their needs and apply to the MWR to coordinate the respective water allocations
Water quality and National drinking water standards	• Libyan Standard 82 year1992 Drinking water standards • Law 106/1976 On Health • Law 15/ 2003 On Environmental Protection and Enhancement • Law 3/ 1982 On Regulating the Utilization of Water Resources	Level 1: MOH Level 2: AEMMmRP and GCWW for self quality control Level 3: casual university and NGO for quality checks
Municipal Water supply and Sanitation	• Law 106/ 1976 On Health • Law 15/ 2003 On Environmental Protection and Enhancement • Libyan Standard 82 year1992 Drinking water standards	Level 1: GCWW for providing the service meeting the guidelines Level 2: MOH, MWR to conduct quality check points on the system Level 3: casual university and NGO for quality checks
Industrial effluent standards	• None	
Irrigation and drainage	• None	MOAAMW

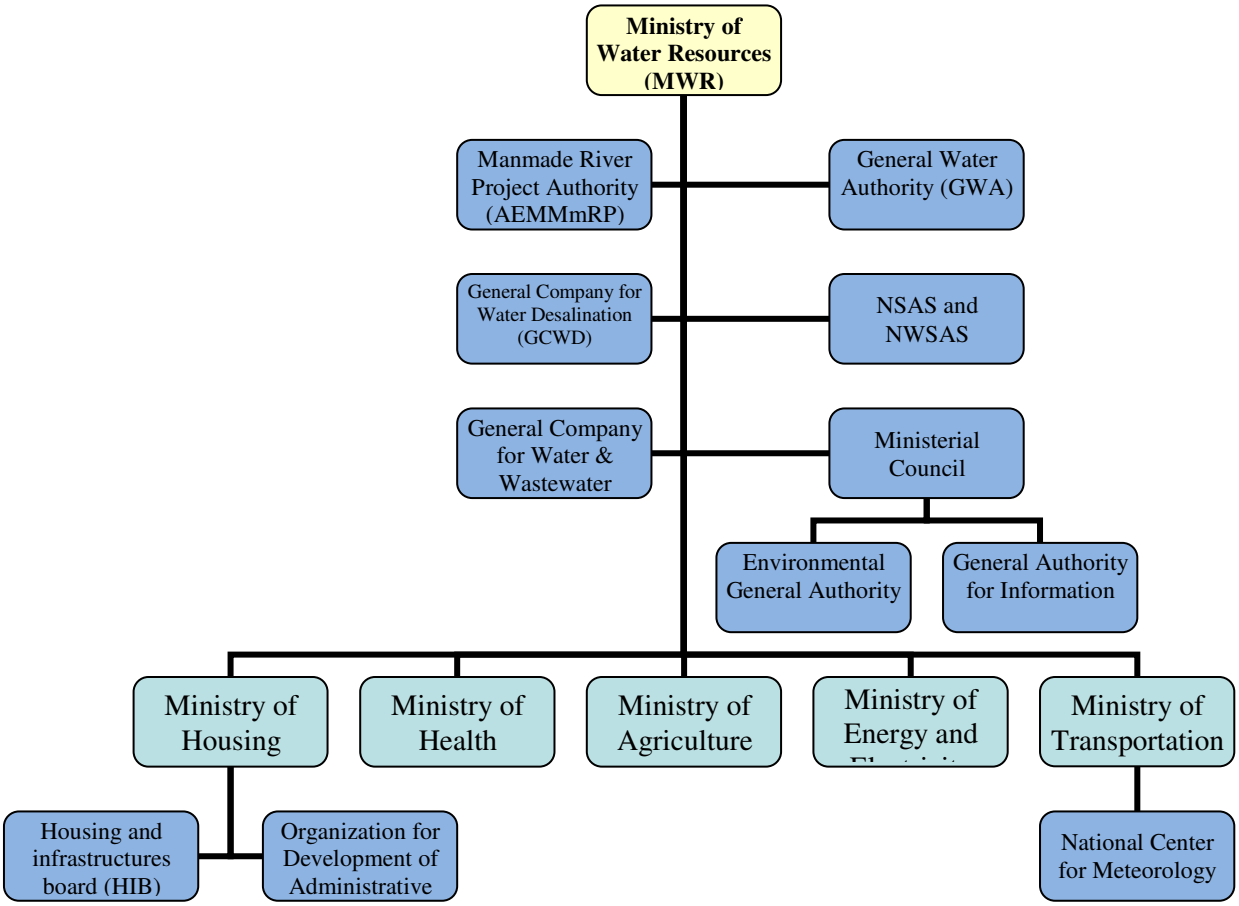

Figure 6.Organization chart for stakeholders in water sector

5.3. Rural Water Supply and Sanitation (RWSS)

As mentioned earlier, over 89 % of the Libyan population lives in urban centers. WSS activities in Libya are centralized; thus there is no clear division in the governance, financing, operation and maintenance between urban and rural Libyan communities. Actually, there is no clear definition of urban and rural communities to be applied for planning, implementation, and management purposes. According to the Urban Planning Department, communities with populations of 5000 persons or below are considered rural. This definition is clearly very conservative and in disagreement with most international definitions of this term.

The major organizations working in the field of rural water supply and sanitation in Libya are the following (Figure 7):

- The MWR exemplified in the GWA, AEMMmRP, and GCWW.
  - The General Water Authority has 5 branches in Libya, by which it governs water resources in urban and rural communities.
  - The AEMMmRP has 5 offices in Libya, by which it govern water resources in urban and rural communities.
  - Similarly, the GCWW has 15 service centers within Libya through which it provides services to its customers.
- The Ministerial Council represented by General Environment Authority, taking over the role of the Ministry of Health.

- The Ministry of Agriculture and Animal Wealth (MOAAMW).
- Joint Authority for Study Development of the Nubian Sandstone Aquifer System (NSAS).
- The North-Western Sahara Aquifer System (NWSAS).
- The National Center for Standards (NCS) which sets water supply and sanitation (WSS) standards and criteria.
- 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 visible and documented outputs (MEWINA Libya, 2013).

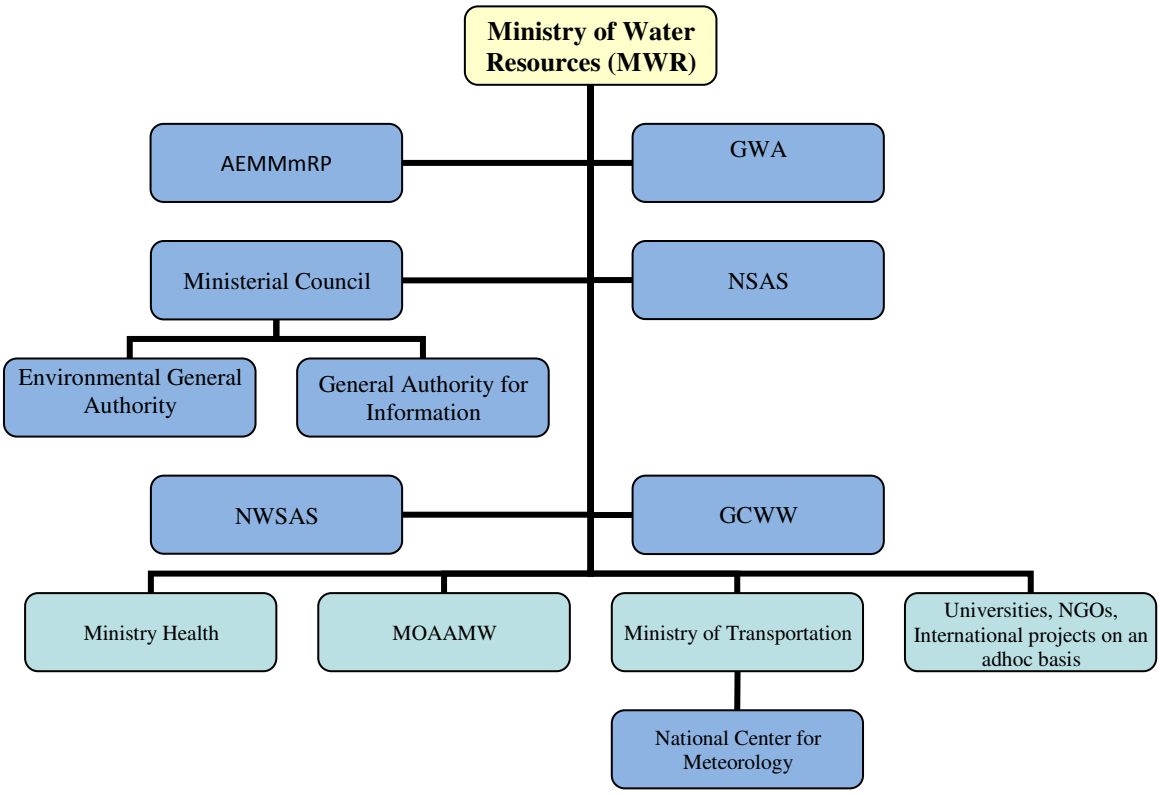

Figure 7.Organization chart for stakeholders in RWSS in Libya

Strengths of RWSS institutions:

1. A ministry for water resources (MWR) has been established whose mandate includes evaluation and assessment of water resources, uses and quality of service along with institutions performance in both urban and rural communities.
2. All major water related organizations are under the mandate of one body, namely, the MWR which simplifies their reorientation.
3. Strong commitment towards improving IWRM and WSS exists.
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.

6. Human and financial resources can be made available readily and sustainably as per the political will.

Weakness of RWSS institutions:

1. There is presently no regulatory framework for rural WSS.
2. Libya is very centralized with no clear aim to segregate urban from rural governance.
3. Very low population densities and very large area to be governed.
4. Non-enforcement of existing laws.
5. No clear criteria are established for targeting rural WSS sector performance.
6. Weak capacities to implementation of existing plans in rural WSS in terms of human resources, financing and clearly-defined institutional roles.
7. Limited human resources for the management of water resources.
8. Weak mechanisms for ensuring good governance, transparency and reporting of rural WSS projects.

5.4. Urban Water Supply and Sanitation (UWSS)

In Libya, the following are the organizations working in the field of Urban Water Supply and Sanitation (Figure 8):

- The MWR exemplified in the GWA, AEMMmRP, and GCWW.
  - The GWA has 5 branches in Libya, by which they govern water resources in urban and rural communities.
  - The AEMMmRP has 5 systems with 5 headquarters in Libya, by which they govern water resources in urban and rural communities.
  - Similarly, the GCWW has 15 service centers within Libya through which it provides services to its customers.
- The Ministry of Housing represented The Housing and infrastructures board (HIB) that constructs supplies potable water and provide sanitary infrastructure for new housing projects, and The Organization for Development of Administrative Centers (ODAC) constructs utilities infrastructure for new housing projects.
- The Ministry of Health.
- The Ministerial Council represented by General Environment Authority, taking over the role of the Ministry of Health.
- The National Center for Standards (NCS) which sets water supply and sanitation (WSS) standards and criteria.
- National Center for Meteorology (NCM), a semi-autonomous organ of the Ministry of Transportation.
- The Ministry of Agriculture, Animal, and Marine Wealth (MOAAMW).
- Joint Authority for Study Development of the Nubian Sandstone Aquifer System (NSAS).

- The North-Western Sahara Aquifer System (NWSAS).
- The Ministry of Energy and Electricity (MOEE), which has historically managed the GCWD as desalination has been linked with power production. The MOEE still manages all power stations employing thermal desalination plants while the GCWD oversees other non-thermal and non-power desalination plants.
- 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 visible and documented outputs (MEWINA Libya, 2013).

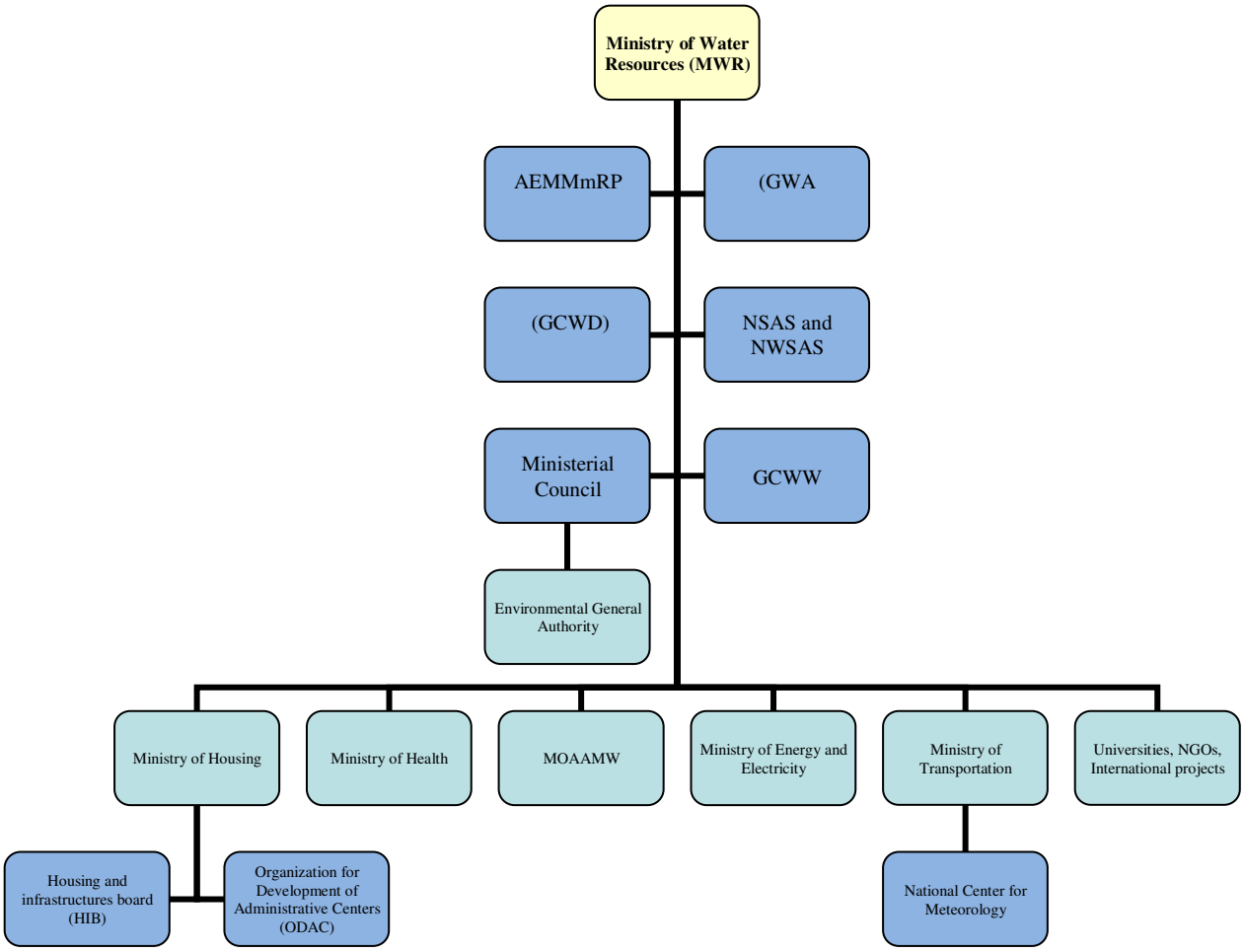

Figure 8. Organization chart for stakeholders in UWSS in Libya

Strengths of UWSS institutions:

- A ministry for water resources (MWR) has been established whose mandate includes evaluation and assessment of water resources, uses and quality of service along with institutions performance in both urban and rural communities.
- All major water related organizations are under the mandate of one body, namely, the MWR which simplifies their reorientation.
- Strong commitment towards improving IWRM and WSS exists.
- Organizations responsible for water resources management, potable water and sanitation have been established.
- The institutional framework already includes many actors with capabilities and on which it will be possible to rely.
- Human and financial resources can be made available readily and sustainably as per the political will.

Weakness of UWSS institutions:

1. Weak enforcement of existing laws.
2. No clear criteria are established for targeting WSS sector performance.
3. Limited human resources for the management of water resources.
4. Weak mechanisms for ensuring good governance, transparency, and reporting of WSS projects.

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 indicators regarding water resources in Libya; however, they are not really active in M&E of the country water resources and depend on weak surveys and sometimes on pre-published old data. Many senior Libyan water sectors officials have serious reservations on these indicators. In addition, the sanctions imposed on Libya for many years had limited the cooperation between such international organizations and the Libyan government.

Regional and Local M&E Organizations:
On the national level, IWRM M&E is undertaken by several institutions, namely:

- Ministry of Water Resources
- GWA with its regional branches
- AEMMmRP with its regional branches
- The EGA, a semi-autonomous organ that belongs to the Prime Minster office directly
- The NCM, a semi-autonomous organ of the Ministry of Transportation
- Joint Authority for Study Development of the Nubian Sandstone Aquifer System (NSAS).
- The North-Western Sahara Aquifer System (NWSAS)

There is no national structured framework for M&E in Libya. Different institutions have their own IWRM M&E frameworks but no national IWRM M&E framework exists. These frameworks are not integrated, in contrast to the National Water Strategy recommendations, and, therefore, their outputs are of limited use. However, the GWA of the MWR plays a key role in IWRM M&E coordination as depicted in Figure 9.

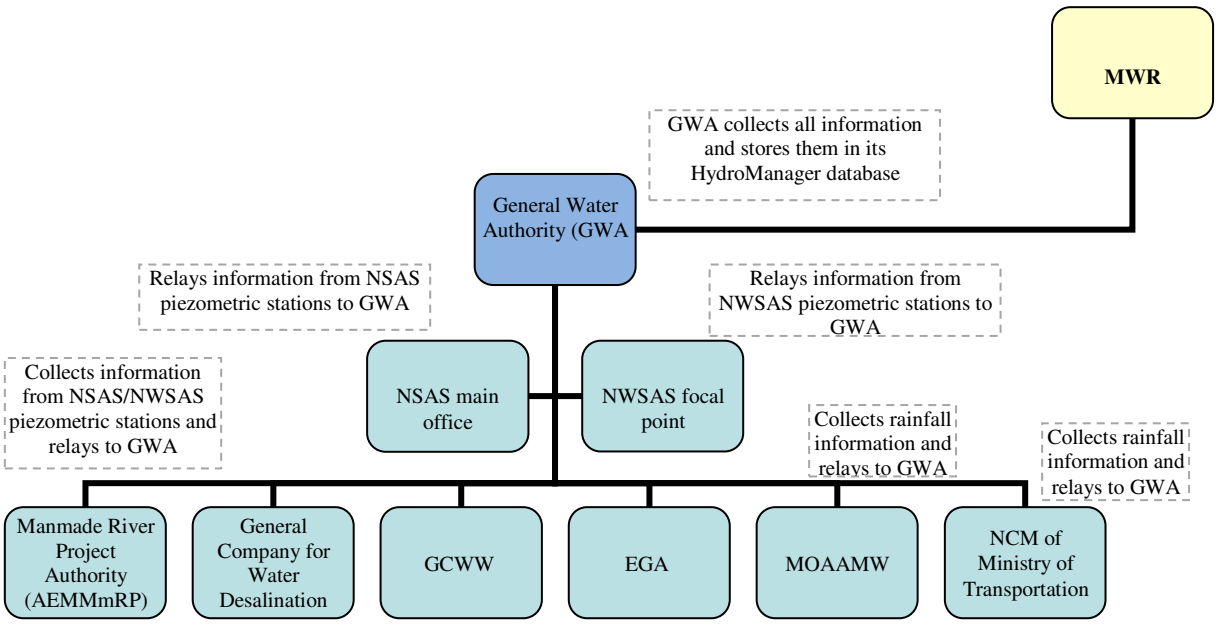

Figure 9. M&E institutional framework in water resources management in Libya

6.2. Basic Monitoring Networks

There are no river basin organizations (RBOs) in Libya. However, there are two transboundary aquifers' organizations; namely NSAS and NWSAS. For these two organizations, there exist basin monitoring networks consisting mainly of piezometric "water level" monitoring associated with water quality monitoring at times. Tables 8 and 9 show the resources, facilities and capabilities of NSAS and NWSAS, respectively.

Table 8. NSAS Monitoring Network & its status (MEWINA Libya, 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 and MSc) • 12 geologists and hydrogeologists • 7 administrative skills	5 in Libya	3 in Libya	*74 wells for the national network (depth to water)	*74 wells for the national network (TDS and conductivity)

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

The information available on the multiple uses of water resources is not collected on an annual basis but is available on sporadic reports and research publications.

Principal strengths of NSAS Office and Data:

- Establishment of four national offices with headquarter in Libya
- NSAS has an 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 newly formed MWR in Libya
- All collected information in Libya is assembled on annual basis and stored in the GWA HydroManager database
- AEMMmRP through its highly experienced personnel operates the wells in Libya and thus provides reliable data.
- There are historic data for trend analyses for many years

Weaknesses of NSAS Office and Data:

- In Libya, only 74 wells out of 1220 are continually being monitored
- The data management system (NARIS, to be described latter) has not been filled with information except up to 1998
- The data management system is still in its trial phase

Table 9. NWSAS Monitoring Network and its status (MEWINA Libya, 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)
• 9 highly experienced (4 PhD, 5 MSc) • 6 Engineers • 6administrative skills	No information	No information	167 observation wells in the NWSAS area	167 observation wells in the NWSAS area (mainly TDS/ conductivity)

There is some information collected about the municipal and agriculture sectors uses of the shared water resources. Supplemental information is also available on the basin's hydrogeologic, hydrochemical and other characteristics in the form of reports and research papers.

NWSAS Multiple user consumptions and estimated irrigated areas per country are summarized in Table 10.

Table 10. NWSAS agricultural allocations of water resources per country

Country	Total amount used, million m^3/year	Agricultural area irrigated (hectares)	Water used per hectare, m^3
Algeria	313	170,000	10,000
Tunis	95	40,000	15,000
Libya	57	40,000	12,275

Principal strengths of NWSAS Office and Data:

- Availability of a country focal point, residing within the premises of the GWA, and therefore, can easily interact with other decision makers of the sector
- A consultation committee has been established under the ministers of water of the 3 transboundary countries
- A monitoring system / plan has been put in place that will feed the database, which is under construction
- All collected information in Libya is assembled on annual basis and stored in the GWA HydroManager database. There is capacity to store all transboundary information within the HydroManager of the GWA if approved by the transboundary countries. However, only data produced in the sporadic "state of aquifer reports" are stored in the GWA
- AEMMmRP through its highly experienced personnel operates the wells in Libya and thus provide reliable data.

Weaknesses of NWSAS Office and Data:

- Information is fed to the HydroManager GWA database manually and only at the time of producing a periodic state of aquifer report
- There is no functioning data management system for NWSAS countries so that the Libyan focal point / water authorities have access to NWSAS data.
- Two independent efforts to build a database management system for NWSAS have been made. The Libyan effort has resulted in developing a Post Grid database. The Tunisian one uses Access, making

the two systems incompatible. This has hindered data sharing between countries and has limited data sharing to MS Excel spreadsheets sent by email to the countries focal point. There is an effort underway to construct a unified database for the shared aquifer.

6.3. Data Analysis, Storage and Dissemination

Table 11 summarizes data analysis, storage and dissemination in Libya

Table 11. A summary table answering key questions regarding data analysis, storage and dissemination assessment in Libya

Question	Response
What is the quality and timeliness of data being collected in each basin?	• All piezometric data collected by the AEMMmRP seems to be of adequate quality following international standards. • Piezometric level/drawdown measurements seems to be timely • Water quality information is less timely
What indicators are being used?	• Water level • Drawdowns • Quality parameters (Salinity (or TDS), E-Conductivity, Sodium, Potassium, Calcium, Magnesium, Iron, Carbonate, Bicarbonate, Sulfate, Nitrate, Nitrogen Dioxide, Boron, Silicon Dioxide, pH, and total harness)
What performance criteria are being used?	No performance criteria used
Is the data verified and are there quality checks on its collection?	Yes but with no clear methodology for data quality checks.
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. • Data are collected regionally and forwarded to central authority for integration and national level analysis. Analysis is done at both regional and central levels with the more in-depth analysis done at the central level and vice versa. • The main office of the GWA in Tripoli is the main hub that collects all data for storage, further quality checks, and preparation of annual/periodic status reports

Question	Response
	• Most of the information is still transferred to the GWA by 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. • 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) • NWSAS has an ACCESS database that is still under construction • GWA uses an Online Information Management System (Schlumberger HydroManager) that is compatible with all other relational Database Management Systems (RDBMS) • 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 used?	• 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. • 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 available?	• 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:

- Data are placed centrally in the HydroManager with easy access to GWA authorized personnel, retrieval, manipulation and analysis, etc.
- Access to the data can be controlled like any sound database. The MWR through the GWA provides limited access for data viewing and editing according to need. At the current time, the GWA and the AEMMmRP are having access to the database.
- 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 no link between other water-related organizations like GCWW, GCWD, etc... and the GWA database, except for the AEMMmRP
- System is still in the initiation phase in the GWA and personnel needs more training to make full use of its capabilities

7. Rural Water Supply and Sanitation M&E

The WSS M&E system in Libya is highly centralized. There is no segregation between rural M&E and Urban M&E. This is also exemplified in the fact that 80% of the Libyan population lives in urban cities. As such, for the specific case of Libya, one section will be included to report rural and urban WSS M&E to avoid unnecessary redundancy.

8. Urban Water Supply and 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:

- Ministry of Water Resources represented by GCWW (Water and Sanitation). The GCWW is the entity that is most concerned and most involved routinely.
- The General Environment Authority (Water and Sanitation). It monitors on a random check basis to ensure adherence to standards and regulations.
- The Ministry of Health (Water and Sanitation). It monitors on a random check basis to ensure adherence to standards and regulations.
- The Bureau of Census, General Agency for Information which collects data on water supply and sanitation as part of the census surveys.

There is no structured M&E framework for the WSS sector. However, M&E activities are assigned to special departments / units within the GCWW and its facilities spread in different locations within Libya. Parameters monitored vary from one location to another. Many basic parameters are identical, however, in consensus with the standard practices. There aren't formal monitoring networks.

According to the GCWW, 45 % of the population is being served by secondary/tertiary wastewater treatment plants and over 54 % (of both rural and urban population) uses septic tanks and on-site decentralized systems that are not controlled by the Ministry. The total number of wastewater treatment plants (WWTPs) constructed exceeds 75 plants of which only 12 are operating efficiently presently. Monitoring and evaluation of WWTPs are not conducted on a regular basis. M&E efforts have been limited to a few stations, discontinuous and not harmonized.

The rest of the plants are undergoing major maintenance operations. At the same time, a large number of wastewater plants are under construction or in the contracting stage. Upon completion of the new plants and those under execution, the total population should be served by wastewater treatment plants with effluents suitable for restricted irrigation.

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 relate to WSS are being estimated based on collecting information on access to water and sanitation, population estimates; as releases by the Ministry of Information in the statistics year book. Water quality data is not taken on a formal basis except for desalination plants; operated by the General Company for Water Desalination; and for wells operated by the AEMMmRP.

8.2. Indicators and Sampling for Data Collection

The GCWW is the major player in sampling and data collection for WSS. The major (rural and urban) sanitation parameters monitored are:

- Network components data (pipes, pumps, etc.).
- Water quantities supplied to urban and rural communities.

- Raw, treated and distributed water quality parameters (Turbidity, TDS, TSS, pH, temperature, bacteriological counts like fecal and total coliform counts, Alkalinity, Hardness, iron, manganese, etc..).
- 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.
- Wastewater treatment plant raw and treated sewage quality parameters (BOD, TSS, pH, temperature, bacteriological counts like fecal and total coliform counts, ammonia, nitrates, orthophosphates, etc..)

The AEMMmRP also monitors the water it supplies to urban and rural communities at the different turn-outs on transmission line. The monitoring and evaluation operations are more regular and comprehensive including both water quantity and quality indicators.

However, most of the data is used for pricing and collecting revenue from WSS system operation and maintenance. Table12 gives an overview on the data collection.

Table12.Indicators and Sampling for Urban/rural WSS Data Collection in Libya

Question	Response	Comments
For what purpose is the data being collected?	• Data is collected for purpose of operation and maintenance of WSS networks by the GCWW; e.g. checking networks pressures and water losses, metering water users for billing, and checking quality of water, and flow rates of treated effluents for reuse or disposal purposes. • Desalination water flow rates are being collected by the GCWD for billing purposes. • Water quantity and quality data for AEMMmRP operated wells are being collected to feed NWSAS and NSAS with piezometric information, for quality control purposes, and for billing purposes.	• Data is kept within the GCWW and is not formally shared. • 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 data is collected through GCWW operators in every populated area and on every network. • Collection of data of water supply is monitored by the AEMMmRP (wells) and GCWD (desalination). • Collection of data on sanitation is conducted by operating wastewater treatment plants	A point of strength that ensures good representation of service to reality
Which indicators are being used? How do they compare to the indicators used by the JMP to measure progress towards the MDG?	Find below information about national indicators used and JMP indicators	National indicators have to be harmonized with the JMP indicators

Question	Response	Comments
What are the geographic areas and/or populations being surveyed?	• Urban cities are covered (80% of the population) • Rural cities are less covered • All piped water supply are routinely monitored (65% of water supply in Libya) • All WWTPs are monitored routinely (45 % of sanitation in Libya)	Surveys are not frequently made by the GCWW and thus some of the information might be outdated
Comment on the survey design and the sample and its representativeness	No design for surveys is made since water service providers do not depend on surveys for data collection. GCWW, GCWD, AEMMmRP operators collect the data.	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?	No quality checks are made and data is not verified	Quality checks are needed maybe through using data of JMP and other companies providing water service
Is the local definition of coverage the same as that of the MDGs	• No, for drinking water. (Libya considers water supplied from publically owned tanker trucks as improved due to the continuity of delivery and the adequacy of water quality) but yes for sanitation. • JMP Improved Drinking Water Sources (Piped water into dwelling, plot or yard, Public tap/standpipe, Tubewell/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)) • 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)	Harmonization is needed for coverage rates. Formal surveys are needed in Libya to identify the actual coverage figures.
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	• Coverage rates are based on population as provided by the Ministry of information projections (i.e. numerator and denominators are timely but population figures are forecasts from last census). The total population is up-to-date and accurate. • 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	Revising coverage rates for accessibility of water is needed according to JMP

Question	Response	Comments
interpretations been made which are of doubtful quality?	total volume of water consumed /population in urban area.	
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. It is rather adhoc. • The GCWW does not have its own laboratories except for small laboratories in WWTPs. • Most samples are being analyzed on the labs of the Libyan petroleum institute. • The AEMMmRP has its own labs. Analyses lab staff are trained for sample analyses and result reporting. Equipment are new and in good condition	• Water quality sampling and analyses are not following a pre-defined protocol • Results are kept local and are not routinely shared with other departments • A more robust data sampling, analysis, and reporting system is needed for M&E purposes
Data segregated by gender	NO	NA

Table 13 shows the indicators for water supply in urban areas and how they are calculated and where these indicators are supposed to go.

Table 13. Definition of key indicators for urban and rural WSS in Libya

Theme	Definition	Frequency	Institution
Accessibility to improved drinking water in urban and rural areas	Number of households provided with uninterrupted water supply from piped networks, truck tankers, bottled water, or rain harvesting / total number of households	Annually	GCWW
% of population served by piped water	Number of households with access to piped water / total number of households	Annually	GCWW
Per Capita water consumption	Volume of wastewater (domestic and industrial)	Annually	GCWW
Total amount of water provided for domestic applications	m^3 sold per year	Annually	GCWW
Coverage of improved sanitation	Number of households with flush toilets that are connected to piped sewer systems or septic tanks / total number of households	Annually	GCWW
Wastewater treated by WWTPs	m^3 treated per year	Annually	GCWW

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

- Data collection is usually practiced only in major cities and towns.
- Approaches and methods for M&E data collection vary from one location to another and from one sector to another as there are sanitation works within industrial and oil sectors as well.
- Data collected on domestic "human" waste are similar but no coordination exists between sectors. Industrial and oil wastes monitor similar parameters for domestic wastes and different parameters for purely industrial wastes.
- There is little agreement on approaches, data collection frequency or methods of analysis. Moreover, the collected data and results of analysis flows are not streamlined. Most of the time, the data and results are kept within their source.
- Data are mostly shared within the institution and, infrequently, between institutions belonging to different ministries.
- There are no information management systems or networks. Data storage is rudimentary as is analysis and applications except for academic researched conducted on these data.
- In summary, the sanitation M&E system is very weak and there is an urgent need to establish a national framework for M&E&R.

Points of Strength:

- A ministry concerned with domestic water supply and sanitation has been established recently with a reasonable experience in managing the sanitation subsector.
- A specialized organ namely the GCWW has been established for many years with a good experience in managing the sanitation subsector.
- Both the Ministry and the GCWW have strong commitments towards improving sanitation subsector.
- Human and financial resources for M&E are available.
- M&E practices have been established but they are still in the evolutionary stage.

Points of Weaknesses:

- Little data are collected without clearly defined approaches, methods, and a drive for M&E.
- Data are usually not demanded by higher executive entities and little use is made of them making the drive to collect and analyze them rather weak.
- An integrated framework for data collection identifying the data, indicators, who collects what among sectors, data flow and analysis methods, does not exist leaving it up to the sectors and subsectors to improvise the approaches and methods. Consistency, standardization, and comparability are, therefore, not possible rendering the data of minimum value nationally.
- Data timeliness, extent, and comprehensiveness are not well respected due to the poor communication between data collectors and data managers.
- Costs are usually not monitored although expenses are recorded with no in-depth analysis of cost related factors, economic feasibility, and recovery.

Recommendations for improvements:

- A national framework for data collection and analysis must be put in place and all entities engaged in water M&E must adhere strictly to this framework. This framework should specify approaches, indicators, methods, and all reporting details.
- This framework should be prepared by all entities involved in water M&E of sanitation subsector to ensure its sustainability.
- The framework should make use of existing international practices and be consistent with them to be of use nationally, regionally and internationally.
- Cost analysis must be considered with incorporation of cost parameters into the M&E indicators.

8.3. Data Storage and Analysis

Data collection, storage, and analysis:

Collection, storage and analysis of water data is performed by the GCWW, GCWD, and the AEMMmRP. The AEMMmRP data are complete, regular, and timely; they are recorded digitally and easily accessible. The GCWD also collects and stores data regularly and timely. The GCWW strives to collect, store, and analysis its data. Its system can be characterized by the following:

- Data collection, storage, and analysis methods vary with entities and locations (towns and cities). Simple approaches/methods are employed in small villages/towns. Data collection methods are identical conforming to standard methods. Storage and analysis start with simple, manual operations and rise in sophistication with increase in the size of community, area, and region.
- In general, data collectors would store collected information in paper sheets and then either archive the paper files or fill simple excel sheets with unclear documentation methodology.
- Practically, in all cases, no models are employed to analyze systems (wastewater networks, wastewater treatment plants, etc.) and no automatic / on-line sampling is used.

The quality of analysis and storage is fair. This quality of analysis, however, varies from moderate to weak in remote locations. Access to information is moderate to weak as data is located in Microsoft excel files in the GCWW computers and is not shared by other entities and ministries.

Data management chain:

Data are recorded and stored in special forms at sites. They are submitted to the GCWW to be digitized and analyzed. Digitized data analysis is carried out using simple programs (Excel). The processed data usually is utilized within the GCWW itself and, when requested, it is submitted to the relevant ministries or disseminated as per request.

The centralization of the data collection and analysis is the result of the GCWW's mandate spanning the whole country and, more importantly, because of the continuous demand for better services and stakeholder pressures. A supporting factor is the company's autonomy and the government's subsidy of the subsector.

There is a simple data base belonging to the GCWW. Data and information are stored in different departments in the company. Simpler data bases exist in the company's different regional branches. There is some coordination between the branches and the central base in the company's headquarters in Tripoli. Ready-made application software and GIS, DBSs are not used within the company yet. Inventories of company's resources (system components such as pipe networks, pump stations, wastewater treatment plants, etc.) have been carried out generating useful data. However, storage and analysis of these data are done employing simple "rudimentary" methods.

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 a good information

system requires that activities in the chain shown in Figure 10 to be designed and implemented sequentially as represented. An "x" is shown beside links that are not found in the WSS data chain in Libya. It is evident that the chain does not constitute a closed loop. The chain is not continuous but interrupted at some locations. Information handling is in form of excel data sheets.

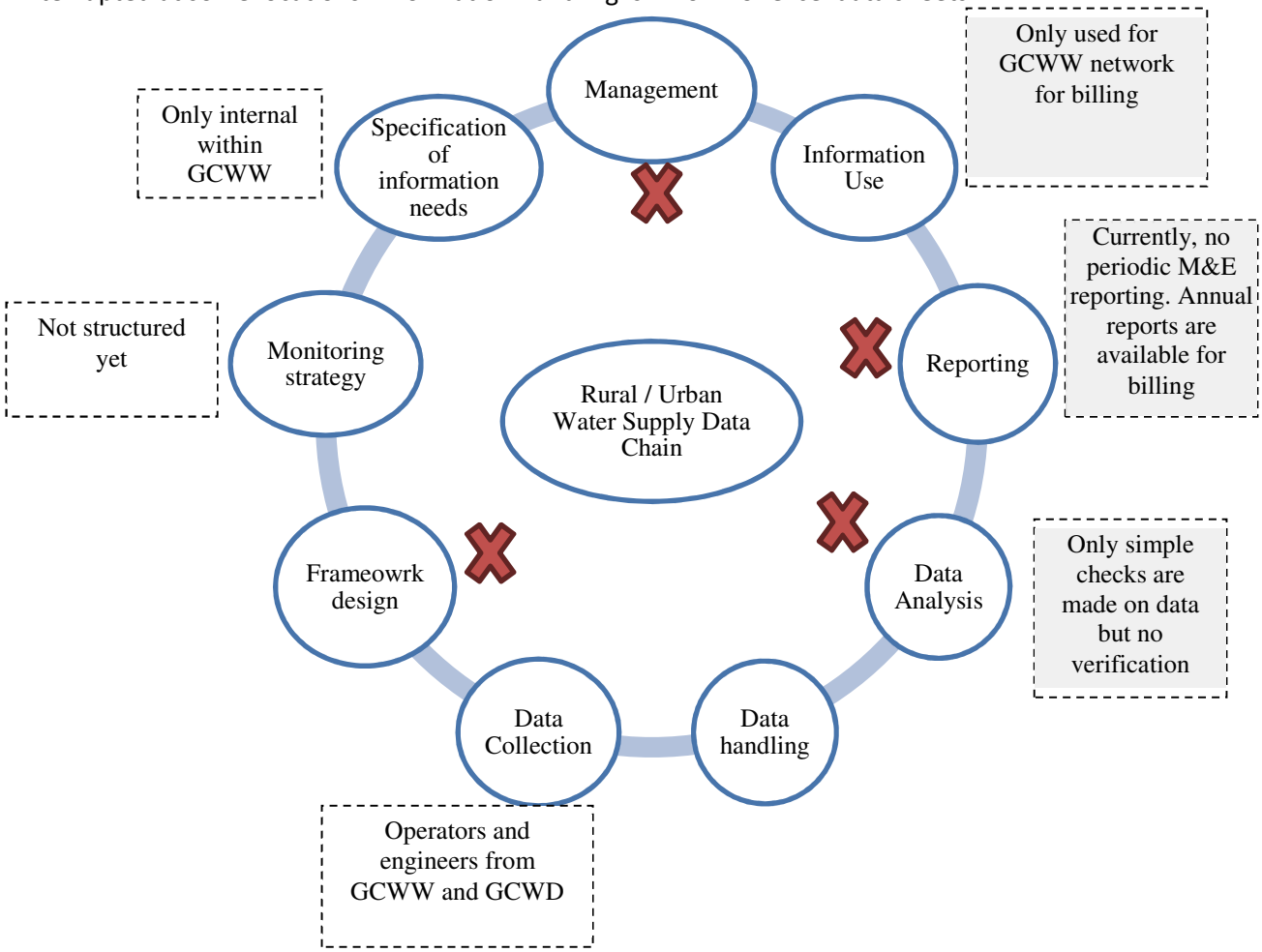

Figure 10.Data management chain of activities for urban and rural WSS in Libya

8.4. Information Dissemination and Use

Water supply and sanitation data produced in Libya are not used by global organizations, which produce monitoring indicators for urban water supply such as JMP.

Information flow:

- Data are used mainly by the GCWW and the Ministry of Housing and Utilities. They are used to a lesser extent by the Ministry of Planning and other concerned organs. Data are used by the GCWW for several purposes, but mostly for billing, documentation of existing state of resource, service, etc. and for comparisons and forecasting of changes.
- In this regard, information may be used for assessment and planning purposes by the GCWW and the MOHU, and infrequently, by other sectors. Generally, data are used to assess sector performance but in a very simple way (GCWW, 2013).
- Data/information is processed manually and, more frequently, digitally. They are published infrequently. 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.

- Data are usually neither pro-active nor targeted. Data are circulated mostly in-house and occasionally publicized in the media. Some data are publicized through the GCWW and MOHU websites, television programs and radio interviews. They do not reach libraries, universities, research and training institutions, the public and the private sectors. EGA publishes a periodical which occasionally contains some data on sanitation in Libya.
- There is a two-way flow of information, particularly between the GCWW and its regional offices. More frequently, however, the flow is from bottom to top reaching the MOHU and other ministries at times. It moves also horizontally to the same levels within the company when requested.

9. M&E Subsystems

9.1. Environment

M&E systems and capacities of related organizations:

The major related organization is the EGA. It has a mandate to monitor all indicators / parameters related to safe water supply and appropriate sanitation.

Currently, EGA has weak systems and capacities for M&E. However, EGA is restructuring and is adding a GIS hub that can be used for mapping contaminant levels. Opportunities exist for generating and sharing data between EGA and the GCWW and the GWA as part of a national M&E system. The available infrastructure can be upgraded to make use of the data management capabilities of the HydroManager at the GWA to store and share collected information by the EGA.

9.2. Physical Surveys

The following data sources that are generated by physical surveys can be useful to the water sector (MEWINA Libya, 2013):

- Agricultural farm surveys to determine areas under full, partial, rain-fed, and other irrigation schemes as well as 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 information collected 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 (subsector) level, data can be used to assess and improve performance and to make strategies and action plans. This same practice is done on the sectorial 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 and Socio-economic Surveys

In Libya, the last census was conducted in 2006. Census is being conducted once every 10 years. Census results are being monitored by the General Authority for Information (GAI). It produces a yearly basic statistics book that has separate sections on population, water, agriculture, economy, etc... Census data is clearly being used in water and sanitation M&E. However, there is always a conflict by adding non-Libyans at times and removing them at other times.

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 because the population growth in Libya is very small and almost constant (1.8- 2.0%, Statistics year book, 2007).

Socioeconomic surveys have not been made in the field of WSS so their significance or relevance cannot be evaluated. Except for few areas, the boundaries that the census covered are the same as those covering the WSS M&E.

9.4. Meteorological Surveys

The National Center for Meteorology (NCM), a semi-autonomous organ of the Ministry of Transportation, is responsible to run and operate meteorological stations in Libya. Table 14 summarizes the continually working stations in Libya.

Table 14. Meteorological stations in Libya

Stations	Latitude (N)	Longitude (E)	Elevation (m)above m.s.l
Agedabia	30 43	20 10	7
Benina	32 05	20 16	130
Derna	32 47	22 35	86
Gagbub	29 45	24 32	-1
Ghadames	30 06	09 29	346
Ghariat	30 23	13 35	497
Hon	29 07	15 57	263
Jalo	29 01	21 32	45
Kufra	24 13	23 18	436
Misurata	32 19	15 03	32
Nalut	31 52	10 59	621
Sebha	27 01	14 27	432
Shahat	32 48	21 53	649
Sirt	31 12	16 35	13

Stations	Latitude (N)	Longitude (E)	Elevation (m)above m.s.l
Tazerbo	25 40	21 05	261
Tripoli airport	32 40	13 09	81
Tubruk	32 06	23 56	50
Yefren	32 05	12 33	691
Zuara	12 06	32 56	2

The data collected can be 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.

Climatic data collected from meteorological stations in Libya suffer from lack of continuity and limited coverage. Advances in geostatistics and interpolations techniques have made it possible to fill data gaps, however, with good reliability. The NCM also performs climatic data evaluation. Its data can be incorporated into the water sector's M&E program simply through identifying the data and indicators needed by the water sector and having these data / indicators exported at the required frequency to the national water database. Either raw data or specific indicators may be exported. In the latter case, indicators may be available as part of the centers outputs in which case they may be exported readily. If not, the national database operators can process the raw data or, if desired and agreed to, have the center process the data and export the indicators.

9.5. Agriculture

The Ministry of Agriculture, Animal and Marine Wealth is the government agency responsible for monitoring any information related to the water uses in the agriculture sector. However, formal agriculture monitoring networks are weak with some reliance on weather stations located within agricultural projects or near them but with no independent monitoring and evaluation networks.

The major water user in Libya, the private sector, has no monitoring network as traditionally this has been the mandate of the state. As such, the information collected by this sector is not reliable and it cannot be integrated or used by the water sector (MEWINA Libya, 2013).

9.6. Universities and Research Institutions

Almost all major universities and technical institutions in Libya provide teaching, training, and research related to the water sector. The major ones are:

- The University of Tripoli, Tripoli
- The University of Benghazi, Benghazi
- Omar AlMukhtar University, AlBaidha
- The University of Sebha, Sebha
- AlMerghib Univesrsity, alKhums
- The University of Misurata, Misurat
- AlJabal AlGharbi (Western Mountain) University, Gharian
- The Water Affairs Higher Institute, Al-Ajeelaat

Generally, these institutions utilize M&E data. 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, or impacts of climate changes on water resources, 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

Libya relies mainly on transboundary groundwater basins. They are the NSAS and the NWSAS. Copies of the agreements between riparian countries using these shared waters are given in Appendixes 3 and 4, respectively.

Formal bodies for managing these basins have been established and consulting/ coordination committees formed. Basic water quality and water level monitoring systems have been established. Accurate withdrawal figures are not available. Modeling efforts are used to estimate withdrawals. Uncontrolled mining of groundwater is a key issue.

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 as is its timeliness. Many of the wells lying within the transboundary systems are monitored by the GWA 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 systems M&E 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

Libya 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 not been systematically assessed for Libya (Goodland, 2007).

In general, there are no practical measures being undertaken to monitor the impact of climate change on domestic and transboundary water sector. A few academic studies have been conducted to assess the impact of climate change on certain regions of Libya with some relevance to the water sector.

A multi-sectoral national committee on climate change and a project to assess the impact of climate change have been formed but they are still in their evolutionary stages. The committee, headed by the EGA, consists of 14 members representing all sectors concerned with climate. The major ones are:

- Ministry of Water Resources
- Ministry of Housing and Utilities
- Ministry of Health
- Ministry of Transportation
- Ministry of Industry
- Ministry of Agriculture, Animal, and Marine Wealth
- Ministry of Oil and Gas
- Ministry of Foreign Affairs and International Cooperation
- Ministry of Labor and Rehabilitation
- Ministry of Electricity and Renewable Energies
- National Center for Meteorology

The National Strategy for Integrated Water Resources Management does not address climate change adaptation explicitly. Thus, Libya needs to direct more resources to formally address the issue of climate change impacts and formulate adaptation strategies that can respond to future climate change challenges.

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 at the institutional level;
- 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 information is not collected and treated to facilitate use by different actors (they often correspond to the specific needs of supervisory structures);
- 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) 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 for the operation and maintenance of wells, for information systems such as GIS, and for DBMSs like HydroManager;
- 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 Libya water sector M&E&R, the following conclusions can be stated:

- A Unified national Water & Sanitation M&E&R system does not exist. However, institutional responsibilities/mandates do include some 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 by all institutions is weak.
- The water sector database is fragmented, not up-to-date, with little analysis and reporting on any level.
- There is a serious data and information gap in the water sector in Libya; data employed in the reports are at times incomplete, outdated, and/or unreliable in addition to its being unofficial in many cases. Moreover, there is a discrepancy between data in national reports produced by different ministries/ agencies. Therefore, the data available are estimates at best.
- Except for the data collected by the Authority for Execution and Management Manmade River and the GWA, collected data are neither timely nor reliable and are therefore of limited use.
- All organizations concerned are well aware of the need for M&E&R on a nationally coordinated level. Efforts to establish such networks are led by the Ministry of Water Resources (established in November 2012).
- The access and coverage data for rural and urban communities can't be determined accurately as there is no clear 'national' definition of rural and urban communities;

- Implementation of MEWINA Project will certainly accelerate these efforts and set a unified standard for both Libyan and Pan African networks and reporting.
- M&E systems have been incorporated into most organs involved with water supply although at sub-sectoral levels only.
- M&E systems have been incorporated into the transboundary basins agreements.
- A national WSS M&E & R system does not exist. The GCWW that is in charge is collecting information for billing purposes and not for M&E. More formal monitoring plan and reporting mechanism have to be included in order to better support an overall water sector M&E&R system.
- Libya started reporting on an annual basis the indicators requested by AMCOW Pan African template as presented in Section 11. Other parameters and indicators collected and measured by the country is summarized herein:

Theme	Definition	Frequency	Institution
Well water drawdowns	Lowering of groundwater water level	Monthly to annual	AEMMmRP
Groundwater 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	Sporadic	AEMMmRP, GCWW, EGA
Accessibility to improved drinking water in urban and rural areas	Number of households provided with uninterrupted water supply from piped networks, truck tankers, bottled water, or rain harvesting / total number of households	Annually	GCWW
% of population served by piped water	Number of households with piped access to water / total number of households	Annually	GCWW
Per Capita water consumption	Volume of water (domestic and industrial) used / total population	Annually	GCWW
Total amount of water provided for domestic applications	m^3 sold per year	Annually	GCWW
Raw, treated and distributed water quality parameters	(Turbidity, TDS, TSS, pH, temperature, bacteriological counts like fecal and total coliform counts, Alkalinity, Hardness, iron, manganese, etc..).	Periodically	GCWW
Coverage of improved sanitation	Number of households with flush toilets that are connected to piped sewer systems or septic tanks / total number of households	Annually	GCWW
Wastewater treated by WWTPs	m^3 treated per year	Annually	GCWW
Wastewater volumes treated / reused / discharged.	m^3 per year	Annually	GCWW
Wastewater quantities generated on basis of sources	m^3 per year	Annually	GCWW
Wastewater	(BOD, TSS, pH, temperature, bacteriological counts like	Periodically	GCWW

Theme	Definition	Frequency	Institution
treatment plant raw and treated sewage quality parameters	fecal and total coliform counts, ammonia, nitrates, orthophosphates, etc..)		

- The GWA is well structured to be the hub for any nationwide M&E activity. It is one of the oldest institutions around. It hosts the HydroManager and GIS lab. It currently stores all information related to the MmRP, some information from the GCWD, and sporadic information from the transboundary aquifers.
- In addition the following recommendations can be made:
- A set of Indicators for monitoring water supply and sanitation have to be agreed upon and harmonized within the institutional framework of water sector. As a minimum the indicators reported herein in the AMCOW template has to be calculated on an annual basis. It is strongly recommended that the validated MEWINA Project indicators be adapted officially and monitored as specified in the Guidelines prepared in association with these indicators.
- Because the agricultural sector is the largest water consumer, it should be the first to be monitored, evaluated and upgraded.
- In absence of reliable data on agricultural water abstraction and rainfed agriculture, it is advisable to start an initiative to calculate annual agricultural water use by remote sensing technologies.
- 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 and Sanitation.
- 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.
- Build capacity for implementation of existing plans in terms of water resources and financing.
- Engage in regional and global monitoring initiatives.
- Develop and implement an efficient Information System with efficient ways of information dissemination in water and sanitation issues.
- Due to the long term stability of the GWA and the skills and capabilities available within GWA, especially the HydroManager, Libya should build on the GWA available infrastructure to create a nationwide unified DBMS for M&E systems as depicted in Figure 11.

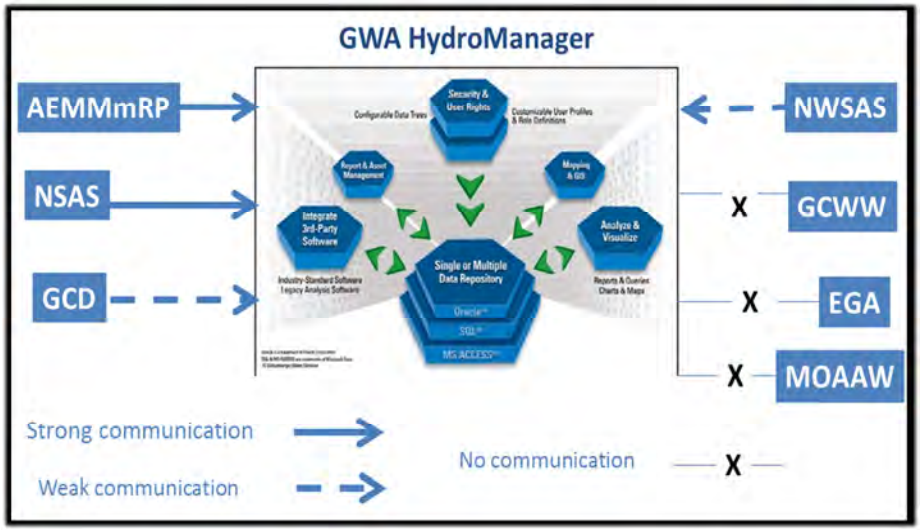

Figure 11. Proposed M&E DBMS

- Establishment of a national water DBMS within the GWA to be the official source and store of all water data in Libya. All public and private entities concerned should transform their data directly to this body and all data should be disseminated from this body to whoever requests it. The HydroManager system in operation in the GWA should be used as the nucleus for the body with all environmental and sectoral data bases such as those of the Man-made River should be connected to it; this way data are identical and updated and in formats that are useful for water users and suppliers, decision makers in all public and private sector institutions;
- This DBMS should be initiated by establishing subunits in the sectors with representatives from the already formed National Task Force within the MEWINA-Libya Project; these subunits should be supervised by the main body in the GWA and should be charged with preparation of the Annual National State of the Water Report;
- As Libya depends almost completely on non-renewable groundwater sources, monitoring and evaluation of water resources must be at the top priorities of the state of Libya with a special role for the MEWINA-Libya Project as a spear head for such operations thus realizing the Project's ultimate objective of improving water sector performance; and
- Implementation of the National Strategy for Integrated Water Resources Management is a necessary step towards improving the water sector performance. Upgrading of this strategy to take into consideration major developments in the sector during the period 2000-present is needed leading to a detailed workplan for water sector performance monitoring, evaluation, and improvement.
- Actual agricultural water use data are not available; existing practices give little value to data generation, analysis, monitoring, etc. Water losses are very high and efficiencies are low due to many factors (climate, soil, cropping patterns, poor management, power costs, no metering, etc.). Reported data are indicative only. More efforts are needed to collect and document the actual water uses of the sector.

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

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

Years	2000	2008	2009	2010	2011
Urban pop.	3908204	4256994	4342827	4430366	4512121
Rural pop.	1207246	1233068	1244959	1256882	1276360
*Total pop.	5115450	5490062	5587786	5687248	5788481
GDP (10^9 USD)	33.13	39.71	38.41	43.49	38.98

*Last census was conducted in 2006. Values are estimates. Values are for Libyans only. Non-Libyans accounts for about 6.5% of the population (2007 Statistics year book)

2. Basis of the existing water sector Policy/ Reform and potential policy targets.

Important issues addressed in the existing Water Sector Reform?

-Bridging water demand / supply deficit.
- Excessive groundwater mining.
- Seawater intrusion and water quality deterioration.
-Improving domestic water supply and sanitation access.
-Review and redirection of irrigated agricultural policies.
- Institutional capacity building.
- Integrated water resources management.
- Uncontrolled groundwater mining
- 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

Years	2008	2009	2010

national water Policy and Reforms.	Drivers of the Reviews	Reducing increasing water deficits Decreasing water quality decline Improving service levels	Reducing increasing water deficits Decreasing water quality decline Improving service levels	Reducing increasing water deficits Decreasing water quality decline Improving service levels
	Targeted Impacts and effectiveness	Decreasing deficits Improving quality Improving services	Decreasing deficits Improving quality Improving services	Decreasing deficits Improving quality 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, c) weak monitoring, evaluation, and enforcement, d) socio-cultural factors, e) geographic and demographic factors (large area and low population density), f) poor inter sectoral coordination. - Opportunities: a) easy access to international experience and technological advancements, b) more stakeholder participation and private sector involvement, c) favorable oil prices, d) favorable climate for international investments, e) availability of water technologies. - 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) lack of data and information, f) lack of a national framework for water planning, M&E.			

Performance Category	Country Information
PC. 1.1. Water and Energy	This category does not apply to Libya
PC. 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: ○ The initiation of a water harvesting programme. ○ Construction of new dams and maintenance of one "damaged" old dam. ○ Local manufacturing of drip irrigation systems and their adaptation by farmers. ○ Mapping and soil classification studies with special reference to rainfed agriculture areas. ○ Construction of rain water collection reservoirs and water retaining structures on Wadis by government and private sector.

▪ Achievement on water productivity:

Years (i)	2000	2008	2009	2010	2011
-Agricultural GDP (10^9 USD) (A)	0.62	0.95	0.94	0.98	NA*
-Total Agri. Water withdrawal (10^9 m^3)(B)	3.68	3.95	4.02	4.09	4.85
-Water Return to Environment (C)	0.2**	0.2	0.2	0.2	0.2
Water productivity (USD/m^3) Wp=A/(B-C)	0.18	0.25	0.25	0.25	Xxxx
Rate of increase $R_iWp(\%) = (Wp_i - Wp_{2000})/Wp_{2000}$	0	38	38	41	Xxxx

*NA = not available
**Estimated

▪ Achievement on irrigated areas:

Years (i)	2000	2008	2009	2010	2011
-Irrigated areas(IA)	387000	415000	423000	430300	438000
Rate of increase $R_iIA(\%) = (IA_i - IA_{2000}) / IA_{2000}$	0	7	9	11	13

▪ Sources of verification:
- Ministry of Planning and Ministry of Agriculture reports.
- National Strategy for Integrated Water Resources Management (2000 – 2025).
- FAO country profile and reports on Libya.

▪ Specific comments:
- Increase in water productivity from rain-fed agriculture is very difficult to estimate or verify as: 1) no data are collected on rain-fed agricultural production, 2) solely rain-fed agriculture is limited geographically and

	plays a minor role in agricultural production, and, 4) rain-fed agriculture is almost always complimented with irrigation in major agriculture areas. An increase is very likely, however, due to actions taken officially and privately to harvest rain water as described in milestones listed above. The increase, although real, is difficult to quantify, however. ○ Water productivity of irrigated agriculture has probably increased due to the rapid increase in drip irrigation systems recently coupled with improvements in traditional irrigation practices. This increase may have also been forced by the water scarcity problem which is spreading rapidly in the Gefara plane, the bread basket of Libya. The increase is difficult to quantify, however, with no data collected especially from the private sector which is the major agricultural producer. ○ Increase of irrigated land by private sector especially on large scales (pivot irrigation) in southwestern Libya. However, in other areas of Libya, the increase in irrigated land areas is very small for several reasons; firstly, water has become limiting in many areas of "traditionally irrigated" areas. Secondly, many of the large scale government administered "public projects" have suffered neglect and deterioration (of wells, equipment, etc.) resulting in a decrease in irrigated areas. Finally, encroachment of urbanization has been at the expense of irrigated areas. ○ On the other hand, new "virgin" lands are being turned into farms by private farmers despite the severe lack of arable land and scarce water resources, a trend that is likely to continue as water and power costs are still very low encouraging large scale farming especially in the south west region of Libya. ○ On the whole, it is safe to assume that there is an increase in irrigated areas and an improvement in irrigation efficiency, but they are below the set target. ○ In the case of Libya, expansion of irrigated areas is not possible and should not be planned due to severe limitations on arable land and, more importantly, on water and to the adverse social, economic and environmental impacts of continuing these practices. Improvement in irrigated water efficiency and other aspects of agricultural production management should be among the Libya's water policy reform priorities. ○ This target is not realistic for Libya and will not be achieved.
PC. 1.3. Water for multiple Uses *Target:* Increase the Water Demand Satisfaction Index *(WDSI)* by	▪ Specific actions taken so far for the milestone: ○ Increase water supply sources through completion of the Manmade River Project. ○ Increase water supply through desalination but quantities were very limited as plant construction takes time. Desalination capacities should increase notably in near future. ○ Increase quantities of treated effluents through execution and rehabilitation of many wastewater treatment facilities which should go into operation in the near future.

10% from 2000 to 2015.

- Increase harvested rainfall through construction and rehabilitation of many dams.

- Achievement:

Years (i)	2000	2008	2009	2010	2011
- Total all sectors Water Demand (A)	5452*	5851	5955	6061	6169
-Total all sectors water supply (B)	3890	3890	3890	3890	3890
- WDSI =B/A	0.70	0.65	0.64	0.63	0.62
Rate of increase $R_iWDSI(\%) = (WDSI_i - WDSI_{2000})/ WDSI_{2000})$	0	- 6.8	- 8.5	- 10.0	- 11.6

*Based on a minimum demand of 1000 m^3/person/year

- Sources of verification
  Ministry of water resources, Public Company for Desalination, and Ministry of Agriculture and Animal Wealth reports.

- Specific comments:
  - Contributions of desalination and effluent reuse were ignored in calculations above as they were insignificant in the specified period (2000-2011).
  - RiWDSI is decreasing with time signaling a serious deficit that must be addressed urgently. The trend should be reversed if sustainable development is to be realized.
  - The major user of water is agriculture which consumes about 85 % of the total water supplied. Any remedies (efforts to reverse the situation) must start with and focus on agriculture and food production policies. Another measure will be to address inefficiencies in irrigation practices and introduce improvements through improving efficiency and not expanding horizontally by increasing areas cultivated.
  - Uncontrolled groundwater mining that is not monitored is expected to account for the imbalance between water supply and demand.
  - The 1000 m^3/capita/yr that is used by the indicator might not be reasonable for Libya.
  - Lack of data is masking the agricultural malpractices along with the "food sufficiency syndrome" which dominates the agricultural strategies and plans of many developing countries including Libya.
  - The agricultural work force is mostly "non-Libyan" and lacks basic skills relying mostly on outdated practices.
  - Agricultural sector suffers many serious weaknesses and faces severe threats especially environmental ones including arid climate, climate change, desertification, and water scarcity.
  - The total sector water supply will increase with the increase in

	productivities of the Manmade River Project, desalination plants, treated effluent, and harvested rainwater. If projects are executed as planned, it will be very likely that the set target will be reached. ○ None-the-less, the deficiency should be taken seriously and used as a base for urgent water policy decisions and actions!
PC. 2.1. Basin and Transboundary water resources management *Target:* Develop a national Water Efficiency Plan by 2015.	ON THE NATIONAL LEVEL ▪ Specific actions taken so far for the milestone: ○ Establishment of the Ministry of Water Resources as an independent organ responsible for the management of water resources on a national level. ○ Preparation of the National Strategy for Water Resources Management (2000 – 2025) and endorsement of this strategy in 2006. ○ Division of Libya into Water Regions and management of each region semi-independently. ○ Establishment of dedicated ministries for the major water using sectors, namely, agriculture, industry, and housing and utilities. ○ Establishment of independent auditing bodies for technical, administrative, and financial performance of the ministries. ○ Establishment of a committee on the level of the National Congress in charge of follow up of infrastructures plans progress. ○ Establishment of the General Environment Authority to oversee the water resources management and monitor resource utilization and quality changes. ▪ Availability of Water Efficiency or IWRM Plan and Year of Adoption: There is a National Strategy for Integrated Water Resources Management and annual sector plans. This strategy, although officially adopted in 2006, has not been operationalized yet. However, it has been followed by the water sector organs as a generated basis / guide for action plans. Many of its recommendations have been implemented. Elements of the policy and legal environment: ○ Water Law (2) / 1982 and Environment Protection and Enhancement Law (15)/ 2006 are in place along with several decrees. ○ The National Strategy for Integrated Water Resources Management (2000 – 2025). ○ Water pollution control and water quality standards are in place. ○ Existing policies and annual plans on level of ministries concerned with water supply and utilization. ○ Regional and international guidelines and targets are considered in policy formulation and execution.

- All water concerned ministries are in the process of preparing sectoral strategies which must include action plans rather than annual plans.

Elements of the institutional arrangements:

- A special ministry for water resources (MoWRs) was established in Nov. 2012.
- The General Water Authority, an organ affiliated with the MoWRs, has been in service for over two decades with capacities and experience in water resources management.
- Several organs specialized in water supply, transportation, and distribution
  have been established. These organs are semi-autonomous with sufficient human and financial resources.

Elements of the financial structure:

- Budgets are allocated annually for water sector organizations.
- Expenditure auditing is practiced on all sectors including water.

Management tools:

- Sectoral plans are available for evaluation and follow-up.
- Regional and international guidelines for M&E&R are available.
- M&E systems are in place in the water sector organs although at different levels of advancement. However, a national M&E system is not in place yet.
- M&E systems are in place in the Environment General Authority but capacities to apply them are limited.
- Research centers, academic institutions, and private consulting offices and laboratories are available to assist in the E&M processes.
- Civil society organizations (NGOs) are emerging with a powerful role in monitoring and overseeing environment and water issues.

- Sources of verification:
  - Ministry of Water Resources
  - General Water Authority
  - Manmade River Execution and Management Authority
  - Environment General Authority

- Specific comments:
  - M&E systems are not present in major water consuming sectors such as agriculture and industry.
  - Enforcement mechanisms are very weak.
  - Request of information and data is limited so M&E systems are driven mostly in response to specific organizations initiatives.
  - 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 are of limited use.

Please refer to section on Observations and Comments at the end of this report for more comments.

ON THE LEVEL OF TRANSBOUNDARY BASINS

- Specific actions taken so far for the milestone:

1. Establishment of the Joint Authority for the Study and Management of the Nubian Sandstone Aquifer System (JASMNSSAS) with headquarters in Tripoli, Libya. This JA has accomplished the following major tasks:

   - Building capacities for the management of the aquifer.
   - Generation of valuable data on the NSSA and modeling.
   - Establishment of a regional database and monitoring system.
   - Preparation of several technical reports.
   - Organization of a conference on shared aquifers.

2. Establishment of the Sahara and Sahel Observatory for the Northwestern Sahara Aquifer System (NWSAS). This organization has accomplished the following major tasks:

   - Conducting of the first phase of the NWSAS project (1999 – 2002): information system, modeling, and consultative mechanisms.
   - Preparation of several reports technical reports.

- Target Indicator: Availability of Water Efficiency or IWRM Plan and Year of Adoption
  There is no Water Efficiency or IWRM Plan presently on the level of the Transboundary water resources management.

  Elements of the policy and legal environment:
  - Memoranda of understanding have been signed between sharing partners.
  - International agreements / conventions have been consulted.
  - International help is available / has been offered.
  - An agreement exists regarding the NSSAS exploitation with quantity and quality monitoring and data collection and exchange.

  Element of the institutional arrangements:
  - Bodies for management of the basins have been formulated with clear mandates.
  - Capacities for execution of plans have been provided in the form of office buildings, manpower, equipment, etc.
  - Database management systems are in place (SAP and SADA)
  - CEDARE is the base for annual data collection and analysis.
  - For NWSAS, a technical level Administerial Mechanism was formulated

	in 2002 along with an Operation Structure (2008) and a Consulting Mechanism (2007). o Official bodies have been undertaking their responsibilities successfully. o Practical experience (technical, legal, financial, and administrative) has been gained. <u>Element of the financial structure</u>: o Financial structures with basic financing mechanisms have been put in place for several years. o Budgets have been approved and money forwarded by the member states for the NSSAS. o Financial assistance from member states, African, European and UN organizations has been available. <u>Management tools</u>: o Basic monitoring and reporting mechanisms agreed to and implemented. o Specialized bodies formed for the shared aquifers management. o Minutes of understanding between partners. o Joint committees with consultation mechanisms. o Engagement of technical consultative bodies (CEDARE). ▪ Sources of verification: o JQSMNSSAS, Tripoli, Libya o NWSAS, Tunis, Tunisia ▪ Specific comments: ▪ Shared aquifers management policies and plans are still in evolutionary stages. ▪ A solid database is being built and data are utilized. ▪ Models have been constructed and implemented. ▪ Memoranda of Understanding have been signed. ▪ Evaluation and monitoring are underway. ▪ Mechanisms for consultation are underway. ▪ Other aspects of management are being developed. ▪ A comprehensive regional water resources management plan will only be possible once all aspects of basin development are completed. ▪ In summary, a satisfactory level of progress has been made with practical results that are essential for sustainable utilization of shared basins. ▪ Progress has been steady and is expected to reach targets easily.
PC. 2.2.Transboundary Infrastructure Development	▪ Not applicable

Rainwater *Target:* Increase by 10% from 2008-2015.	
PC. 2.3. Groundwater *Target:* AGC Roadmap implemented at more than 80%.	▪ Not applicable
PC. 2.4. Rainwater *Target:* Increase the share of rainwater use in total municipal water consumption up to 10% by 2015.	▪ Specific actions taken so far for the milestone: -A national programme on rainwater harvesting has been initiated. New dams are under construction along with reservoirs for collection of rainwater. - The ministry of agriculture has financed private collection reservoirs. - Rainwater has been traditionally harvested by a very small number of people for domestic purposes. The amount harvested is negligible, however. ▪ Achievement:

Years (i)	2008	2009	2010	2011
-Total municipal water supply (A)	0.534	0.543	0.553	0.563
- Rainwater use (B)	0*	0	0	0
-Water use from other sources (C)	0.534	0.543	0.553	0.563
-Total municipal water consumption (%) (Twc = A+B+C)	0.534	0.543	0.553	0.563
Percentage of rainwater use *pRu*(%)= *B/Twc* .	0	0	0	0

*No data are available, but the amounts harvested are negligible relative to the total municipal demand.

▪ Sources of verification:
- General Company for Water and Wastewater
- Ministry of Housing and Utilities reports
- Ministry of Agriculture

▪ Specific comments:

	○ Therefore, this target has not been achieved because rainfall is sporadic and collectable amounts are very low in most cases so people rely heavily on piped water or on transported water. ○ The realization of this objective is possible, however, if special efforts are made to encourage people in water short regions to collect water. This should be a major component of the Ministry of Agriculture's "Water Harvesting Program" under way currently. A major obstacle will be that major water supply schemes are under construction and, when completed, practically all Libyans living in urban areas will have piped water.
PC. 3.1. Urban Water Supply PC. 3.2. Urban Sanitation PC. 3.3. Rural Water Supply PC. 3.3. Rural Sanitation and Hygiene *Target:* 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).*	▪ Specific actions taken so far for the milestone: ○ Establishment of the National Programme for Water and Wastewater (NPWWw) intended to identify all urban communities, towns, and cities in need of WSS systems or whose existing systems need to be expanded or upgraded. ○ As part of the NPWWw, WSS systems were designed for all "urban" communities, towns, and cities of Libya. ○ Establishment of the Development Programme 2008 – 2012, a comprehensive national programme with a special focus on housing and infrastructures. The programme implementation costs were estimated at 100 billion Libyan dinars (US $ 80 billion); about 15 billion Libyan dinars are allocated to infrastructures. The programme projects are in line with the NPWWw. ○ Establishment of public service companies, namely, the General Company for Water and Wastewater for operation and maintenance of WSS systems and the General Company for Water Desalination for supplying desalinated water. ○ Establishment of the Manmade River Authority in charge of execution and management of the Manmade River Project. The project is nearing completion and will supply water for all purposes including domestic uses. The Project has been supplying Libya's major coastal cities with water for over 20 years. Over 50 % of domestic water supplies in 2012 were from the Manmade River Project. ○ National drinking and effluent standards have been promulgated. ○ Establishment of the Ministry of Water Supplies in Nov. 2012 with authority to oversee the water sector in Libya. ▪ Achievement in water supply:

Years (i)	1990	2008	2009	2010	2011
-Urban access (%)	72	92	93	94	94
-Rural access (%)	68	80	82	84	84
-Total access (%) (W)	71	89	91	92	92

Rate of Inaccessibility reduction for water IRwat (%) = $(W_i - W_{1990})/(100-W_{1990})$	0	62%	69%	72%	72%

- Achievement in improved sanitation:

Years (i)	1990	2008	2009	2010	2011
-Urban access (%)	84	94	94	96	99
-Rural access (%)	85	95	96	96	97
-Total access (%) (S)	84	94	94	96	98.8
Rate of Inaccessibility reduction for sanitation IRsan (%) = $(S_i - S_{1990})/(100-S_{1990})$	0	63	63	75	92.5

- Sources of verification
  - General Company for Water and Wastewater Reports.
  - CEDARE, MDGs Achievement Status in the Arab Region.
  - WHO / UNICEF Joint Monitoring Programme for Water Supply and Sanitation Report, 2008.

- Specific comments:
  - Libya has exceeded the MDGs targets in reducing inaccessibility to safe water supply and sanitation and hygiene in urban areas.
  - Libya has exceeded the MDGs targets in reducing inaccessibility to safe water supply and sanitation and hygiene in rural areas.
  - Libya has exceeded the MDGs targets in reducing inaccessibility to safe water supply and sanitation and hygiene nationally, i.e., in urban and rural areas.
  - Access and coverage rates higher than those presented above have been cited in some references mainly those of the UN organizations.

PC. 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):* ○ The National Committee for Climate Change (CC) has been formed; it is headed by the Environment General Authority with members from 14 concerned ministries and institutions. The Ministry of Water Resources is a member in this Committee. ○ A National Project for Studies of Climate Change has been started by the National Authority for Scientific Research to study and research the phenomenon and its impacts on Libya. ○ Libya has endorsed / ratified all CC conventions and participated in most Climate Change Panel Meetings. ○ Several studies have been conducted on climate change and its impacts on parts of Libya. ○ However, the overall institutional framework is still weak and little concrete results have been obtained. ▪ Existence of a National Climate Change Adaptation Strategy and Year of adoption: ○ There is no National CC Adaptation Strategy despite recommendations to develop this strategy made by several concerned institutions. ▪ Existence of a Actions Plans on Water for Climate Change resilience: ○ No. ▪ Existence of Programmes for implementing the Actions plans: ○ No ▪ Sources of verification and Specific comments: ○ National Authority for Scientific Research ○ Environment General Authority. ○ National Center for Meteorology.
PC. 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)*: ○ Establishment of the National Safety Authority in 2008 which is affiliated directly with the Prime Ministers Council. Its mandate includes water disaster management. ○ Establishment of the Environmental Emergencies Administration in the General Environment Authority whose mandate include environmental monitoring and disaster mitigation. ○ Preparation of the National Plan for Natural Disaster Management. ▪ Existence of Early Warning Disaster prevention System and Year of establishment: ○ No. ▪ Sources of verification:

	○ Environment General Authority. ○ National Safety Authority ▪ Specific comments: ○ This goal is likely to be realized as the National Plan for Disaster Management exists. Updating of this plan and establishment of an early warning system is part of this plan. ○ Bodies concerned with early warning are still in early stages of formation; there is little experience, lack of skilled personnel and equipment, and above all, lack of a national strategy. ○ Bodies concerned take part in regional and international events to benefit from accumulated experience and know-how. ○ There is a clear overlapping in mandates and a lack of coordination between concerned bodies.
PC. 5.1. Institutional arrangements PC. 5.2. Ethics, transparency, empowerment PC. 5.3. Public and private roles PC. 5.4. Right to water PC. 5.5. 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.*	▪ Specific actions taken so far for the milestone: ○ Establishment of the Ministry of Water Resources (MoWRs) which combined for the first time most of the organizations/institutions dealing with water. It controls planning and execution decisions on water centrally. ○ Existence of water law and environmental protection law. ○ Formation of several committees by the MoWRs to draft an action plan and craft policies for integrated water resources management. ○ Formation of a water research center within the MoWRs. ▪ Existence of Water sector policy that reflects good governance principles, and Year of latest update: ○ A policy on good governance does not exist. However, the National Strategy for Integrated Water Resources Management and the action plans of water concerned institutions included continuously upgrading of institutional capacities with strong stress on governance. <u>Elements on Partnership and commitment</u>: ○ Policies of institutions don't address partnership explicitly while partners roles are not well defined and exclusive. Overlapping exists in roles. Coordination and cooperation are unstructured. ○ Commitment varies with institutions and their capacities. Lack of monitoring and accountability leave the door open for institutions to be completely committed or not committed at all. This phenomenon is enforced by weak legislation and overlapping mandates. <u>Elements on Ethics - transparency, equity and fairness</u>: ○ Establishment of the National Congress as a representative system whose members are accountable to their constituents. ○ Establishment of a transparency Committee within the Higher Judicial system of Libya.

	○ Establishment of Infrastructures Committee and Legislation Committee's within Libya's National Congress. ○ Establishment of several water/environment non-government organizations. ○ Establishment of many mass media organizations (papers, radio and television stations) with a multi-faceted role of informing and uncovering of government actions. ○ Water from major sources (Manmade River) is allocated "equitably" between users with special attention to domestic users, water-short agricultural areas, and existing agricultural projects (settlements). ○ Water costs are subsidized in consideration of its significance to domestic and agricultural users. ○ Water use regulations are known to all users and applied fairly. <u>Elements on responsibility and accountability</u>: ○ These elements are not always stated clearly in regulations; moreover, their applications are very limited. <u>Elements on inclusiveness, participation, predictability and responsiveness</u>: ○ These elements are not well defined. Role of stakeholders is evolving slowly and is "unseen" presently. Use of private water sources and independence of users from the government may be the cause of this poor participation. Predictability and responsiveness are neither well defined nor addressed in water policies. <u>Elements on Coherence</u>: ○ These elements are neither well defined nor well adhered to. ▪ Sources of verification: ○ National Strategy for Integrated Water Resources Management (2000-2025). ○ GWA reports. ▪ Specific comments: ○ Water sector policies have always been centrally planned and executed. Water legislation and management practices have focused on addressing the users' needs at practically no cost to the user. This practice did not encourage user participation or the development of good governance.
PC. 6.1. Financing Local Authorities *<u>Targets:</u>* -Allocate immediately at least 0.5 % of	▪ Specific actions taken so far for the milestone: ○ Full commitment to financing all water supply and sanitation schemes as well as operation and maintenance of these schemes. ▪ Achievement for GDP allocation: Years (i) 2008 2009 2010 2011

GDP to sanitation & hygiene.

and

-Allocate immediately 5% of national budget for water & sanitation.

- GDP (A_1)	39.71*	38.41	43.49	38.98
- Sanitation and Hygiene Budget (B_1)	1.91	1.91	1.91	Xxxx**
Percentage of GDP to Sanitation and Hygiene gdpSH (%) = B_1/A_1	4.8	5.0	4.4	Xxxx

*Estimated
**No data available

- Achievement for national budget allocation:

Years (i)	2008	2009	2010	2011
- Total National Budget (A_2)	19.86	19.21	21.75	NA**
- Water and Sanitation Budget (B_2)	2.86	2.86	2.86	xxxx
Percentage of national Budget to Water and Sanitation BdgWS (%) = B_2/A_2	14.4	14.9	13.1	xxxx

*Estimated
**No data available

- Sources of verification
  - Ministry of Planning.
  - General Company for Water and Wastewater.
  - Manmade River Execution and Management Authority.
  - General Company for Water Desalination.

- Specific comments:
  - Targets have been met.
  - Values for GDP and budget are in US dollars.
  - Investments in WSS have been very large.
  - Actual amounts spent may vary from allocated budgets reported above. However, a strong commitment can still be seen from the high percentages planned.
  - Improvements may be constrained by the ability of execution bodies (contractors, etc.) rather than by the availability of financing/funding.

PC. 6.2. Pricing Strategies

PC. 6.3.Pro-poor financing Strategies

Target:

- Specific actions taken so far for the milestone:
  - The water law states that water is a common property and that every citizen has the right to water for different uses. This principle is the base for all water strategies including pricing strategies.
  - A tariff for water according to user type is in place.
  - Water prices are higher than water tariffs.
  - The cost difference is subsidized by the state reflecting a pro-poor financing strategy.

Set by 2015, water tariff system that addresses cross-subsidy and the need of poor.

- The state finances all infrastructure projects (construction, operation and maintenance). This has been the implemented strategy since independence (1951).

- Describe the Water Tariff Structure:
  - ✓ *Lifeline Water (l/ca/day):* *150-350*
  - ✓ *Minimum salary of the population (Libyan dinar LYD):* *450*
  - ✓ *Rate (USD / LYD):* *1 USD for 1.26 LYD*

Tariff Structure:

Consumption categories (m^3)	*Rate (local currency)*
< XX m^3	XXX *llcc/* m^3
XX m^3 to XX m^3	XXX *llcc/* m^3
XX m^3 to XX m^3	XXX *llcc/* m^3
> XX m^3	XXX *llcc/* m^3
Any other specific charge?	0.25 *LYD/* m^3

Adjustments for cross-subsidy:

Adjustments	*Rate*
Industrial	0.796 *LYD/* m^3
Commercial	0.25 *LYD/* m^3
Regional Adjustment	None
Other? Agricultural	0.47 *LYD/* m^3
Companies and public sector	1.30 *LYD/* m^3

Tariff for rural areas if any:
- None

- Describe the sanitation services pricing if there is any:
  - Included with water supply tariffs.

- Sources of verification:
  - National Water Strategy.
  - General Water and Wastewater Company.
  - Manmade Execution and Management Authority.

- Specific comments:
  - Water tariffs vary with user type.
  - Water tariffs include both water supply and sanitation.
  - Tariffs don't cover of water production. Domestic and commercial uses are subsidized by the state.
  - Tariffs cover only about one third of the total cost; the remainder is subsidized by the state.
  - The state subsidizes heavily the water production organizations.
  - Tariffs recovery rate is low.

	○ For a hypothetical 5 persons family: ✓ *water used = 175 l/c/d * 5 * 30 /1000= 26.3 m^3* ✓ *cost at 0.25 LYD/m^3 = 6.6 LYD* ✓ *% of minimum monthly income = 6.6/450 = 1.5 % < 3%*
PC. 7.1. Education and capacity development *Target:* *To be identified.*	▪ *Not to be reported.*
PC. 7.2. Information *Target:* 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.	▪ Specific actions taken so far for the milestone: ○ M&E systems have been incorporated into most organs involved with water supply although at subsectoral levels only. ○ M&E systems have been incorporated into the transboundary basins agreements. ○ M&E systems don't evolve from Africa-wide systems as such systems have only been in use recently. However, it is expected that the present M&E systems are in line with the African M&E systems. ▪ Existence of national Water & Sanitation M&E, & R System, and Year of Establishment. ○ A National Water & Sanitation M&E, & R system does not exist. However, annual plans are made by the General Company for Water and Wastewater, a sub-organ of the Ministry of Housing and Utilities with basic M&E&R operations. Recent updates in the M&E System: Items / Year 1 / Year 2 / Year 3 / 2011 -New Elements incorporated: xxxx / xxxx / xxxx / xxxx -Drivers: xxxx / xxxx / xxxx / xxxx Elements of the pan African M&E incorporated: ○ Institutional capacity building. ○ Improving governance. ○ Improving knowledge base. ○ Improving financing. ○ Meeting the MDGs in water supply and sanitation. ○ Meeting Sharm-ElSheikh and Africa Water Vision 2025.

	▪ Sources of verification: o General Water Authority. o General Environment Authority. o General Company for Water and Wastewater. o Manmade River Execution and Management Authority. ▪ Specific comments: o A unified national Water & Sanitation M&E&R system does not exist. However, institutional responsibilities/mandates do include M&E&R procedures. o The M&E&R mechanisms and database are not coherent and the efforts are not well coordinated. o Implementation of the M&E&R procedures by all institutions is weak. o The water sector database is fragmented, not up-to-date, with little analysis and reporting on any level. o Some organizations have good data, however, namely, the Manmade River Execution and Management Authority and, to some extent, the General Water Authority. o All organization concerned are well aware of the need for M&E&R on a nationally coordinated level. Efforts are led by the Ministry of Water Resources to establish such networks. o Implementation of MEWINA will certainly accelerate these efforts and set a unified standard for both Libyan and Pan African networks and reporting.
PC. 7.3. Water and Technologies *Target:* *To be identified.*	▪ *Not be reported.*
PC. 7.4. Professional Networks/ Associations *Target:* *To be identified.*	▪ *Not be reported.*

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:

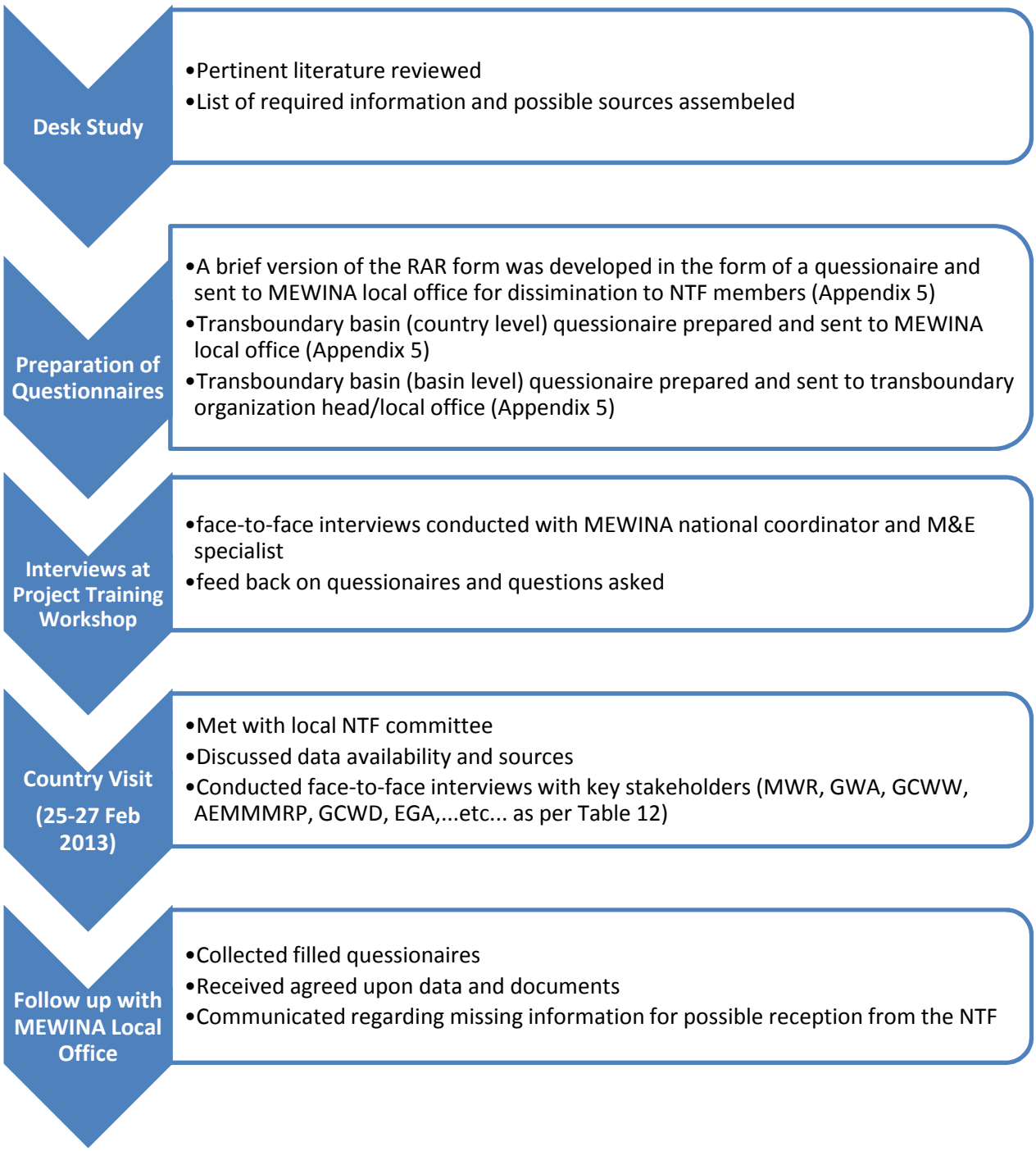

Figure 12. Data collection methodology

12.2. List of Stakeholders Interviewed

Table 15. A List of stakeholders interviewed during the Libya country visit

Interviewed Organization	Persons Interviewed	Contact Information	Position
Ministry of Water Resources (MWR)	HE Minister El-Hady Hansheer		Minister of Water Resources
GWA	Mr. Mohamed El-Kadi		
NSAS	Mr. Lotfi Madi		NSAS Libyan focal point
NWSAS	Mr. Rashid EL-Foutaisy	E-mail: Rashid-elfutaisi@yahoo.com Tel.: +21671206633	NWSAS Libyan focal point
EGA	Mr. Nuri Almargmani	E-mail: nmarghari@gmail.com Tel.: +218214870266	EGA committee member
AEMMmRP	Mr. Assadeik Elmashat	E-mail: s_elmashat@yahoo.com Tel.: +218913807636	Manager of follow-up and quality control department
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GCWD	Mr. Khaled GCWD	E-mail: khaledGCWD@yahoo.com Tel.: +218214917669	Research and studies manager
	Mr. Omar Said Mohamed	E-mail: omarsoltani@live.com Tel.: +218917858208	Technical planning manager

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.

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 in a country that had been suffering sanctions and isolation for many years, not all data were available during this first round of collection. In Libya, 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. 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 Libya and the newly formed MWR.

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…	GWA, GCWW, MWR	Organograms NSIWRM (2000-2025)	Organograms submitted, copies of laws, strategies, and agreements submitted
Data on budgets, financial plans, and infrastructure financing, etc…	MEWINA Libya office after discussion with MWR, GWA, GCWW, GWDC,and international databases like CIA	Annual GDP, agricultural sector GDP	Not validated
Data on water resources (withdrawals and sectorial water use)	AEMMmRP, NSAS, NWSAS, GWA, GDC	Annual withdrawals, domestic water uses, agricultural water uses	State of Water Report for the year 2006 submitted. National Strategy for Sustainable Development submitted. Other sources of verification: UNDP reports, published manuscripts as per the references
Water supply and	GCWW, BC	Number of	Calculations made to

Data Category	Data Sources	Examples of Collected Data	Validation
sanitation coverage		households with piped access to water / total number of households	calculate per capita consumption based on reported values and was found to be 175 l/c/d which is matching the literature value
Water quality information	EGA	BOD_5, TDS, Alkalinity, coliform counts, etc….	Sporadic data. Not collected routinely and not verified
Census and demographics data	GAI	Population count	Last census in 2006. 2007 Statistics year book submitted. There is some confusion about counting non-Libyans. All calculations were conducted using Libyans plus non-Libyans.

Some noticeable differences:

- GCWW reported a value of 1,726,000 m^3/day, amounting for 630 Mm^3/yr for domestic water uses. GWA reported a value of 700 Mm^3/yr. The difference is expected to be from pipe losses (> 10%). The losses are expected to highly exceed this value. However, there are no measurements to document the exact percentage of water losses to date.

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