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N-W-EG-1

Strengthen the water utilities capacities to manage/reduce NRW and detect leakage / T1.1 - Inception Report

Version	*Document Title*	*Author*	*Review and Clearance*
v.4	*WES-EG-1 Inception Report*	*Paolo Rufini* *Walid Albarki* *Zakaria Yehya*	*Suzan TAHA*

WATER AND ENVIRONMENT SUPPORT IN THE ENI SOUTHERN NEIGHBOURHOOD REGION

The "Water and Environment Support (WES) in the ENI Neighborhood South Region" project is a regional technical support project funded by the European Neighbourhood Instrument (ENI South). WES aims to protect the natural ressources in the Mediterranean context and to improve the management of scarce water resources in the region. WES mainly aims to solve the problems linked to the pollution prevention and the rational use of water.

WES builds on previous similar regional projects funded by the European Union (EU) (Horizon 2020 CB/MEP, SWIM SM, SWIM-H2020 SM) and strives to create a supportive environment and increase capacity all stakeholders in the partner countries (PCs).

The WES Project Countries are Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Libya, Palestine, Syria and Tunisia. However, in order to ensure the coherence and effectiveness of EU funding or to promote regional cooperation, the eligibility of specific actions can be extended to neighboring countries in the Southern Neighborhood region.

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ABBREVIATIONS

AWWC	Asyut Water and Wastewater Company
DMA	District Metered Areas
ENI	European Neighbourhood Instrument
EU	European Union
GIS	Geographic Information System
HCWW	Holding Company for Water and Wastewater
HA	Hydraulic Analysis
IWA	International Water Association
l/c/d	liters/capita/day
m^3	Cubic meters
NRW	Non-revenue Water
QGIS	Quantum GIS
WTP	Water Treatment Plants
WES	Water and Environment Support (Project funded by the EU)

WSS **Water Supply System**

1 INTRODUCTION

1.1 PROJECT BACKGROUND

The total domestic water use in Egypt is estimated at about 5.5 billion cubic meters (m^3) per year or 8% of total water use. This corresponds to an average of about 200 liters per capita per day (l/c/d). Water use varies considerably between different localities in Egypt. For example, the installed drinking water supply capacity ranges from 70 liters/capita/day (l/c/d) in Upper Egypt to 330 l/c/d in Cairo. Water consumption in Alexandria is about 300 l/c/d. Furthermore, actual domestic water use is lower because of network losses. For example, in 2011, the water transmission and distribution losses amounted for 31% of the produced amount of water. This is estimated to be partially due to pipe leakage and partially due to unaccounted for water calculated by subtracting amount of water sold from amount of water produced[1].

Egypt has also seen rapid population growth over the past few decades, from a level of 25 million in 1953 to approximately 90 million in 2015, resulting in the expansion of urban areas and a spread of villages in the rural areas. The population is forecast to continue to increase and is likely to reach between 120 and 150 million by 2050. The Ministry of Water Resources and Irrigation estimate that the threshold of absolute water scarcity (500 m3/capita/year) will be reached by 2025. Egypt's reliance on the Nile as a water resource, combined with the forecast growth in water demand, highlights the importance of conserving and managing this scarce resource, both from an environmental and economic perspective.

As a result, Egypt has asked the WES Project to implement a national activity entitled "[Strengthen the water utilities capacities to manage/reduce NRW and detect leakage]". The activity falls under *topic 1: "Water Use Assessment, estimation ", topic 2 "Water Efficiency Gains at Decentralised Level" and 3 "Water Resources Valuation, Cost Recovery, Affordability of water services", sub-topic 2.2: "Non-Revenue Water (NRW) Management"* and *dimensions 1 & 2 "Technical Assistance and/or Capacity Building.*

The focus area of the project is Asyut city (Figure 1), the capital of the homonymous Governorate. Asyut city has a population of approximately 400.000 inhabitants.

[1] https://en.wikipedia.org/wiki/WatersupplyandsanitationinEgypt#Access

FIGURE 1: LOCATION OF ASYUT CITY

Nationally, **the activity supports the Real Loss Reduction Strategy (2017)** prepared with the support of the second phase of the European Union's (EU) Water Sector Reform Program, which promotes integrated nonrevenue water reduction strategy and its alignment with the real Loss Reduction Strategy.

At the regional level, the activity is linked to the UfM Water Agenda (Priority areas Water and Sanitation hygiene, Outputs A, B & C and Water and Climate Change Action, Outputs A & B) –and target 6.4 of the Sustainable Development Goals: "By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity", namely; indicator 6.4.1: "Change in water-use efficiency over time"[2].

1.2 PROJECT CONCEPT

The overall objective of this activity is "to assist a selected water utility to target the reduction of Non-Revenue Water (NRW) and to continue its efforts to improve NRW management". During the activities, the project will introduce internationally accepted best management practices for improving NRW, such as hydraulic modelling, the design of Distribution Zones, water balancing to enable quantifying the individual

[2]https://unstats.un.org/sdgs/indicators/Global%20Indicator%20Framework%20after%202019%20refinement_Eng.pdf

components of losses (including commercial losses) and estimating the overall NRW rate at the decentralized level. It will equally contribute towards the adoption of other best practices such as the use of GIS to allow the analysis of the geographic distribution of leaks, and subsequently facilitate the establishment of the link between the customers' information and the GIS.

The recommended interventions to reduce NRW in the Distribution Zones (DZs) will also help the partner utility to implement tangible and immediate actions in the pilot zones/sectors and thus help improve its performance in NRW management.

The activity can concern many other service areas in Egypt, posing the same problem with a high NRW. It is expected that with the on-job training and the strong involvement of the personnel concerned in the activity will result in learning by doing. This should help the implicated personnel to transfer their experience to other areas served by the same public water service provider or other providers.

1.3 DEFINITIONS & OBJECTIVES

1.3.1 DEFINITIONS

Any discussion relating to losses must be preceded by a clear definition of the water balance components and supplementary data used in water supply. The International Water Association (IWA) has developed a standard international water balance structure and terminology[3] shown in Figure 2 that has been adopted by national associations in many countries across the world.

This terminology includes the following definitions:

Water Abstracted is the volume of water obtained for input to raw water mains leading to water treatment plants

Water Produced is the volume of water treated for input to water transmission mains or directly to the distribution system

Water Imported and Exported relates to the volumes of bulk transfers across operational boundaries

System Input Volume is the volume of water input to a transmission system or a distribution system

Authorised Consumption is the volume of metered and/or unmetered water taken by includes items such as fire fighting and training, registered customers, the water supplier and flushing of mains and sewers, street cleaning, others who are implicitly or explicitly authorised to watering of municipal gardens, public fountains, do so by the water supplier, for domestic, frost protection, building water. These may be commercial and industrial purposes. It includes billed or unbilled, metered or unmetered according water exported. to local practice.

Water Losses of a system are calculated as:

Water Losses = System Input Volume — Authorised Consumption

[3] IWA International Water Association "the blue pages" - Losses from Water Supply Systems: Standard Terminology and Recommended Performance Measures

Water Losses can be considered as a total volume for the whole system, or for partial systems such as raw water mains, transmission or distribution. In each case the components of the calculation would be adjusted accordingly. Water Losses consist of Real and Apparent losses.

Real Losses are physical water losses from the pressurised system, up to the point of customer metering. The volume lost through all types of leaks, bursts and overflows depends on frequencies, flow rates, and average durations of individual leaks.

Apparent Losses consist of unauthorised consumption (theft or illegal use), and all types of inaccuracies associated with production metering and customer metering. Under-registration of production meters, and over-registration of customer meters, leads to under-estimation of real losses. Over-registration of production meters, and under-registration of customer meters, leads to over-estimation of Real Losses.

FIGURE 2: THE IWA STANDARD WATER BALANCE

<table>
<tr><td rowspan="9">System Input Volume

M^3/year</td><td rowspan="3">Authorised Consumption

M^3/year</td><td rowspan="2">Billed Authorised Consumption

M^3/year</td><td>Billed Metered Consumption (including water exported)</td><td rowspan="2">Revenue Water

M^3/year</td></tr>
<tr><td>Billed Unmetered * Consumption</td></tr>
<tr><td rowspan="2">Unbilled Authorised Consumption

M^3/year</td><td>Unbilled Metered Consumption</td><td rowspan="7">Non-Revenue Water**

M^3/year</td></tr>
<tr><td>Unbilled Unmetered Consumption</td></tr>
<tr><td rowspan="6">Water Losses

M^3/year</td><td rowspan="2">Apparent Losses

M^3/year</td><td>Unauthorised Consumption</td></tr>
<tr><td>Metering Inaccuracies</td></tr>
<tr><td rowspan="4">Real Losses

M^3/year</td><td>Leakage on Transmission and/or Distribution Mains</td></tr>
<tr><td>Leakage and Overflows at Utility's Storage Tanks</td></tr>
<tr><td colspan="2">Leakage on Service Connections up to point of Customer metering</td></tr>
</table>

Non-Revenue Water (NRW) is the difference between System Input Volume and Billed Authorised Consumption. NRW consists of Unbilled Authorised Consumption (usually a minor component of the water balance) and Water Losses.

NRW = System Input Volume - Billed Authorised Consumption

This equation assumes that:

1. System input volume has been corrected for any known errors
2. The billed metered consumption period for customer billing records are consistent with the System Input Volume period

1.3.2 OBJECTIVES OF THE ACTIVITY

The specific objectives of the activity are to:

- Investigate the situation of non-revenue water management in a pilot city served by Asyut Water and Wastewater Company and prepare its network, as part of a rational planning aimed to NRW reduction, to the next stage of implementation of distribution zones/sectors and their subsequent division into District Metered Areas (DMAs).
- Implement and calibrate a hydraulic model for the network of the pilot city as a tool to provide valid support to move into the design stage and establishment of DMAs
- Introduce internationally recognised best practices for improving NRW (including the design of Distribution Zones and the use of GIS to enable analysis of the geographical distribution of leakage).
- Build the capacity of the utility staff involved in the pilot area on the implementation of best practices for the management of non-revenue water through on-the-job training and direct involvement in the implementation of the tasks with the support of non-key experts (field data analysis, water balancing, model calibration, and fixing anomalies between the results of the model calculations and the field data).
- Develop a manual documenting the proposed procedures for reducing NRW in Asyut city water network.

The implementation of all tasks will be **designed to provide a practical training opportunity** (on the job and in the field) for the GIS, NRW (including hydraulic analysis engineers and field staff) partner teams, and to ensure the **direct participation** of the two teams in the implementation of tasks.

1.4 INCEPTION REPORT FORMAT

This Inception Report is the first deliverable required from the Consultant. The Inception Report presents the Consultant's understanding of the ToR, in addition to the methodology submitted with the original proposal. Additional understanding of the ground situation, surveys and other studies carried out, have enabled the Consultants to revisit the methodology proposed initially by the ToR and identify the most effective and reliable approach for implementation.

This Inception Report gives an overview of the works carried out by the team since mobilization and also sets out the revised methodology to be followed for the entire project period. The Report has been prepared on the basis of an inception fielding and a review of the available information, studies and reports presented to the consultants during their mission to Asyut Water and Wastewater Company (AWWC). It presents the information assessed during the inception phase and the detailed work schedule along with the milestones and tasks' responsibilities and manning schedule.

The Inception report covers the following topics:

- Project Background: Definition, aims and objectives, Terms of Reference and organizational structure
- Overview of the existing Water Supply System (WSS)
- Findings during the Inception Phase

- Review of Project Tasks: each of the tasks is reviewed and recommendations made for modification, where considered appropriate
- Implementation Program: a revised work plan is presented and discussed, based on the conclusions arising from the review of the available information and the inception workshop
- Risk and Assumptions.

1.5 OFFICIAL START AND END OF THE PROJECT

The project started on September 2nd 2020 with the Kick-off meeting. The estimated end of the project is, as per the TOR, September 30th 2021 (thirteen months).

2 SUMMARY OF RESULTS OF THE INCEPTION PHASE

The implementation of the program has been carried out in agreement with the Contracting Authority. After signing the contract, the Consultant carried out the following activities:

- Kick-off meeting
- Mobilization of the consultant team
- Establishment of communication lines internal to the project and with Asyut Water Utility and the Client
- Data assessment and evaluation

After the kick-off meeting and mobilization, the Consultant's team carried out two missions in Asyut during the Inception phase: the first on September 23rd, 2020 and then on October 27th and 28th, 2020. Annex 1 and Annex 2 show the two mission reports the Consultants' team has prepared.

The objectives of the missions were the following:

1. Getting common understanding of the project scope and objectives with AWWC departments,
2. Enable the project team to:
    a. better understand the situation of NRW management in Asyut water supply system
    b. Select the Hydraulic modelling and GIS software
3. Collect the data needed to carry out an initial data assessment (e.g.: water supply network, infrastructure and operation, customer database, etc.)
4. Identify the main stakeholders in the public and private sectors to be associated/consulted in the activities
5. Agree to the establishment of the Hydraulic Analysis (HA), Non-Revenue Water (NRW), and GIS teams from AWWC who will be involved with the experts in the implementation of the activity
6. Agree with AWWC on the pilot area where the project is to be developed
7. Start to identify the plan of actions necessary to carry out the activities.

2.1 KICK-OFF MEETING

The Consultant's mobilization started as programmed and initial activities started - in accordance with the proposed plan - on September 2nd, 2020. with the remote kickoffmeeting which took place by videoconference via Webex Videocinference.

The experts involved in the kick-off meeting were:

- Team leader - Michael SCOULLOS
- Key water expert - Suzan TAHA
- Key Expert - Engagement - Emad ADLY
- Key Expert - Communication - Pam VAN DE BUNT
- International non-key expert – Paolo Rufini
- GIS non-key expert – Zakaria YIHYA
- NRW Non-key expert – Walid elbarki

2.2 MOBILIZATION & COMMUNICATION

Due to the impact of the COVID-19 pandemic both in the region and in Europe, it has been necessary to launch the activity remotely until it becomes possible to undertake missions in Egypt. To this effect, internet meetings have been and shall continue to be organised with the main partners and beneficiaries, as needed to discuss ways to implement parts of the tasks remotely and to agree on the type of information / data needed which can be sent to the experts electronically.

The list of international and national experts, mobilized in the Inception period, is reported in Table 1. Communication lines internal to the project and with the partners (AWWC and the Holding Company for Water and Wastewater (HCWW)) were also established using mostly internet meetings platforms with the local experts and emails, in addition to the official electronic exchange channels and emails with AWWC through HCWW.

TABLE 1: INTERNATIONAL AND NATIONAL STAFF MOBILISED

Type of Expert	Name	Team	Position
International	Paolo Rufini	Rambøll	Expert in NRW, Water and Leak Detection and Technical Coordinator
National	Walid El Barki	Rambøll	Expert in NRW, Water and Leak Detection
National	Zakaria Yehia	Rambøll	GIS Specialist

2.3 INITIAL DATA ASSESSMENT AND EVALUATION

2.3.1 UNDERSTANDING THE INSTITUTIONAL FRAMEWORK

The key implementing organization in Asyut city are the Holding Company for water and wastewater (HCWW) and the Asyut Water and Wastewater Company that are responsible for water supply.

The departments of AWWC directly involved in the project are:

- Planning Sector (Dir.: Eng. Mohamed Mostafa)
- Measurements and Losses Department (Dir.: Eng. Marwa Ahmed)
- Leak detection Department (Dir.: Eng. Mostafa Mohamed Kamal Eldien)
- GIS Department (Dir.: Ms. Zainab Ramadan)
- Reduction of water losses Department (Dir.: Eng. Nesreen Adly)
- Hydraulic Analysis Department (Dir.: Eng. Manar Makarem Gabr)

In addition to those listed, also the following should also be considered to contribute to the successful completion of the project:

- Commercial department (for billing and collection data)
- IT department (for SCADA data).

2.3.1.1 STAKEHOLDERS INVOLVED

External Stakeholders to be consulted during the activity are:

1. The Asyut Governorate and corresponding municipal divisions
2. The Electricity Company of Asyut
3. The Asyut Bridges and Roads Directorate
4. The Asyut Traffic Department
5. The telecommunication companies in Asyut (Telecomm Egypt, Etisalat, Vodafone Egypt, etc.)
6. The Egyptian Natural Gas Holding Company (EGAS)

All other relevant stakeholders will be identified as needed during the course of implementation to ensure their ample engagement with the project activities; as applicable. These include : environmental and water-related NGOs, Academia, local consultants, consumer associations, women's and youth organizations in the region, in addition to representatives of local authority community representatives and the media concerned with water issues at the local level.

2.3.2 ESTABLISHMENT OF AWWC PARTNER TEAMS

One of the aims of the inception mission is also to agree with AWWC on the establishment of two teams made up of the staff who will be involved with the experts in the activity throughout its implementation to ensure the transfer of know-how, training and learning by doing; namely a Non-Revenue Water team comprising hydraulic analysis engineers and field staff, in addition to GIS team . To this end **the scope of work and the job profile of the different teams' members (NRW & GIS) have been prepared** and were discussed during the inception workshop. **Annex 3 presents the proposed "Scope of work and job profile of AWWC NRW and GIS team's members" – a note prepared for this purpose.**

2.3.3 SELECTION OF THE GIS AND HYDRAULIC MODELLING TOOLS

AWWC already uses GIS and Hydraulic modelling tools. At the moment, the GIS staff (4 persons; two field workers for assets' documentation and two digitising the network) has one license of ArcGIS 9.3.

The AWWC Reduction of Water Losses and Hydraulic Analysis department uses WaterCAD as hydraulic modelling tool. They developed a schematic of the overall network; importing the data from the GIS.

Generally, and in view of avoidable licence costs, the use of shareware software is recommended; therefore, the Consultant proposed in the inception workshop that was held on 30 November 2020 (i.e. at the end of the Inception phase), the use of such tools as EPANET for network documentation and hydraulic design or Quantum GIS (QGIS) for Geographic Information System applications.

Whatever tools are selected for the project, what is fundamental to the success is the preparation of a GIS database that can offer a valid support to all the NRW reduction operations. In this regard, in addition to the verification of WSS network and customers data, the project is aimed to prepare the GIS DB Conceptual and Logical Data Model, the structure of which will be implemented focusing on NRW reduction and analysis activities.

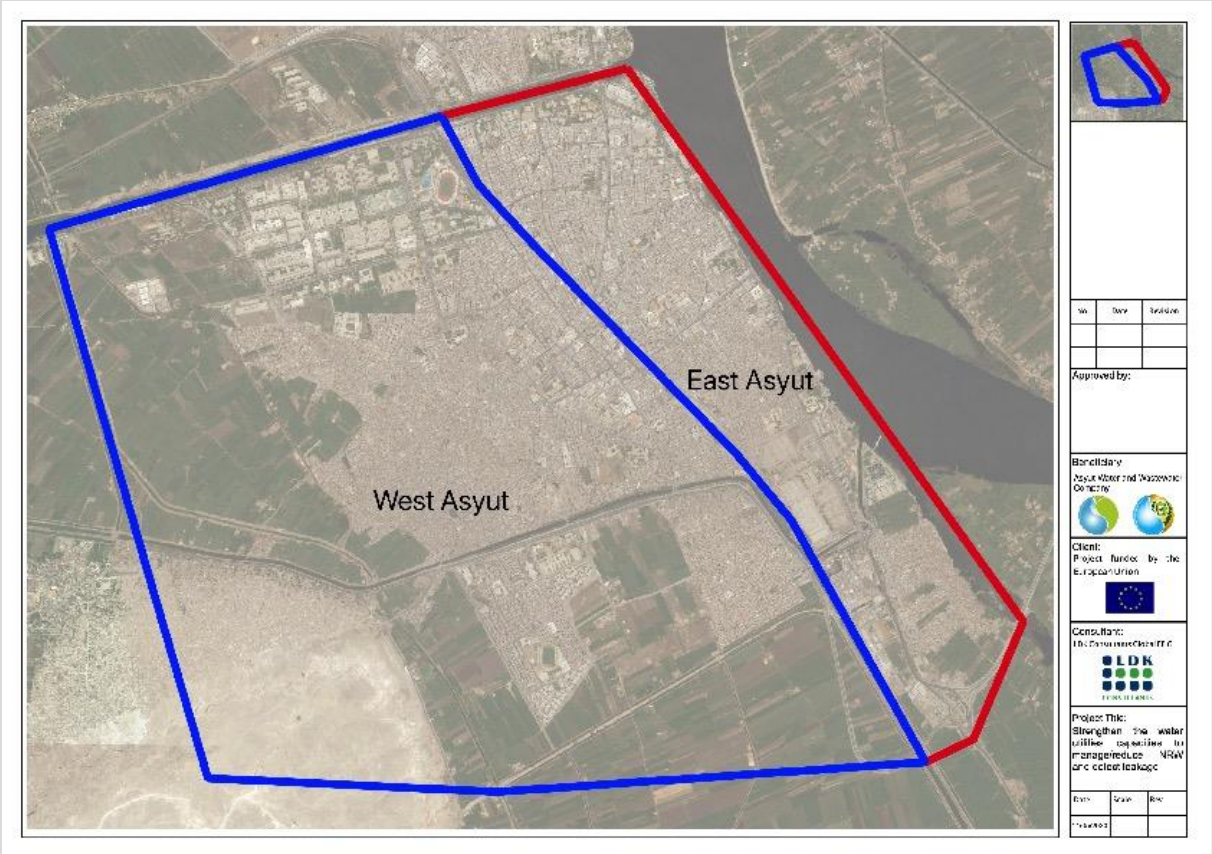
2.3.4 RESULTS OF THE DATA ASSESSMENT

The project's team made two field missions (23 September 2020 and 27-28 October 2020) – Pease refer to Mission 1 and Mission 2 reports annexed to this report. In preparation for the mission to Asyut, the team set up a questionnaire (see Annex 4) to evaluate the availability of data (See Questionnaire prepared in support of Mission 1 in Annex 4) and ease its collection. In this regard, the **availability of** the following data and information were the subjects of the questionnaire:

1. Background cartography information (either raster like satellite imagery or vector like dwg files)
2. Layouts of the WSS network with information on pipe material and diameters, location of valves and other fittings, etc.
3. Information on the main infrastructures of the WSS like water intakes, Water Treatment Plants (WTP), pump stations, and storage tanks
4. Information on the operation of the WSS in Asyut city, with particular attention to intermittent supply and existence of separated distribution areas
5. Information on existing flow and pressure monitoring, meaning both the availability of historical data
6. Flow and pressure monitoring equipment to use in the proceedings of the project
7. Information on customers, with particular care to the existence of any type of customer database
8. Information on existing procedures to calculate and prepare water balances either for the whole WSS or for selected sections of the water distribution network
9. information on existing DMA and corresponding data and information
10. Hydraulic models already developed in the area
11. GIS tools and type of software adopted
12. Hydraulic modelling tools and type of software adopted
13. Information on existing leakage detection adopted procedures and on results of leakage detection campaigns (number of leaks detected and zones with high number of leaks)
14. Leak detection equipment, type and quantity.

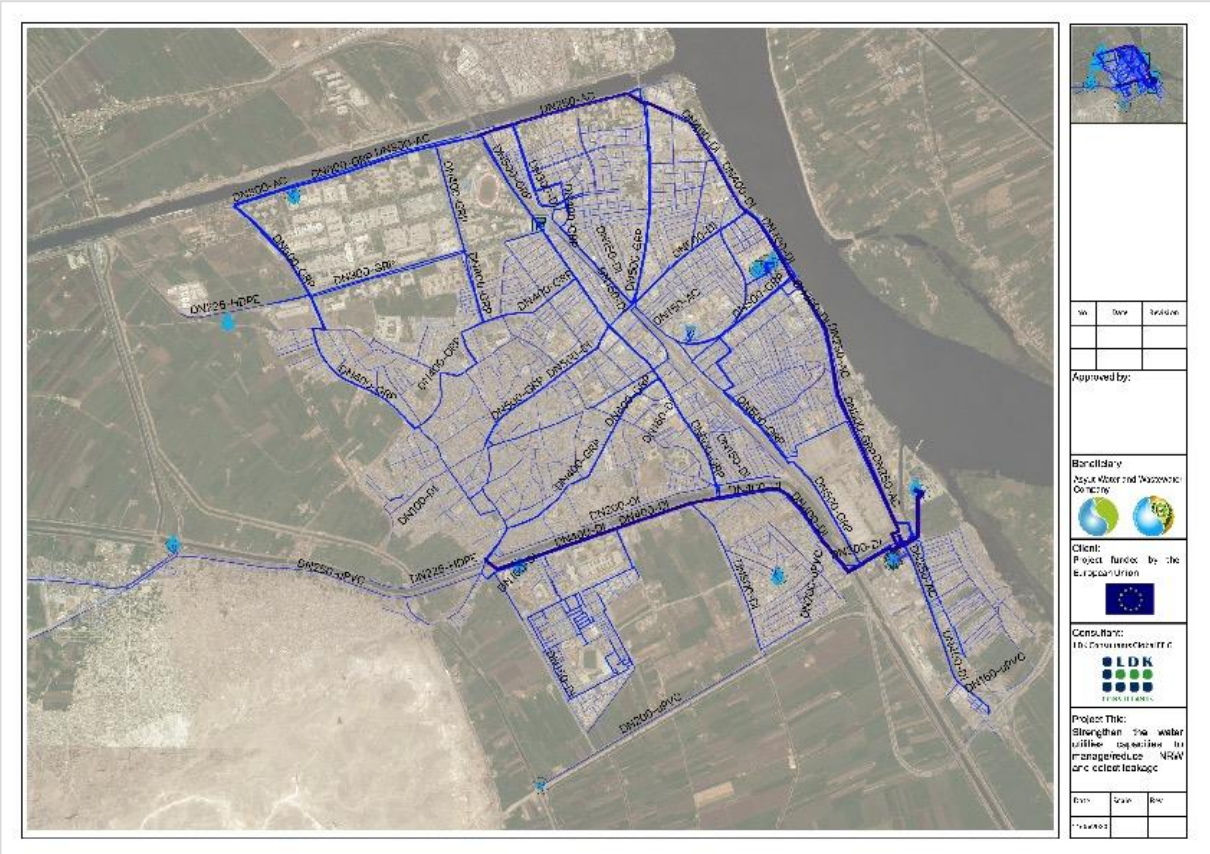
The questionnaire was completed by the heads of the AWWC departments involved and in general the situation of data and NRW procedures followed by the company is positive. AWWC divided Asyut city in two sub-areas: East Asyut and West Asyut; Figure 3 shows the study area of Asyut and the two sub-areas in which it has been divided.

FIGURE 3: ASYUT CITY AREA



Next Figure 4 shows a large-scale view of the overall Water Supply network of Asyut city.

FIGURE 4: ASYUT CITY WATER SUPPLY SYSTEM



Summarising the results of the held meetings:

- East Asyut city covers an area of around 4,3 km^2, AWWC customers count for about 56.500, this amount does not include the pre-paid customers.
- West Asyut city covers an area of around 14,9 km^2, AWWC customers count for about 50.too, this amount does not include the pre-paid customers.
- Then, totalising: Asyut city covers an area of about 19,2 km^2, AWWC customers count for about 107.000 not considering the pre-paid customers (the ones who pay a fixed amount in advance) which count for about 63.000 bringing the total number of customers to around 170.000.

The overall water supply network layout (including infrastructures such as: Water Treatment Plants (WTPs), water intakes, pumps and tanks) has been uploaded in a GIS with the only exception of house connections.

The diameters of the Water Supply System – as shown in Figure 4 - range from 1200mm to 100mm, materials are various: Asbestos Cement, Ductile Iron, GRP, Steel and plastic, as shown by the next Table 2 that indicates the lengths of pipe by DN and material.

TABLE 2: ASYUT WSS PIPE LENGTH BY MATERIAL AND DN

	100	110	125	150	160	200	225	250	280	300	400	500	600	800	1000	1200	
AC	1.47	0	0	0.79	0	0.38	0	2.94	0	2.35	0.15	0	0	0	0	0	**8.084**
DI	16.09	0	0	60.55	0	24.03	0	0	0	26.50	6.73	2.18	0	0	0.05	0	**136.1**
GRP	0	0	0	0	0	0	0	0	0	0.99	6.24	7.73	2.30	5.55	1.24	0.37	**24.42**
HDPE	0	1.857	0	0	3.76	0	2.61	0	0.23	0	0	0	0	0	0	0	**8.465**
Steel	0.11	0	0	0.40	0	0.53	0	0.74	0	0.30	0.01	0.36	0.14	0.34	0.16	0.08	**3.167**
uPVC	0	32.32	0.21	0	25.19	13.37	0	4.60	0	0	0	0	0	0	0	0	**75.69**
	17.66	**34.18**	**0.21**	**61.74**	**28.95**	**38.31**	**2.61**	**8.28**	**0.23**	**30.14**	**13.14**	**10.27**	**2.44**	**5.89**	**1.45**	**0.45**	**256**

The data in the GIS database are also exported to the hydraulic modelling software (WaterCAD). GIS data are also used to plot maps and to support decision making by using attributes selection criteria.

AWWC also started approaching the design of DMAs and 13 have been identified inside Asyut city, although not yet implemented.

GIS data are also used by other AWWC departments like: O&M, leak Detection and planning for their daily operations.

In the course of the two missions performed by the project team in Asyut, AWWC made available the documents listed below. **However, all the information cannot go out of AWWC until permission for data sharing and use is provided by Asyut Water Company**:

1. Asyut Water Distribution System maps
2. Asyut water distribution system sketches
3. Asyut Input system volume.
4. Information on hourly water flow supply from Asyut WTPs
5. List of the existing DMAs in Asyut surroundings
6. List of proposed DMAs in Asyut neighbourhoods
7. Maps of proposed DMAs in Asyut city and surroundings
8. The number of subscribers of the city of Asyut.

In general, good quality information is available on: water supply networks and infrastructures, costumers and network operation. In addition to the number of subscribers, also their position and consumption are extremely important for any NRW reduction activity and might not be present in the AWWC dataset; the Consultant, during the inception phase and also during the next phases of the project will provide advice and instruction to the AWWC departments on how to collect, store and treat this data to make the start of a permanent NRW reduction activity possible.

The proposed TOR presented initially two possible options:

Option 1: If network and facility data and customers' database are available, these data will be collected and evaluated for application in NRW reduction.

Option 2: if the data are not available, the team will develop a list of necessary and relevant data/information and prepare an action plan for the collection of such information.

The inception missions showed that **all data are available and in large part reliable; GIS and Hydraulic Analysis tools are available and ready to use.**

2.3.5 DELINEATION OF THE SERVICE AREA

Identifying controlled areas in a water distribution network is an important step towards an active NRW management and a sound water balance. The water supply into the controlled area must be metered and recorded, either by installing bulk meters or portable meters. By deducting the legitimate consumption from the total inflow in the controlled area, the volume of physical losses can be calculated. Besides providing the basis for water balance calculation by this, the implementation of controlled areas allows prioritizing leak detection efforts to those areas with the highest volume of physical losses and therefore guarantee the most efficient use of leak detection resources.

Controlled areas can be named either "Sector/Zones" or "DMA" depending on their size (i.e.: the number of customers).

In large and complex networks, it might be preferable to divide, early on, the network into larger sectors to identify the leakiest parts. Small urban and rural networks however, tend to lend themselves into DMAs, eliminating the need for sectors.

Establishing feasible Sectors/DMAs means dividing the network into parts that can be prioritized. The division of a large water network can be a delicate operation, which – if not undertaken with care – can cause supply and quality problems. The key is to have a detailed and in-depth knowledge of the existing network infrastructure and the hydraulic operation; consequently, the first stage of establishing such areas should include a review of the infrastructure supplying the network. Then, the planning would commence from the trunk mains and extend towards the distribution network.

Two more alternatives were discussed with AWWC during the two missions, to decide about whether to:

1. Establish feasible sectors/zones of the whole network of Asyut city by using the existing tools to design the size of the zones, positions of bulk meters and boundary valves and check whether it works under present and future conditions.
2. Identify an existing zone of the service area to be divided into DMAs by performing an analysis – at a smaller scale – same as for the previous alternative.

And in case alternative 2 was preferred, the west Asyut area would be the zone where to operate.

The size of network's partitions has an impact on the cost of creating and operating them: the smaller the partition the higher is the cost, as more valves and flow meters will be required. In consideration of this premise, the Consultant suggested to follow **alternative 1** by dividing the overall distribution network into sectors that should not be larger than 10.000 properties while the existing isolated small urban or rural networks will be considered as natural DMAs for which monitoring and water balance analysis will be performed.

These sectors/DMAs should not include trunk mains, so that the flexibility of the supply system is maintained; in this way it will be possible either to close line valves or to disconnect boundary pipes to create permanent zones without affecting the operation of the existing networks.

2.4 INCEPTION WORKSHOP

The workshop concluding the initial phase was held on 30 November 2020 by videoconference. Together with the experts' team, the following table lists the participants to the workshop and the departments they represented.

The objective of the inception workshop is to:

- Present the summary of the conclusions of the inception mission
- Define the requirements and necessary resources of the partner team (NRW and GIS) and stakeholders
- Present the job profiles proposed for the members of the partner team (NRW, and GIS)
- Agree on the targets of the intervention
- Establish the partner teams (NRW and GIS)

TABLE 3: INCEPTION WORKSHOP PARTICIPANTS

No.	Name	Position	Company
1	Eng. Manar Makarem	Hydraulic Analysis Department Manager	AWWC
2	Eng. Marwa Ahmed	SCADA and Loss General Manager	AWWC
3	Eng. Mohamed Mostafa	Planning Head Sector	AWWC
4	Eng. Mohamed SALAH ELDIN	Chairman	AWWC
5	Eng. Mostafa Mohamed	Loss Reduction Department	AWWC
6	Eng. Nesreen Atia	Loss Reduction Department Manager	AWWC
7	Eng. Zeinab Ramadan	GIS Department Manager	AWWC
8	Dr. Ayman AYADI	Water and Utilities Sector Manager	Delegation of the EU Delegation to Egypt
9	Dr. Abo Elabbas Eissa	Hydraulic Analysis Department General Manager	HCWW
10	Dr. Ahmed MOAWAD	Vice Chairman	HCWW
11	Dr. Mohamed Hasan	GIS Department General Manager	HCWW
12	Dr. Tarek NADA	Head of Planning and Design Sector	HCWW
13	Eng. Hosam Fawzy	Hydraulic Analysis Department Manager	HCWW
14	Eng. Mohamed Saad Eldin	Loss Reduction Department	HCWW
15	Eng. Sayed Elbeltagy	Loss Reduction Department	HCWW
16	Dr. Walid HAKIKI	WES Focal Point	Ministry of Water Resources and Irrigation
17	Paolo Rufini	International NRW Expert and Leak Detection and technical Coordinator	WES
18	Suzan TAHA	Key Water Expert	WES
19	Walid ElBarki	NRW Expert	WES

No.	Name	Position	Company
20	Zakaria Yehia	GIS Expert	WES

After the opening of the workshop, Suzan Taha (WES) gave a brief presentation of the WES team and the project objectives and requirements, then the agenda of the workshop - as reported here below – was introduced.

TABLE 4: INCEPTION WORKSHOP AGENDA

Hours	Subject	Animation / Moderator
09:30 – 10:00	Welcome of the participants	
10:00 - 10:20	Opening of the workshop	- Dr. Ayman AYADI, EU Delegation - Dr. Walid HAKIKI WES Focal Point (MWRI) - Dr. Ahmed MOAWAD, Vice Chairman HCWW - Dr. Tarek NADA, Head of Planning and Design Sector, HCWW - Mohamed SALAH ELDIN, Chairman, AWWC - Suzan TAHA, Key water Expert, WES
10:20 -10:30	Scoping of the workshop: objectives and Agenda	Paolo RUFINI – Non-key International Expert NRW (WES)
10:30 – 11:30	Presentation of the results/conclusions of the inception phase	Walid ELBARKI – Non-Key Local Expert/NRW (WES) (15 mins) Zakaria Yehia Non-Key Local Expert/GIS (WES) (15 mins)
	Integration of GIS in NRW analysis (10 mins)	Paolo RUFINI – Non-Key International Expert NRW (WES)
	Debate and discussions (20 min)	Moderation Paolo RUFINI (NRW) Walid ELBARKI (NRW) Zakaria YEHIA (GIS)
11:30 - 11:40	**Pause**	
11:40 - 12:10	Presentation of the Action Plan for the activity and for the next three months. Presentation of the resources and requirements for its implementation.	Paolo RUFINI (NRW) Walid ELBARKI (NRW) Zakaria YEHIA (GIS
	Debate and discussions	Moderation Paolo RUFINI (NRW) Walid ELBARKI (NRW) Zakaria YEHIA (GIS)
12:10 – 12:30	Identification of the implicated stakeholders	Suzan TAHA (WES)

Hours	Subject	Animation / Moderator
12:30 – 13:00	Summary of results Key recommendations and closure Next steps	Moderation Paolo RUFINI (NRW) Walid ELBARKI (NRW) Zakaria YEHIA (GIS) And Suzan TAHA (WES)
13:00 – 13:15	Evaluation of the workshop	All participants

A presentation of the findings of the inception/start-up phase was given, and the proposed plan of action for the implementation of the remaining tasks was presented. The full presentation was provided electronically to the partners.

The main stakeholders have been identified (See section 2.3.1 above) and HCWW and AWWC have been also directly involved in the study. External Stakeholders to be consulted during the activity were also identified. Other relevant stakeholders will be identified as needed during the course of implementation, as applicable.

The requirements and necessary resources needed from the partners were also presented, including the job profiles needed to create the AWWC GIS and NRW teams that are supposed to join the WES team for the implementation of the activity. In this regard, AWWC confirmed the full availability of its staff for this purpose, although the partner GIS and NRW teams are not yet officially established.

It has also been agreed that the project would continue using the GIS software and the Hydraulic modelling software already in use at AWWC, i.e., ArcGIS and WaterCAD; although the WES team strongly recommend the adoption of shareware and freeware software i.e., QGIS and EPANET to make possible the diffusion of such tools and connected methodologies at any level of the company without additional costs; keeping also in mind the full interoperability existing between those software.

The most challenging point that emerged from the discussions during the workshop was concerning the availability of data. In fact, the distribution of tasks and duration of activities presented by WES in the TOR - foresees full access and sharing of the Asyut water network data so that a home-based and on-site work distribution is possible.

Field mission reports prepared by WES team had already indicated that the AWWC would not allow access to data by the WES experts or sharing data with them. The only possible way in which the experts would have access to data - according to HCWW and AWWC managers - is at the AWWC headquarters in Asyut, using AWWC equipment (desktops and printers).

The position held by HCWW and AWWC has been confirmed during the Inception workshop. Accordingly, WES proposed to schedule a restricted meeting with HCWW and AWWC to discuss the way forward with the implementation of the activity in Asyut and sort out possible solutions to overcome the impasse generated by that situation. With this in mind, a meeting was held on December 7th, 2020 during which the WES team proposed three possible alternatives to make the project continue:

1) The **original alternative**, which foresaw to sectorise the whole water network of Asyut; this original planning was also proposed and subsequently approved by AWWC engineers during the inception field missions. However, this option requires access to the data of the whole Asyut water supply network.

2) The **second alternative** proposed is to consider a limited area of the Asyut WSS – a zone – and apply the same process of sectoring to the zone dividing it into DMAs. The technical approach to follow is the same as for the previous one, the quantity of data required is less than for the other option, the knowledge transfer to the local staff is guaranteed as for option 1.
3) The **third option** is to provide a general training (to be delivered in remote sessions) based on typical data and not on local information.

In the end, a common solution that was agreed upon was for WES to reschedule its workplan to include a number of missions to Asyut as judged necessary for its experts to ensure sufficient time working with the local AWWC staff and data on-site This was deemed acceptable to achieve both the technical results and capacity building objectives of the AWWC staff within the existing national security restrictions.

3 ACTION PLAN OF ACTIVITIES

After revision of the existing work-plan and LOE, the project tasks and deliverables remain as per the original planning, the only change that should be considered is the effort of the local and international experts and the number of missions that they have to do. Table 5 below summarises all the expected deliverables.

TABLE 5: UPDATED ACTION PLAN OF ACTIVITIES

Tasks	Deliverables
Task 1: Inception Phase	T1.1: Inception report. The report includes the results/outcomes of the Inception Workshop and the preliminary list of the main stakeholders involved in the activity
Task 2: Verification of GIS Maps and Customers DB	T2: GIS Database DB and Customers' DB Report reflecting the results of the workshop on GIS DB and Hydraulic Modelling
Task 3: Calibration of the Hydraulic Model for the network	T3: Schematic Model and Hydraulic Model Report reflecting the results of the workshop on GIS DB and Hydraulic Modelling
Task 4: Preliminary division and design of the network system into distribution zones (DZ) and design the zones	T4: Hydraulic Model and Zone Design Report reflecting the results of the workshop on GIS DB and Hydraulic Modelling
Task 5: Elaboration of procedures to reduce NRW and prepare the synthesis report	T5.1: NRW reduction procedure reflecting the results of the workshop on GIS DB and Hydraulic Modelling T5.2: The report on the "GIS DB and Hydraulic Modelling" workshop according to WES guidelines. T5.3: Synthesis report

Table 6 shows, for each task and for each WES expert, the updated number of days – both on-site and home-based – deemed necessary to achieve the objectives under the new work approach.

TABLE 6: UPDATED LEVEL OF EFFORT TABLE

No.	Task	Updated LOE					
		International Expert		Local GIS Expert		Local NRW Expert	
		Home-Base	On-site	Home-Base	On-site	Home-Base	On-site
1	**Task 1: Inception Phase**	**3,5**	**0**	**1,5**	**1,5**	**4**	**4**
1.1	Initial data assessment and evaluation	1		1	1,5	4	1,5
1.2	Selection of the GIS and HM software	0,5					2,5
1.3	1-day Inception workshop	1		0,5			
1.4	Preparation of the Inception Report	1					
2	**Task 2: Verification of GIS Maps and Customers Database**	**8**	**0**	**0,5**	**13**	**0,5**	**3**
2.2	Organization of missions and WES work area at AWWC premises[1]			0,5	2,5		0
2.3	Network and Customer Data Evaluation	2		0	3		3
2.4	Preparation of the GIS DB Conceptual and Logical Data Model	2					
2.5	Preparation of the draft GIS DB + Customer DB Report	0,5					
2.6	Implement recommendations for updating or digitising network and infrastructures GIS Map	1		0	6	0,5	0
2.7	Quality Control and GIS Data Import	1		0	1,5		
2.8	Finalisation of GIS DB + Customer DB Report	1,5					
3	**Task 3: Calibration of the Hydraulic Model for network**	**6**	**0**	**0,5**	**6**	**1,5**	**14**
3.2	Import GIS DB into HM software	0,5		0,5	**1,5**		
3.3	Organize/Select Network Data for HM			0	2		
3.4	Organize/Select Data for Demand Allocation			0	**2,5**		
3.5	Identify QP monitoring sites					1	
3.6	**Model Calibration**	**5,5**	**0**	**0**	**0**	**0,5**	**14**
3.6.1	Select QP monitoring equipment	1				0,5	
3.6.2	Provision of meters and pressure equipment	0,5					**2**
3.6.3	QP Monitoring Fieldwork	0,5					5
3.6.4	QP field data analysis	0,5				0	2
3.6.5	Adapt HM calculations to field results	3	0				**5**
4	**Task 4: Preliminary Division of the Network into DZ and design the zones**	**2**	**9**	**0**	**0**	**2**	**8,5**
4.2	Preliminary Design of the Zones	2					1
4.3	Identify QP Zones monitoring sites for permenent installations						1
4.4	Check tightness of the DZs					2	
4.5	Perform Zones Water Balance Calculations	0	**4**			0	**4**
4.6	Prioritize NRW Reduction Projects		1			0	**2,5**
4.7	Preparation of HM + Zone Design Report		**4**				
5	**Tak 5: Elaboration of procedures to reduce NRW abd prepare the synthesis report**	**10**	**0**	**2**	**0**	**4**	**0**
5.2	Elaboration of procedures to reduce NRW	2				1	
5.3	Prepare the synthesis report	1					
5.4	Prepare and conduct Workshop and reporting	2,5	0			1	0
5.5	Project Coordination	**4,5**		**2**		**2**	
		29,5	**9**	**4,5**	**20,5**	**12**	**29,5**
		38,5		**25**		**41,5**	
		105					

4 REVISED WORK PROGRAM

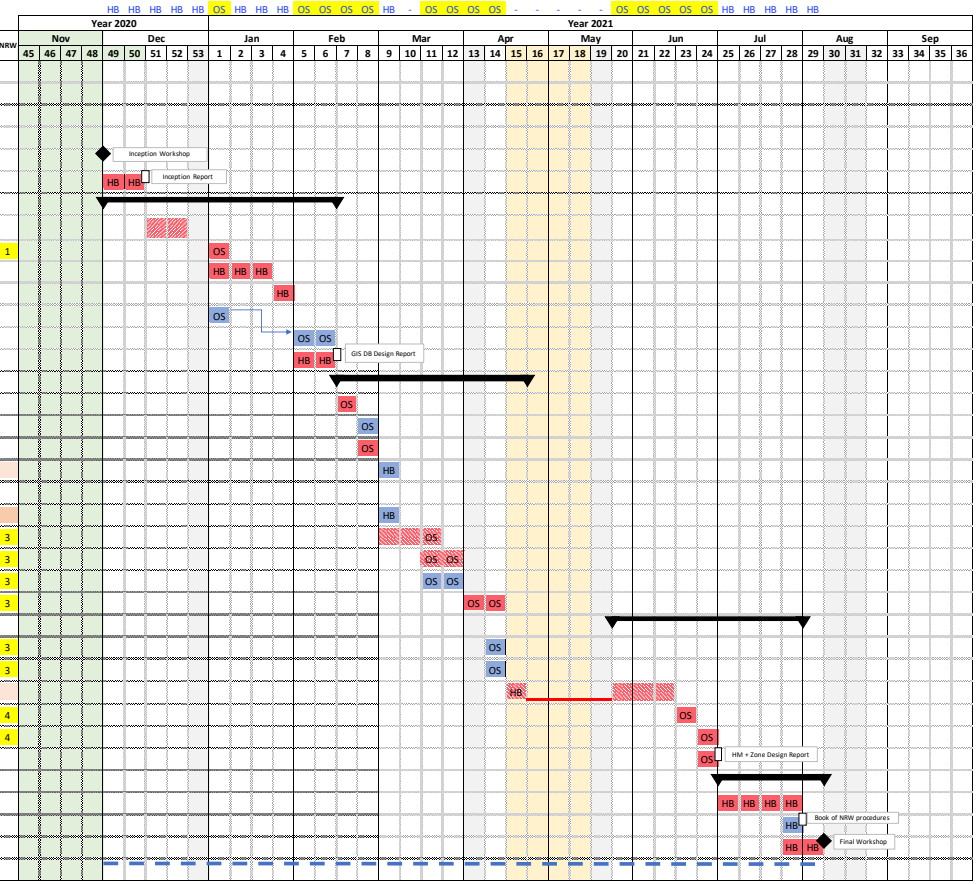
The revised time table for the duration of the intended activities is shown below; basically, the tasks are organized as they were in the original work program, the only difference being the number of working days the experts need to spend on-site rather than home-based. On top of that, also an overall project coordination activity has been introduced to keep into consideration the additional work required to keep on the same page all the project's actors. An addition of a total of 20 days were needed to excecute the new work approach

The proposed work program shows:

- The number, period and duration of the missions intended to be performed by the project team members at the AWWC premises;

- Which activities are expected to be performed as home-base or on-site tasks;
- The reports that will be delivered and the expected times of the delivery.

No.	Task	Notes	IE	GIS	NRW
1	**Task 1: Inception Phase**				
1.1	Initial data assessment and evaluation				
1.2	Selection of the GIS and HM software				
1.3	Additional trip to continue task 1.1 & 1.2				
1.4	1-day Inception workshop				
1.5	Preparation of the Inception Report				
2	**Task 2: Verification of GIS Maps and Customers Database**				
2.2	Organization of missions and WES work area at AWWC premises[1]				
2.3	Network and Customer Data Evaluation			1	1
2.4	Preparation of the GIS DB Conceptual and Logical Data Model				
2.5	Preparation of the draft GIS DB + Customer DB Report				
2.6	Implement recommendations for updating or digitising network and infrastructures GIS Map			1	
2.7	Quality Control and GIS Data Import			2	
2.8	Finalisation of GIS DB + Customer DB Report				
3	**Task 3: Calibration of the Hydraulic Model for network**				
3.2	Import GIS DB into HM software			2	
3.3	Organize/Select Network Data for HM			2	
3.4	Organize/Select Data for Demand Allocation			2	
3.5	Identify QP monitoring sites				
3.6	**Model Calibration**				
3.6.1	Select QP monitoring equipment				
3.6.2	Provision of meters and pressure equipment				3
3.6.3	QP Monitoring Fieldwork				3
3.6.4	QP field data analysis				3
3.6.5	Adapt HM calculations to field results				3
4	**Task 4: Preliminary Division of the Network into DZ and design the zones**				
4.2	Preliminary Design of the Zones				3
4.3	Identify QP Zones monitoring sites for permenent installations				3
4.4	Check tightness of the DZs				
4.5	Perform Zones Water Balance Calculations		4		4
4.6	Prioritize NRW Reduction Projects		4		4
4.7	Preparation of HM + Zone Design Report		4		
5	**Tak 5: Elaboration of procedures to reduce NRW abd prepare the synthesis report**				
5.2	Elaboration of procedures to reduce NRW				
5.3	Prepare the synthesis report				
5.4	Prepare and conduct Workshop and reporting				
5.5	Project Coordination				



Home-base critical task	HB
critical task not carried out by one of the three experts (in this case: Suzan)	
On-site critical task	OS
On-site Non critical task	OS
Home-base non critical task	HB
AWWC team critical task	
Home-base	
On-site	
Workshop	
Deliverable (Report)	

[1] ex "Get Clearance to Data Access + Data collection"

5 CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

NRW water activities present an important link between physical interventions (installation of measuring equipment, valves, recorders), technical interventions such as leak detection and analytical work such as downloading recorders, data processing. It is therefore important that the partners' teams have the adequate job profile to assist the experts in the implementation of the activity.

The inception missions showed that **data are available and in large part reliable; GIS and Hydraulic analysis tools are available and ready to use.**

After having agreed upon the new work approach, WES will proceed with the implementation of the revised workplan. The proposed workplan shows also the critical elements to the successful and timely implementation of the project; it is worth mentioning as "most critical" the ones that require a strong cooperation and interaction between the WES projet members and the AWWC teams, in particular:

1 Preparation of the GIS DB Conceptual and Logical Database, that requires a very strong interaction between the AWWC departments and the WES team members to fully incorporate in the database the requirements needed for making the database an effective supporting tool in the implementation of NRW reduction activities.

2 the provision of meters and pressure equipment in due time, that is mid of March 2021 in correspondence with the mission planned for that period.

In addition to the mentioned activities, the timely completion of the elaboration of procedures to reduce NRW has a great importance to keep the project on the track. For that, it is important to set strict cooperation enabling the correct interpretation of the different operative rules of the AWWC departrments involved in the project.

On end, the availability of the AWWC staff and the prompt activation of both the local GIS team and NRW team are essential for the success of the project.

5.2 RECOMMENDATIONS

In order to speed up the implementation of the activity as per the revised workplan, a schedule of missions was developed based on the revised workplan indicating the objectives of each mission and the proposed period and duration of each mission (Table 7). The availability of the staff and equipment during those missions is of paramount importance. To this effect, it is highly recommended that AWWC guarantees during the mission periods the following when needed for the project:

1. The full availability of one room, furniture, workstations/printers/plotters, monitoring equipment, van, electricity, internet etc.
2. the stationary needed for the team's routine work.
3. the provided workstations are always in the condition to handle the last versions of the data
4. The full availability of the staff which will be requested by the project team in due course.

The software to be used in the project is that already in use at AWWC: WaterCAD for HM and ArcGIS for GIS.

TABLE 7: SCHEDULE & OBJECTIVES OF MISSIONS

No.	Expert	Proposed date	Duration	Objectives	Comments
1	GIS expert	4 days	Early January 21	Setting up the working environment in terms of infrastructures, work processes and data manipulation for both for the GIS and HM components	
2		5 days	End of February 21	Support the AWWC staff in uploading the existing data into the developed GIS DB structure while checking the correctness of the data to be imported and - finally - importing the data into the GIS DB structure. An additional task of the mission is to make sure that the data for HM are correctly exported into the HM software.	
3	NRW expert	6,5	Mid-March 21	Setting up the hydraulic model (construction of the network schematic, demand allocation and identification of the monitoring sites) and the setting up of the monitoring equipment. Additionally, field work objectives, procedures and practices will be shared with the local staff so that they can carry out the field work exercise independently (or remotely supported). In this regard.	AWWC to provide the necessary equipment and personnel; the estimated time is sufficient with AWWC cooperation. AWWC is involved also in the organization/selection of HM data because they already developed a HM schematic that can be used by the project team.
4		4,5	End of May 21	support/advice on how to handle and check the data at end of the field test activities, analysis of the field test data,	

No.	Expert	Proposed date	Duration	Objectives	Comments
				support/advise in the solving possible anomalies and adapting the model results to the field test data. In this task we share procedures and methods to be applied by AWWC staff.	
5	International Expert	8	Early June 21	Advise and support implementing the zones, performing Water Balance calculations and prioritizing the NRW activities.	
6	NRW Expert	1.5	End of July 21	set up and participate in the final workshop	

ANNEXES

ANNEX 1 - MISSION 1 FIELD MISSION REPORT

Number of days worked:	One
Period: From - To:	23-9-2020 To 23-9-2020
Mission Purpose	**the Inception Phase** • Establish common understanding of the TOR • what is the actual situation there in terms of data, and what is ongoing? • Check Availability of data and restrictions • Softwares to be used • GIS team of Asyout WWC • HM team of Asyout WWC • Reduction of water losses team of Asyout WWC
Organisations visited:	Planning Sector, Measurements and Losses Department, Leak detection department, GIS department, Reduction of water losses Department and Hydraulic Analysis department in Asyut water company.

Meetings/Activities	Date	Participants (name), (title), (institution)
Meeting 1 / Activity 1	23-9-2020	- Eng. Mohamed Mostafa (Head of Planning Sector) (Asyut Company) - Eng. Marwa Mahmoud (Director of the Measurements and Losses Department) (Asyut Company) - Eng. Mostafa Mohamed Kamal Eldien (Leak detection Engineer) (Asyut Company) - Ms. Zainab Ramadan (Director of the GIS) (Asyut Company) - Mr. Mohamed Metwally (GIS Engineer) (Asyut Company) - Eng. Nesreen Adly (Director of the Reduction of water losses Department) (Asyut Company) - Eng. Manar Makarem Gabr (Director of Hydraulic Analysis) Ms Maha Farghaly (Hydraulic Analysis Engineer) (Asyut Company) - Dr. Walid Elbarki (Hydraulic and Leak detection Expert) (WES Project) - Dr. Zakaria Yehia (GIS Expert) (WES Project)
Key Issues Discussed	• The Asyut Company is waiting for security approval before they can share any data. All information will be held until this approval. • The questionnaires were discussed with AWWC (GIS, Hydraulic Modelling (HM), Water Leak Detection (WLD) teams) and the answers to the questionnaire will be forwarded to the experts from Asyut Company following the security approval. • The experts were asked to create WhatsApp group for the team work in Asyut Company and WES project team. **Summary of the mission findings related to the GIS department:**	

Meetings/Activities	Date	Participants (name), (title), (institution)
		1- AWWC carry out field survey to collect data but without the coordinates. They use ArcGIS server 10.4 and SDE layers as GIS format 2- The GIS department consists of 4 personnel. 3- The updating of the Maps is done manually and lacks good accuracy 4- AWWC uses the Program satellite image as background 5- The customers information is currently not connected with GIS 6- To date, AWWC established 11 District Metered Areas (DMAs), with the last DMA having been established on 30-6-2020. AWWC is interested to establish a new DMA with the WES project for West of Asyut. 7- For any selected area (DMA), GIS team should update and review the GIS maps with collecting the meters **Summary of the mission findings related to the Hydraulic Modelling (HM) and Water Leak Detection (WLD) departments:** 1. AWWC is using WaterCAD connect Edition 2. They established 11 DMAs in villages and are planning to start the establishment of two more DMAs in October 2020 3. department content of 2 persons  
Outputs		Filled questionnaire showing an overview regarding the status
Difficulties Encountered or Other Comments		• Eng. Mohamed Salah (The chairman of the Asyut water company) had a meeting, we did not see him. We hoped to discuss with him the data security and data sharing. • They are holding all data and info until they receive the security approval

Name	Date	Signature
Zakaria Yehia Ahmed	29-9-2020	
Walid Elbarki	29-9-2020	

ANNEX 2 - MISSION 2 FIELD MISSION REPORT

Number of days worked:	Two
Period: From - to	27-10-2020 To 28-10-2020
Mission Purpose (Project Activity #)	1. Getting common understanding of the project scopes and objectives with AWSSC departments, and enable the project team to: a. better understand the situation of NRW management in Asyut water supply system, b. Select the Hydraulic modeling and GIS software c. Collect the data needed to carry out an initial data assessment (e.g.: water supply network, infrastructure and operation, customer database, etc.) d. Start to identify the plan of actions necessary to carry out the activities 2. Identify the main stakeholders in the public and private sectors to be associated/consulted in the activities 3. Propose and agree with ASSWC on the pilot area where the project is to be developed 4. Agree to the formation of the HA, NRW, GIS teams from ASSWC who will be involved in the activity
Organisations visited:	Asyut Water and Wastewater company Planning Sector, Measurements and Losses Department, Leak detection department, GIS department, Reduction of water losses Department and Hydraulic Analysis department in Asyut water company.

Meetings/Activities	Date	Participants (name), (title), (institution)
Meeting 1 / Activity 1	27 Oct 2020	1. Eng. Mohamed Mostafa (Head of Planning Sector) (AWWC) 2. Eng. Marwa Ahmed (Director of the Measurements and Losses Department) (Asyut Company) 3. Eng. Mostafa Mohamed Kamal Eldien (Leak detection Engineer) (Asyut Company) 4. Ms. Zainab Ramadan (Director of the GIS) (Asyut Company) 5. Eng. Nesreen Adly (Director of the Reduction of water losses Department) (Asyut Company) 6. Eng. Manar Makarem Gabr (Director of Hydraulic Analysis) 7. Ms Maha Farghaly (Hydraulic Analysis Engineer) (AWWC) 8. Eng. Mahmoud Gamal (Hydraulic Analysis Engineer) (AWWC) 9. Dr. Walid Elbarki (Hydraulic and Leak detection Expert) (WES Project) 10. Dr. Zakaria Yehia (GIS Expert) (WES Project)
Meeting 2 / Activity 2 (…..please amend accordingly	28 Oct. 2020	Same as above
Key Issues Discussed	• Non-revenue water management situation in AWWC • Information and data gaps needed to complete the inception phase and report. • The stakeholders to be consulted during implementation • The scope of the activity and its geographic extent & the proposed pilot area • The establishment of the counterpart teams. • The availability of IT room for the inception workshop in preparation for the inception workshop,.	

Meetings/Activities	Date	Participants (name), (title), (institution)
	• The availability of space for the local experts to work on-site • Data sharing with the project	
Outputs	1. Collected relevant information to better understand the situation of the water supply the non-revenue water management situation in AWWC and enable the preparation of the inception report. Interviews were made to understand the existing network and infrastructure, operation and maintenance, leak repair procedures, level of services, demand forecasting, use of GIS and hydraulic modelling, customers' database, etc. The outcomes of these interviews were sent to the international expert in a document listing all the questions raised and detailing the reply to all these questions. The **experts also collected some maps and images but still waiting permission to receive them.** 2. Stakeholders to be consulted during the activity were also discussed and proposed as follows: **External stakeholders:** Governor (District Chief) - President of the Electricity Company of Assiut - The director of the bridges and roads - Traffic Department – Telephone Department - Natural Gas Department **Internal departments**: Leak detection – Stations – Network – Billing – Customer service – Projects – Financial - Contracts and purchases – IT (Scada) 3. The scope of work will remain as proposed in the TORs (i.e. dividing the overall Asyut distribution network in zones, design the monitoring system and prioritize the zones on NRW reduction criteria), rather than identifying a Zone to be divided in DMAs, design the monitoring system of the DMAs and prioritize the DMAs on NRW reduction criteria. **The proposed pilot area is West of Asyut city** 4. Regarding the establishment of the HA, NRW, GIS teams from ASSWC who will be involved in the activity, it was pointed out that all the department staff will available for our support. **5. Other Issues Raised:** • In preparation for the inception workshop, the availability of IT room for the inception workshop was discussed and was found possible to use it. • There is space available for the local experts to work on-site • HCWW instructions are required for data sharing with the project	
Difficulties Encountered or Other Comments	• Eng. Mohamed Salah (The chairman of the Asyut water company) had a meeting, we did not see him. We hoped to discuss with him the data security and data sharing. • AWWC should take permission to send any data. Procedures for data sharing with the project involves sending the data to the holding company – the holding company decide which data can be sent to us)	

Name	Date	Signature
Zakaria Yehia Ahmed	30-10-2020	
Walid Elbarki	30-10-2020	

ANNEX 3 - SCOPE OF WORK AND JOB PROFILE OF AWWC NRW AND GIS TEAM'S MEMBERS

INTRODUCTION

Out of the main objectives of Inception phase is to establish two teams (one GIS team and one NRW team of the "Asyut Water and Wastewater Company" and defining:

- the requirements and necessary resources of the partner teams
- the scope of work and job profiles of the partner's teams

In this regard, preliminary to the establishment of the AWWC teams is the preparation of a note indicating the scope of work and the job profile of the AWWC teams' members. This brief report covers these two aspects.

PROPOSED SCOPE OF WORK FOR AWWC TEAMS

GIS team

The partner GIS team must work closely with the project team in supporting the project and providing in timely manner all data and information required. In details, the task requiring the support of the AWWC GIS team is:

1. **Task 2: Verification of GIS maps and Customers DB, that implies:**
    a. On-site full access to the existing background maps
    b. On-site full access to the existing network layout maps (primary, distribution and tertiary pipelines)
    c. On-site full access to the existing infrastructures data (water intakes, tanks, pump stations and WTP)
    d. On-site full access to the existing operation and maintenance information
    e. On-site full access to the existing customer database
    f. Ensure the Quality Check of the available information
    g. Support in the preparation of the WSS GIS DB Design Report

In addition to the provision of support to this task, the AWWC GIS team will ensure the availability of at least two workstations suited for geographical data browsing and editing and the access to printing and plotting equipment. The workstations will be equipped with the necessary GIS and Hydraulic modelling software and the full set of data requested to carry out the task.

The AWWC GIS team is expected to be formed by, at least:

- One GIS expert
- One data input staff
- One IT specialist.

NRW TEAM

The partner NRW team must work closely with the project team in:

- Supporting the project team in making available the equipment and fittings required to implement the field works
- Perform the field activities and field data analysis required for the implementation of the project.

In details, the tasks requiring the support of the AWWC teams are:

1. **Task 3: Calibration of the Hydraulic Model**
   a. Identify Q-P monitoring sites
   b. Q-P monitoring field work
   c. Q-P field data analysis
   d. Adaptation of the Hydraulic Model calculations to the fieldwork results
2. **Task 4: Preliminary division of the network into DZ**
   a. Preliminary design of zones
   b. Identification of inflow monitoring sites and boundary sites
   c. Q-P monitoring fieldwork and data analysis
   d. Perform Zone Water Balance calculation
   e. Prioritization of NRW actions by zones

The AWWC NRW team is expected to be formed by, at least:

- One Hydraulic engineer
- One field-work squad made of one supervisor and two workmen. The field team must be equipped with a van and must have full access to flow and pressure monitoring equipment and leak detection equipment.

JOB PROFILES

GIS expert

The expert should have the following experiences:

- Familiarity with GIS conceptual data modelling and logical data modelling for water supply database design
- Previous experience in using GIS tools for water assets management
- Familiarity with open-source GIS software
- Experience in GIS data collection and data importing and conversion from different sources,
- Experience in data quality control and review
- Experience in linking GIS to other utility databases and application

GIS Data input staff

The expert should have the following experiences:

- Previous experience in using GIS tools for water assets management
- Familiarity with open-source GIS software

- Familiarity with GIS data input (aerial and satellite imagery, vector cartography, coordinate reference systems, etc.)
- Experience in water supply network GIS data editing/browsing (pipelines layout and WSS infrastructures, WSS entities connectivity rules and attributes) and data import/exchange
- Experience in data quality control
- Experience in linking GIS to other utility databases and application
- Preferably, fluency in English language

IT specialist

The expert should have the following experiences:

- Experience in overseeing the maintenance, backing up, and securing of databases, as well as retrieving files when needed
- Experience in providing assistance to the project team, with particular regard to hardware assistance concerning: desktops, computer peripherals (printers, scanners, hard disks, monitors, etc.) or software assistance concerning the installation and updating of software.

Hydraulic engineer

The expert should have the following specific experiences:

- experience in hydraulic modelling and calibration, experience in water supply network operation and maintenance
- familiarity with open-source hydraulic calculation software
- experience in flow and pressure monitoring and field data analysis, with installation and use of bulk flowmeters, pressure gauges, digital data-loggers
- experience in NRW reduction methods: Pressure management and network design, leak detection techniques, design and management of zones and District Metered Areas
- experience in network management: conducting water audits, quantifying leaks, performing water balance calculations, key NRW performance indicators.

Field work squad

The squad is made of three persons:

- The responsible of the team (the supervisor)
- Two workmen to support the activities of the responsible
- The team needs a car or a van to carry out the activities.

The responsible of the team should have the following specific experiences:

- Experience in flow and pressure monitoring, with installation of: bulk flowmeters (permanent and temporary installations) and pressure gauges and data-loggers.
- Experience in water supply network operation and maintenance activities (e.g.: valve shut-off and opening)

ANNEX 4 - MISSION 1 QUESTIONNAIRE

CATEGORY			CLASS	PURCHASED DATA	RESTRICTED DATA (RD)	PAPER DATA (PD)	DIGITAL DATA (DD)	DD FORMAT	DEPT.	CONTACT PERSON	CELL PHONE	EMAIL
GIS			BACKCROUND MAPS (RASTER)				✓	jpg	GIS	Jawab Ramadan	01006384960	awalugis2017@gmail.c
GIS			SATELITE IMAGERY				✓	jpg	Measurment	Manar Ahmed	01064541772	Measurments@ekcew.
GIS			BACKCROUND MAPS (VECTORIAL)				✓	GDB	Hydrulic Analysis	Manar Makarem	01000759329	eng.manarmakarem@g
GIS	HM		WSS NETWORK LAYOUT MAPS									
✓	✓		TRANSMISSION PIPES LAYOUT			✓	✓	SHP GDB				
✓			DIN			✓	✓	SHP GDB				
✓			MATERIAL			✓	✓	SHP GDB				
✗	✗		PROFILE				✗					
✓	✓		DISTRIBUTION PIPES LAYOUT			✓	✓	SHP GDB				
✓	✓		DIN			✓	✓	SHP GDB				
✓	✓		MATERIAL			✓	✓	SHP GDB				
✓	✓		NODE ELEVATIONS				✓	SHP GDB				
✓			TERTIARY PIPES LAYOUT									
✓			DIN				✓	GDB				
✓			MATERIAL				✓	GDB				
✓			NODE ELEVATIONS				✓	GDB				
GIS	HM	M	WSS INFRASTRUCTURES [1]									
✓			WATER INTAKE (DATA AND POSITION)				✓	GDB				
✓			TYPE				✓	GDB				
✓			DESIGN CAPACITY				✓	GDB				
✓			ACTUAL CAPACITY				✓	GDB				
✗			Q HISTORICAL DATA SERIES				✗					
✓	✓		WTP (DATA AND POSITION)				✓	SHP GDB				
✓			TYPE				✓	GDB				
✓	✓		DESIGN CAPACITY				✓	GDB				
✓	✓	✓	ACTUAL CAPACITY				✓	XLS				
		✓	Q HISTORICAL DATA SERIES [3]				✓	XLS				
✓	✓		TANK (DATA AND POSITION)				✓	SHP GDB				
✓	✓		GROUND WATER TANKS VOLUME				✓	GDB				
✓	✓		GROUND WATER TANKS LEVELS				✓	GDB				
✓	✓		ELEVATED WATER TANKS VOLUME				✓	GDB				
✓	✓		ELEVATED WATER TANKS LEVELS									
	NA		Q-H HISTORICAL DATA SERIES									
✓	✓		PUMP STATION (DATA AND POSITION)				✓	GDB SHP				
✓	✓		PUMPS TYPE				✓					
	✓		PUMPS Q-H CURVES DATA				✓	XLS				
	✓		Q HISTORICAL DATA SERIES				✓	XLS				
GIS	HM	M	OPERATION AND MAINTENANCE									
✗			WARNING DATABASE (DATA AND POSITION)									
✗			INTERVENTION DATABASE (DATA AND POSITION)									
NA		✓	LEAKS DATABASE (DATA AND POSITION) [2]				✓	XLS				
NA		✓	REPAIR DATABASE (DATA AND POSITION)				✓	XLS				
✗			INTERMITTENT SUPPLY - ZONING DATA									
✗			SHUT-OFF VALVE (DATA AND POSITION)									
GIS	HM	M	Q-P MONITORING									
		✓	Q MONITORING POINT (DATA AND POSITION)				✓	XLS				
		✓	P MONITORING POINT (DATA AND POSITION)				✓	XLS				
GIS	HM	M	CUSTOMER									
✗	✗	✓	CUSTOMER DATABASE				✓	XLS				
✗	✗		CUSTOMER MAPS									
	✓	NRW	WATER BALANCE			✓		XLS				
			TECHNICAL DOCUMENTATION									
	✓		IN PROGRESS PROJECT				✓	SHP XLS				
			PROPOSED PROJECT									
	HM		HYDRAULIC MODELLING									
	HM		POPULATION DATA				✓	XLS				
	HM		GROWTH POPULATION DATA				✓	XLS				
	HM		DEMAND DATA				✓	XLS				
	HM		URBAN PLANNING				✓	SHP				
	HM		NETWORK LAYOUT DATA				✓	SHP				
	HM		MODEL CALIBRATION DATA				✓	WATER GEMS				
			IT SOFTWARE TOOLS									
GIS			GIS SW				✓	GDB				
GIS			HYDRAULIC MODELLING SW				✓	WATER GEMS				
GIS			WATER BALANCE SW				✓	XLS				
		NRW	NRW EQUIPMENT									
		NRW	P MONITORING EQUIPMENT				✓	XLS				
		NRW	Q MONITORING EQUIPMENT				✓	XLS				
		NRW	LEAK DETECTION EQUIPMENT				✓	XLS				
			STAFF									
			GIS STAFF NUMBER					4				
			GIS STAFF QUAIFICATIONS					3				
			HM STAFF NUMBER					2				
			HM STAFF QUAIFICATIONS					2				
			REPAIR STAFF NUMBER					NA				
			REPAIR STAFF QUAIFICATIONS					NA				
			LEAKAGE STAFF NUMBER					10				
			LEAKAGE STAFF QUAIFICATIONS					2				

DATA AVAILABILITY
✗
✓
NA

DD FORMAT	
DOC	MS WORD
DWG	AUTOCAD
DXF	AUTOCAD
GDB	ARCGIS
JPG	ABOBE
PDF	ADOBE
SHP	ARCGIS
XLS	EXCEL
OTHER	

IMAGERY FORMAT
GEOEYE
WORLD VIEW-1
WORLD VIEW-2/3
QUICKBIRD
IKONOS
PLEIADES
OTHERS

pre-filled input data
manual input data

(1) data to collect for each infrastructure
(2) It is a sub-section of the Warning and Intervention DB
(3) Data to collect for any available historical period (yearly, monthly, etc.)