

# Geo-radar scanning and GIS mapping of an old water utility network in Paphos District area in Cyprus under the project: 'Upgrade of the hydraulics laboratory for the modeling of water supply networks & design and operation optimization study'

Kyriacos Themistocleous<sup>1</sup>, Athos Agapiou<sup>1</sup>, Andreas Papachristodoulou<sup>1</sup>, Ploutarchos Evlogiminos<sup>1</sup>, Pavlos Sotiropoulos<sup>2</sup>, Spyros Maroulakis<sup>2</sup>, Charalambos Karaolides<sup>3</sup>, Maria Theodorou<sup>1</sup>,  
Marinos G. Hadjimitsis<sup>1</sup>, Diofandos G. Hadjimitsis<sup>1</sup>

<sup>1</sup> Department of Civil Engineering and Geomatics, Faculty of Engineering and Technology, Remote Sensing and Geo-Environment Lab, Cyprus University of Technology, 2-6, Saripolou Str., 3603, Lemesos, Cyprus

<sup>2</sup> Terra Marine, Greece, 10, Str. Tompra, 15342, Ag. Paraskevi, Athens, Greece

<sup>3</sup> Municipality of Pafos, Pafos, Cyprus

Email: athos.agapiou@cut.ac.cy, d.hadjimitsis@cut.ac.cy



## SUMMARY

This work is part of a research project named as 'HYDROGIS LAB'. A preliminary underground survey using the newly acquired ground penetrated radar has been taken place and presented. This technology provides accurate scanning and 3D spatial representation of the underground piping network. The main aim is to refine as much as possible the digital imprint of the water supply network under consideration. Work has also been initiated in the development of a GIS platform for managing all information (maps, satellite imaging, 3D scans, network system components etc). The geo-radar scanning is required to support the modeling of water supply network, design and operation.

## INTRODUCTION

The Project aims to satisfy the dire need for authorities to solve the extremely serious problem of water supply as a result of continued water shortage. The grave and chronic problems of water losses in the water supply network pipes, the uncontrolled and non-optimum operation of pumping stations, the often wrong design of the networks because of various interventions (e.g. town planning, wrong mapping of existing networks), are some of the most important problems which need to be tackled in order to optimize the performance of the networks and, consequently, save on this precious resource, as well as, on the energy consumed. The innovative aspect of the Project is that, for the first time, state-of-the-art technologies will be combined for the mapping of water networks through the Global Positioning System (GPS), Radar Scanners and Satellite Remote Sensing (SRS). The data will be entered into a Geographic Information System (GIS), with the aim of developing a digital imprint and the mapping of the network. Several other attempts have been made by other researchers for using GIS for managing and mapping utility network in Pafos area in Cyprus. After that, a representative part of the network will be selected and modeled in the new upgraded laboratory for conducting detailed experimental studies, which will be correlated with computational/mathematical studies.

## MAPPING AND DEVELOPMENT OF A DIGITAL IMPRINT OF EXISTING SELECTED WATER SUPPLY NETWORK IN PAPHOS MUNICIPALITY

Paphos Municipality is one of the Municipalities facing very serious problems with the water supply network, firstly because of the age of the network and secondly because of the rapid town development and the urgent needs for expanding the network in an unorganized manner. One of the aim of the project is to the study of an existing selected water supply network in the Municipality in an effort to understand the 'logic' of the network and select a representative part of it that will include almost all the components (i.e. pumping station, main piping, valves, flowmeters etc) present in the networks of the Municipality in order to conduct a comprehensive study.

The GIS is used to develop a comprehensive management system of the information, including cartographic and quantitative data, as well as text. In conjunction with the maps and ground measurements, it will be possible to develop an accurate digital imprint. Finally all the retrieved information that are available through the acquired software regarding surveying, analysis, management, processing, will be inserted in the GIS database. The GIS system will be flexible, allowing the addition of any layer considered necessary for the better management of the Project information.

It must be noted that depending on the results of the initial study of the networks in Paphos Municipality, the final structure of the digital imprint as well as necessary information to be contained therein will be decided, in order to proceed with an accurate modeling of the representative network.



Figure 1.a & b Geo-radar Scanning of the Paphos water utility network

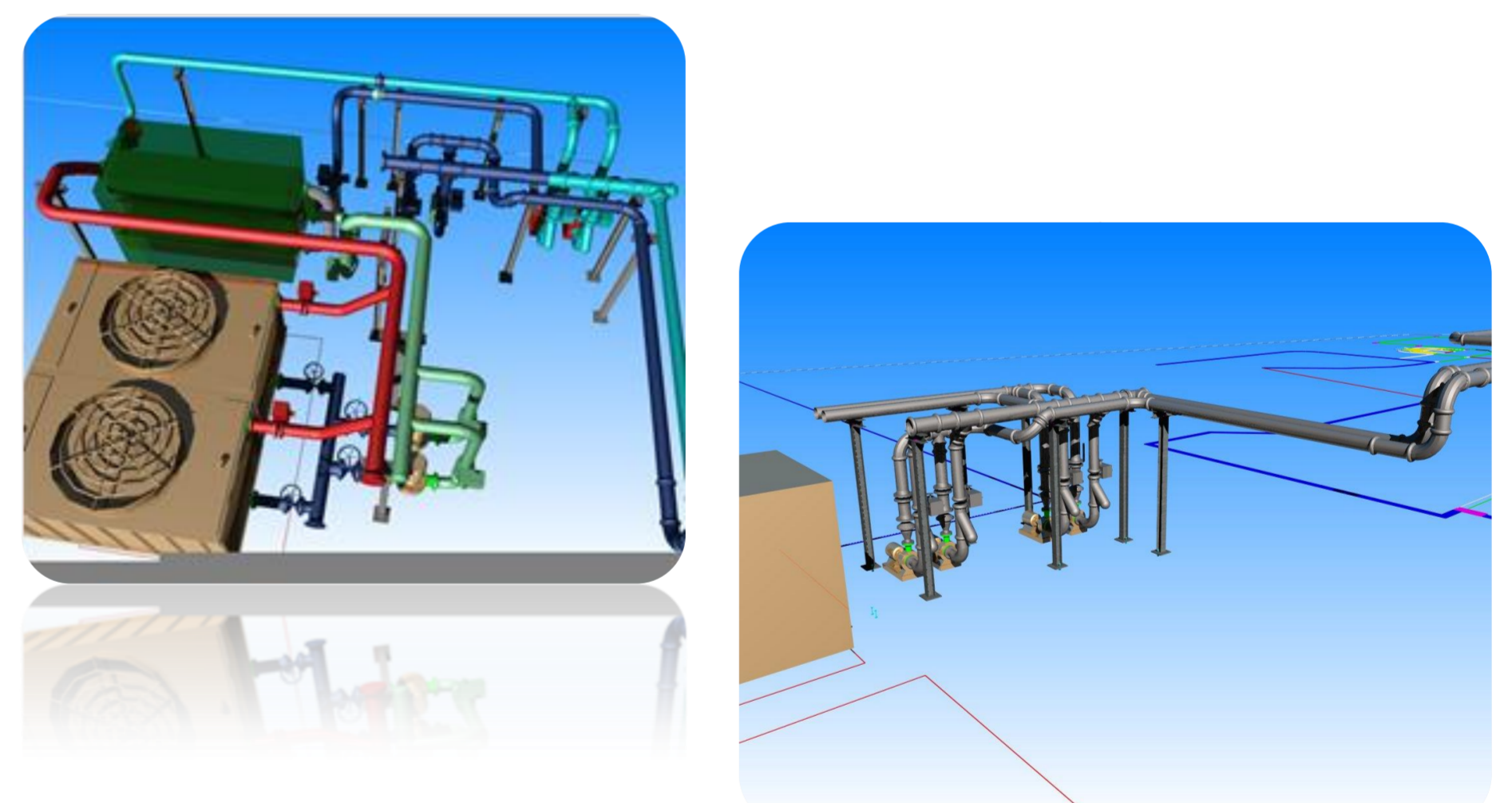


Figure 2. Typical 3D drawing of a distribution network

## PRELIMINARY CONCLUSIONS

Based on the digital imprint of the selected network, CUT will develop constructional drawings of the part of the network to be modeled. These drawings will include all necessary information of the piping and locations of all components to be installed. It is important to be noted that all parameters included in all four layers of the GIS System will be used for the accurate modeling of the network (i.e. altitude and gradients of piping, etc). Using its existing workshop facility, then it is required to be constructed the piping and will assemble the network together with all its necessary components. Figure 2 shows some similar 3D drawings of distributions networks.

**Participantas:**  
HO=CYPRUS UNIVERSITY OF TECHNOLOGY  
PA1=WATER DEVELOPMENT DEPARTMENT  
PA2=NATIONAL TECHNICAL UNIVERSITY OF ATHENS  
PA3= ISOTHERM LTD  
PA4=MUNICIPALITY OF PAFOS