

Water Wells Monitoring Using SCADA System for Water Supply Network, Case Study: Water Treatment Plant Urseni, Timis County, Romania

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Abstract. The water supply system in Timisoara Municipality is insured with about 25-30 % of the water demand from wells. The underground water headed to the water treatment plant in order to ensure equal distribution and pressure to consumers. The treatment plants used are Urseni and Ronaț, near Timisoara, in Timis County. In Timisoara groundwater represents an alternative source for water supply and complementary to the surface water source. The present paper presents a case study with proposal and solutions for rehabilitation /equipment /modernization/ automation of water drilling in order to ensure that the entire system can be monitored and controlled remotely through SCADA (Supervisory control and data acquisition) system. The data collected from the field are designed for online efficiency monitoring regarding the energy consumption and water flow intake, performance indicators such as specific energy consumption KW/m³ and also in order to create a hydraulically system of the operating area to track the behavior of aquifers in time regarding the quality and quantity aspects.

1. Introduction

Timisoara water supply system receives water from two different sources: surface water from the Bega River and underground water from several water collection fronts. The water supply system is managed by the local water supply network Manager, Aquatim S.A.

These wells provide about 25-30% of the city water demand and the water intake is directed into a treatment plant Urseni and Ronaț, in order to ensure equal distribution and pressure to all consumers. In Timisoara underground water represent an alternative and complementary source for the surface water source.

Having two water sources for the water supply of Timisoara offers more security and flexibility for the local water supply network manager, because the two sources can be used alternatively when needed.



2. Underground water collection front Urseni

The groundwater source which supplies the Water Treatment Plant Urseni is equipped with two water fronts:

1. *The capture front Southeast Timisoara (old front)* - captures water at depths between 60-80 m, with a designed capacity of 210 l/s.

The 16 water well drilling are organized into well groups, which are named as follows:

-GF III – a total of 5 wells (a, b, c, d, e), equipped with Grundfos submersible pumps

-GF IV– a total of 5 wells (a, b, c, d, e), equipped with Grundfos submersible pumps

-GF V– a total of 4 wells (a, b, c, d), equipped with Grundfos submersible pumps

-GF VI– a total of 2 wells (b, e), equipped with Grundfos submersible pumps

Besides the 4 well groups exist inside the water plant 3 boreholes: F1c, F1d and F1e, equipped with HEBE submersible pumps.

Measurement of the water flow captured by each group of wells or drilling is performed with MEINEKE counters equipment.

This capture front ensures a water flow of 93 l/sec

2. *The capture front Eastern Timisoara (new front)* captures water at depths between 110 m-160 m through 40 boreholes with a projected flow of 600 l/s with and a water rate of exploitation flow of 325 l/s. The 40 boreholes are equipped with submersible pumps Grundfos and Goulds and MEINEKE counters. The water from 40 boreholes reaches the treatment plant through a telescope adduction, composed of three sections with diameters of 600mm, 800mm and 1.000 mm. The adduction pipe is made of pre stressed concrete pipes (PREMO). In various places the prestressed concrete tubes are joined with the metal sections of steel of the same size.

3. Constructive proposal details to ensure monitoring and remote control of boreholes

Regarding their structural strength, the inspection pit and cabins of the designed wells are proposed solutions that will provide waterproofing rehabilitation and thermal retaining for the drilling cabins. The rehabilitation will include the access doors, the manhole, and the sealing of the wells cabins. Restoration actions will include plaster, washable paint and paints resistant to moisture used inside cabins and manholes of the boreholes.

For the mechanical works and utilities are proposed dismantling measures of all non-functional mechanical facilities from the boreholes cabins. Mechanical works will be executed using proper material for the processes [1]. All the hydraulic equipment will be replaced (pipes, fittings, accessories and existing jointing systems), there will be provided replacement of water meters with electromagnetic flowmeters. The existing submersible pumps will be checked and replaced where appropriate with new pumps with higher efficiency operating point (rated speed).

The inspection works and rehabilitation of boreholes including desanding where necessary according to the inspection report [2, 3]. In terms of electrical and automation works are proposed rehabilitation of inside lighting of the wells cabins and the use of efficient energy lighting. Proper ventilation system was ensured and temperature control for the optimum functioning in the electric supply panel with electricity and automation of boreholes. There were conducted dismantling measures of all non-functional electrical installations from the wells cabins. All necessary measuring equipment to monitor the level of pressure and energy was installed.

It was ensured the functionality of the submersible pumps with variable speed by using frequency converters to enable the optimal flow rate [4].

For the submersible pumps were ensured the following operating conditions:

- Manual - Local Mode (for maintenance)
- Distance - Manual Mode (on/off pump)
- Automatic mode with adjustable flow pumped for

- maintaining a prescribed flow rate
- maintaining a minimum level of water in borehole – the minimum hydrodynamic level

For this purpose the wells will be equipped with:

- electromagnetic flowmeters
- hydrostatic level transducers
- pressure transducers

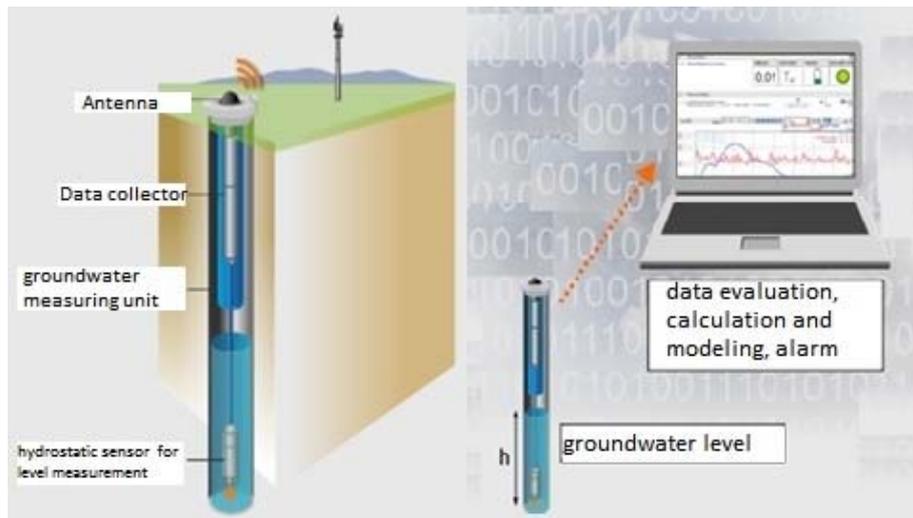


Figure 1 Radio communication or GPRS Remote control of boreholes

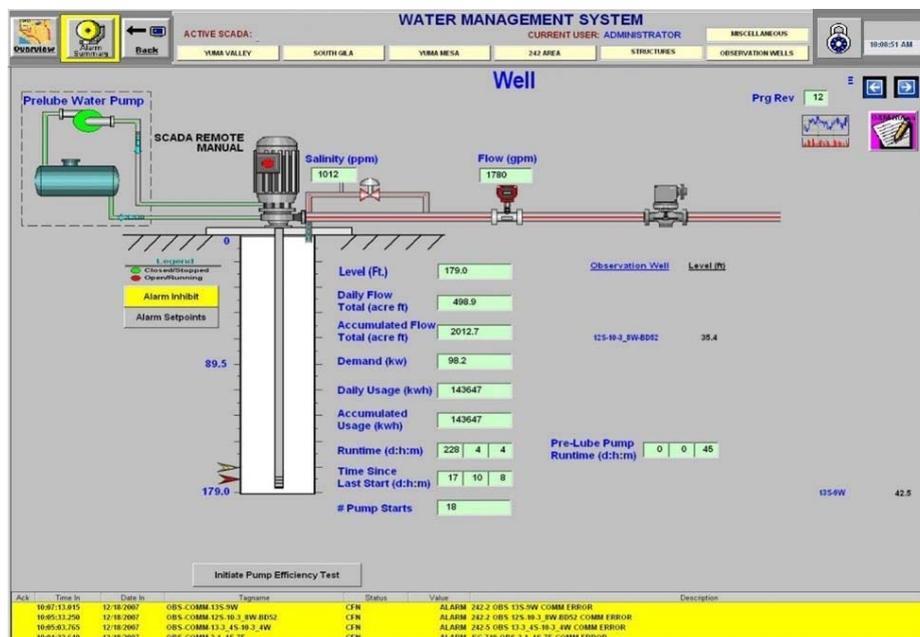


Figure 2 SCADA system – underground water management

After the completion of all works and installation for the specific equipment it is desired to implement a system to monitor and remote control the wells through RTU type equipment in order to integrate it into the SCADA Dispatch of Water Treatment Station Urseni and also to ensure the monitoring boreholes at the Operational Regional Water Treatment Station Bega [5].

Automation panels of the boreholes must ensure their operation in manual or automatic remote local [6, 7] (for example: radio communication in an unlicensed frequency band or GPRS).

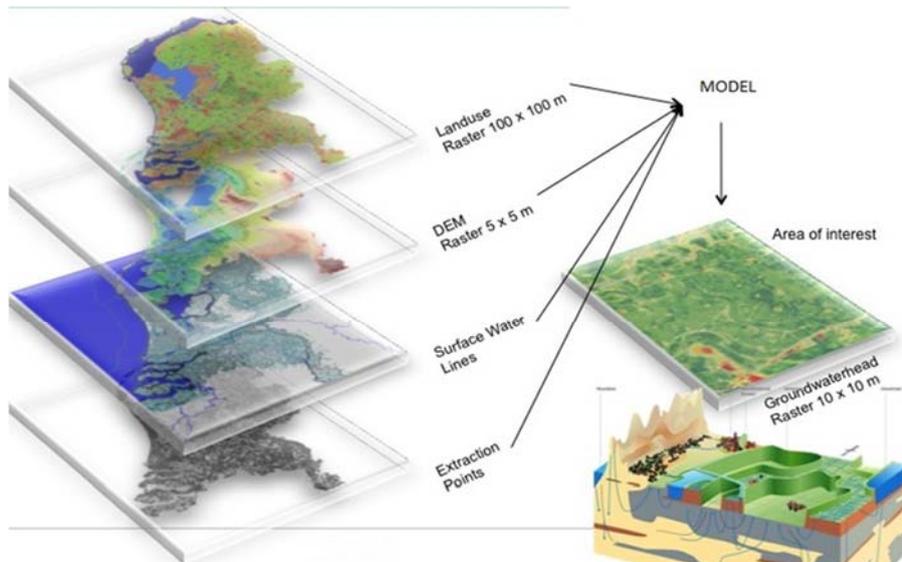


Figure 3 The Hydraulic model system

The equipment will have to implement the following protections and minimum facilities:

- an analog input to measure the water level in borehole;
- an analog input pulse to measure water flow pump, and reading index (volume of water pumped) will use a data interface serial Modbus, Profibus etc.
- an analog input for measuring water pressure in the pressure pipe;
- a digital input for pressure switch
- a phase imbalance protection
- a power supply protection Umin and U max
- protection for missing phase/phase sequence
- short-circuit protection
- pump motor overheat protection
- protection from moisture in the pump motor terminal box
- surge protection
- an electric size analyser (current, voltage, power, energy index)
- an hours counter of operation
- a sensor input for burglary
- an installation of equipment for the security objectives.

4. Conclusions

This solution for the rehabilitation/equipment/modernization/automation of drilling was adopted to ensure that the entire system can be monitored and controlled remotely through SCADA system.

The data collected from the field are designed for online monitoring of the efficiency in terms of energy consumption and water flow intake performance indicators such as specific energy consumption KW/m^3 . The operation of equipment in the field in normal conditions will provide the possibility to monitor and intervene in real time with the purpose to reduce potential damage. Remote operating capability without the need to make evaluation on the site for specific actions is an important accomplishment that is currently lacking in the case of boreholes being scattered over a large area.

Online synoptic graphing monitoring of the entire technological flow, the acquisition of long-term data and storing them in order to create a hydraulic system of the operating area to track the behavior in time of aquifers in terms of quality and quantity presents a high importance in quality water monitoring.

References

- [1] Binnie, Chris, Kimber, Martin, & Smethurst, George, Basic water treatment (3rd ed.). London: Thomas Telford Ltd 2002.
- [2] C. Florescu, I. Mirel, Carabeț A., Stăniloiu C, Water supply, www.ct.upt.ro/users/ConstantinFlorescu/index.htm, 2015.
- [3] Giurconiu M., Mirel I., Carabeț A., Chivereanu D., C Florescu, Stăniloiu C., Construcții și instalații hidroedilitare, Vest Publishing House, Timișoara, 2002
- [4] I. Haiduc, environmental chemistry. Water quality control, Babeș–Bolyai University Publishing House, Cluj–Napoca, 1996.
- [5] V. Rojanschi, F. Bran, G. Diaconu, Engineering and environmental protection, Second Ed., Economic Publishing House, București, 2002.
- [6] V. Rojanschi, T. Ogneanu, The book of the operator in stations and wastewater treatment, Publisher. Technical Publishing House, București, 1989.
- [7] Vigneswaran, S. & Visvanathan, C., Water treatment processes: Simple options. Boca Raton, Florida: CRC Press. 1995.