IMPROVEMENT OF THE PRESSURIZATION STATION SPP 44, IRRIGATION SYSTEM OGRADA, ROMANIA

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Abstract. *In the conditions of the current climatic changes, the increase of temperatures during the summer periods is observed, respectively the accentuation of the drought, which leads to the necessity of irrigating the agricultural surfaces. This involves modernizing, expanding and increasing existing irrigation capacity. Most of the existing irrigation systems in Romania, due to their age and the accentuation of the drought, no longer meet the needs for obtaining a constant agricultural production, respectively an efficient agricultural production. This will be materialized by replacing the irrigation pipes with new pipes made of modern materials with lower roughness that ensure a higher transported flow, the replacement of hydrants and accessories as well as irrigation equipment. Increasing irrigation capacity leads to a substantial increase in water demand, which requires the replacement of existing pumps with new pumps with higher flows and high energy efficiency. This paper presents such a project for the modernization of an irrigation system composed of a pumping station, a network of underground pipes and irrigation equipment serving an area of 1245 ha. The proposed works will be limited to the improvement of the SPP44 pressure pumping station and irrigation system pipe replacement.*

Key words*: irrigation system, pumping station, improvement, cost of water supply.*

INTRODUCTION

The water supply of the arrangement is made from the Danube through the I.M. Georghiu base station and is pumped in the CA Lunca Canal. The socket of the floating station is located on the Crafna arm of the Danube River at km.221 + 650. The necessary flow for the Ialomiţa Călmăţui terrace is 110m3 / sec.

CA canal the 6.7 km long meadow leads the water through the Călmăţui-Gropeni meadow to the base of the Mihai Bravu terrace north of Spiru Haret, from where through the SRPA1 pumping station Spiru Haret is raised on the terrace and directed on the CA adduction channel Terrace. This channel is dimensioned in 3 sections (NATIONAL AGENCY FOR LAND IMPROVEMENTS, 2018):

- the first section with a length of 12,445 km crosses the area from the discharge basin of the SRPA1 Spiru Haret pumping station to DN21 Slobozia-Brăila, which it intersects to the south of Însurăţei locality.
- the second section is comprised between DN21 (km12 + 445) from the channel and the SRPA4 station at km30 + 835.
- the third section with a length of 2690 m is between km30 + 835 and km33 + 525.

From the main adduction channel CA Terasa derives in the following channels: CD1 at km2 + 285, CD3 at km10 + 750, CD7 near the SRPA3A station and CD9 fed from the downstream end of the CA Terasa channel.

The total length of the supply and distribution canals in the Ialomiţa Călmăţui perimeter is 318,886 km, the net surface of 137291 ha arranged for irrigation and consists of 512 plots, generally rectangular in shape.

From the CD3 channel, the CD5 channel stage 1 is formed in a length of 14.3 km, from which SRPA4 Bucșa is fed. This pumping station feeds 13.1 km long CD5 channels stage 2 and CD4B, CD4C. The latter channel supplies the SPP44 pressurization station serving 1245 ha belonging to OUAI Ograda (MAROSSY et al, 2016).

The SPP44 pumping station, proposed for rehabilitation, was put into operation about 30 years ago, it is an open above-ground construction.

The irrigation water is taken from the Danube by the basic floating station SPA I.M. Gheorghiu and pumped into the CA terrace terrace, after which it is repumped by the SRPA4 Bucşa station, after which it reaches the CD4B bypass channel from which the SPP44 pressure pumping station sucks (NATIONAL ADMINISTRATION ROMANIAN WATERS, 2018).

The object of activity of the O.U.A.I. The yard is the delivery of water for irrigation, administration, operation, maintenance, and repairs in the arrangement for irrigation Ialomiţa Călmăţui Terrace, serving agricultural land located on the territory of Ograda commune, Ialomiţa county (HAUSLER et al, 2020), (MAN et al, 2020), (PASC et al, 2020).

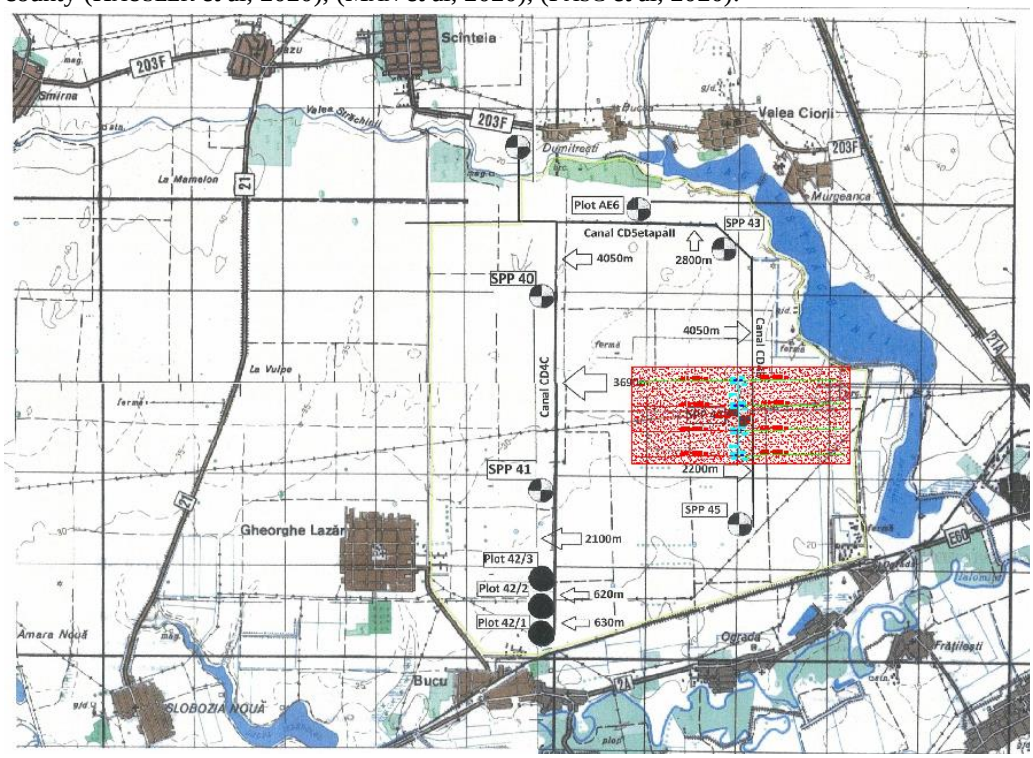

Figure 1. Area layout plan

PROPOSED WORKS

SPP 44 - Located on the CD4B channel, it has 6 units, mounted on base plates fixed in the tank floor, of which 3 units type MV 253x3 with 160 kW electric motor at 1500 rpm with 0.4 kV supply voltage, 3 VTP 1434-04 units with 132 kW electric motor at 1500 rpm with 0.4 kV supply voltage modernized by EAFRD. It is powered by 1600 KVA PTS type PT. It serves a net area of 1245 ha. The network of buried pipes consists of two CPs from which 8 antennas leave telescopically (PFA CIOCLOV, 2019).

Following the verifications performed on the technical expertise at the SPP44 pumping station, it resulted that the construction works are in good condition, they do not present visible defects (cracks, collapses, displacements, inclinations, etc.), which require consolidation works.

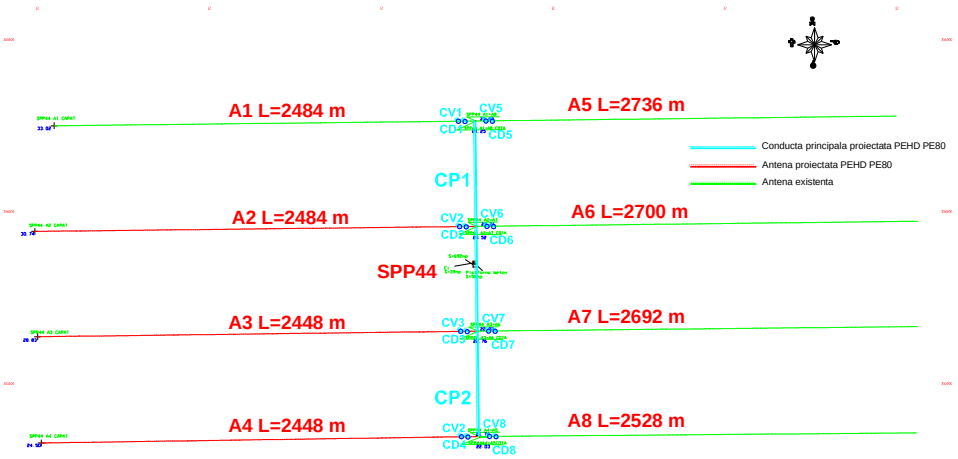

Figure 2. Master plan

On the technical condition verification, the following resulted:

● The SPP44 pumping station requires rehabilitation and re-equipment works, especially of the hydromechanical installations related to the three MV 253x3 type aggregates.

● The equipment related to the three MV 253x3 type aggregates mounted in the station are old (over 30 years old), are physically and morally worn and damaged.

● The basic pumps and electric motors related to the three MV 253x3 type units work poorly, with low efficiencies and high energy consumption.

● The discharge valves related to the three MV 253x3 type units operated manually, are worn, do not close perfectly, are difficult to open, block, etc. ;

● Retaining flaps have an advanced degree of wear due to age;

● The electrical installations related to the three MV 253x3 units are old, physically, and morally worn and no longer safe in operation.

● Main pipes, antenna pipes, main pipe valves and main pipe antenna connection valves are leaking, old, worn and must be replaced.

The refurbishment interventions provided by this project are proposed to be done on the plot related to the SPP44 station, by modernizing the equipment with high-performance pumps of the pumping station, modernizing the hydromechanical and electrical equipment in the station, replacing the main pipes, pipes of three antennas in ownership of the organization, of the valves on the main pipes and of the connecting valves with the antennas.

In order to bring the SPP44 pumping station to the superior operating parameters, operating with high efficiencies and low energy consumption, rehabilitation works are required which will consist of:

-disassembly of the equipment related to the three MV 253x3 type units existing in the station (pumps, motors, valves, dampers, mounting compensators, pipe sections, etc.);

-purchase of technological pumping equipment (pump and motor) with pumping height 60mCA and flow rates of 500 m3 / h for new basic pumps;

- the new electric pumps will be provided with frequency converters for taking over the flow variations and for protecting the electric motors and their economic operation;

-the valves and flaps on the discharge pipes will be replaced with new ones;

-electrical installations will be dismantled and will be replaced with new installations (general panel with USOL type switch, electrical panels for frequency converters);

- the main pipes and the pipes of the premo and azbo antennas of the station will be replaced with other pressure pipes made of HDPE dimensioned so as to meet the requirements of the irrigation installations equipped by OUAI members.

- CP and line valves will be replaced with new ones;

- water meters will be mounted on each antenna, after the line valve;

- the dismantling of the old equipment and installations will be done by qualified personnel respecting the current norms of labor protection and hygiene;

- the machinery, equipment, pipes and fittings that are replaced will be removed from the location of the stations and stored in spaces specially arranged for capitalization;

-rehabilitation works will not affect the environment and human health (LEGEA 50, 10, 137, 138, 28, 77, 125, 4.3.I).

RESULTS AND DISCUSSIONS

The proposed works will be limited to the refurbishment and consolidation of the SPP44 pressure pumping station.

The project will propose modern and energy efficient solutions for pumping units type MV 253x3 and related electrical installations, including by creating the possibility of varying the flow rates of the pressure pumping station, with variable speed, to increase the elasticity in operation of the modernized system. The main pipelines and the pipelines of three premo and azbo antennas of the station owned by the organization will be replaced.

By carrying out these modernization works, the cost of water at the SPP44 water delivery point will decrease by over 20.84%, the cost of electricity will decrease by over 27.2%.

Following the hydraulic calculations, the pressure distribution diagram for each main pipe was obtained (Figure 3).

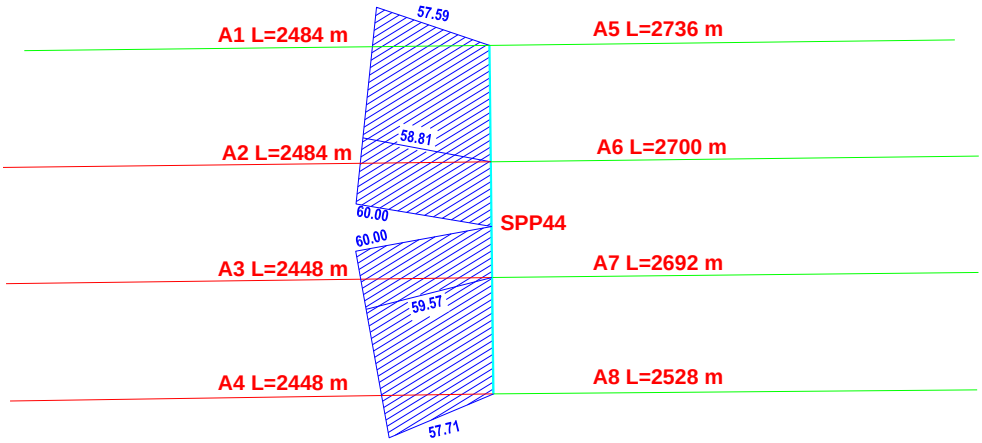

Figure 3. Pressure distribution diagram

CONCLUSIONS

Considering the degree of use of 85.00% of the surface of SPP44 station we have 1058 ha with a crop structure for 2013 - average year of the period 2010 - 2015 (according to Annex 2 to the multiannual contract): 300 ha of corn, 330 ha of wheat, 300 ha of sunflower and 128 ha of other crops; irrigation norms are 1000 m3 / ha for corn and 800 m3 / ha for wheat, sunflower and other crops, resulting in a volume of water per plant of 906.4 thousand m3; using a field watering efficiency of 75%, a transport efficiency between SPP and field of 90%, an SPP

pumping efficiency of 70%, a main canal transport efficiency of 70% and aggregate efficiency of pumping stations 60% - according to the Project for the Rehabilitation and Reform of Irrigation in Romania - we will have a volume of water taken from the source (SRPA4 Bucşa) of 4567.3 thousand cubic meters. This volume is used for three months: May, June and July, so for one month we will have 1522.4 thousand cubic meters of water taken from the source.

The cost of water supply to the hydrant represents the cost of electricity consumed with the pumping units of the station, the cost of the salaries of the serving staff of the station, the cost of transporting water from SPP to the hydrant, filling the network of buried pipes. Hydrant water delivery costs remained constant between 2010 and 2015, respectively at SPP44 - 250 lei / 1000 cubic meters.

To reduce the cost of water supply to the hydrant and reduce the cost of electricity, the MV 253x3 vertical pumps driven by the electric motor will be replaced with P = 160 kW and n = 1500 rot / min with high-performance vertical pumps driven by the electric motor with P = 110 kW, n = 1500 rpm, flow 500 m3 / h for SPP44 station. For flow variation and slow starts without current shocks the electric motors will be provided with frequency converters. Currently, the station has a specific consumption of 292 kWh / 1000 m3. By replacing the existing pumps with high-performance pumps, the specific consumption will be 242 kWh / 1000 m3, the water saving (loss reduction) will be 27.14%, the water delivery cost will be reduced by over 20.84%, the energy cost electricity will be reduced by more than 27.2%.

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