

ANNEX 3.7:

SET OF AVAILABLE LESKOVAC WASTEWATER QUALITY AND QUANTITY DATA, 1990 - 2007

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Feasibility Study Leskovac
Draft Report

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Table 1 Water quality in the Veternica River in 1990 (downstream of sewerage outfall)

No	Analysed Parameter	Units	Just downstream of the outlet	1 km downstream of the outlet	Just upstream of the confluence to Southern Morava
1.	pH		8,35	8,30	8,5
2.	KMnO ₄	mgO ₂ /dm ³	142,7	127,6	130,8
3.	BOD ₅	mgO ₂ /dm ³	85,62	76,2	79,66
4.	Phenols	mg/dm ³	0,300	0,009	0,017
5.	Detergents	mg/dm ³	0,11	0,88	0,68
6.	Oil and fats	mg/dm ³	20,4	8,1	7,2
7.	Nitrates	mg/dm ³	18,2	21,4	16,8
8.	Nitrites	mg/dm ³	0,5	0,5	1
9.	Sulphates	mg/dm ³	33,5	33,0	31,0
10.	Phosphates	mg/dm ³	0,005	0,110	0,100
11.	Chlorides	mg/dm ³	29,9	29,9	29,9
12.	Cr	mg/dm ³	0	0	0
13.	Fe	mg/dm ³	0	0	0
14.	Cu	mg/dm ³	0	0	0
15.	Hardness	° DH	7,3	6,2	5,6
16.	„M“ – alkalinity	mWal	2,6	2,65	2,67
17.	Dissolved oxygen	mgO ₂ /dm ³	3,12	4,65	4,77
18.	Electro-conductivity	µS /cm	525	369	361
19.	Pb	mg/dm ³	0	0	0
20.	Ammonia	mg/dm ³	3,92	5,51	12,33

Table 2 Leskovac wastewater quality and its effect on the Veternica River – spring 2004

	Analysed parameter	Unit	MAC (class IIb)	1	2	3	4
1.	Water/air temperature	°C		20/16	18/16	18.5/16	18.5/15
2.	Turbidity	NTU		Moderately turbid	Clear	Clear	Clear
3.	Colour	°Co/Pt scale	Without	Without	Without	Without	Without
4.	Floating matter		Without	Without	Without	Without	Without
5.	pH		6,8-8,5	7.80	7.55	7.50	7.56
6.	Electro-conductivity	µS/cm		682	285	344	309
7.	Settled matter after 2h (by Imhof)	mg/dm ³		0.8	0.3	0.4	0.3
8.	Total dry residue	mg/dm ³	1000	488	220	264	274
9.	Dissolved matter dry residue	mg/dm ³		438	164	212	190
10.	Suspended matter	mg/dm ³	40	50	56	52	84
11.	Ammonia (as N)	mgN/dm ³	0,1	26.67	0.27	1.36	1.50
12.	Nitrates (as N)	mgN/dm ³	10,0	9.11	2.34	2.82	2.50
13.	Nitrites (ASN)	mgO/dm ³	0,05	0.11	0.04	0.06	0.04
14.	Consumption KmnO ₄	mgO/dm ³	/	/	21.3	35.3	40.4
15.	COD	mgO/dm ³	/	181	/	/	/
16.	BOD ₅	mgO/dm ³	6	57	2.6	8.7	6.0
17.	Dissolved oxygen	mgO/dm ³	Min. 5	/	8.04	7.12	4.48
18.	Saturation with O ₂	%	/	/	85	76	48
19.	Chlorides	mg/dm ³	/	43.0	11.5	17.0	15.15
20.	Sulphates	mg/dm ³	/	88.3	44.9	54.2	56.2
21.	Phosphates	mg/dm ³	/	9.78	0.22	0.61	0.89
22.	Oils and fats	mg/dm ³	/	9.3	3.7	5.8	4.4
23.	Detergents	mg/dm ³	0,05	1.89	0.000	0.75	0.000
24.	Phenols	mg/dm ³	0,001	0.007	0.000	0.002	0.001
25.	Mn	mg/dm ³	/	0.00	0.00	0.00	0.00
26.	Fe	mg/dm ³	0,3	1.02	2.08	0.76	0.92
27.	Cr	mg/dm ³	0,1	<0.05	<0.05	<0.05	<0.05
28.	Cu	mg/dm ³	0,1	0.04	0.025	0.03	0.025
29.	Pb	mg/dm ³	0,05	<0.05	<0.05	<0.05	<0.05
30.	Zn	mg/dm ³	0,2	0.08	0.05	0.05	0.65
31.	Cd	mg/dm ³	0,005	<0.005	<0.005	<0.005	<0.005
32.	Ni	mg/dm ³	0,2	<0.04	<0.04	<0.04	<0.04
33.	Total hardness	°DH	/	/	6.04	6.40	6.60
34.	Permanent hardness	°DH	/	/	5.04	3.80	4.87
35.	Alkalinity	cm ³ n/10HC l/dm ³	/	/	0/19	0/23	0/22
36.	Ca (CaO)	mg/dm ³	/	/	27/38	30.4/42	30.4/43
37.	Mg (MgO)	mg/dm ³	/	/	9.7/16	6.5/11	10.1/17
38.	UV - extinction		/	/	0.098	0.130	0.124

Table 3 Leskovac wastewater quality and its effect on the Veternica River – summer 2004

	Analysed parameter	Units	MAC (class IIb water courses)	1	2	3
1.	Flowrate	l/s	/	240	/	/
2.	Water/air temperature	°C	/	22/25	22/24	22,5/24
3.	Colour	°Co/Pt scale	colourless	colourless	colourless	Colourless
4.	Turbidity	NTU	/	turbid	turbid	Turbid
5.	Floating matter	/	without	without	without	without
6.	pH	/	6,8-8,5	7,76	8,08	8,03
7.	Electro-conductivity	µS/cm	/	980	250	329
8.	Settled matter after 2h (by Imhof)	mg/dm ³	/	1,5	0,1	0,5
9.	Total dry residue	mg/dm ³	1 000	608	148	266
10.	Dissolved matter dry residue	mg/dm ³	/	554	122	182
11.	Suspended matter	mg/dm ³	40	54	26	84
12.	Ammonia (as N)	mgN/dm ³	0,1	30	0,40	2,43
13.	Nitrates (as N)	mgN/dm ³	10,0	8,24	2,23	2,98
14.	Nitrites (as N)	mgN/dm ³	0,05	0,07	0,04	0,05
15.	COD	mgO/dm ³	/	190	/	/
16.	BOD ₅	mgO/dm ³	6	69	1,31	9,98
17.	Dissolved O ₂	mgO/dm ³	Min. 5	/	8,38	4,98
18.	Consumption KmnO ₄	mg/dm ³	/	/	23,06	41,0
19.	O ₂ saturation	%	/	/	96,6	58
20.	Chlorides	mg/dm ³	/	65,0	11,5	15,0
21.	Sulphate	mg/dm ³	/	64,2	15,1	19,9
22.	Phosphates	mg/dm ³	/	5,16	0,28	0,98
23.	Oils and fats	mg/dm ³	/	12,3	2,7	6,3
24.	Detergents	mg/dm ³	/	0,175	0,024	0,100
25.	Phenols	mg/dm ³	/	0,092	0,000	0,018
26.	Mn	mg/dm ³	/	0,00	0,00	0,00
27.	Fe	mg/dm ³	0,3	0,17	0,13	0,19
28.	Total hardness	°DH	/	/	5,94	7,28
29.	Permanent hardness	°DH	/	/	3,64	3,75
30.	Alkalinity „R ⁺ –„M“	cm ³ n/10HCl/dm ³	/	/	0,0/22,0	0,0/28,0
31.	Calcium (CaO)	mg/dm ³	/	/	30,4/42,6	33,7/47,1
32.	Magnesium (MgO)	mg/dm ³	/	/	7,24/12,1	11,1/18,5
33.	UV – extinction	/	/	/	0,097	0,117
34.	Cr	mg/dm ³	0,1	0,054	0,000	0,037
35.	Cu	mg/dm ³	0,1	0,080	0,041	0,043
36.	Pb	mg/dm ³	0,05	<0,05	<0,05	<0,05
37.	Zn	mg/dm ³	0,2	0,079	0,032	0,037
38.	Cd	mg/dm ³	0,005	<0,005	<0,005	<0,005
39.	Ni	mg/dm ³	0,05	0,017	0,000	0,013

1 – Sewerage outlet; 2 - River Veternica upstream of the outlet; 3 River Veternica just downstream of the outlet;

Table 4 Leskovac wastewater quality and its effect on the Veternica River – autumn 2004

	Analysed parameter	Units	MAC (class IIb water courses)	1	2	3
1.	Flowrate	l/s	/	240	/	/
2.	Water/air temperature	°C	/	22/25	21/25	22/25
3.	Colour	°Co/Pt scale	colourless	yellowish	colourless	Colourless
4.	Turbidity	NTU	/	turbid	clear	Clear
5.	Floating matter	/	without	wastes	without	without
6.	pH	/	6,8-8,5	7,7	8,0	7,8
7.	Conductivity	µS/cm	/	1461	570	1326
8.	Settled matter after 2h (by Imhof)	mg/dm ³	/	0,20	0,0	0,0
9.	Total dry residue	mg/dm ³	1 000	1194	240	460
10.	Dissolved matter dry residue	mg/dm ³	/	644	188	340
11.	Suspended matter	mg/dm ³	40	550	52	128
12.	Ammonia (as N)	mgN/dm ³	0,1	15,2	0,11	5,33
13.	Nitrates (as N)	mgN/dm ³	10,0	6,68	1,25	4,45
14.	Nitrites (as N)	mgN/dm ³	0,05	0,02	0,006	0,01
15.	COD	mgO/dm ³	/	311,1	/	/
16.	BOD ₅	mgO/dm ³	6	136,5	1,51	26,5
17.	Dissolved oxygen	mg/dm ³	Min. 5	/	7,27	5,28
18.	Consumption KmnO ₄	%	/	/	14,86	171,9
19.	O ₂ saturation	mg/dm ³	/	/	78,93	57,32
20.	Chlorides	mg/dm ³	/	81,0	19,0	79,0
21.	Sulphates	mg/dm ³	/	69,12	23,7	68,6
22.	Phosphates	mg/dm ³	/	7,78	0,07	7,53
23.	Oils and fats	mg/dm ³	/	3,9	1,9	3,1
24.	Detergents	mg/dm ³	/	1,34	0,00	0,52
25.	Phenols	mg/dm ³	/	0,047	0,000	0,044
26.	Manganese	mg/dm ³	/	0,10	0,00	0,00
27.	Fe	mg/dm ³	0,3	0,36	0,30	0,32
28.	Cu	mg/dm ³	0,1	0,053	0,011	0,020
29.	Zn	mg/dm ³	0,2	0,08	0,011	0,035
30.	Cr	mg/dm ³	/	<0,05	<0,05	<0,05
31.	Ni	mg/dm ³	0,2	<0,04	<0,04	<0,04
32.	Cd	mg/dm ³	0,005	<0,009	<0,009	<0,009
33.	Pb	mg/dm ³	0,05	0,006	0,002	0,003
34.	Total hardness	°DH	/	/	6,83	11,2
35.	Permanent hardness	°DH	/	/	3,20	11,9
36.	Alkalinity „R“ – „M“	cm ³ n/10HCl/dm ³	/	/	0,0/20,0	0,0/25,0
37.	Calcium (CaO)	mg/dm ³	/	/	36,8/51,6	48,1/67,3
38.	Mg (MgO)	mg/dm ³	/	/	7,2/12,0	19,3/32,1
39.	UV - extinction		/	/	0,026	0,236

1 – Sewerage outlet; 2 - River Veternica upstream of the outlet; 3 River Veternica just downstream of the outlet;

Table 5 Water quality in Southern Morava before 2000

No	Analysed parameter	Unit	Profile					
			V.Han	Predejane	Grdelica		Vlasina	
			downstream		upstream	downstream	upstream	downstream
1.	pH		8,5	8,5	8,4	8,1	8,5	8,5
2.	Suspended matter	mg/dm ³	120	24	20	20	18	16
3.	Consumption KMnO ₄	mgO ₂ /dm ³	123	65	32	32	26	18
4.	BOD ₅		14	9	6	8	3	3
5.	Phenols	mg/dm ³	0,068	0,036	0,011	0,01	0,009	0,009
6.	Detergents	mg/dm ³	0,151	0,076	0,09	0,14	0,14	0,056
7.	Cu	mg/dm ³	0	0	0	0	0	0
8.	Nitrates	mg/dm ³	6	5	6	5	5	5
9.	Zn	mg/dm ³	0	0	0	0	0	0
10.	Nitrites	mg/dm ³	0,1	0	0	0	0	0
11.	Pb	mg/dm ³	0	0	0	0	0	0
12.	Sulphates	mg/dm ³	33	34	25	24	21	19
13.	Phosphates	mg/dm ³	0,086	0,05	0,195	0,041	0,005	0,011
14.	Dissolved O ₂	mgO ₂ /dm ³	2	4	6	8	9	10
15.	Fe	mg/dm ³	0	0	0	0	0	0
16.	Tannin	mg/dm ³	20	9	6	4	4	3
17.	Ammonia	mg/dm ³	0,1	0	0	0,05	0	0



Table 6 Water quality in Southern Morava before 2000

No	Analysed parameter	Unit	Profiles			
			Leskovac		Pecenjevac	Korvin grad
			upstream	downstream		
1.	pH		8,5	8,8	8,3	8,2
2.	Suspended matter	mg/dm ³	18	253	22	20
3.	Consumption KmnO ₄	mgO ₂ /dm ³	16	22	20	17
4.	BOD ₅	mgO ₂ /dm ³	2	14	7	4
5.	Phenols	mg/dm ³	0,01	0,012	0,009	0,009
6.	Detergents	mg/dm ³	0,09	0,18	0,072	0,06
7.	Cu	mg/dm ³	0	0	0	0
8.	Nitrates	mg/dm ³	4	8	6	4
9.	Zn	mg/dm ³	0	0	0	0
10.	Nitrites	mg/dm ³	0	0,36	0	0
11.	Pb	mg/dm ³	0	0	0	0
12.	Sulphates	mg/dm ³	21	23	26	22
13.	Phosphates	mg/dm ³	0	0,034	0,04	0,003
14.	Dissolved O ₂	mgO ₂ /dm ³	11	8	9	10
15.	Fe	mg/dm ³	0	0	0	0,
16.	Tannin	mg/dm ³	3	2,5	2,5	2,5
17.	Ammonia	mg/dm ³	0	0,5	0,4	0,5

Table 7 Water quality in Southern Morava after 2000 – Grdelica station

Smell	Colour	Floating wastes	pH	O ₂ (mg/l)	O ₂ %	COD (mg/l)	NH ₄ N (mg/l)	NO ₂ N (mg/l)	Conductivity μS/cm
Without	Without	Without	-	13,5	112	4,4	-	-	169
Without	Fair	Without	-	13,0	112	4.0	-	-	209

Table 8 Set water quality criteria for class II water courses

	Water quality	Water course class	
		Class IIa (Sothorn Morava)	Class IIb (Veternica)
1.	Suspended matter	Up to 30 mg / l	Up to 40 mg / l
2.	Total dry residue	Up to 1.000 mg/l	Up to 1.000 mg/l
3.	pH	6,8 – 8,5	6,8 – 8,5
4.	Dissolved oxygen	Min. 6 mg / l	Min. 5 mg / l
5.	BOD ₅	Up to 4 mg / l	Up to 6 mg / l
6.	Visible waste matter	Without	Without
7.	Noticeable colour	Without	Without
8.	Noticeable smell	Without	Without