

# **The Technological Management of Water and Wastewater in Ancient Greece: the case of Western Greece, Past- Present and Future.**

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Western Greece is interwoven with water. The existence of so many aquatic systems necessitated the construction especially in ancient and in modern times of many hydraulic and drain systems. This aquatic environment has been developed by the river Acheloos, which in ancient times was considered a God, symbolizing the “spirit of the water” Along its banks, many towns had been established such as: Stratos, Metropolis, Palaiokastro, Arsinoe Pleurona etc. These towns had developed important water management systems, characterized by versatility, flexibility and adoptability to the environmental changes, the management being based on careful planning, and economy of means, materials and energy, bringing fresh water from the nearby mountains, via an aqueduct, dispensing the water into a network of cisterns and reservoirs for water supply to the town of Pleurona.

Mycenian civilization(1600ca-1100BC)

This civilization was developed by the Achaians , who managed their water resources very efficiently, undeniable proof being the “Persian Spring” i.e. an underground water source by which the Akropolis of Mycene was supplied with water by means of a pipe system.

Minoan civilization (2000 to 1600BC)

The Minoans of Crete, upgraded the management of water resources from 2000 to 1600BC. They indeed advanced the sanitary hydraulic techniques in urban areas of Crete. These techniques included aqueducts, cisterns, and wells, also systems for public and private baths, as well as sanitation and sewage systems.. They were constructing the hydraulic systems according to the altitude, which was considered an important factor. For example, at high altitude they used to construct drain pipes of conical shape for entering to each other.. The complexity of these constructions was the main characteristic, the total length being 150m. The Minoan water management included: rain water collection for use under at dry and adverse ecological conditions, fields covered with flagstones,, horizontal roofs, and stone ditches, which led the water to the cisterns, transfer of water by open ducts, and later on to closed and underground clay pipe systems. Also they were using the principle of “communicating vessels” for the effective water distribution system, and transfer networks. . In Crete, underground cisterns were used for the collection and storage of rainwater. Generally, the Minoans advanced in managing the water with such effective systems. They also designed urban wastewater drain systems, covered by stones, which contributed to healthy life. The cleaning of these drain systems from the wastewater was made by the surplus of the rain water which was led into the

central canal of the drainage system, thus decreasing the possibility of the occurrence of contagious diseases

Archaic period ( 5<sup>th</sup>-6<sup>th</sup> century).

Monumental hydraulic structures emerged in ancient Greece overtime, including: dams, tunnels, water transfer pipe systems, numerous devices for hydraulic uses of different kinds, devices for lifting water, mechanisms for pumping water, such as the hydraulic wheel of Perachora, for pumping water from small to medium differences in height( Archimedes and Phillon, respectfully). Also, ancient Greeks with their high ingenuity constructed, cisterns, aqueducts, pipe systems for water transfer and distribution, fountains, toilets, and sanitary systems. In Athens, dams were constructed of various dimensions, deep wells and cisterns for water storage. Generally, they had established complicated hydraulic infrastructure. Ancient Greeks also constructed in Athens tunnels for water distribution. Also, they had passed special laws related to the maximum efficiency of rain water and designed structures to resist the effect of time, so that they can last for a long time. The Eupollinus tunnel was constructed on the basis of Euclidian geometry and its bottom was laid with pipes where the smaller diameter ones was entering into the pipes of higher diameter, a method of transferring water to long distances, like the typical aqueduct of 50 km distance found in Nikopolis. These ducts had a slope of 2% so that the water was being transferred by means of gravity. The ancient Greeks having realized the importance of the relation between healthy conditions and quality of life, they were taking all the necessary measures towards improving their lives in the context of hydraulic constructions. So they constructed all those means that were aiming at protecting their health. i.e. the toilets,, drain networks and even tried to reuse the wastewater in Agriculture. They prevented the occurrence of contagious diseases by controlling the polluted waters. The drain system was made using underground ducts, made of stone or clay. They also improved the drainage of Agora, the public place for gathering, to prevent the occurrence of diseases.

Generally, the question is posed whether it is worth to study the usefulness of the ancient water management and technology? This can be answered as follows: Yes it worth, because ancient Greeks with their ingenuity opened new avenues accomplishing cotemporary technological achievements, which have been considered the basis and the motivation of modern technological and hydrological advancements, where many of them are still in use, in a number countries, like Africa, India Iran, Egypt .