HYDRAULIC CALCULATION OFF IRRIGATION CHANNEL CLOSURE (ADDUCTION I) IN IRRIGATION SYSTEM "FANTANELE-SAG" ON THE OVERLAPPING PORTION WITH INVESTMENTS "BUTTERFLY PARK & GOLF"

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Abstract: *Golf and recreation base "Butterfly Park Golf course" is partially & overlaid with irrigation system "Fântânele-Sag," situated in Arad County, Romania, in the Mures plain, South of the Mures River, and is administered ANIF - territorial branch West. Realization of investment requires intubation irrigation channel "Adduction I" (the main channel), which overlaps with the investment location. This requires a hydraulic calculation to ensure complex irrigation system operation "Fântânele - Sag". In less than three years, the village of Fântânele will become a magnet for lovers of golf in Europe. The "Bellavista Golf Villas & Resort LLC" presents an impressive investment project which includes a golf course with 18 holes, a five-star hotel, a clubhouse and a residential complex of 50 villas with swimming pool. The future of golf course will cover 56 acres of recreation will respectively occupy 72 hectares and will have the shape of a butterfly. The future of golf will cover 56 hectares, but complex agreement "Butterfly Park" will occupy 73 hectares and will have a butterfly. The main feature of the project is respect for green space, not less than 350,000 square meters will be allocated to private green spaces and 150,000 square meters of public green spaces. Project golf course aims to achieve two ambitious goals, building a modern field, using cutting edge materials and technologies and respecting the environment. The complex will also landscaped parks with fitness, markets, postal services, a pharmacy, a home, a primary school, church, basketball, tennis and football. Based on these theoretical foundations analytical calculations were performed for different variants of the proposed pipeline and the existing channel Ad I. Large roughness of corrugated steel pipes under study, which are higher than the roughness of existing channel, leading to low water transport capacities for long lines or large sections of the pipeline. These pipes are well suited for culverts or undercrossing on short lengths. The study results need to pipe roughness uses small (smaller than existing channel) presented version including polyethylene pipes. There are other similar types of polyethylene pipe roughness such as prestressed concrete pipes (PREMO), tubes of fiberglass reinforced polyester (PASFIN) or ductile iron pipe.*

Key words: *hydraulic calculation, irrigation channel closure, irrigation systems.*

INTRODUCTION

In less than three years, the village Fântânele will become a magnet for lovers of golf in Europe.

Beneficiary "Bellavista Golf Villas & Resort Ltd." author impressive investment project comprises an 18-hole golf course, a five star hotel, a club house and a residential complex of 50 villas with pool.

The future of golf will cover 56 hectares, but complex agreement "Butterfly Park" will occupy 73 hectares and will have a butterfly. The main feature of the project is respect for green space, not less than 350,000 square meters will be allocated to private green spaces and 150,000 square meters of public green spaces. Project golf course aims to achieve two ambitious goals, building a modern field, using cutting edge materials and technologies and respecting the environment. The complex will also landscaped parks with fitness, markets,

postal services, a pharmacy, a home, a primary school, church, basketball, tennis and football. Investors chose Fântânele common because it is very close to the border of Arad and Timisoara, and the highway will connect the area to Europe. The "Butterfly Park" is presented in Figure 1.

Irrigation system Fântânele - SAG, is located in western Romania, Arad County, in Plain Mures, south of the river and the administration ANIF West Branch Territorial Arad. The total area of irrigation is 6920 ha, that whole area covered Irrigation infrastructure Fântânele - Sag. The system was conducted during 1968-1972 and has not undergone extension works or rehabilitation.

Irrigation systems, Fantanele - SAG "is supplied with water from the river Mures through SP Floating Pumping Station Fântânele. Taken from the river flow are 7.40 m / s.
SP Fântânele pumping water main supply channel Ad I, 2984 m long channel is lined with concrete slabs.

Below the water is pumping through pumping station SRP Fântânele in Ad II supply channel length of 15,400 m.

Route, channel distributor channel feeds CPA Ad II, which is not waterproof.

Ad II channel at km. 6 and 150 km. 8 490 there are two weirs flow and level.

Irrigation Scheme Fântânele-SAG has three power stations put under pressure, serving distribution pipeline through which the sprinkler irrigation. Pipes are made of asbestos cement.

Perimeter and schedule planning system is shown in Figure 2.

Figure 1: Butterfly Park & Golf (Project nr. 12/23.02.2012, 2012)

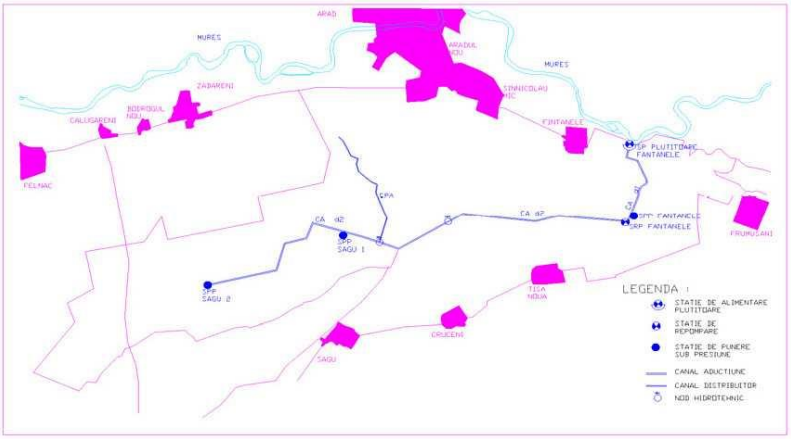

Figure 2: Irrigation system Fântânele - Sag (Project nr. 12/23.02.2012, 2012)

Headrace canal is the total length of the channel Ad I is 2984 m and is lined with concrete slabs pitching simple degraded enough ballast placed on a layer of 10 cm below the tiles waterproofing.

Length that overlaps investment, "Butterfly Park & Golf" is 1677 m and were executed in one numaăr topographic studies of eight (8) cross sections numbered from 1 - to 8.

Of topographic data that Ad I irrigation canal section is trapezoidal maximum base width - 3.50 m (average width 3.00 m), average depth 2.2 m, 8.60 m land requirement, 1:1 slope gradient, is lined up to share with tiles is 1.90 m.

Maximum flow that could be transported by canal irrigation Ad I is Q = 7.40 m / s, a thalweg slope of hydraulic gradient 0.1495% or 1.0% this flow is only theoretical and is the maximum flow over the station Fântânele pumping, irrigation channel throughput rate is given by the sum of consumers fed channel.

Channel also serves as water retention volume of approximately 30,000 cubic size of the project warrants for periods when the town Pumping Station Floating Fântânele not works, to use energy cheaper elective during the night.

Projected flow pumping station Fântânele is 7.40 m3 / s This flow represents 20% of the minimum flow assurance probability of 80% of the Mures, but only 2.7% of the average flow of the river.

Irrigation territory is crossed and communal roads connecting villages Fântânele with Sag Manastur - Mănăştur Vinga and Arad.

MATERIAL AND METHODS

Free level uniform motion is made in white artificial straight and prismatic (canals, galleries, gutters, ditches, etc.) (DAVID, 1984).

In general, technical applications currently are using Chezy formula type:

$$V = C\sqrt{Ri} \quad (1)$$

Associating continuity equation is obtained for flow:

$$Q = VS = SC\sqrt{Ri} \quad (2)$$

Hydraulic radius is explicit and obtain

$$Q = SC\sqrt{\frac{S}{P}i} = \frac{S^{\frac{3}{2}}}{P}C\sqrt{i} \quad (3)$$

Associating Chezy formula is obtained for flow:

$$Q = \frac{1}{n}\frac{S^{1,5+y}}{P^{0,5+y}}\sqrt{i} \quad (4)$$

By replacing Manning relationship is obtained:

$$Q = \frac{1}{n}\frac{S^{\frac{5}{3}}}{P^{\frac{2}{3}}}\sqrt{i} \quad (5)$$

For the particular case of trapezoidal section is noted that the area (S) and the wetted perimeter (P) can be expressed as:

$$S = bh + mh^2 = (\beta + m)h^2 \quad (6)$$

$$P = b + 2\sqrt{1+m^2}h = \left(\beta + 2\sqrt{1+m^2}\right)h \quad (7)$$

Resulting in replacement:

$$Q = \frac{1}{n}\frac{(\beta + m)^{1,5+y}}{\left(\beta + m^{'}\right)^{1,5+y}}h^{2,5+y}\sqrt{i} \quad (8)$$

where the m' were noted:

$$m^{'} = 2\sqrt{1+m^2} \quad (9)$$

Commonly used in engineering applications, especially in sewers, standardized profiles such as circular profile, ovoid etc.

An important feature of these channels is hydraulic fill level defined by:

$$\lambda = \frac{h}{H} \quad (10)$$

where:

h is the depth to fill current free level partial section;

H - current depth of the solid section (geometric height section).

It can be seen that the analyzed sections can define two characteristic features (DAVID, 1984):

- Report to the partially filled flow (Q_λ) and full (Q), which assuming a constant roughness coefficient can be put as a function of the degree of filling:

$$A = \frac{Q_\lambda}{Q} = \frac{K_\lambda\sqrt{i}}{K\sqrt{i}} = \frac{K_\lambda}{K} = f_1(\lambda) \quad (11)$$

- Gear ratio under the same conditions as above:

$$B = \frac{V_\lambda}{V} = \frac{C_\lambda\sqrt{R_\lambda}}{C\sqrt{R}} = \frac{K_\lambda}{K} = f_2(\lambda) \quad (12)$$

These functions can be standardized for different sections.

RESULTS AND DISCUSSIONS

Based on these theoretical foundations analytical calculations were performed for different variants of the proposed pipeline and the existing channel Ad I.

Topographic studies for existing channel Ad I result input the following data: b = 3,0 m, m = 1, i = 0,000205882353, n = 0,015 (concrete)

The construction curve Q = Q (h) is presented in Figure 3:

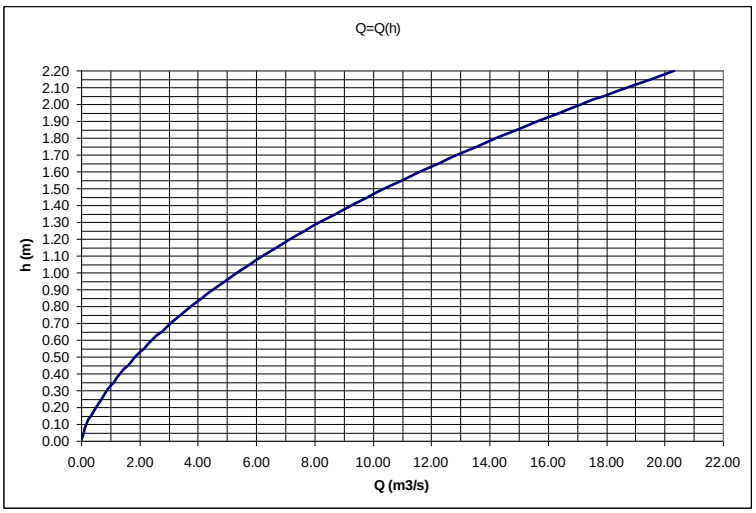

Figure 3: Curve Q = Q (h) for channel Ad I

The projected flow for pumping station Fântânele results the following data for existing open channel:

h = 1.2215 m

v = 1.43 m/s

Q = 7.40 m3/s

For various pipe diameters for intubation channel can build curves Q = Q (h), A = A (λ) and B = B (λ).

For example for 2 pipes with steel corrugated steel sheet with diameter of 3100 mm circular cross section and roughness n = 0.025, curves are shown in Figure 4 (TUBOSAIDER, 2012).

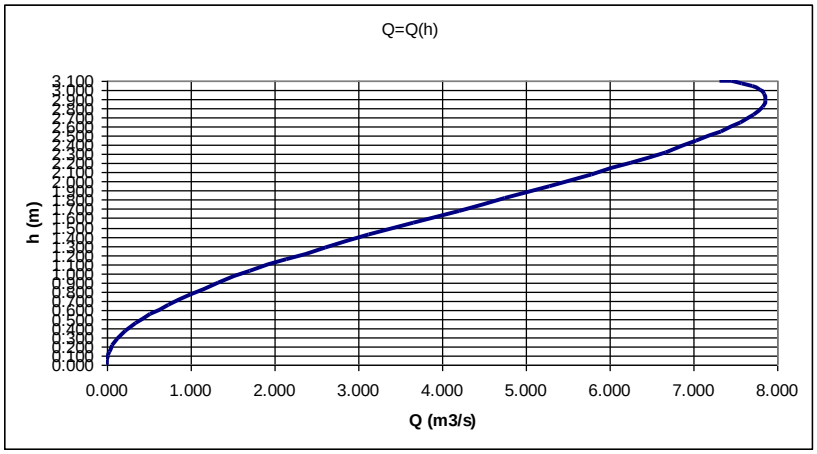

Figure 4: Curve Q = Q (h) for 2 steel corrugated pipes

For example for 2 HDPE pipe with diameter of 2200 mm and roughness of n = 0.01 curves are shown in Figure 5 (VALROM, 2012).

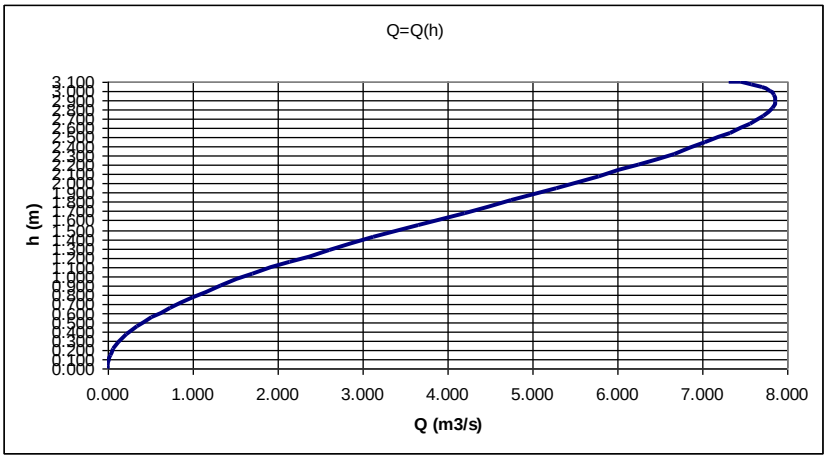

Figure 5: Curve Q = Q (h) for 2 PEID pipes

Curves A = A (λ) and B = B (λ) are shown in Figure 6.

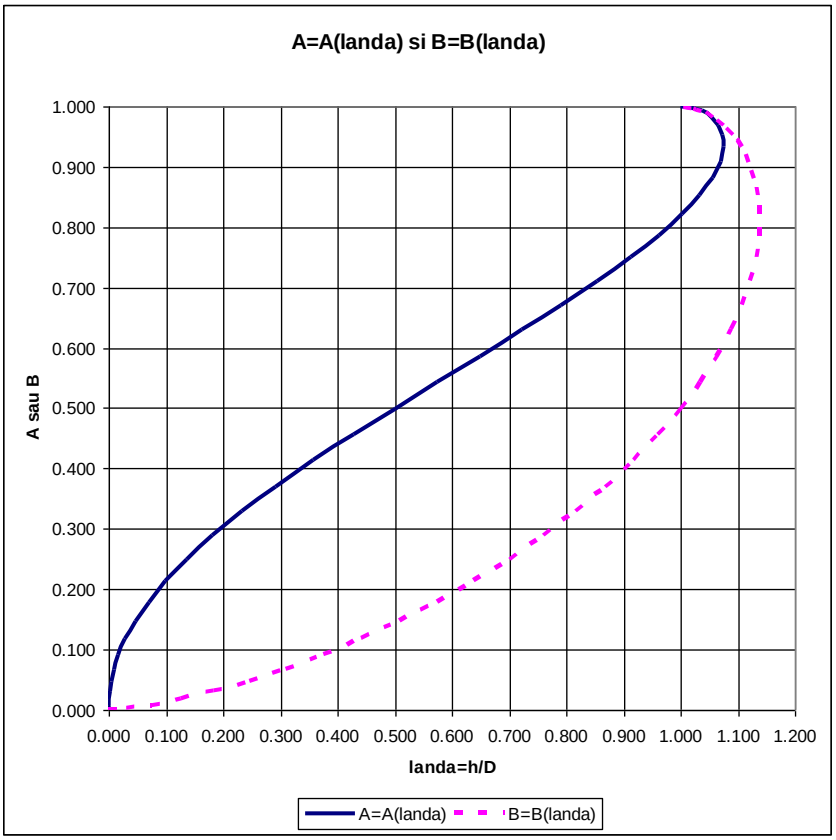

Figure 6: Curves A = A (λ) and B = B (λ)

CONCLUSIONS

Choosing a variant listed above can be made after completion of economic calculation to minimize the total cost.

Large roughness of corrugated steel pipes under study, which are higher than the roughness of existing channel, leading to low water transport capacities for long lines or large sections of the pipeline. These pipes are well suited for culverts or undercrossing on short lengths.

The study results need to pipe roughness uses small (smaller than existing channel) presented version including polyethylene pipes. There are other similar types of polyethylene pipe roughness such as prestressed concrete pipes (PREMO), tubes of fiberglass reinforced polyester (PASFIN) or ductile iron pipe.

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