Water treatment and water supply infrastructure

- **Thessaloniki Water Treatment Plant Expansion (2017):** Tender Document Revision & Update (Recent) Description: This project involved a thorough revision and update of the tender documents for the expansion of the Thessaloniki Water Treatment Plant. Client: EYATH S.A. Key tasks included:
  - Preliminary Design: Designing protective covers for rectangular flocculation-sedimentation tanks to shield them from solar radiation.
  - Document & Drawing Updates: Updating all tender documents, plans (general layouts, P&IDs, electrical/mechanical, and hydraulic drawings), and the budget of the approved Final Design. This specifically involved removing the low-pressure membrane unit that was originally planned for backwash water treatment.
  - SCADA System Adaptations: Implementing necessary adjustments and expansions to the SCADA (Supervisory Control and Data Acquisition) system. This ensures it integrates the removal of the microfiltration unit and accommodates other changes EYATH has initiated in the existing facility.
  - Tender Document & H&S File Update: Updating all tender documents, along with the Health & Safety File (SAY/FAY).
  - Project File Preparation: Compiling a detailed project file, including technical data, a program for required studies, feasibility assessments, technical specifications for studies, and estimated study fees. This comprehensive file supports the design of crucial additional components, such as a second D2 tank at the plant's entrance (4,450 m^3 useful volume), a second D3 treated water storage tank (77,077 m^3 useful volume), and a second lime saturation tank for Phase A2 to optimize pH levels.

- **Tender Study for the design-of an underwater water supply pipeline connecting the island of Aegina with Attika water supply network (2015)**

  The project concerns the design of the onshore section of the pipeline, from the existing well at Perani beach in Salamina to the starting point of the submarine pipeline (~180m) and of a submarine pipeline 13,954 m long. The pipeline route is practically straight and is placed at depths of up to 95m. The hydraulic capacity of the pipe is of 250 l/sec,

- **Study of the extension of Thessaloniki Water Treatment Facility – Phase A2 (2006)**. Preliminary, Final Design and Tender Documents. The study has been assigned by the Greek Ministry of Environment, Physical Planning and Public Works of Thessaloniki. The study includes the Preliminary and Final design of necessary facilities for the completion and operation of phase A2, in order to raise the capacity of Thessaloniki Water Treatment Facility from 150,000 m^3 to 300,000 m^3 daily. The main components of the project are:
  - Water Oxidation Unit to be treated with ozone (O_3) and peroxide of hydrogen (H_2O_2) use, in order to tackle smell and taste problems.
  - Ph Adjustment Unit with sulfate acid use.
  - Rapid Mixing Unit with flocculant use [$Al_2SO_4)_3$].
  - Flocculation-Sedimentation Unit, that comprises of twelve (12) rectangular tanks with inclined places (Lamella Type) and pumping station that lifts the sludge to the thickening tank.
  - Refinery Complex that includes: fast-refineries with double refinery unit that comprises sand and anthracite, ozone unit, activated carbon unit, pumping station with activated carbon for leaching the refinery plates.
  - Chlorination Unit for water disinfection.
  - Circular sludge thickening tank, where an increase of 5% in solid concentration is achieved.
  - Sludge dehydration Unit, with a tape-filter press that ensures a total solid concentration of 20 %.

- Water treatment plant for leaching the refinery plates with low-pressure membranes.
- Pipelines and networks in the surrounding area in order to service the facilities (water treatment pipelines, sludge excess, chemicals, industrial water, drainage network, sewage network, roads, irrigation, lighting, fire extinguishing system, electricity).
- Planting and landscaping projects.
- Automatic recording system installation for monitoring and operation of the new facilities.

Cost of the works summed up to 15,500,000€, (Ministry of Environment, Regional Planning and Public Works / General Secretariat of Public Works, 2012).

- **Design of necessary works for Aliakmon - Axios Canal operation and modification to convey water to the city of Thessaloniki (2001)**. The Aliakmon-Axios Canal is located in northern Greece and delivers water from the Aliakmon River to Thessaloniki plain for irrigation. It has a total length of 54km and is divided into six reaches by gated check structures. Canal capacity ranges from 78m³/sec at the upstream end to 24m³/sec at the downstream end. The project involves the extension, renovation and regulation of the operation of the canal to provide additional water supply for the city of Thessaloniki (approx. population 1m).

  The study includes the design of canal repair works, cross section modifications, replacements and additions of control works (weirs, gates) as well as remote monitoring and remote control system development in order to dependably deliver water to Thessaloniki and at the same time satisfy irrigational needs along the canal.

  The project involves the extension, renovation and regulation of the operation of the canal; the study includes:
  - Design of the required control works of the canal for the uninterrupted water supply of Thessalonica, in parallel to its irrigation function
  - Design and specification of the methodology for the determination of canal leakages in its various sections
  - Repair and rehabilitation of the canal
  - Protection of the canal from pollution and physical damage.

  A hydraulic model has been developed for the simulation and the analysis of the operation of the Aliakmon-Axios canal and Computer simulation has been used as a tool to refine the civil design, to establish operating guidelines, to develop and test control schemes and to train operating personnel. The project includes the inspection and leakage detection of the Aliakmon – Axios canal. In the frame of this project the reaches of the Aliakmon-Axios canal that presented important failures and leakage problems were detected, detailed specifications for leakage assessment and evaluation were defined and necessary equipment was proposed and prescribed. (Cost of the works: 5,194,420 €, 2001)

  Description of actual services provided by our company within the assignment:
  - Assessment of the canal capacity for water supply in addition to irrigation
  - Preliminary dynamic analysis of the canal for various control system options and canal operational scenarios; assessment of the required additional storage in order to meet the water demand fluctuations and design of the associated reservoir.
  - For the selected control system (automatic regulation gates) and canal operation mode, assessment of the response of individual canal reaches to changes in water demand at the downstream end through detailed dynamic analysis with the CanalMan hydraulic model [Utah State University]
  - Design of the necessary control works of the canal (weirs, gates) to replace and augment the existing ones

- Design of the canal regulation system (SCADA), based on water and discharge monitoring wireless transmission of data.
- Identification of the reaches with increased damages
- Design of the necessary repair and rehabilitation works of the canal
- Detailed specifications for leakage assessment were defined including section length, isolation works, required equipment and measurement procedure.
- Specification of the necessary safety and water quality protection measures of the canal.

Client: Greek Ministry of Environment, Physical Planning and Public Works.

- **Dynamic Operational Analysis of Aliakmonas–Axios Interconnecting Canal (2000-2001):** This dynamic analysis, also for the Ministry of Environment, Physical Planning and Public Works (in collaboration with ECOS Meletitiki S.A. and G. Kafetzopoulos-D. Benakis-I. Printaktor & SIA E.E.), focused on optimizing the operation of the 61km Aliakmonas-Axios interconnecting canal. The primary goal was to prioritize water transfer for Thessaloniki's water supply (150,000 m^3/day initially, scaling to 600,000 m^3/day). The analysis utilized advanced dynamic canal modeling tools to examine system response to various flow control regulation methods and scenarios of unforeseen demand changes for Thessaloniki. Alternative operational strategies were evaluated based on: a) the system's ability to immediately adjust flow to Thessaloniki, b) timeframes for larger flow adjustments, c) impacts on agricultural water withdrawals, and d) potential overflows. The firm collaborated with canal management and regulation specialists from the U.S. Bureau of Reclamation for this pioneering study.
- **Hydraulic works for Olympic Equestrian Center and New Racecourse of Athens in Markopoulo area.** Preliminary Design of water supply network, sewerage, flood control system, stormwater network, irrigation network for the Equestrian Center and New Racecourse of Athens (2001).
- **Water supply works for East Coast of Varkiza.** Final Design and Tender Documents preparation. The water supply network was designed for the coastal area of Varkiza where recreation and sport facilities are planned. Works included: a) conveyance pipeline to transfer water from the existing network. A PVC pipeline of 750 m length, 160 mm diameter and 10 atm pressures was designed. b) Distribution pipelines of total length 1,715 m. The cost of the works summed up to 117,380 €. (Municipality of Vari, 2000)
- **Water supply of Communities in Dodecanese Islands from small dams and reservoirs.** Detailed design and tender documents of 5 water supply schemes for domestic consumption and small scale irrigation of towns and villages in Dodecanese Islands. The projects includes the intakes from small dams and reservoirs in the islands, the water treatment, pumping stations and the conveyance and distribution pipelines (Ministry of Agriculture, 1997-98).
- **Township of Larissa water supply works.** Preliminary design, Final Design and Tender Documents preparation for three groups of water wells in karstic aquifers. The project included the design of the pumping equipment, conveyance pipelines 24,6 km and storage tank 5,400 m^3. Works cost: 4,402,050€. (Water Supply and Sewerage Municipal Company of Larissa, 1992).