


Interreg Greece-Bulgaria

European Regional Development Fund



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<p>INTERREG V-A "GREECE - BULGARIA 2014 – 2020" COOPERATION PROGRAMME</p>		
<p>PROJECT BENEFICIARY:</p>	<p>Municipality of Pilea - Hortiatis</p>	
<p>PROJECT:</p>	<p>Management of underground water resources for the needs of non-portable water, heating and underground areas protection (GREEN PUMP) within the framework of INTERREG V-A "Greece-Bulgaria 2014-2020.</p>	
<p>OBJECTIVE:</p>	<p>Preparation of studies</p>	
<p>OPERATION:</p>	<p>2.5.2 Overall public open report on the projects results</p>	
<p>BUDGET :</p>	<p>«TOTAL BUDGET FOR THE OPERATION (CONTRACTED BUDGET in €) (ERDF: 766.194,23 € / National Funds: 135.210,75 €)»</p>	



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1. GENERAL

The Municipality of Pylaia-Chortiatis, participated in the European Cooperation program INTERREG V-A "Greece-Bulgaria 2014-2020 entitled "Management of groundwater resources to meet the needs of non-potable water, heating and protection of underground spaces "(GREEN PUMP)". The project aimed to utilize shallow aquifers for secondary water uses, such as toilet cisterns and irrigation. Within the framework of the program, the 1st General High School of Pylaia was selected for the pilot application for the management of the underground water potential and its use in irrigation of external adjacent areas of the school but also for use in sanitary areas (toilets).

The choice of the 1st General High School of Pylaia was made because the aquifer is quite high and its management would contribute in the following cases:

- Reduce flooding problems in the school basement
- Water saving for irrigation of the green space in the adjacent stadium

In the context of the above, the following project was announced: Drilling of water wells and installation of irrigation water supply at the 1st Lyceum of Pylaia.

The drilling location is at the point shown in the image below:



Image 1: Drilling location

The location of the drilling is at the 1st Highschool of Pylaia.

Indicatively, the locations of the drilling according to EGSA '87:

X	413749
Ψ	4493787



2. UPDATED BILL OF COSTS AND QUANTITIES AND PROCUREMENT

A drilling was executed in the 1st High School with a pump which supplies through tanks the irrigation networks of the school's trees and also the toilets of the ground floor, according to the project drawings.

The drilling pump supplies 4 tanks of 500 lit (L) each, which are installed in the basement area of the school as it is stated in the drawings.

For the determination of the tank positioning the following parameters were taken under consideration:

- The altitude and regional position of the drilling
- The altitude and regional distribution of the irrigative fields

These tanks then, through a network of pipes, supply the irrigation and supply network of the Ground floor WCs through two different pumps. The electrical connection of the drilling pump is installed on an underground ditch of 70cm depth outside of the building. The pumps are connected with cables on the wall in the area of the tanks.

A volume flow meter is installed in the hydraulic network before of the tanks supply. The drilling will have the following characteristics:

- Drilling depth 60cm
- Water supply 5 m³/h
- Tube diameter 12in
- Casing tube diameter 12in, width 6mm and depth 4m
- Piezometric tube diameter 1½ in and length of 48 m
- Copper filter 4-8 mm, quantity 8 m³
- Precited concrete plates for the drilling protection dimensions 1X1X0,2 with the lid

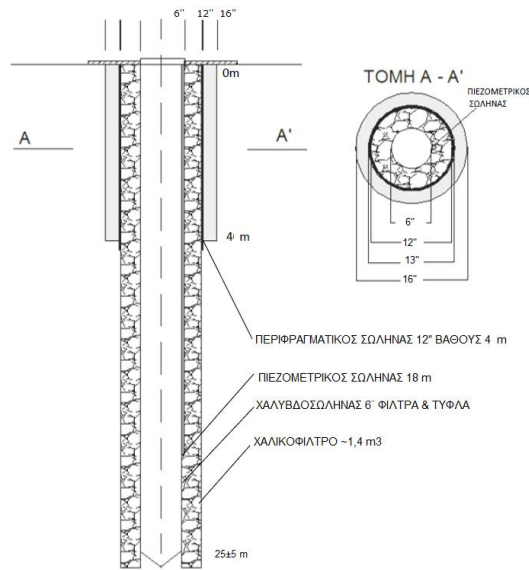


Image 2: Drilling section

3. INSTALLATION OF PROCURED EQUIPMENT TECHNICAL WORKS

The drilling works of the drilling were done with a hydraulic drilling rig. The test pumping of the drilling with a 1.5 HP submersible pump, which was installed at a depth of 43 meters, took place in three phases:

- **Pre-pumping**, which helped in the cleaning and gave data on the drilling capacity. The pre-pumping phase lasted 4 hours.
- Then followed a program of **two levels** of fixed supply. The step phase lasted 6 hours.
- After the complete development of the drilling, ie the purity of the water at the maximum possible pumped flow, followed by **continuous pumping** lasting 24 hours.

All measurements were performed volumetrically. The drilling works were executed from 13/08/2020 to 14/08/2020. When the work was finished, all materials and components were removed and the area around the drilling was restored.





Image 3: Photos during construction

The construction of the hydraulic installation was taken place under study's standards.



Image 4: Storage tanks



Image 5: Switchboard and flowmeter



Image 6: Connection with WC



Image 7: Irrigation network and well

Data collection is performed with special monitoring equipment which is installed in the system and has access to internet in the “log in” form. Data being collected are:

- Temperature of drilling water
- Flow
- Energy consumption of irrigation and drilling system

The monitoring equipment is UNICOcoder ®MP, Singlejet consumption meter, diameter of DN 15, with M-Bus interface according to EN 13757-2, suitable for temperature measurement until the value of 50 °C. An indicative part of the data recorded in the recording system during the period 26/10/2020-31/5/2022, during which the installation was monitored in order to control its operation, are presented below.



Table 1: Indicative recorder's data

Consump. Start	Consump. End	Daily Consump. (m3)	Energy consump. Start	Energy consump. End	Daily Energy Consump. (kWh)	Energy Consump./m3	Mean Temperature 1 (°C)	Mean Temperature 2 (°C)	Consump. Start
5/12/2020	7,13	7,32	0,19	718,18	731,21	13,03	68,58	17,8	18,40
6/12/2020	7,32	7,33	0,01	731,23	737,37	6,14	614,00	17,10	17,85
7/12/2020	7,33	7,36	0,03	737,4	744,02	6,62	220,67	18,3	18,85
8/12/2020	7,36	7,57	0,21	744,05	757,17	13,12	62,48	18,35	18,85
9/12/2020	7,57	7,59	0,02	757,19	763,82	6,63	331,50	18,45	19,05
10/12/2020	7,59	7,76	0,17	763,85	776,42	12,57	73,94	18,85	19,60
11/12/2020	7,76	7,9	0,14	776,45	783,34	6,89	49,21	18,55	19,25
12/12/2020	7,9	8,11	0,21	783,37	796,47	13,10	62,38	17,55	18,25
13/12/2020	8,11	8,12	0,01	796,5	802,62	6,12	612,00	16,85	17,60
14/12/2020	8,12	8,15	0,03	802,65	809,33	6,68	222,67	17,60	18,30
15/12/2020	8,15	8,35	0,2	809,36	822,36	13,00	65,00	18,1	18,60
16/12/2020	8,35	8,49	0,14	822,39	829	6,61	47,21	17,65	18,50
17/12/2020	8,49	8,66	0,17	829,03	841,55	12,52	73,65	18,3	19,00
18/12/2020	8,66	8,69	0,03	841,58	848,35	6,77	225,67	17,90	18,55
19/12/2020	8,69	8,78	0,09	848,37	861,57	13,20	146,67	17	17,85
20/12/2020	8,78	8,79	0,01	861,59	867,93	6,34	634,00	16,30	17,35
21/12/2020	8,79	8,82	0,03	867,96	874,82	6,86	228,67	17,5	18,10
22/12/2020	8,82	8,9	0,08	874,85	888,08	13,23	165,38	17,70	18,25
23/12/2020	8,9	8,91	0,01	888,11	894,36	6,25	625,00	17,45	18,00
24/12/2020	8,91	9,11	0,2	894,39	907,57	13,18	65,90	17,10	17,90
25/12/2020	9,11	9,14	0,03	907,59	914,33	6,74	224,67	16,8	17,65
26/12/2020	9,14	9,31	0,17	914,36	927,06	12,70	74,71	16,60	17,35
27/12/2020	9,31	9,34	0,03	927,09	933,8	6,71	223,67	16,6	17,50
28/12/2020	9,34	9,35	0,01	933,83	939,97	6,14	614,00	16,40	17,35
29/12/2020	9,35	9,41	0,06	939,99	952,72	12,73	212,17	16,85	17,55
30/12/2020	9,41	9,44	0,03	952,75	959,55	6,80	226,67	16,85	17,60
31/12/2020	9,44	9,64	0,2	959,58	972,63	13,05	65,25	17,2	17,75
1/1/2021	9,64	9,64	0	972,66	978,98	6,32	#ΔIAIP/0!	16,65	17,45
2/1/2021	9,64	9,95	0,31	979,01	992,08	13,07	42,16	16,8	17,55
3/1/2021	9,95	9,95	0	992,1	998,21	6,11	#ΔIAIP/0!	16,50	17,40
4/1/2021	9,95	9,98	0,03	998,24	1004,87	6,63	221,00	17,6	18,00
5/1/2021	9,98	10,04	0,06	1004,9	1017,31	12,41	206,83	17,50	18,10
6/1/2021	10,04	10,05	0,01	1017,33	1023,51	6,18	618,00	16,25	17,25
7/1/2021	10,05	10,23	0,18	1023,54	1036,23	12,69	70,50	17,75	18,20
8/1/2021	10,23	10,26	0,03	1036,26	1043,1	6,84	228,00	17,95	18,50
9/1/2021	10,26	10,32	0,06	1043,13	1055,74	12,61	210,17	17,40	18,00
10/1/2021	10,32	10,35	0,03	1055,77	1062,43	6,66	222,00	16,85	17,65
11/1/2021	10,35	10,36	0,01	1062,46	1068,51	6,05	605,00	17,15	17,60
12/1/2021	10,36	10,36	0	1068,54	1069,84	1,30	#ΔIAIP/0!	17,1	17,00
13/1/2021	10,43	10,44	0,01	1081,1	1087,41	6,31	631,00	16,35	17,20
14/1/2021	10,44	10,5	0,06	1087,44	1100,18	12,74	212,33	16,1	17,05
15/1/2021	10,5	10,54	0,04	1100,2	1107,09	6,89	172,25	15,50	16,60
16/1/2021	10,54	10,59	0,05	1107,12	1119,23	12,11	242,20	13,5	15,2
17/1/2021	10,59	10,6	0,01	1119,26	1125,54	6,28	628,00	13,20	14,75
18/1/2021	10,6	10,63	0,03	1125,57	1132,43	6,86	228,67	13,25	14,25



- Flow: The daily flow (m³).
- Energy consumption: The daily energy consumption (kWh)
- Temperature 1: The measured temperature (°C) in the drilling network
- Temperature 2: The measured temperature (°C) near the storage tanks

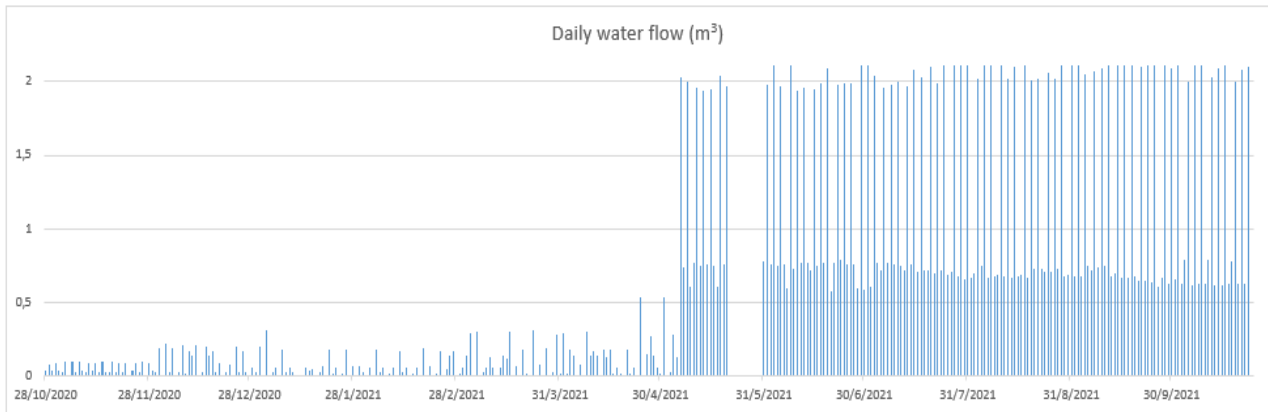


Image 8: Daily water consumption (26/10/20-24/10/21)

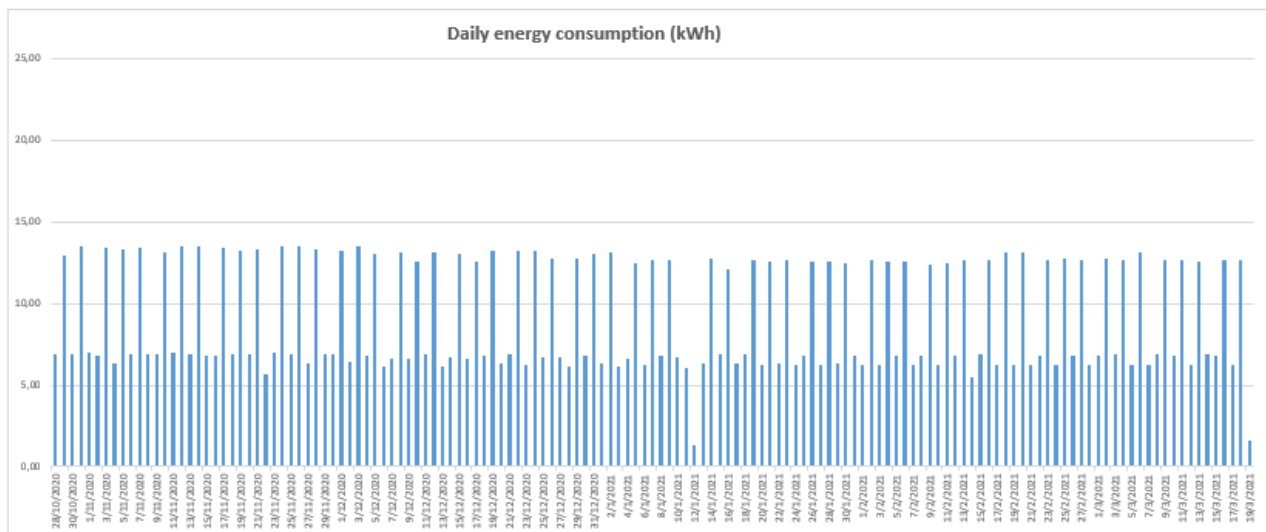


Image 9: Daily energy consumption (26/10/20-24/10/21)

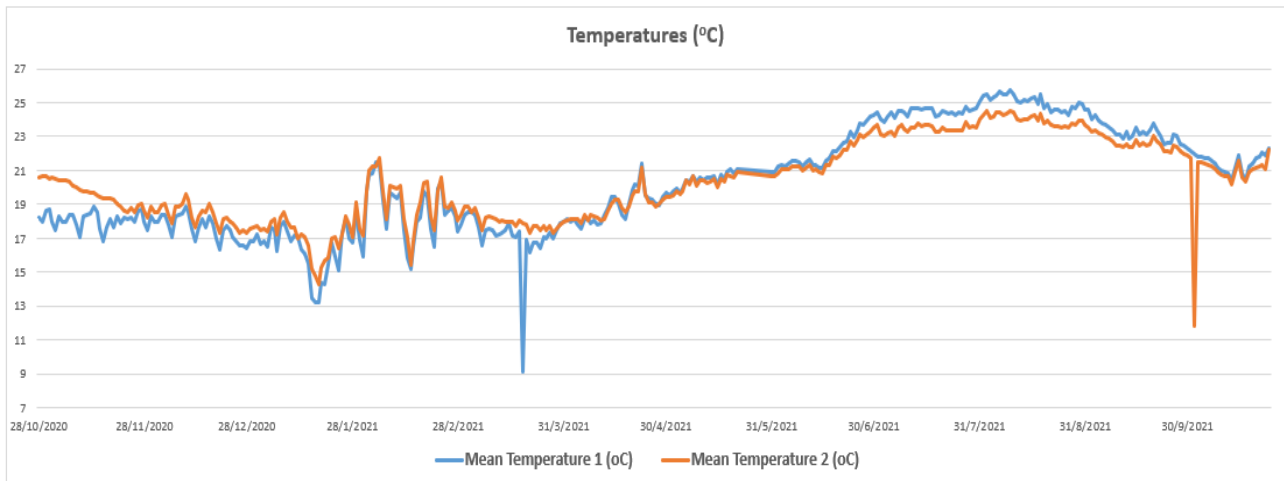


Image 10: Recorded temperatures (26/10/20-24/10/21)

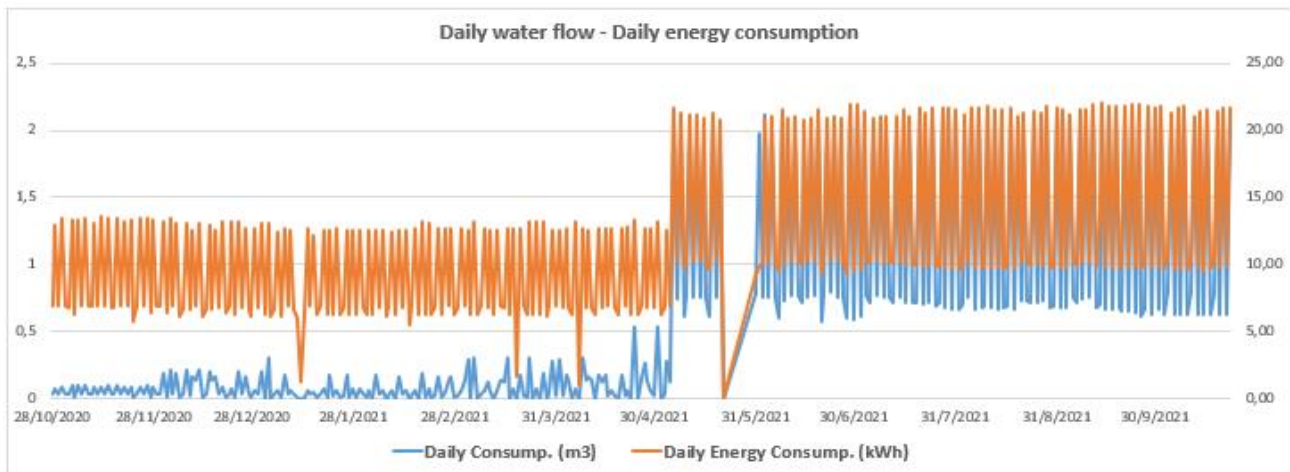


Image 11: Daily water consumption - Daily energy consumption (26/10/20-24/10/21)



4. ELABORATION OF CRITERIA FOR SITE SELECTION IN THE SCHOOLS' PREMISES

Building selection (i.e. schools and other public buildings) for the implementation of projects concerning the use of shallow drilling for irrigation, sanitation and energy use should be evaluated by a number of criteria related to:

- The existence of an aquifer.
- The location of the building.
- The size.
- The facilities and areas of the building.

Existence of an aquifer

Groundwater maps

Indication, but not accurate, of groundwater availability could be given by Geodata maps (<http://geodata.gov.gr/maps>). The website of MoE provides maps that include the Greek groundwater boundaries. Groundwater is the sum of the water beneath the surface of the soil, in the saturation zone and in direct contact with the soil or underground. The last revision of these maps took place on 4/11/2015.

Therefore, if the location of the building is included in similar groundwater maps, it means that water is likely to be at a shallow depth.

Hydrogeological study

The existence of an aquifer is certified, for each area, through an appropriate hydrogeological study. The main purpose of the study is to record the current status of the groundwater reserves and to propose plans for future groundwater reuse projects. In addition, it provides knowledge of the hydrological behavior of the formations, estimation of their water potential and identifying problems that may arise during their exploitation. Furthermore, it provides information on separation into good and bad quantitative zones and suggestions to manage them.

Therefore, it is the basic tool for documenting the existence of groundwater in the wider area of the building.



Criteria for the location of the building

Buildings outside urban zone

Buildings within the urban zone usually do not have green spaces in the backyard. As a result, buildings with green facilities outside the urban zone should be preferred so that a drilling can take place. Drilling has to be accompanied by proper permits, which is difficult to be done in the case of buildings within the urban zone.

Available surface for drilling

There should be room for drilling. The usual required space is not large (~ 4-5 m²). A fence for protection has to be installed and at a suitable location has to be chosen in order to minimize the risk of accidents. This area should also be within walking distance of the drilling water use points, in order to reduce the cost of construction of the water network and its proper operation.

Ability to enter the building site vehicles for construction work and especially for drilling work.

Basic and necessary condition. Drilling cannot exist without direct access and routing for heavy duty machinery.

Size of building

The size of the building is a criterion of low weight but it affects the size of the premises. It is believed that larger and newer buildings have large population buildings, in which interventions can be done. In addition, they have higher consumption so the installation of drilling to meet water needs in sanitary facilities makes sense. It is also noted that larger schools are more likely to have green facilities for the use of irrigation water.

Facilities and spaces of the building

Gathered sanitary facilities

In most school buildings, sanitation facilities are concentrated in one place per floor. As a result, drilling water networks can be made without high cost of piping and high running costs.

In the case of old buildings, there is the possibility of scattered installations that do not fit the network. It is, therefore, important to state that sanitation facilities are concentrated on one side of the building.



Lands of greenery for irrigation

As mentioned in the previous paragraph, there should be such facilities, otherwise it does not make sense to use drilling water for irrigation.

Electromechanical installation facilities

The criterion of space is very essential for the electromechanical installations. A space of 30 m² is required near the sanitary facilities. If not, it is difficult to locate the positioning of the facilities.

Criteria for designing plants for energy purposes

Specifying the energy uses

Drilling water can also be used for purposes other than irrigation and sanitation. Heating and cooling needs of buildings, as well as hot water (energy uses), utilizing geothermal energy are some examples. Geothermal energy is defined as the use of energy from the inside of the soil by means of geothermal pumps (heat transfer from and to the ground).

Drilling water utilization criteria for energy uses

Air conditioning (heating, cooling) is the main area – energy use. Therefore, utilizing geothermal energy will help save energy and reduce greenhouse gas emissions (climate change). This criterion is critical for large area buildings and users (such as public buildings, schools) and old buildings (exposed buildings, high temperature openings, etc.). It is emphasized that in order to improve the energy performance of a building, the design and installation of energy efficient air conditioning systems is not enough. Several interventions in the building shell (building blocks, openings) is necessary to be done. In addition, if the use of geothermal heat pumps is economically acceptable, it could be used for cooling in the building.

The criteria for the use of geothermal energy include the following:

- Sufficiently insulated buildings of category B+ of KENAK
- Cooling need of the building
- Available spaces for installation of equipment

The evaluation of the criteria mentioned in the previous chapter is based on the following table:



Table 2. Importance factors and criteria evaluation				
A/A	CRITERION	YES	NO	IMPORTANCE
1. Existence of aquifer				
1.1.	Initial indication from Geodata groundwater maps			□□
1.2	Groundwater hydrogeological study of the wider area of the building			□□□
2. Criteria for the position of the school				
2.1.	Building outside the urban zone			□□
2.2	Available surface for drilling			□□□
2.3	Ability to enter in the school premises vehicles for work			□□□
3. Building size				
3.1	Population			□
4. Facilities and premises				
4.1	Gathered sanitary facilities			□□
4.2	Lands of greenery for irrigation			□□□
4.3	Available spaces for installation of electromechanical installation			□□
5. Good use of energy				
5.1	Building rating by KENAK (>B+)			□□□
5.2	Building cooling needs			□□□
5.3	Available spaces for installation of electromechanical installations			□□

5. ON SITE MEASUREMENTS FOR GROUNDWATER QUALITY OF PUMP

Table 3 presents several mean characteristic values of the drilling installation that are result of calculations using data collected from the monitoring system during period 28/10/2020 – 24/10/2021.



Table 3. Mean values of installation's consumption

Data			
<i>Days (total)</i>	361	<i>Average energy consumption/m³</i>	
<i>Min consumption (kWh)</i>	354,60	18,69	kWh/m ³
<i>Max consumption (kWh)</i>	4531,08	<i>Average energy consumption/day</i>	
<i>Min water flow (m³)</i>	4,76	11,57	kWh/day
<i>Max water flow (m³)</i>	228,28	<i>Average water flow/day</i>	
		0,62	m ³ /day
Total			
<i>Total consumption (kWh)</i>	4176,48	kwh/m ³ /day	0,05
<i>Total water flow (m³)</i>	223,52		
<i>Emissions</i>		8,7	kg CO ₂ /m ³

Conclusions extracted from data are:

- The capability of pumping could be higher. During summer period, irrigation's system flow could be increased.
- From the beginning, a total amount of 223,5 m³ of water was pumped.
- Energy consumption is not low and calculated at 11,57 kWh/day (this is also the function cost of the installation)
- Mean consumption for irrigation system of school's trees is 0,62 m³/day.

6. POLICY REPORT DOCUMENT ON THE SIMPLIFICATION OF PERMITS REQUIRED, AND THE ELIMINATION OF BUREAUCRATIC BARRIERS FOR BOTH COUNTRIES (GREEK PARTNER CONTRIBUTION)

Authorization process and required documents

For new waterwell projects, the Greek ministerial decision 146896 applies "Categories of licenses for the use and execution of water use projects. Procedures and conditions for issuing licenses, their content and validity and other relevant provisions" Government Gazette 2878/2014. According to this decision, the following apply to the authorization process of the project:



Article 4: Authorization procedure

1. The issuance of a water resource or/and water use project authorization, requires the interested party to submit in three times (the original in hard copy and digital form accompanied by two copies) to the relevant department of the relevant municipalities where applicable, hereinafter referred service. The file contains an application with the required supporting documents as set out below. The host agency must provide interested parties with the application in hard copy as long as electronically and provide the necessary assistance and information to complete it properly.
2. The host service carries out a formal check on the completeness of the file in order to determine whether the required supporting documents have been provided and whether the application details are complete and in addition: a) if the host service is municipality, it will be examined whether the water needs for the intended use are or could be covered by a public or municipal water supply network and b) if the host is region, the possibility of covering the requested needs by a public or municipal water service provider shall be considered on its own initiative. In the event that the above-mentioned network is found to be covered or capable of covering the needs requested, the provisions of article 8 of the above decision 146896.
 - 2.1. The audit shall be carried out within ten (10) business days of the date of submission of the file. During this time, the host may ask the interested party to write any clarifications, as well as additional information and supporting documents in support of its request. In this case and after the submission of the requested information, the deadline for examination of the file shall be extended by five (5) additional working days. In the event that the file is found to be manifestly incomplete, the service shall return the file to the person concerned without delay in writing.
 - 2.2. The host agency carries out the necessary sample checks in accordance with paragraph 3 of article 10 of Law 3230/2004 and in its opinion, the necessary on-the-spot checks to facilitate its work. In this case, the above deadline shall be extended for a further ten (10) working days.
 - 2.3. Upon completion of the formal check of the file, the host within (5) five working days, shall draw up a summary report on its actions. After retaining a copy of the file, they shall send the original file in hard copy and digital format as well as the other copy of the file along



with its report to the competent Directorate for Water of the Decentralized Administration.

3. Upon receipt of the dossier, the competent Directorate of Water of the Decentralized Administration shall examine and evaluate its compatibility with respect to (a) the River Basin Management Plan, (b) any regulatory measures and restrictions that may have been adopted, (c) any legislation that may specify a specific water protection regime in the area and (d) the general water management policy of the area in pursuit of the environmental objectives set out in Article 4 of decision 51/2007.

- 3.1. The above evaluation is completed within twenty (20) business days of receipt of the dossier. During this time, the above service may ask the interested party to write any clarifications, as well as additional information and supporting documents in support of its request. In this case the above deadline may be extended for another five (5) business days.

4. Within fifteen (15) business days of completing the evaluation of the dossier in accordance with paragraph 3, the licensing authority shall issue a permission to execute water resources and/or water use projects, or a decision to reject the application license. The rejected decision, which is issued by the Secretary General of Decentralized Administration upon recommendation by the competent Directorate of Decentralized Water, must be adequately reasoned.

- 4.1 The licensing authority, at its discretion, may carry out on-the-spot checks to facilitate its work, either independently or in co-operation with the host services concerned.

- 4.2. Upon issuance of the license, the licensing authority shall inform the relevant municipality concerned and shall make available, upon request, a copy of the licensing dossier to facilitate checks.

5. In the case of new projects to meet public utility needs or new projects financed by the European Union, the licensing authority may consider giving priority to applying for a permission for the execution and/or use of water if the person concerned submits a preference request together with the necessary information, documenting the need to expedite the issuance of such authorization.

This file is accompanied by the following supporting documents:

A. GENERAL DOCUMENTS

They are submitted to the host service.



- A1. Application - Statement
- A2. Cadastral map or topographic copy, or orthophoto map, or digital application image, or GIS topographic map on an appropriate scale, depending on the type and size of the project, presenting:
- a) the point of hydration with projector coordinates,
 - b) the outlines of the water use areas from the abstraction point, unless this information is provided by the Greek register as well as building and other installations, provided that they are connected and serviced or serviced by the project,
 - c) for linear projects, the route and the coordinates of the beginning and the end of the project and the focal points of their route.

B SPECIAL DOCUMENTS IN CASE

- B1. If the applicant is acting on behalf of a legal person, a legal authorization of representation.
- B2. Opinion of the competent Archaeological Services for the construction of the required works if they are located in whole or in part within a declared archaeological site, protection zones A or B or near ancient, within the meaning of Articles 12, 13 and 10 par. 3028/2002 (AI53).
- B3. Opinion of the competent Forestry, Environmental Services and / or Management body in the case of projects which are wholly or partly in the NATURA 2000 area, in forest areas and in general areas of special protection.
- B4. For surface water abstractions (watersheds, lakes) of Category A projects, a hydrological study that captures the other hydrations from that surface body and includes the minimum downstream benefits required to protect the environment and to provide quantities for the needs of downstream water uses during peak demand. For surface water abstraction (watercourses, lakes) Category B hydrological report which captures the other abstractions from this surface body and includes the minimum downstream requirements required to protect the environment and to provide the quantities for their needs downstream water use during peak demand.
- B5. For drillings/wells/springs, hydrogeological report includes at least:
- Technical characteristics of water intake (such as depth, anchorage diameter, type and diameter of piping, type and diameter of piezo tube in case of drilling).
 - Geomorphology of the area.
 - Geological - Hydrological - Hydrogeological Elements (such as geological formations, hydrogeological behavior of formations, expected level - flow)



- Geological map of the area - assessment of the quantitative and qualitative status of the groundwater body in accordance with the current Management Plan.

B6. In case of individual water supply, building permit or legalization document from the competent town planning authority or permit.

B7. Specific drilling level lowering program for quarrying / mining and protection of technical works, including a provision for the use of abstracted water.

C SUPPLEMENTARY DOCUMENTS

The supporting documents shall be filed with the competent Water Directorate, in accordance with the river basin management plan concerned and any applicable regulations.

The term of validity of licenses follows the revision cycle of the Management Plans and for licenses issued after the entry into force of the KYA their validity is set to one (1) year after the second revision of the River Basin Management Plans, that is, until 2022.

WATER LICENSE PROCEDURES

Procedure and required supporting documents

The provisions of the previous paragraph shall apply accompanied by the following supporting documents:

A. GENERAL DOCUMENTS

A1. Application - Statement

A2. Cadastral map or topographic copy, or orthophoto map, or digital application image, or GYS topographic map, on an appropriate scale, depending on the type and size of the project, presenting:

- a) the point of abstraction with projector coordinates,
- b) the outlines of the water use areas from the abstraction point, unless this information is provided by the Greek register.

B. SPECIAL DOCUMENTS IN CASE

They shall be deposited with the Host in accordance with Article 4 (2).

B1. New projects require:

- a) Any other technical data reports/studies requested by the competent Directorate of Water for Decentralization at earlier licensing stages. (b) Project implementation report which shall include at least:

- Execution site.



- Technical specifications of hydration such as: drilling method, drill type, operator name, project execution dates, depth of drilling, type and diameter of tubing, type and diameter of piezo tube, hydrostatic flow meter, flow meter, flow meter.
- Geological-hydrological-hydrogeological data that emerged during the execution of the project. Perforation stratigraphy and recording depth and type of aquifers.
- Estimation of project capacity (especially in wells after test pumping).
- Calculation of hydraulic parameters of water permeability, water transfer capability after pumping, as well as radius of convection from the abstraction, and estimation of interactions with adjacent abstractions and impacts on existing water projects.

B2. If the applicant is acting on behalf of a legal entity/collective body, a legal authorization of representation. In this case, a copy of the legal constitution of the legal entity of private law or of the collective body shall also be accompanied by any amendments thereto.

B3. For agricultural use recorded in the Integrated Management and Control System (IACS), copies of statements of the last five (5) years.

C. SUPPLEMENTARY DOCUMENTS

They shall be deposited with the competent Water Directorate if required, in accordance with the river basin management plan concerned and the applicable regulations.

7. MONITORING OF GROUND WATER QUALITY AT THE PUMP

The results of the first water analysis are presented in the following table. A comparison between them and the parametrical limits is also conducted.

The red values concern the parameters above limits of drinking water. These are the following:

- Total plate count 36 °C, with an above-limit value
- Coliforms, with intense presence
- Escherichia coli, its presence doesn't suit with standards
- Enterococcus, same image as Escherichia coli
- Total dissolved salts (TDS), above limits
- Total hardness (TH), above limits



- Chlorides (Cl^-), above limits
- Sulfates (SO_4^{-2}), above but close to limits
- Sodium (Na), above limits

Comparing the results of the (4) analysis with the help of the following Table , it seems that the microbiological characteristics of the 2nd, 3rd and 4th analysis are better than those of 1st:

- Total plate count at 36 °C presents lower value but still above limit
- Coliforms' value still above limit but presents big reduction (increase at 4th analysis)
- Escherichia coli's value still above limit of zero but reduced
- Enterococcus presents same image as Escherichia coli except from 3rd analysis where it present big increase

The rest physicochemical categories present small differences in certain values between the 4 analysis:

- Electrical conductivity is increased at 2nd analysis, which suggests higher content in salts thus in 3rd analysis level falls lower than 1st analysis.
- Total dissolved salts' increased level of 2nd analysis and its reduced value at 3rd analysis confirms the above.
- Total hardness is through all 4 analysis above limits, with the value of the 2nd analysis being a bit more increased than the other.
- F- and Cl- concentrations of third analysis are a bit reduced in comparison with the former two, while NO₃⁻ and SO₄⁻² concentrations are following the opposite route during 2nd analysis but present reduced values at 3rd analysis. It is noted that the chlorides and sulfates of the 4th analysis are below the limit.
- Concerning metals' category, between 1st and 2nd analysis there is an increase in concentration values of Na, Cr, and Fe while between 2nd and 3rd they follow an opposite path. In the case of Mn, there is a reduction between 1st and 2nd analysis which continues further.

The four analysis don't present, in general, big differences except from microbiological values of 2nd, 3rd and 4th analysis, that are better than values of 1st. The exception is enterococcus' concentration which is very increased during



3rd analysis. Moreover, coliforms' presence is significant and it is thought to be a result of wastes of the nearby installations and streams.

According to all the above comments, drilling water is characterized as non-drinking and unsuitable for use in the hygiene installations (WC) of the school. More water analysis will be conducted in order to prove the fact mentioned.



Table 4: Comparison of Water Analysis Results – Drinking water limits						
Parameter	Units	Result				Limits ¹
Microbiological Test						
		Analysis				
		1st	2nd	3rd	4th	
Total Plate Count 36°C	CFU/ml	680	220	250	41	20
Coliforms	CFU/100 ml	280	4	6	22	0
Escherichia coli	CFU/100 ml	1	<1	1	<1	0
Enterococcus	CFU/100 ml	1	<1	7	<1	0
Physicochemical Tests						
pH	pH units	7,74	7,7	7,52	7,68	≤6,5 και ≥9,5
Electrical Conductivity 20°C	µS/cm	2260	2316	1922	1650	2500
Total dissolved salts (TDS)	mg/L	1684,3	1726,1	1432,4	1229,7	250
Total hardness (TH)	°F	25	26,2	24,9	24,3	6
Ionic chromatography						
F⁻	mg/L	0,75	<0,45	0,44	0,34	1,5
Cl⁻	mg/L	340,08	314,67	302,56	234,68	250
NO₂⁻	mg/L	<0,45	<0,45	<0,30	<0,30	0,5
NO₃⁻	mg/L	16,2	19,32	18,88	13,56	50
PO₄⁻³	mg/L	<0,45	<0,45	<0,30	<0,30	5
SO₄⁻²	mg/L	267,93	288,57	253,54	201,94	250
Metals						
Ca	mg/L	45,94	47,75	46,23	45,24	100
K	mg/L	1,4	1,63	1,70	1,52	12
Mg	mg/L	32,85	34,79	32,52	31,46	50
Na	mg/L	330,6	359,27	337,13	268,84	200
As	µg/L	<3,3	<3,3	<3,3	<3,3	10
Cd	µg/L	<1,65	<1,65	<1,65	<1,65	5
Cr	µg/L	<3,3	4,5	<3,3	<3,3	50
Fe	µg/L	33	56,7	34,1	<10	200
Mn	µg/L	31,2	14,8	7,3	4,2	50
Ni	µg/L	<3,3	<3,3	<3,3	<3,3	20
Pb	µg/L	<3,3	<3,3	<3,3	<3,3	10

¹ Source: GG 3282/B/19-9-2017 and European Union Legislation 2020/2184/16-12-2020)



8. EVALUATION OF THE ENVIRONMENTAL AND SOCIAL BENEFITS

Procedure of carbon footprint calculation

In this application we consider the fingerprint to be:

The direct emissions of the pumping and irrigation system

The emissions of the pumping system are practically due to energy consumption, as no chemicals are used, no water is chlorinated and there is no other direct or indirect emissions. In practice, the broadcasts are only direct.

Equivalent emissions of water being replaced due to the above use are due to:

- In pumping, drilling, transport and storage systems
- In water treatment systems to make it drinkable
- In the transmission and distribution networks through pumping stations to the end users

Carbon footprint of drilling energy

The installation consumes electricity in detail, so the emissions are indirect and are due to the use of electricity. These indirect emissions are given for the consumption of electricity depending on the provider on an annual basis. They differ depending on the mix of energy production that each provider has.

These indirect emissions change on a daily basis as the power generation mix is constantly changing. The average annual figures that will be used here, for 2020, are given in the annual report of DAPEEP and are presented in the following table. Since the school is supplied by PPC, the emissions due to electricity consumption are 468.26 gCO₂ / kWh.

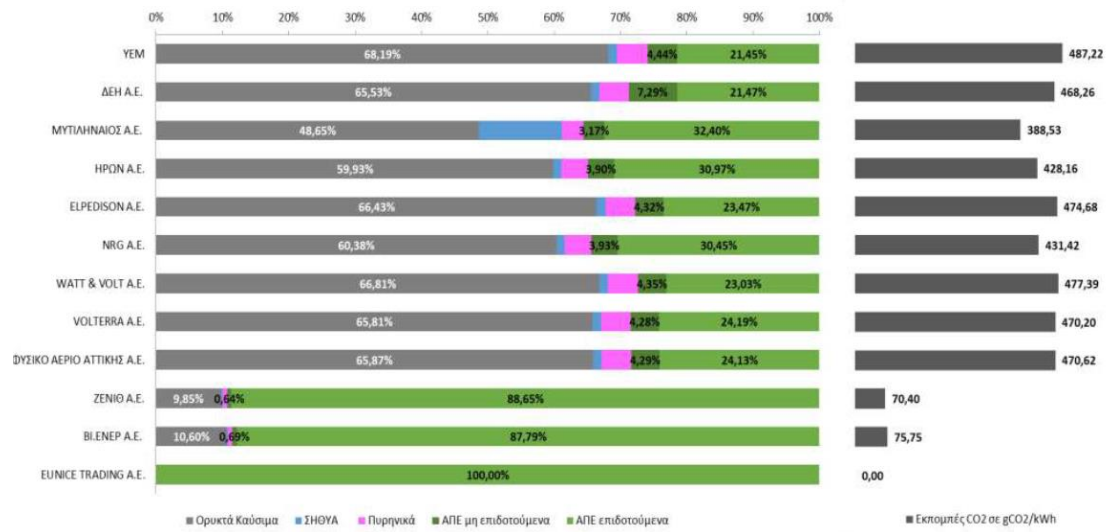


Image 12: CO₂ emissions per provider

According to the above, electricity is consumed only for the process of pumping and transporting drilling water for irrigation. Based on Table 1, this electricity consumption per cubic meter is estimated at 18.69 kWh / m³. Therefore, 8.7 kg CO₂ / m³ are indirectly released from the drilling operation for irrigation.

This imprint can not be directly compared with the corresponding imprint of EYAth (from which the school would supply the corresponding amount of water), as there are no published data. This footprint is probably smaller due to the size of the facilities.

In any case, however, it should be taken into account that there is an immediate reduction of the water footprint through the reduction of the network water by 226 m³ / year.

SOCIAL BENEFIT

In addition to the environmental benefits of the project, mentioned above, it is worth mentioning its particularly direct and indirect social benefits.

The Municipality of Pylea - Chortiatia through its participation in this European Program invests in projects which:

- present the social actions of the Municipality which can be a model for the citizens, raising their awareness regarding the sustainable use of water
- create new jobs in the context of assignment, implementation and management of the Program (consulting company, drilling construction company, etc.).



In terms of indirect social benefits, they stem mainly from the opportunity given to the whole school to watch the process for life, to study it, to evaluate it and to ask questions about the ways and techniques that govern it.

One of the most important parts of society as a whole that must be aware of environmental issues, and in particular the major issue of water resources protection, is today's youth, the students. Informing them on relevant issues through the transfer of knowledge by experts or even better through actions in which they are actively involved are appropriate for a better understanding of the subject.

As it is already known, the location of the installation of this drilling is next to the 1st General High School of Pylea. This allows the students - and not only - to be in direct contact with the project. The mode of operation of the drilling system as well as the results of its use are immediately visible. This can be a motivation for teachers to incorporate in their teaching more practical applications of the theory they teach. Through experiential learning clearly better results are achieved: Students can see and understand the real operating conditions of the drilling as well as appreciate its benefits.

Through awareness-raising, students have the opportunity to broaden their horizons, making it very likely that some of them will delve even deeper into the issue in the future, seeking solutions to problems that arise or even improvements. Still, no one could overlook the fact that the aforementioned further engagement-study of the object of the project may well be a stimulus in the context of the career guidance of a prospective student.

In recent years, the effects of climate change have become more apparent than ever before with enormous environmental, social and economic consequences. There is an urgent need to implement actions aimed at promoting sustainable development and ensuring environmental protection.