COMPARISON ON RESULTS FOR YIELD OF WATER SPRINGS IN YEAR 1990 AND 2007

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Abstract:

From the aspect of the flora and fauna, including the existence of the human, the role of the water has very significant importance. This fact enforces the need of immediate attention accompanied with permanent research and monitoring of the water resources.

In the period of 1975 to 1977, the Water Development Institute of RM has developed cadastral database of the springs. This database contains information, about 4414 springs on the territory of the whole republic.

Using immediate measures all of the important springs in the RM, with yield of 10/100 l/s, were surveyed with direct measurements of the spring capacity. With this study 125 springs were surveyed in the western part of the country which were situated in 17 municipalities.

The previous survey, conducted in 1990 included 907 registered springs out of which 177 were dried up (144 were registered in the cadastre and 33 new registered). This amount is 19.5% dried up springs from the whole. According the parameters and available data in the Water Development Institute of RM and with consulting other experts on this issue, the year 1990 is considered the driest year in this period.

Key words: *yield, cadastral, spring, dried.*

1. INTRODUCTION

From the aspect of the flora and fauna, including the existence of the human, the role of the water has very significant importance. This fact enforces need of immediate attention accompanied with permanent research, and monitoring of the water resources.

In the period of 1975 to 1977, the Water Development Institute of R.M has developed cadastral database of the springs.

The change of the flow regime, as a result of the climate, technological and urban development has to be recognized, noted and activities for flow improvement have to be undertaken.

With permanent survey and following the yield, of the water springs we can observe the real changes, the water quality and the possibilities for rational water usage.

The development of the urban and rural areas, affects the water quality and quantity.

There is a process of the mechanical and chemical quality decrease throughout the years.

The pollution around the watercourse is affecting the quality of the water and affects the living environment as well.

If we consider the present adverse climate and the present adverse hydrology development, in the region and the territory of R. Macedonia can be concluded that permanent survey of the primary spring flow is absolutely necessary. That will give overview of the water resources and condition on the primary springs.

2. METHODOLOGY

The yields of the water springs are surveyed with the methodology regulated in “Intervene survey of primary water springs in SRM 1990”

When compared with the results in 1990, there are some newly captured water springs in 2007. On some of the newly captured water springs there is no free flow, and on the springs where there is a free flow the flow is measured beneath the capture point. Most of the springs are with decreased water flow, and some of them are completely dried-out.

The water springs that are not captured have pipe or tap flow. This flow is measured with stopwatch and bucket.

On the springs were the flow cannot be measured with bucket and stopwatch, the flow is calculated on empiric way with the data and parameters that were gathered with the field research.

In the appendix of this project there is photo documentation on some of the springs.

In the calculation templates were the water speed is used as a value (V), the speed is reduced with factor. This factor value is in function with the depth of the water in the profile.

Depending on the altitude, the springs are mostly in the oak or beech region (Appendix number 1 chart for altitude allocation of the springs).

Most common tree types maintained in the oak and beech regions are: (Quercus petraea), (Quercus frainetto), (Quercus pubescens) in the oak region, and (Fagus sp.) in the beech region.

On most of the springs which are not captured, the flow is in a puddle. They are used for irrigation.

Around the watercourses hydrofoil vegetation is present, mostly from the following types: Alnus sp. (Alder), Populus sp. (Poplar), Salix (osier), and other types of bushes that require humidity for their growth.

Around some of the springs there is noticeable amount of lodged waste material.

After finishing the field work, there was a process of data processing and data analysis undertaken, then yield calculation and consultation with other experts that are working on the similar problematic was done. In the following phase the data was inserted in table sheets and overview maps were produced.

3.AIM

The aim of the project is surveying the yield of the springs and comparing with the results of the previous research.

The springs that are presented in the data sheets with yield less than 10 l/sec are the springs that in the previous survey had yield more than 10l/sec. Out of different reasons the yield is decreased, one of which is adverse climate and hydro condition.

The water springs that are subject of this research are important for the water supply of the industry, the local population, the agriculture, the stockbreeding and the economy.

It is very important that these surveys are done on a regular basis. Making proper researches, data analysis and comparison can give an overview of the relationship between the climate and hydro changes on the springs yield.

The intervene survey, data analysis and the presentation of the results will be carried out with the same methodology used for establishing and follow-up of the spring cadastre in R. Macedonia.

The subjects of the survey are the springs that were in the initial base of the cadastre as well as the springs added with the follow-up survey (Intervene survey of primary water springs in SRM 1990 carried out by Water Development Institute of RM 1990).

In the present project we surveyed three springs, that were registered neither in the cadastre nor in the previous follow-up survey. These three new-surveyed springs will be registered in the cadastre and the information gathered with the research will be used for further analysis.

4. RESULTS AND DISCUSSION

The water development institute of R.M, has well developed data base that can be used for analysis and monitor the yield of the springs in R.M.

In the period of 1975 to 1977, the Water Development Institute of RM has developed cadastral database of the springs. This database contains information, about 4414 springs on the territory of the whole republic.

There is certain data, for a small number of springs from 1968. In the period of 1981-1990, with number of different technologies the yield of 550 registered and 50 unregistered springs in Central and western Macedonia has been monitored.

Between 1988-1990 there have been, 150 water springs which have been monitored. The results are showing that there is intensive decrease of the water yield. The monitoring has been done twice a year, and there are results for two calendar years.

In this project the survey includes 125 most important springs in western Macedonia with yield between od 10 - 100 l/sec and above.

The survey was realized in 17 municipalities and in 4 drainage basins:

- Drainage-basin of the river Vardar;
- Drainage-basin of the river Treska;
- Drainage-basin of the river Crni Drim and
- Drainage-basin of the Ohrid Lake.

The fast and uncontrolled industry, development and the increasing birth rate are also accomplishing for the water and soil pollution. This requires constant monitoring of the water quality. Bacteriological analyses have to be done and the results have to be compared with the database.

In this project, 125 spring yields have been surveyed. These springs belong to 17 municipalities in the West part of R. Macedonia. 122 (one hundred and twenty two) are registered in the database and three are newly researched. The newly researched springs will be registered and the data will be used for further researches and comparison.

Some of the springs are captured for local water supply. The research showed that just some of the captivities are properly build, properly protected with fence, and surrounded with lawns.

The research shows that around the springs there is noticeable soil pollution, mostly dump left by the local population, sometimes directly in the spring. This attitude is leading to pollution of the soil, surface and underground water. This issue is getting more serious having in mind that this water is used for farm irrigation. Out of the surveyed springs in this project, the most polluted are the ones in the Struga municipality, (on the road to the Kafasan cross border point, in the region Kalishta-Frangovo-Radozjda).

5. COMPARISON OF THE RESULTS

Out of 36 springs that were compared, 20 (twenty) are with decreased flow, 15 (fifteen) are with increased and 1 (one) spring has the same flow as 17 years ago.

Note, the springs that are captured, the flow is measured after the capture.

Eight of the springs that show increased flow are partly captured. That means that the measured flow is not real, (it is measured after the capture). The rest of the springs 7 (seven) has increased flow.

The 1990 measuring project showed that 177 out of 907 springs were dried-out. 144 were already registered in the cadastre and further 33 were newly registered.

19 of the measured springs were dried out. According to the data and parameters of the institute, and with consultation with other professionals can be concluded that 1990 was the driest year in this period.

Eleven out of 125 measured springs in 2007 were dried out. Three of the dried out are in the Vardar river basin, three in Treska River and 5 in the Ohrid lake basin. That represents 8.8% of whole surveyed springs.

Note that with the project program have to be measured the springs with 10 l/s that means that 8.8% of the dried springs had yields more than 10 l /s.

Nine of the springs with decreased yield are in the Basin of Crni Drim River, (12) in Ohrid Lake, (14) of the springs with increase yield are Ohrid Lake drainage basin .

Table 1

Number	Cadastre number	Vicinity of the village:	Condition of the Spring	Yield in 2007	Yield in 1990	Condition
				(l\sec)	(l\sec)	
1	2	4	5	6	7	
1	3558	Godivje	Flows freely	**11.21**	**58.52**	▼
2	3550	Godivje	Flows freely	**0.05**	**6**	▼
3	3551	Godivje	Flows freely	**30.00**	**8.8**	▲
4	3562	Mramorec	Partly captured	**36.00**	**5.65**	▲
5	3575	Peso~ani	Flows freely	**5.00**	**6**	▼
6	3573	Grkoec	Partly captured	**86.10**	**72**	▲
7	3572/1	Krasta	Flows freely	**6.80**	**64**	▼
8	3577	Novo Selo	Flows freely	**43.70**	**43.2**	▲
9	3586	Zlesti	Flows freely	**0.10**	**0.94**	▼
10	3585		No flow	**/**	**22.78**	▼
11	3583/2	Grko Pole	Flows freely	**5.10**	**3**	▲
12	3583/1	Grko Pole	Partly captured	**6.00**	**6**	—
13	3579	Velmej	Partly captured	**74.20**	**9.6**	▲
14	3580	Velmej	Partly captured	**310.00**	**89.28**	▲
15	3523/1	Sv.Naum	Flows freely	**5270.00**	**6007**	▼
16	3525	El{ani	Partly captured	**1.60**	**0.5**	▲

17	3539	Re~ica	Fully captured	**/**	**0.87**	▼
18	3541	Zavoj	Flows freely	**3.50**	**6**	▼
19	3542	Zavoj	Flows freely	**1.50**	**2**	▼
20	3538	Plake	Captured for EMO Ohrid	**0.30**	**4.42**	▼
21	3535	Velgo{ti	Completely captured	**/**	**2.96**	▼
22	3591	Frangovo	Partly captured	**28.90**	**9.28**	▲
23	3593		Flows freely	**35.10**	**17.28**	▲
24	3600/1	G.Belica	Flows freely	**6.20**	**23.3**	▼
25	3605/1	Drslajca	Flows freely	**110.00**	**140**	▼
26	3604	Xepin	Partly captured	**19.00**	**212**	▼
27	3605	Xepin	Partly captured	**16.10**	**5**	▲
28	3623	Prisovjani	Flows freely	**47.50**	**36**	▲
29	3621	Prisovjani		**/**	**1**	▼
30	3612	Podgorci	Flows freely	**18.90**	**8.7**	▲
31	3627	Jablanica	Completely captured	**0.10**	**15.2**	▼
32	3636	Bezovo	Tap	**0.40**	**1.48**	▼
33	3635	Nerezi	Partly captured	**/**	**6.18**	▼
34	3535	G.Lukovo	No flow	**/**	**2.96**	▼
35	3639	D.Lukovo	Partly captured for fisch tank	**85.00**	**170**	▼
36	3608	Vev~ani	Flows freely	**472.00**	**307**	▲

Struga has the biggest number of measured surveyed springs, 21 (twenty one). Eleven or 52.3% are with yield less than 1 l/s, two or 9.5% are with yield from 1 to 10 l/s, 28.5% are with yield from 10 l/s to 100 l/s and 9.5% of measured springs are with yield more than 100 l/s.

In this project the measuring activates were done on 10 springs or 8 of the springs with yield 100 l/s.

Two springs in the following municipalities Gostivar, Struga, and Ohrid. One spring in Vevcani Debarca, Drugovo i Makedonski Brod. In drainage basin of Treska and Ohrid lake there are 3 springs each with yield more than 100 l/s, and two each in Vardar River and Crni Drim.

6. REFERENCES

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