

Work Package 4

Elaboration of studies

Deliverable 4.6.3

Design of the conjunctive water and energy conservation system for third party

Beneficiary 6 (PB6) - Municipality of Petrich

**INTERREG V-A COOPERATION PROGRAMME:
GREECE – BULGARIA 2014-2020**

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Summary Report

- An external expert from HIDRORESURS Ltd. provided opinion about the new system and how it to be used for the needs of the population of the village of Kavrakorovo. A design of irrigation system was drafted to find an optimal solution for choosing a system for exploitation of the well.

The Well Design:

- Depth – 60m
- The well is built from an operational-filter PVC column with a diameter of $\varnothing 160 / 7.7$ mm, composed of blind pipes and filters in the range from 0 to 60 m and a conductor solid PVC column with a diameter of $200 / 3.9$ mm in the range from 0 to 10 m.

Around the mouth of the well is built an water-meter shaft from reinforced concrete with dimensions 230 cm x 200 cm x H=280 cm, covered with a metal lid and locked with a padlock.

The main parameters of groundwater abstraction, according to the Permit for groundwater abstraction issued on 25.09.2019 are:

- Drawing period - seasonal (in the period 01.04 to 30.10 month of the year or about 214 days a year);
- The forecasted annual volume of groundwater abstraction \approx up to 20 780,5 m³ / year.
- Daily volume of pumping \approx up to 97.11 m³ / day.
- Average annual flow rate \approx 0.66 l / sec.
- Maximum pumping flow - 9.6 m³ / h (2,666 l / sec) / for a period of up to 10 hours and 7 minutes /.

The Operating resources of the new facility are:

Technically possible annual flow rate calculated by hydrodynamic method is up to 53 926,56 m³ / year, and the possible annual flow rate calculated by hydraulic tests is up to 162 725,76 m³ / year.

Water flow on hourly basis – 9,6 m³/h

Water flow on daily basis – 97,11 m³/day

Field tests were performed to check the functionality of the groundwater facility, as well groundwater quality measurements were performed.

According to Physical -Chemical analysis of the groundwater samples:

Water temperature : + 13,5oC (means "cold")

Water type: Hydrogen Carbonate- Calcium-Magnesium- Sodium-Sulfate

On the basis of the value of the chemical indicators that determine the pollution of the groundwater with products from organic decay and decomposition of substances of animal and plant origin and fertilization with artificial fertilizers as follows:

(ammonia - <0.30 mg / l, oxidizability - 0.96 mgO₂ / l, chlorides - 36.29 mg / l, nitrites - <0.02 mg / l)

It can be concluded that the groundwater lacks such pollution.

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The chemical composition of the groundwater entirely meets the criteria of Annex 1, Article 10, paragraph 2, item 1 of the Regulation No.1 of 10.10.2007 on the exploration, use and protection of groundwater, excluding Fe content ($\text{Fe}^{+2} + \text{Fe}^{+3}$) - 360 $\mu\text{g/l}$ (the allowable value is 200 $\mu\text{g/l}$)

The tests for the quality composition of the groundwater are carried out in an accredited laboratory, having ISO 9001 and 9002, as the test methods are in compliance with the values of the ecological threshold for groundwater under Regulation 1 No.1 of 10.10.2007 on the exploration, use and protection of groundwater.

The extraction of underground water will be carried out by means of a submersible pump with a maximum flow rate of up to 9.6 cubic meters per hour. The daily extraction of underground water will not exceed the permitted volume of 97.11 cubic meters per day. The annual volume of extracted water quantities will not exceed 20,780.5 cubic meters per year.

Water supply is intended to be provided by the submersible groundwater extraction pump installed in the tube well, which draws water from a Precambrian aquifer. Rotor and deflector spreaders are included for spotting areas. Each sector is controlled by electromagnetic valves.

The parameters of the automated system are adapted to the requirements of the pump: flow = up to 150 liters per minute at pressure = up to 6.0 atm. A $\Phi 50$ mm supply pipe starts from the submersible pump, from which each individual unit with valves is supplied with outputs.