ApaSan Proiectul Elveţiei de Apă şi Sanitaţie în Moldova

Water Consumption Study

Water consumption in 2015 and 2016 in seven Moldovan villages with a village-wide water supply system

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The document is based on contributions from the ApaSan project team.
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Introduction

The following document presents the results of a water consumption study conducted in seven villages with water supply systems (WSS) which were constructed with the support of the Water and Sanitation Project in Moldova (ApaSan). The ApaSan project (2008 – 2019) was funded by the Swiss Agency for Development and Cooperation (SDC), co-funded by the Austrian Development Cooperation (ADC), and implemented by Skat Consulting Ltd.

The goal of this study was to document the actual water consumption per day and per capita in the selected villages in order to contribute to a better understanding of water needed for designing water supply systems in rural Moldova.

Methods

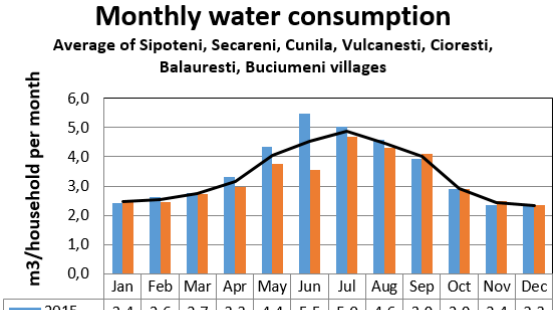
Data was collected from seven villages throughout 2015 and 2016. 1,990 households' monthly water consumptions were registered during this period. Monthly water consumption data was compiled from the accounting books of Water Consumer Associations (WCA) in villages having a functioning water supply system constructed within the ApaSan project.

As villages were not randomly selected and thus may not be representative of all Moldovan villages, background information on the villages is provided in *Annex 1* to contextualize the study.

The data was cleaned by removing consumers with no consumption over the full year, social institutions and businesses, as well as consumers with aberrant consumption patterns, based on analyst's judgement. For a summary on data cleaning, see *Annex 2*.

Results

The monthly water consumption of the seven villages studied from 2015 to 2016 is presented in Figure 1. More detailed results are available in *Annex 3*. The average water consumption in 2015 and 2016 was of **3.35 m^3 per month per household** or **36.7 litre per capita per day** (the surveyed villages have an average of 3 persons per household). The monthly minimum water consumptions per household were 2.3m^3 in December 2015 and 2.4m^3 in December 2016, and the maxima were 5.5m^3 in June 2015 and 4.6m^3 in July 2016. For both years, water consumption from May through September were above the yearly average, showing peak consumption during the summer.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	2,4	2,6	2,7	3,3	4,4	5,5	5,0	4,6	3,9	2,9	2,4	2,3
2016	2,5	2,4	2,7	3,0	3,8	3,6	4,7	4,3	4,1	2,9	2,5	2,4
Average	2,5	2,5	2,7	3,1	4,1	4,5	4,9	4,5	4,0	2,9	2,4	2,3

Figure 1 Average monthly water consumption for the 7 villages studied in 2015 and 2016.

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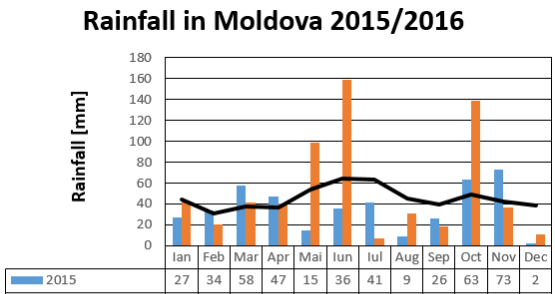
Discussion

Overall, the results from the different villages appear consistent. Higher consumption was observed between May and June 2015/2016, as villagers tend to use water for their animals and watering their garden. However, the summer peak consumption appeared to vary from year to year. The maximum monthly water consumption in 2015 was significantly higher than in 2016, which correlates to low rainfall in May and June of the year 2015 and high rainfall in 2016 (see Figure 2). Water consumption during winter seemed to be stable during those two years.



	Ian	Feb	Mar	Apr	Mai	Iun	Iul	Aug	Sep	Oct	Nov	Dec
2015	27	34	58	47	15	36	41	9	26	63	73	2
2016	42	20	41	40	99	159	7	31	18	139	37	11
Average for 2002 to 2016	44	30	37	36	53	64	63	46	39	49	42	38
Standard deviation for 2002 to 2016	21	20	21	14	31	46	41	35	25	34	33	34

Figure 2 Rainfall in Moldova during 2015 and 2016 (source: Serviciul Hidrometeorologic de Stat, Moldova)

Within the last 15 years, 2015 was a dry year (431mm) and 2016 a wet one (644mm). The average of these two years (540 mm) is close to the overall average rainfall in the past 15 years. (543mm). Therefore, it can be assumed that the average water consumption observed in these two years is representative.

The water consumption being strongly correlated to its price[1], rates applied by local operators had a direct influence on the water consumption. This influence has not been investigated in the present study, therefore results are likely to diverge in villages with different tariff policies. In the considered villages, tariffs were of 10-20 MDL/m3 at the time of the study.

Conclusion

A water consumption of 36.7 litre per capita per day is expected to be representative of the average water consumption in Moldovan villages having a water supply system and similar features to the ones surveyed (see *Annex 1*). An increased consumption up to 5.5m^3 per month per household is expected between May and September, as people tend to use water from the WSS to water their gardens and animals. During the winter months, the average daily consumption can drop down 2.3m^3 per month per household.

[1] Source: **JJ Hoffman, JA du Plessis. 2013.** A model to assess water tariffs as part of water demand management. *Water SA Vol. 39 No3 WISA 2012 Special Edition 2013.* South Africa

Annexes

Annex 1 Features of studied villages

Village	Inhabitants*	Number of persons connected to the water system*	% HH connected	Year of WSS implementation	Number of years living with a WSS (in 2016)
Sipoteni	950	900	84%	2005	11
Secareni	660	350	92%	2007	9
Cabaiesti	1083	805	74%	2014	2
Vulcanesti	1154	933	81%	2014	2
Cioresti	3500	3000	72%	2009	7
Balauresti	2500	1200	61%	2005	11
Buciumeni	1500	1100	66%	2010	6
Average	**1607**	**1184**	**76%**	**2009**	**7**
Standard Deviation	1028	845	11%	4	4

* number in red are estimations: Number of inhabitants gathered on http://localitati.casata.md/ (last access September 2018) , number of beneficiaries from estimation of the municipality.

Annex 2 Number of households per village: raw data, removed and retained

	Number of households			
	Raw data	Removed: consumption = 0	Removed: not domestic or anomaly high consumption	Retained for analysis
Sipoteni, 2015/2016	206/207	18/16	1/1	187/190
Secareni, 2015/2016	86/86	13/13	2/2	71/71
Cabaiesti, 2015/2016	225/227	21/28	0/0	204/199
Vulcanesti, 2015/2016	181/185	28/37	3/0	150/148
Cioresti, 2015/2016	691/693	87/97	5/6	599/590
Balauresti, 2015/2016	539/538	55/41	3/2	481/495
Buciumeni, 2015/2016	319/318	21/18	1/2	297/298

Annex 3 Summary of data per village and year [m^3 per household per month]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	#HH
Sipoteni, 2015	2.6	1.9	1.9	2.5	4.3	3.2	4.3	5.0	5.3	3.1	2.6	2.5	3.3	187
Secareni, 2015	1.6	1.8	1.9	2.4	3.6	4.9	4.7	4.1	3.9	3.1	2.5	2.3	3.1	71
Cabaiesti, 2015	1.2	4.1	2.4	1.6	8.7	6.6	6.1	6.8	5.6	5.7	2.4	2.0	4.4	204
Vulcanesti, 2015	1.7	1.7	1.7	5.0	4.0	5.4	6.2	5.9	5.0	0.9	0.9	0.9	3.3	150
Cioresti, 2015	2.7	2.7	2.7	3.7	3.9	7.2	6.1	4.9	3.9	2.6	2.6	2.6	3.7	599
Balauresti, 2015	2.6	2.8	3.9	3.6	3.6	4.1	3.6	3.0	2.6	2.3	2.3	2.3	3.1	481
Buciumeni, 2015	2.8	2.2	2.3	3.1	3.9	5.0	4.5	4.2	3.7	3.2	2.4	2.4	3.3	297
All villages 2015: (weighted average)	2.4	2.6	2.7	3.3	4.4	5.5	5.0	4.6	3.9	2.9	2.4	2.3	3.5	1989
Sipoteni, 2016	2.5	2.3	2.3	2.4	2.9	2.8	5.6	5.8	4.1	3.1	2.4	2.1	3.2	190
Secareni, 2016	2.0	2.1	2.5	2.9	3.1	3.4	5.9	4.9	4.1	2.8	2.1	1.8	3.1	71
Cabaiesti, 2016	2.4	1.7	3.7	3.0	3.2	2.7	4.8	6.3	5.8	6.7	4.2	3.2	4.0	199
Vulcanesti, 2016	1.4	1.4	1.4	3.7	4.6	5.1	5.9	5.6	4.1	0.6	0.6	0.6	2.9	148
Cioresti, 2016	3.1	3.1	3.1	3.2	5.1	3.9	5.5	4.7	4.9	2.8	2.8	2.8	3.7	590
Balauresti, 2016	2.4	2.6	2.8	2.8	3.0	3.6	3.2	2.8	2.8	2.1	2.2	2.1	2.7	495
Buciumeni, 2016	2.5	2.1	2.2	2.9	3.1	3.2	4.1	3.2	3.5	2.9	2.4	2.5	2.9	298
All villages 2016 (weighted average)	2.5	2.4	2.7	3.0	3.8	3.6	4.7	4.3	4.1	2.9	2.5	2.4	3.2	1991
All villages, average 2015/2016	2.5	2.5	2.7	3.1	4.1	4.5	4.9	4.5	4.0	2.9	2.4	2.3	3.35	