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Joint management of Latvian – Lithuanian trans-boundary river and lake water bodies (TRANSWAT) LLI-533

RIVER CROSS-SECTIONS MEASUREMENTS

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LVĢMC

UNIVERSITY OF LATVIA

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I. INTRODUCTION

In the frame of the “Joint management of Latvian – Lithuanian trans-boundary river and lake water bodies” project (TRANSWAT) LLI-533 financed by the Interreg V-A Latvia–Lithuania Programme 2014-2020, the ecological water discharge will be modeled for each Hydropower Plant (HPP) in the pilot rivers.

An important element in hydraulic modelling is the topography data of the riverbed and the floodplain area of rivers. If the floodplain elevation can be obtained directly from digital terrain models, the riverbed topography often is not available. Since in the airborne survey only the elevation of the water surface is recorded, information about the riverbed topography can be gained only from field measurements.

River cross-section measurements were carried out in three pilot rivers: Varduva (Lietuva), Ciecere and Losis (Latvia). Results of those measurements are described in the present Report.

II. CROSS-SECTIONS OF THE PILOT RIVERS

Results of the river cross-sections' measurements are reviewed for each pilot rivers separately. These reviews include map of cross-sections along the river and pictures of it profiles. Data of those cross-sections in *shp* format is available in the project materials.

2.1. Cross-sections of Varduva River

Figure 2.1.1. Location of cross-sections (according to numbering of Table 2.1.1) of Varduva River

Cross-sections were used to determine the profiles across the Varduva River length from the confluence of Varduva and Sruoja rivers to the mouth. These measurements indicated the geometry of river cross profiles as well as the slope of the longitudinal profile of the river. These parameters are essential for the hydrodynamic modelling of the HPPs cascade because they describe the change of profile area in the connection with rivers discharge and determine the average velocity of the streamflow at a certain profile. For the Varduva River, 26 cross-sections were measured (Fig. 2.1.1).

The measured cross-sections of Varduva River contain the information of location in coordinates and distance from the mouth (Table 2.1.1). Moreover, the height above sea level of geometry of river bed was measured in each cross-section.

Table 2.1.1 Hydro-morphological elements for the river cross-sections

No. of cross-section	Distance from the mouth, km	Longitude	Latitude
1	67.975	380843.817	6227702.548
2	66.560	381486.024	6228028.098
3	63.150	381316.638	6229841.525
4	61.495	380487.789	6229849.970
5	58.590	379650.875	6229936.554
6	54.000	379073.833	6232051.346
7	48.395	379674.162	6234183.692
8	48.015	379906.014	6234003.792
9	41.835	381008.211	6235144.100
10	39.990	381277.884	6235772.591
11	39.165	381498.264	6236310.518
12	37.035	381111.413	6237290.312
13	36.535	381116.690	6237549.441
14	32.975	380812.987	6239544.386
15	31.565	381118.730	6240386.406
16	27.715	381782.471	6240429.121
17	25.185	381977.718	6242053.566
18	24.310	382402.834	6242228.552
19	22.135	383476.060	6243025.432
20	21.505	383642.299	6243484.149
21	19.700	384351.707	6244598.634
22	6.895	389216.789	6252053.574
23	4.755	389598.105	6253548.175
24	1.915	389012.016	6255079.270
25	1.020	389004.217	6255497.622
26	0.195	389448.342	6255821.563

The geometry of each cross-section is displayed in Figure 2.1.2. Most of the cross-sections were with a quite flat river bottom and shallow depths at low discharges. However, only in the upstream and in some parts of the midstream the deeper profiles were found.

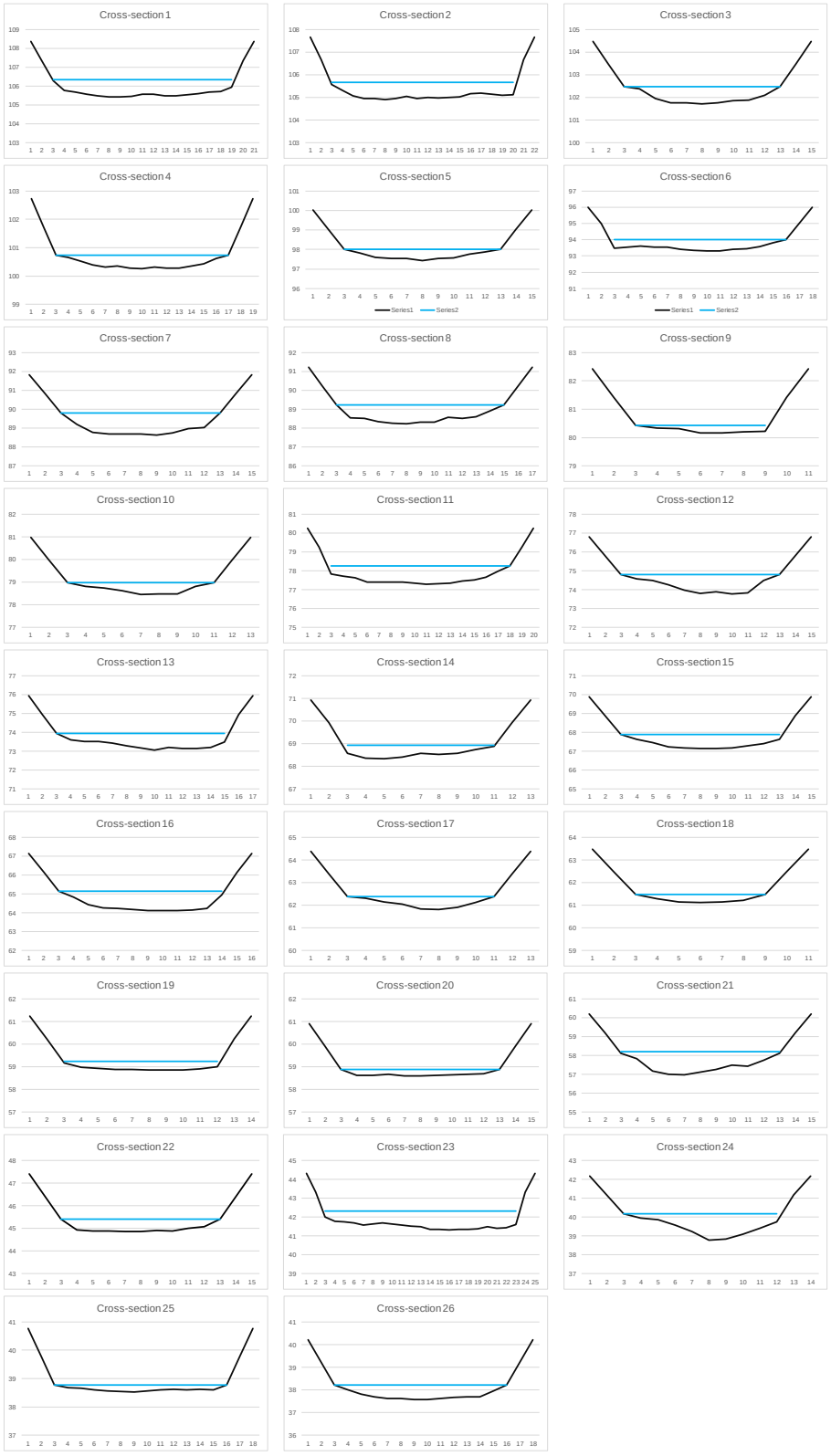

Figure 2.1.2. Profiles of cross-sections of Varduva River

On the Figure 2.1.2 the black curve is river bed profile and the blue curve – water surface. Vertical axes represent height above sea level in meters and horizontal axes represent width in meters.

2.2. Cross-sections of Ciecere River

Cross-sections were designed to determine the profiles across the Ciecere River from its start at Lake Ciecere to the river mouth. Measurements results indicate the geometry of river cross sections as well as the absolute height of the river bed. For the Ciecere River 29 cross-sections were measured (Fig.2.2.1) at a distance of more than 58 km.

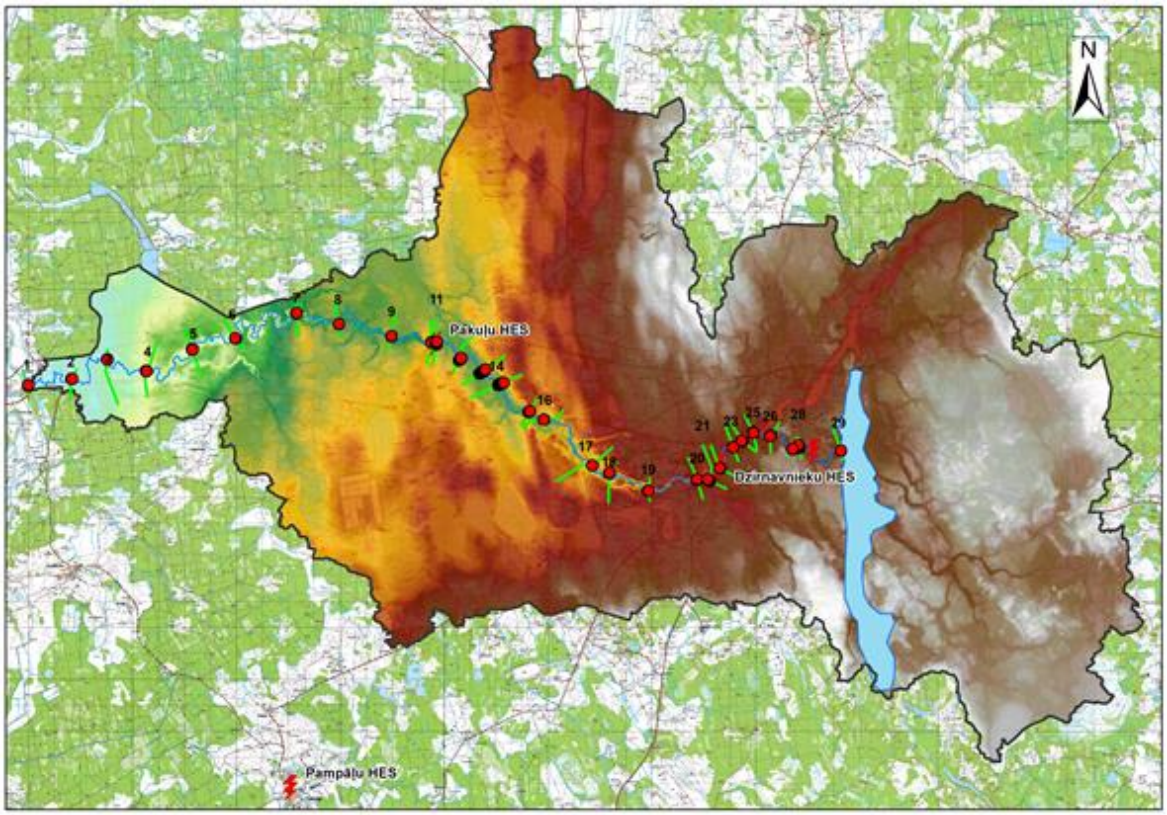

Figure 2.2.1. Location of cross-sections in Ciecere River (according to numbering of Table 2.2.1

Measured cross-sections of Ciecere River contain the information of location in coordinates (XYZ) and distance from the river mouth (Table 2.2.1).

Table 2.2.1. Description of river Ciecere cross sections

No. of cross-section	Distance from the mouth, km	Longitude	Latitude
1	58.22	379940.4055	283369.3259
2	54.50	381633.2543	283472.9017
3	51.43	383054.3593	283623.1479
4	48.91	384589.3777	283869.7129
5	45.13	386349.2092	284550.5123
6	42.41	387844.0701	285292.4881
7	35.52	390307.9446	285926.3564
8	33.09	391909.9042	285872.2878
9	29.31	393984.5961	285401.3641
10	26.39	395512.6936	284976.8921
11	26.20	395693.3357	284953.8702
12	24.94	396683.7765	284707.5045
13	23.70	397518.9668	283878.5546
14	22.82	398003.789	283309.0408
15	20.93	399279.6396	282321.3877
16	19.98	399844.3026	281996.6884
17	16.00	401436.9769	280230.5748
18	14.56	402340.7958	279629.3787
19	12.30	403845.829	279312.7184
20	9.48	405719.4175	279761.9339
21	8.73	406253.2657	279989.1872
22	8.08	406564.9927	280216.8827
23	6.68	407058.9269	281104.7108
24	6.09	407429.9738	281237.7451
25	5.37	407882.4742	281524.9767
26	4.51	408544.4266	281370.9463
27	2.92	409426.768	280923.1864
28	2.64	409666.8852	280912.0228
29	0.01	411172.0941	281115.2733

Most of upstream cross-sections has U-shaped river bottom (Fig. 2.2.2) and all of them is quite shallow, downstream cross-sections have a flat river bottom with small depths over of year. Only river profiles closed to HPPs have the depth and width much bigger but its river bed differs from the natural river cross-sections.

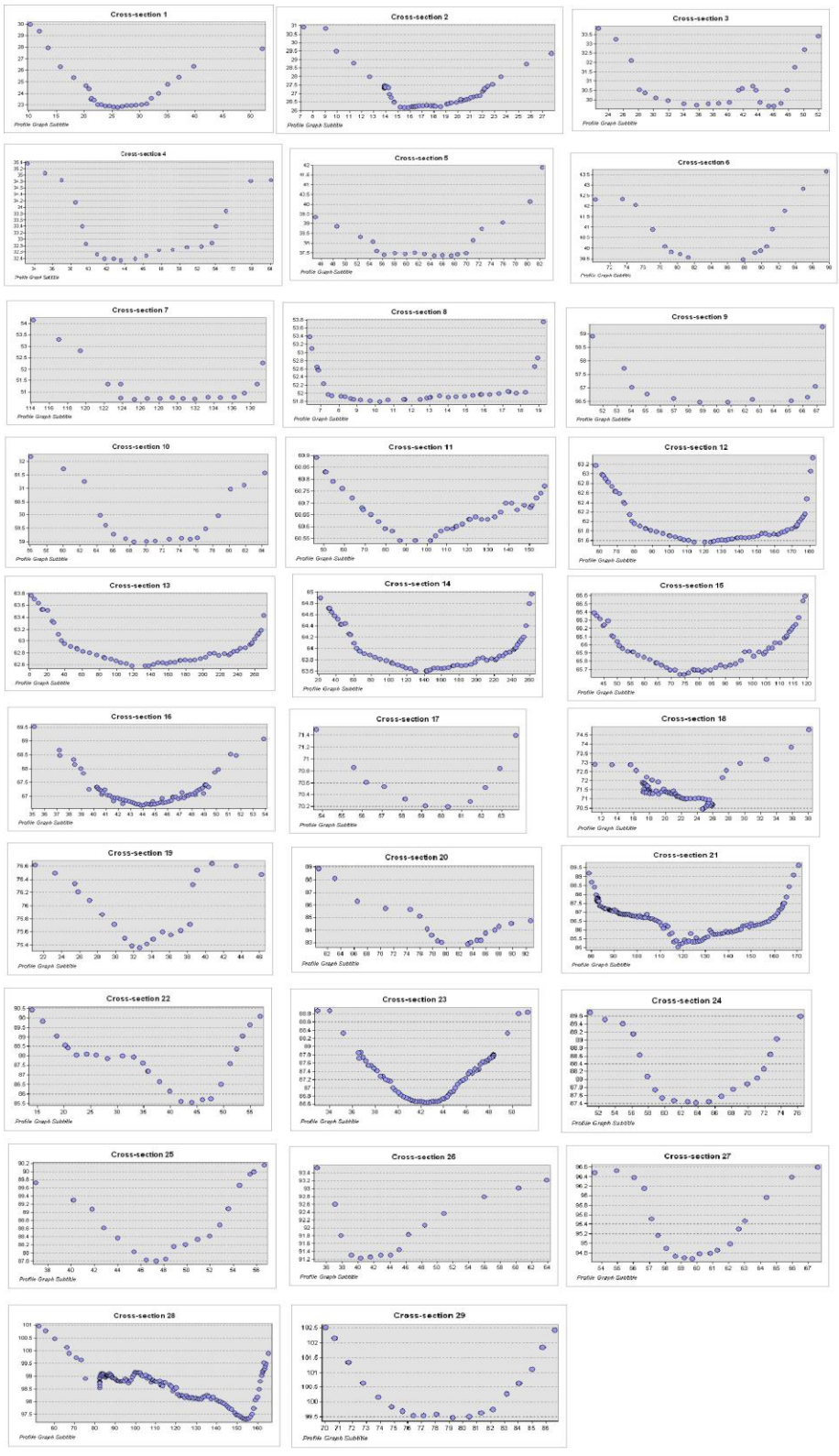

Figure 2.2.2. Profiles of cross-sections (according to numbering of Table 2.2.1) of Ciecere River.

On the Figure 2.2.2 the blue points shows the river bed profile. Vertical axes represent the height above sea level in meters and horizontal axes - the width in meters.

2.3. Cross-sections of Losis River

Cross-sections were designed to determine the profiles across the Losis River from the Latvian-Lithuanian state border to the river mouth. Measurements results indicate the geometry of river cross sections as well as the absolute height of the river bed. For the Losis River 12 cross-sections were measured (Fig.2.3.1) at a distance more than 30 km.

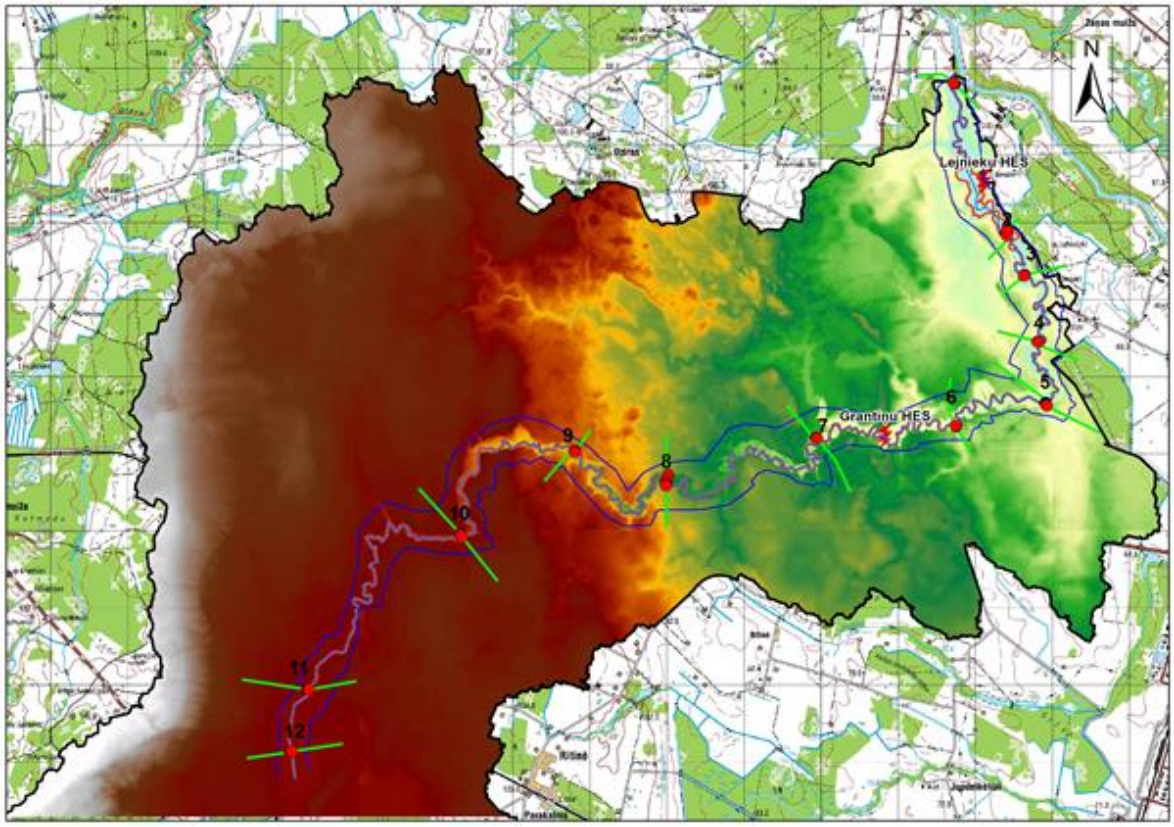

Figure 2.3.1. Location of cross-sections (according to numbering of Table 2.3.1 of Losis River

Measured cross-sections of the Losis River contain the information of its location in coordinates (XYZ) and distance from the river mouth (Table 2.3.1). The geometry of each cross-section for the Losis River is displayed in Figure2.3.2.

Table 2.3.1. Description of river Losis cross sections

No. of cross-section	Distance from the mouth, km	Longitude	Latitude
1	0.16	383710.9	259817.3
2	3.19	384411.1	257790.4
3	4.07	384724	257338.1
4	5.85	384826.3	256445
5	7.26	384906.8	255674.1
6	9.31	383690.6	255477.3
7	12.69	382026	255106.5
8	17.80	379990.4	254640.1
9	20.90	378720.2	254983.2
10	24.41	377311.1	253967.6
11	29.23	375225.9	251957.4
12	30.13	375166	251142.3

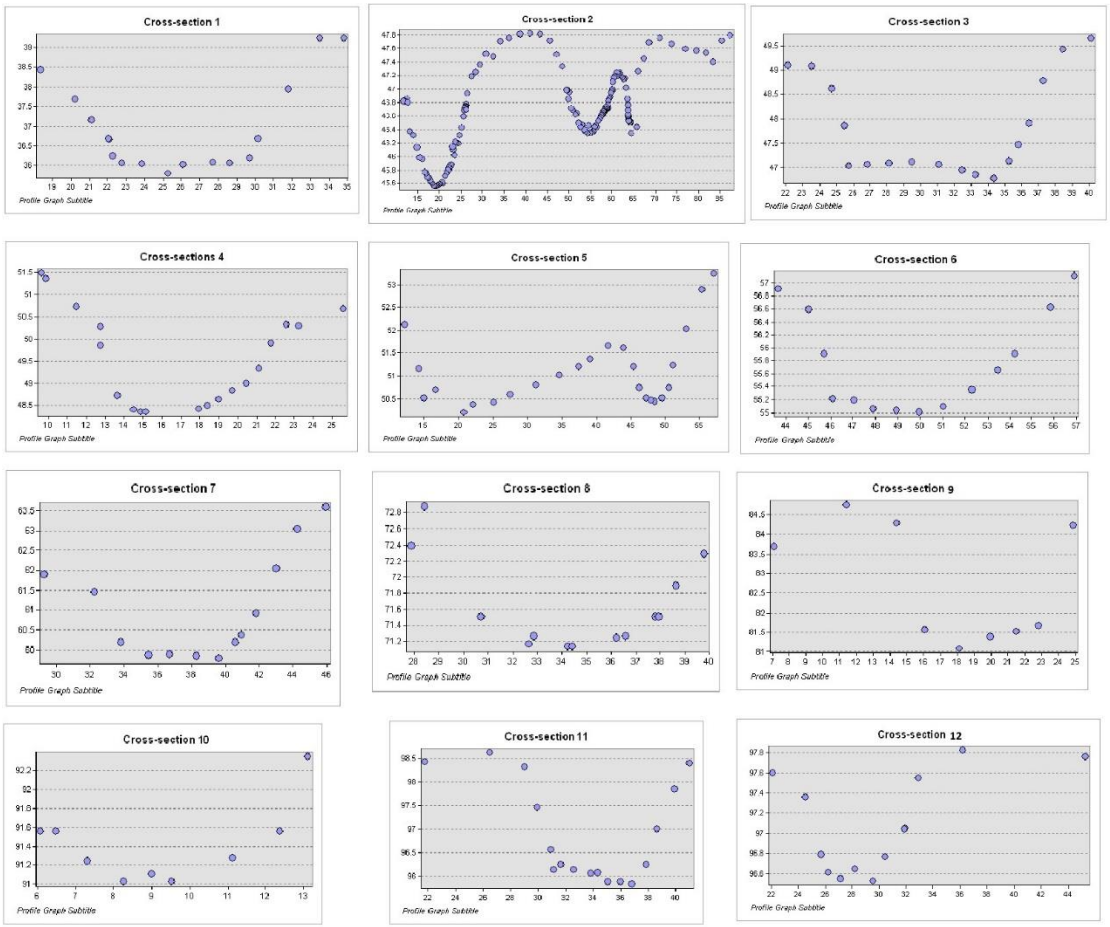

Figure 2.3.2. Profiles of cross-sections (according to numbering of Table 2.3.1) of Losis River.

On the Figure 2.3.2 the blue points shows the river bed profile. Vertical axes represent the height above sea level in meters and horizontal axes - the river width in meters.

Most of cross-sections has U-shaped river bottom and all of them is quite shallow, but river shores are quite steep. Closer to river mouth the river bed becomes wider and some of cross-section has a trapezoidal shape.

III. CONCLUSIONS

The cross-sections of the pilot rivers were measured at a distance more than 150 km. The river bed data was obtained and integrated to the digital terrain models of the project area.
The collected data will be used for the upcoming hydrodynamic modelling of HPPs cascade by the HEC-RES model.