



*Agricultural University in  
Krakow*



*Department of Water  
Engineering and  
Geotechnics*

## Problems found during generating the flood zones on the base of data from 1-D modelling

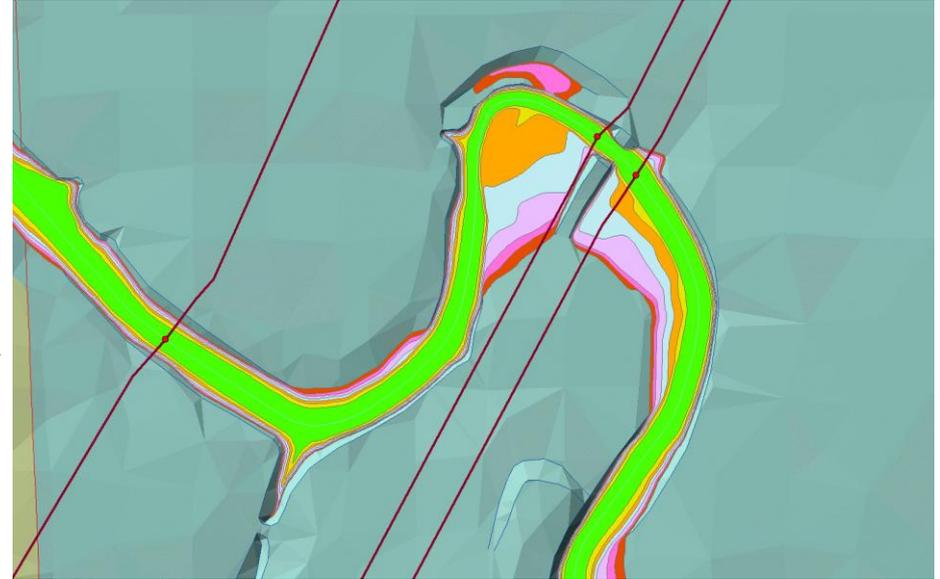
Dr inż. Jacek Florek  
Dr inż. Andrzej Strużyński  
Mgr inż. Mateusz Strutyński  
Mgr inż. Maciej Wyrębek  
Dr inż. Leszek Książek



## Data

Geometric measurement in the river bed area

- cross-sections separation 500m
- hydrotechnical objects
- bridges
- flood banks



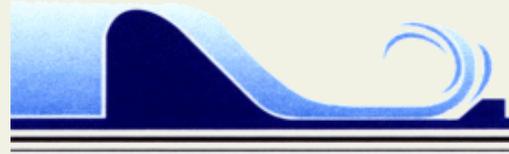
Roughness on the separated parts of the cross-sections

Numerical Model of Terrain (NMT, ang. DTM)

- points (ASCII) -> data NMT (TIN)

Numerical Model of Water Surface

- 1D in modeling: river beds, flood plains, terrain protected by dykes



## Numerical Model of Terrain (NMT, ang. DTM)

ASCII files:

system: PUWG 1992

Field data from the time period 2003-2005

Grid resolution of the mesh: 25 m

Accuracy of DTM: +/- 0.6 m

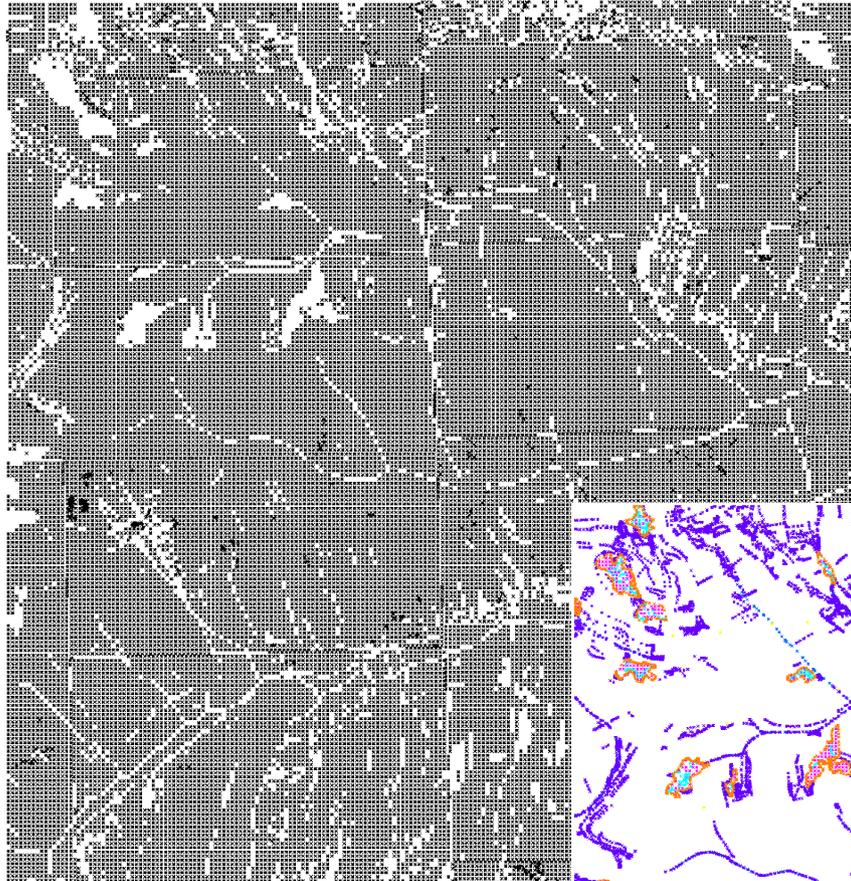


Additional points representing morphological forms of the terrain:

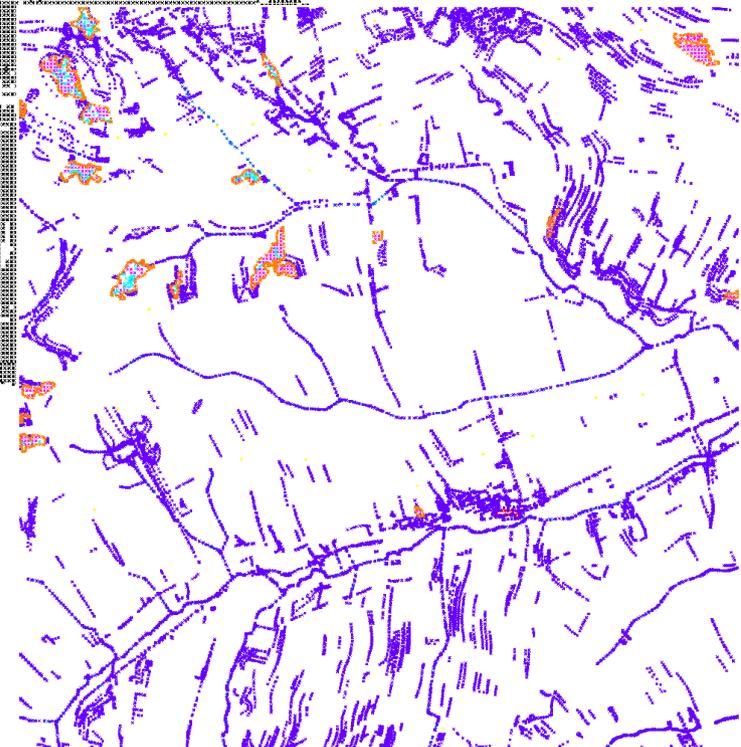
- contour lines (bridges, rivers),
- incontinuity lines (pricipice, embankments),
- excluded surfaces (buildings),
- extremal hights (top, bottom).



Numerical Model of Terrain –  
source of data  
39 562 points

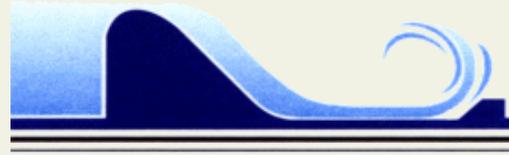


Numerical Model of Terrain –  
source of data  
28 107 points



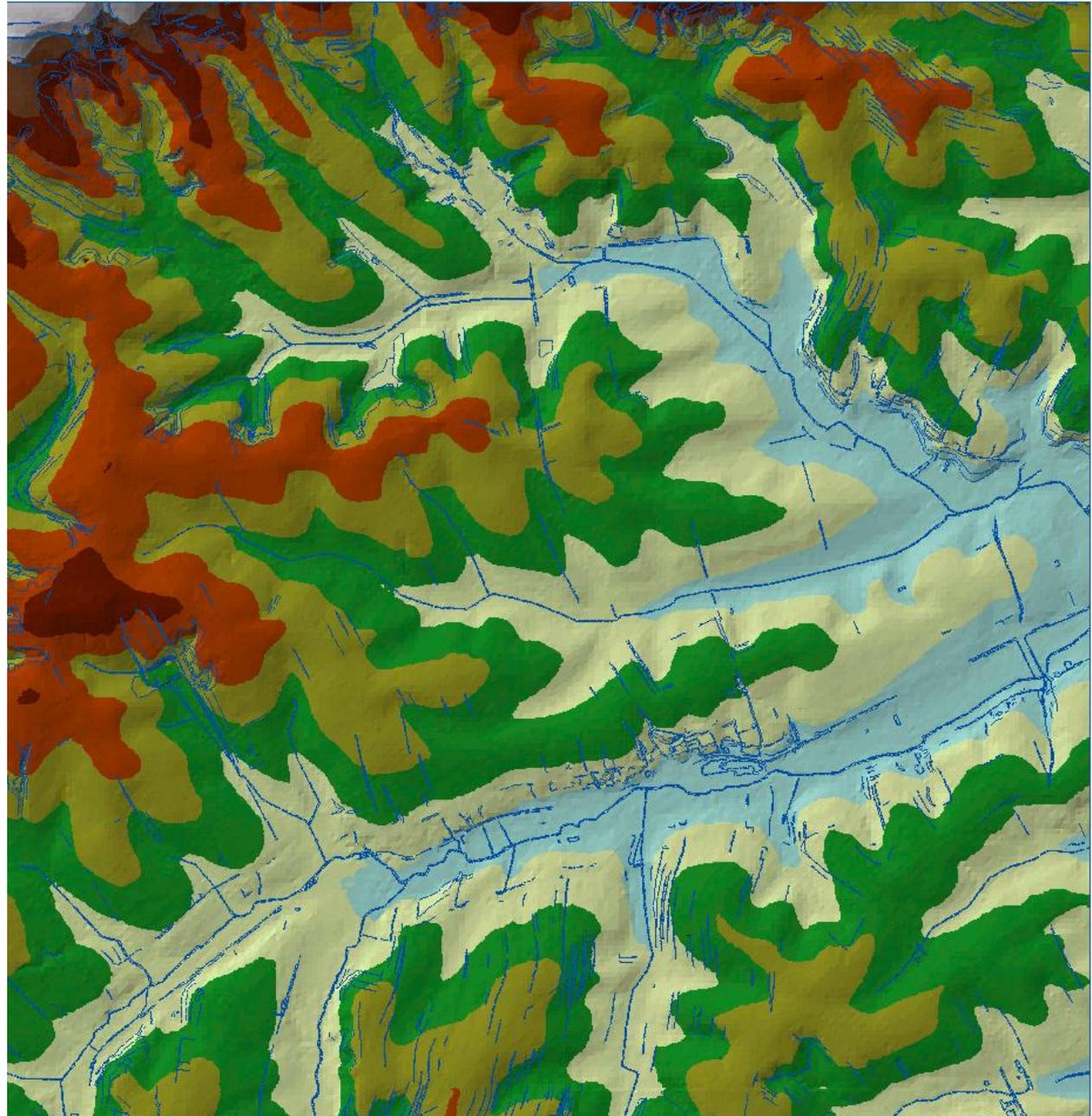


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Numerical Model of Terrain –  
the net of triangles



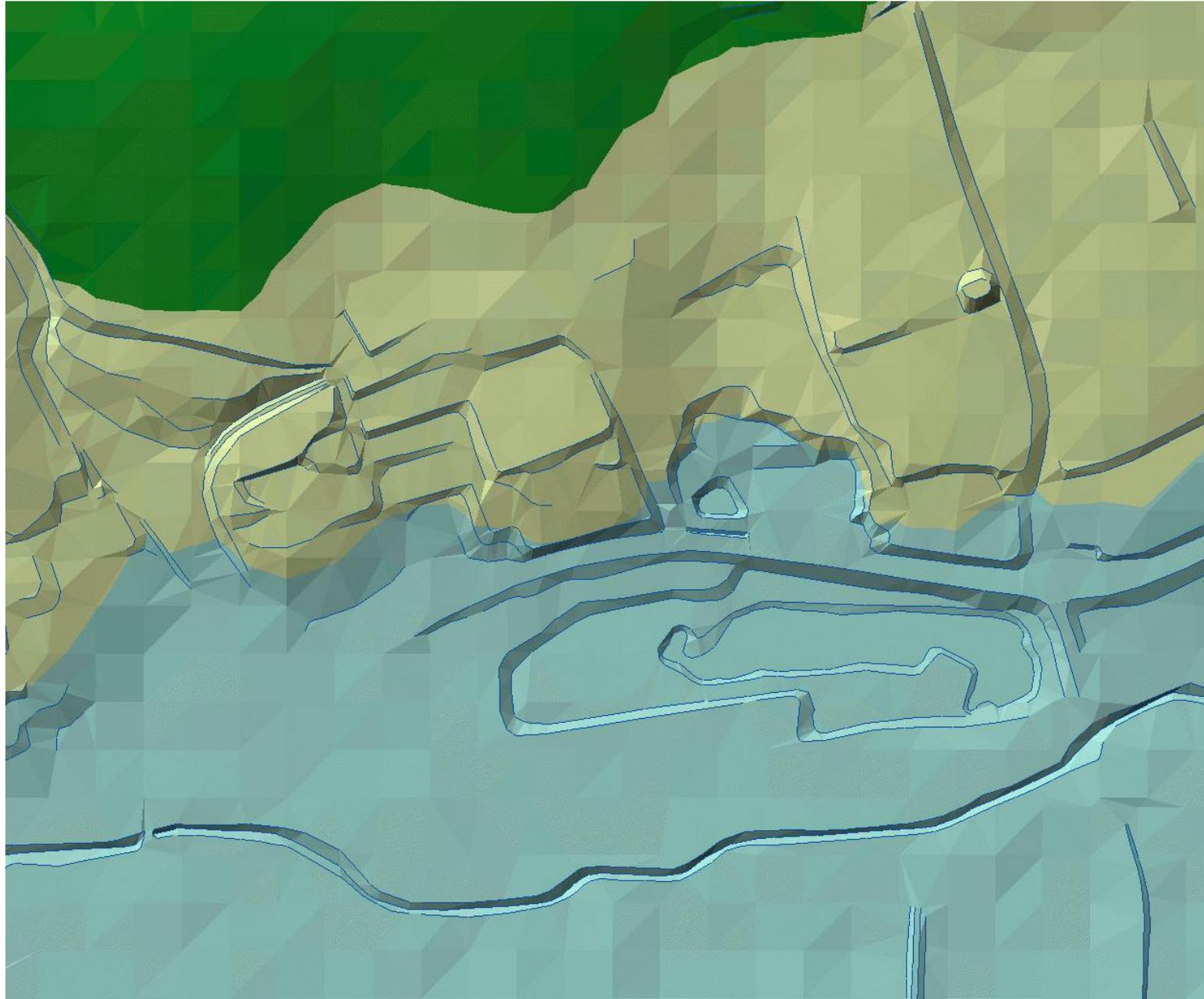


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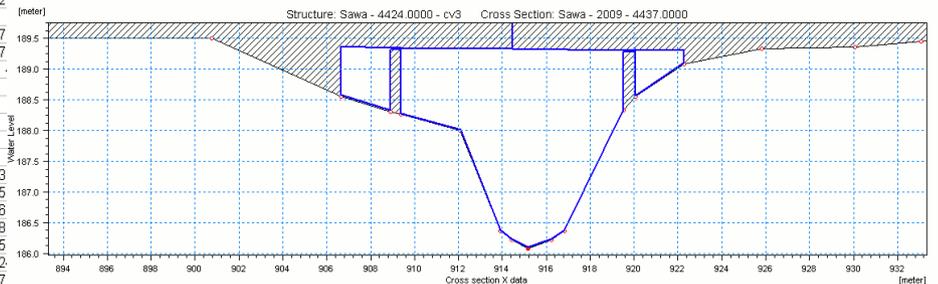
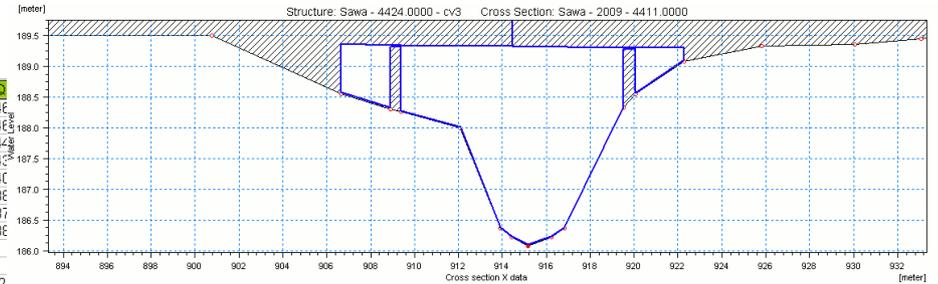
Numerical Model of  
Terrain – representing  
incontinuous lines





## Modelling results 1D

RZĘKA	ODLEGŁOŚĆ	Q05_RZEDNA	Q1_RZEDNA	Q2_RZEDNA	Q5_RZEDNA	Q10_RZEDNA	Q20_RZEDNA	Q50_RZEDNA	ID	HYD	R	Q			
MLECZKA_WSCHODNIA	4344	196.06	195.94	195.82	195.65	195.47	195.3	194.45	22688	24E					
MLECZKA_WSCHODNIA	4686	196.19	196.09	195.99	195.85	195.72	195.63	194.89	22688	24E					
MLECZKA_WSCHODNIA	5115	197.11	196.99	196.81	196.51	196.24	196.06	195.5	22688	24E					
MLECZKA_WSCHODNIA	5149	197.4	197.3	197.19	196.93	196.59	196.3	195.61	22688	24E					
MLECZKA_WSCHODNIA	5553	197.54	197.44	197.36	197.24	197.09	196.92	196.12	22688	24C					
MLECZKA_WSCHODNIA	5873	198.69	198.59	198.46	198.15	197.83	197.47	196.6	22688	23E					
MLECZKA_WSCHODNIA	5897	198.98	198.82	198.65	198.29	197.95	197.56	196.67	22688	23T					
MLECZKA_WSCHODNIA	6012	199.36	199.18	198.96	198.57	198.21	197.79	196.73	22688	23E					
W_TZP439-3550	439	193.02	192.81	192.47	192.02	191.6	190.92	190.92							
W_TZP439-3550	485	193.02	192.81	192.47	192.02	191.6	190.92	190.92							
W_TZP439-3550	869	193.03	192.81	192.47	192.02	191.6	190.88	190.29							
W_TZP439-3550	1246	193.03	192.81	192.47	192.02	191.6	190.88	190.35							
W_TZP439-3550	1741	193.03	192.82	192.48	192.03	191.6	191.39	191.17							
W_TZP439-3550	2187	193.04	192.82	192.49	192.05	191.67	191.54	191.27							
W_TZP439-3550	2653	193.04	192.82	192.49	192.06	192.06	192.06	192.06							
W_TZP439-3550	3098	193.04	192.82	192.49	192.35	192.35	192.35	192.35							
W_TZP439-3550	3550	193.29	193.21	193.16	193.06	193.06	193.06	193.06							
W_TZL439-3999	439	193.03	192.82	192.47	192.09	191.85	191.25	191.25							
W_TZL439-3999	485	193.03	192.82	192.47	192.09	191.85	191.25	191.25							
W_TZL439-3999	869	193.03	192.82	192.47	192.09	191.85	190.91	190.07							
W_TZL439-3999	1246	193.04	192.82	192.48	192.1	191.85	190.91	189.88							
W_TZL439-3999	1741	193.04	192.82	192.48	192.1	191.85	190.91	190.32							
W_TZL439-3999	2187	193.05	192.83	192.5	192.13	191.85	191.49	191.22							
W_TZL439-3999	2653	193.21	193.07	192.95	192.77	192.6	192.46	192.13							
W_TZL439-3999	3098	193.4	193.3	193.18	192.97	192.69	192.46	192.16							
W_TZL439-3999	3550	194.4	194.32	194.22	194.06	193.8	193.6	193.6							
W_TZL439-3999	3999	195.03	194.95	194.86	194.7	194.45	194.28	194.28							
W_TZL5115-6012	5115	197.47	197.36	197.24	196.97	196.77	195.75	195.42	16.21	12.94	9.67	3.79	1.22	0	0
W_TZL5115-6012	5149	197.47	197.36	197.24	196.97	196.77	195.75	195.42	16.21	13.05	9.7	4.01	2.49	0.4	0
W_TZL5115-6012	5553	197.48	197.37	197.25	196.98	196.77	196.41	196.31	162.11	134.46	98.93	51.47	19.57	3.03	0
W_TZL5115-6012	5873	197.48	197.37	197.25	196.98	196.74	196.64	196.64	1.81	1.6	1.38	0.54	0	0	0
W_TZL5115-6012	5897	197.48	197.37	197.25	196.98	196.73	196.64	196.64	1.5R	1.3R	1.2	0.4R	0	0	0
W_TZL5115-6012	6012	197.48	197.37	197.25	196.98	196.52	196.12	196.12							
W_LC-15115 0.00	197.11	196.99	196.81	196.51	196.24	196.06	195.5								
W_LC-15115 50.00	197.47	197.36	197.24	196.97	196.77	195.75	195.42								
W_LC-15149 0.00	197.4	197.3	197.19	196.93	196.59	196.3	195.61								
W_LC-15149 50.00	197.47	197.36	197.24	196.97	196.77	195.75	195.42								



Resistance numbers	Transversal Distribution	Resistance Type
16.21	12.94	Distributed
16.21	13.05	Manning's n
162.11	134.46	Manning's n
1.81	1.6	Manning's n
1.5R	1.3R	Manning's n

River name: Sawa | TopoID: 2009 | Chainage: 0.00

Section Type: Open | Radius Type: Resistance Radius

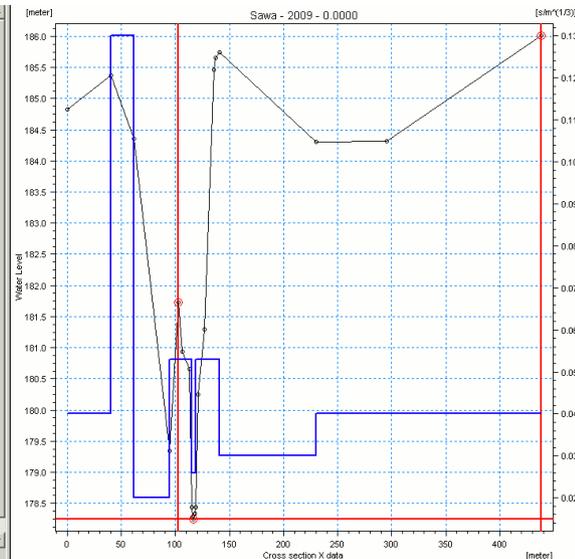
Coordinates:  Apply X Y |  Calculate angle

Resistance numbers:  |

ID	I	X	Z	Resist.	Mark
1		0.000	184.63	0.040	
2		40.480	185.38	0.040	
3		61.910	184.35	0.130	
4		94.820	179.34	0.020	
5		102.31	181.73	0.053	1
6		106.62	180.94	0.053	
7		113.16	180.66	0.053	
8		115.35	178.44	0.053	
9		115.59	178.28	0.026	
10		116.72	178.25	0.026	2
11		118.14	178.34	0.026	
12		118.52	178.44	0.026	
13		120.64	180.25	0.053	
14		126.45	181.29	0.053	

Synchronize processed data |  Update processed data automatically

Buttons:

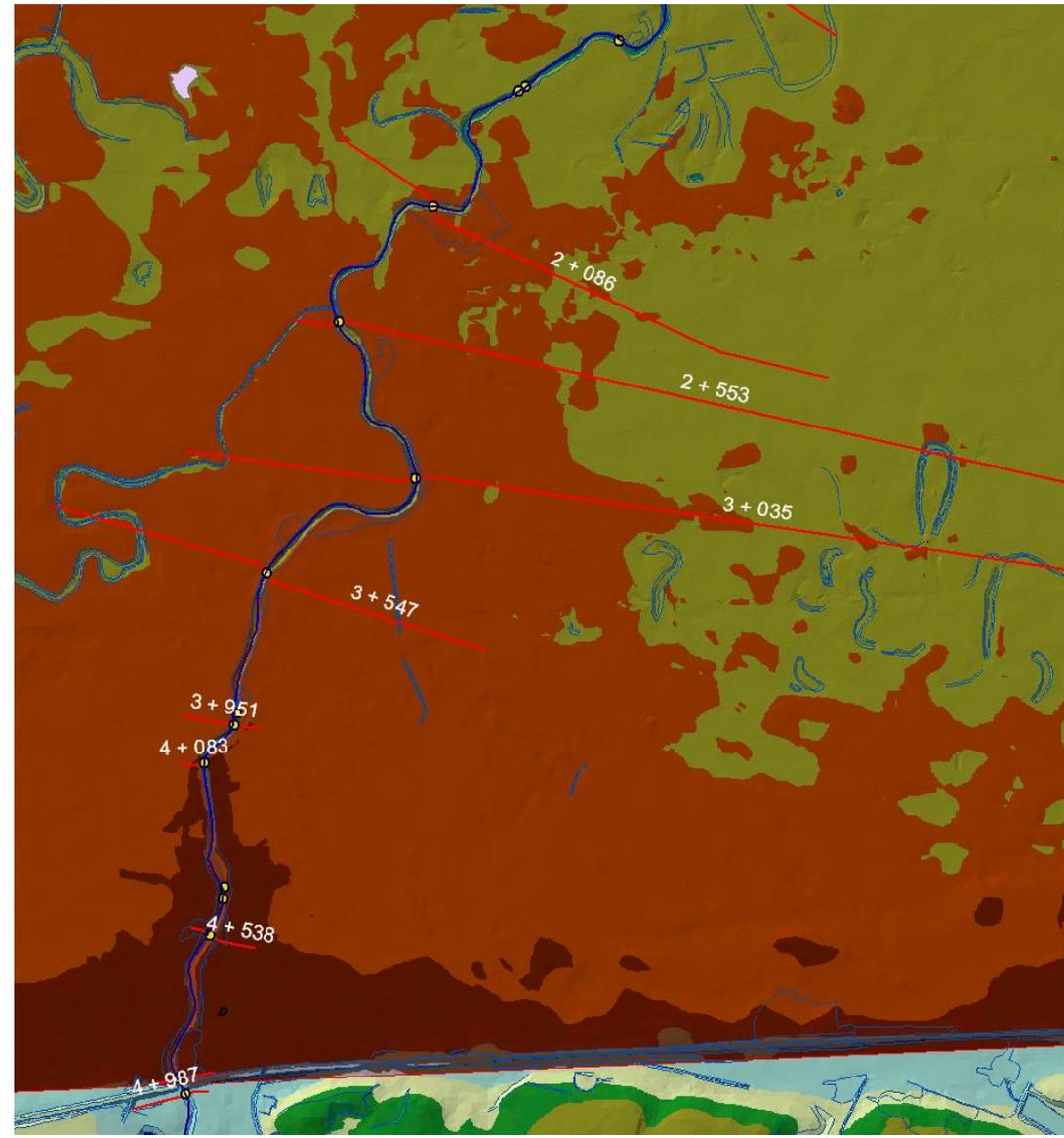
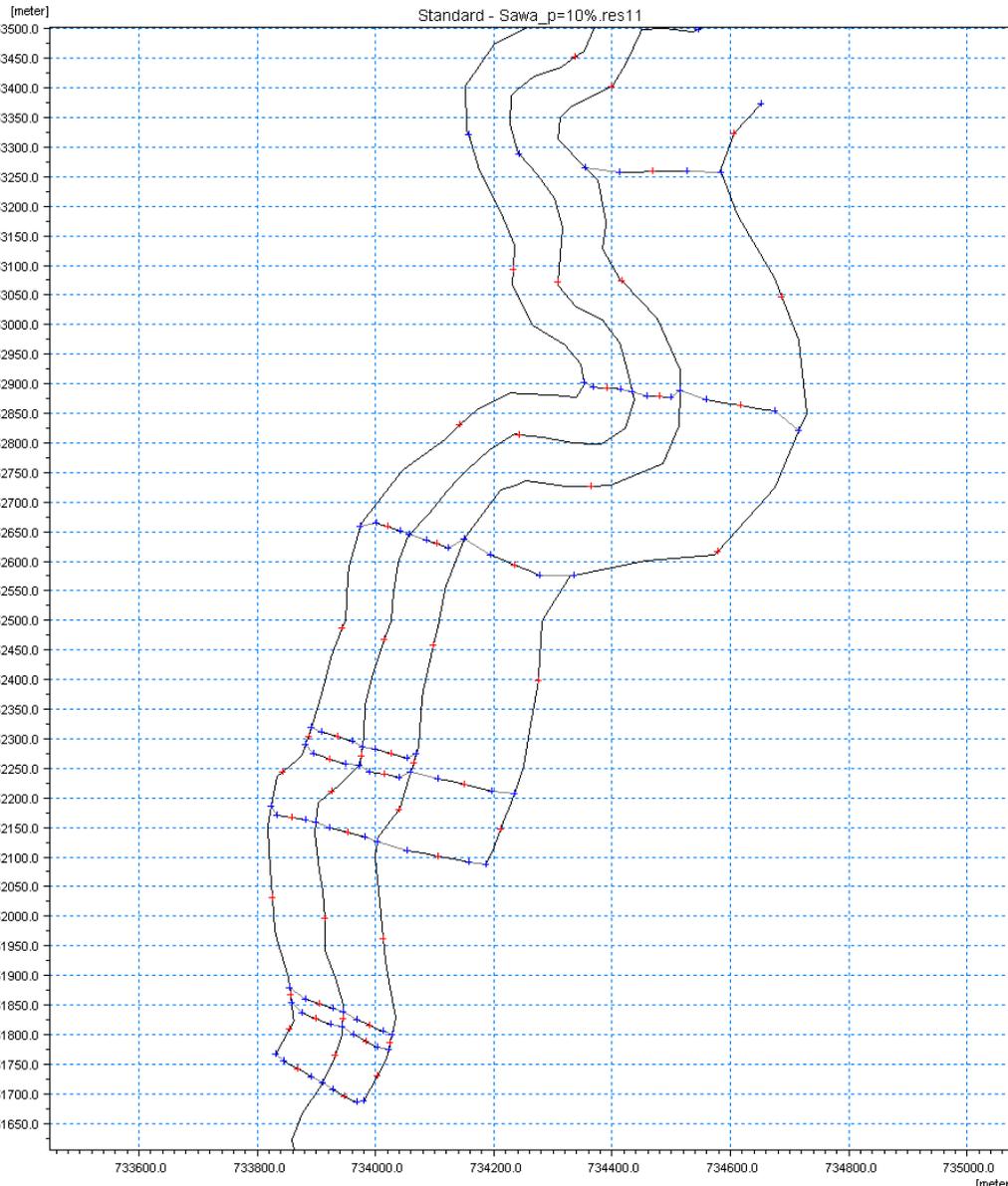


The complete data from modelling was used



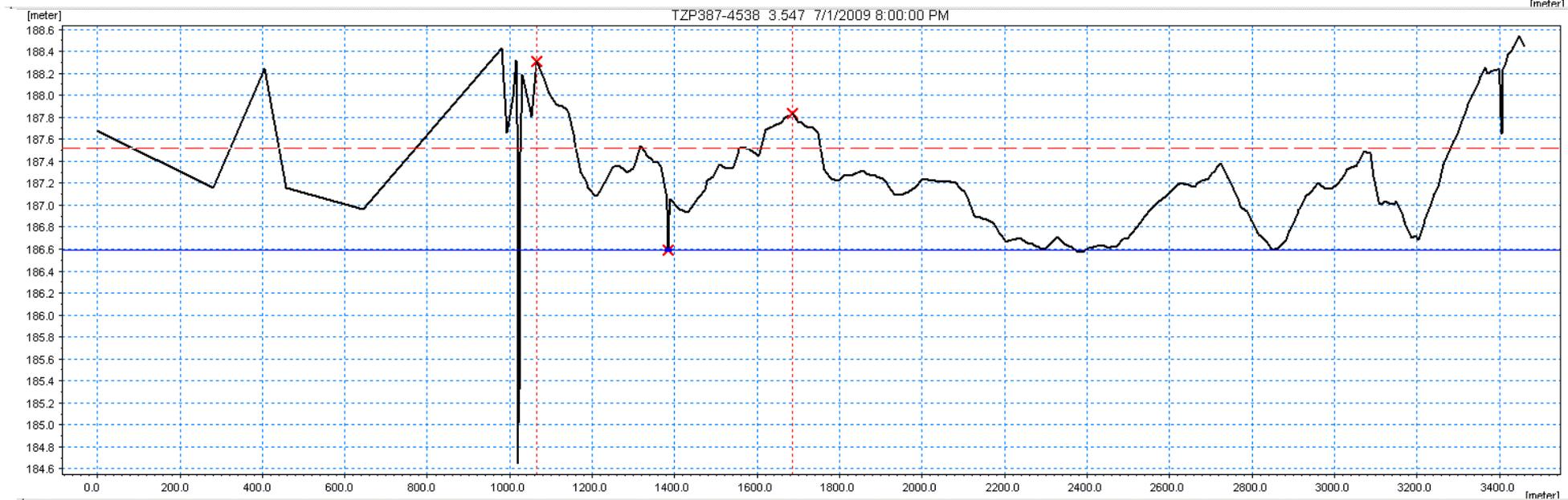
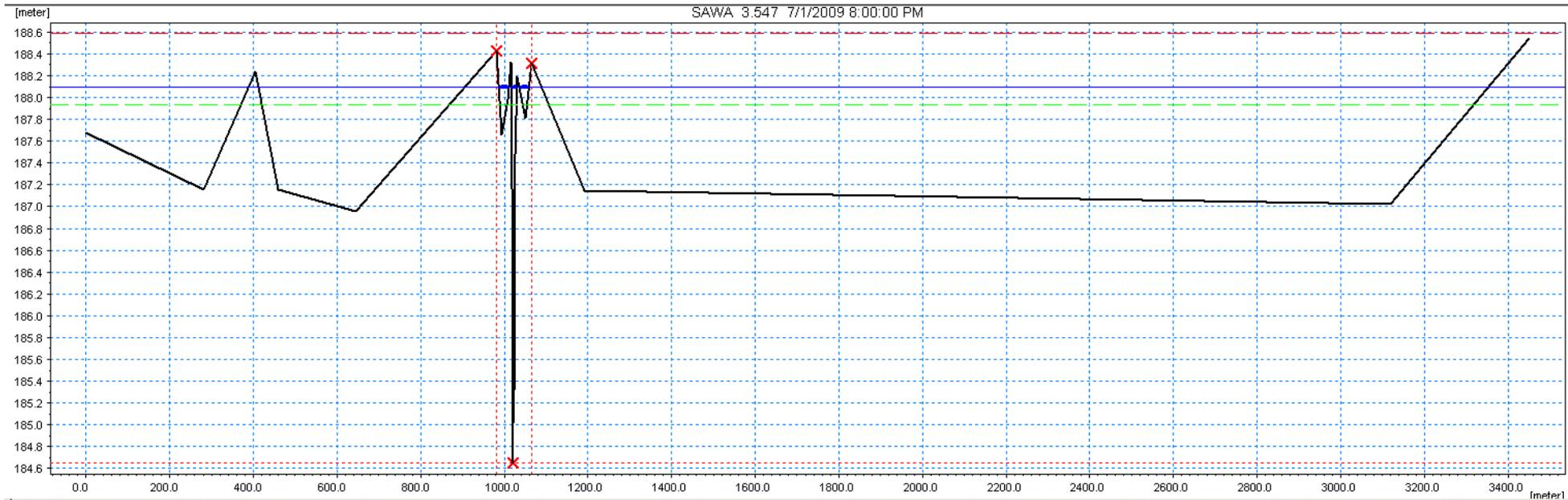
## Modelling results 1D

The results were used on the layers:  
modelling points and cross-sections



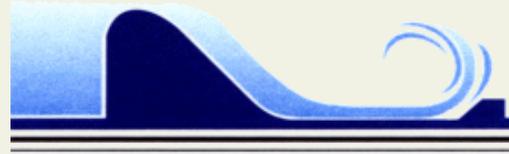


## Modelling results 1D – main channel and the flood plain



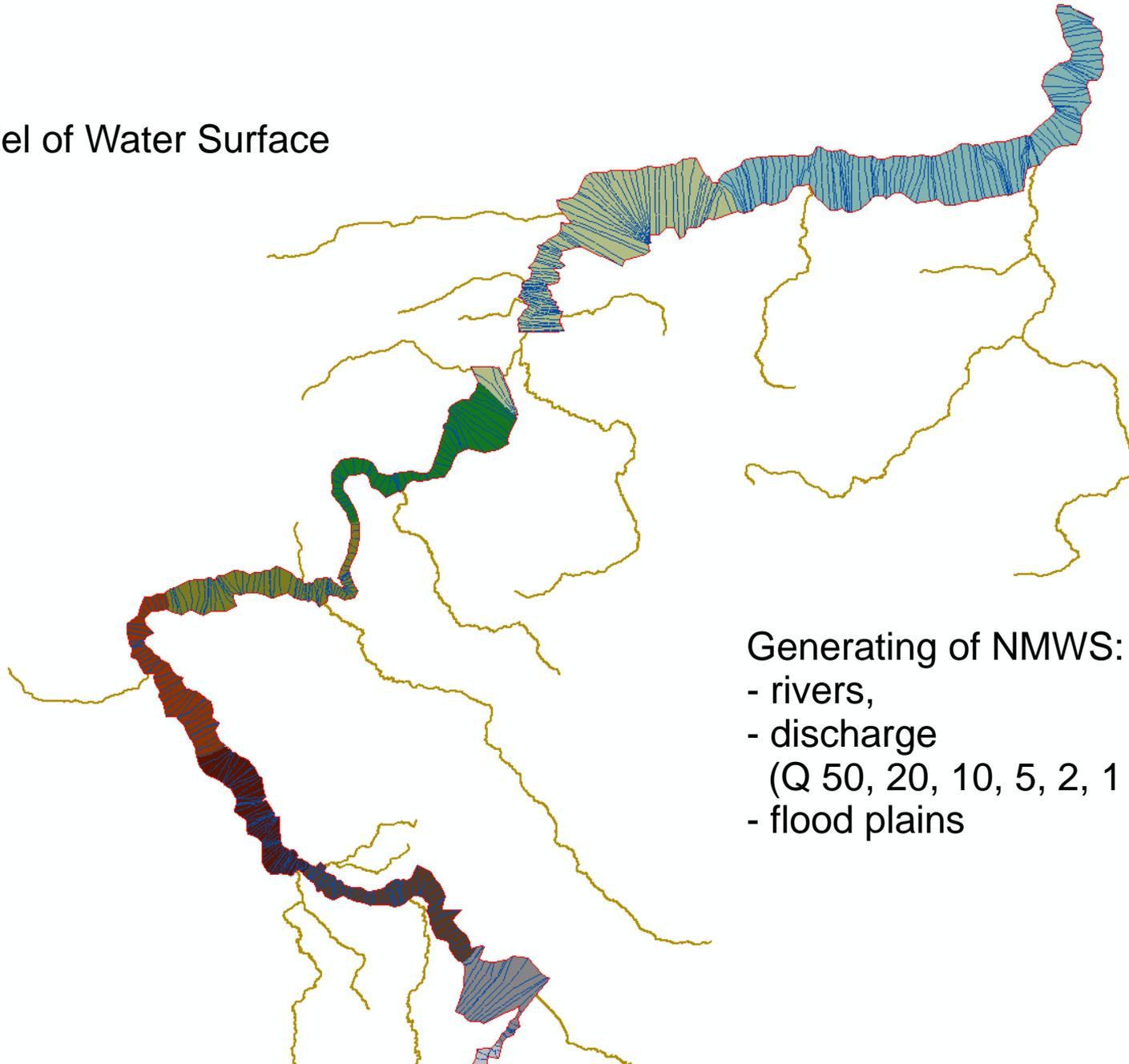


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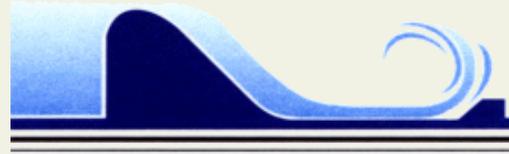
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## Numerical Model of Water Surface



Generating of NMWS:

- rivers,
- discharge  
(Q 50, 20, 10, 5, 2, 1 i 0,5%)
- flood plains



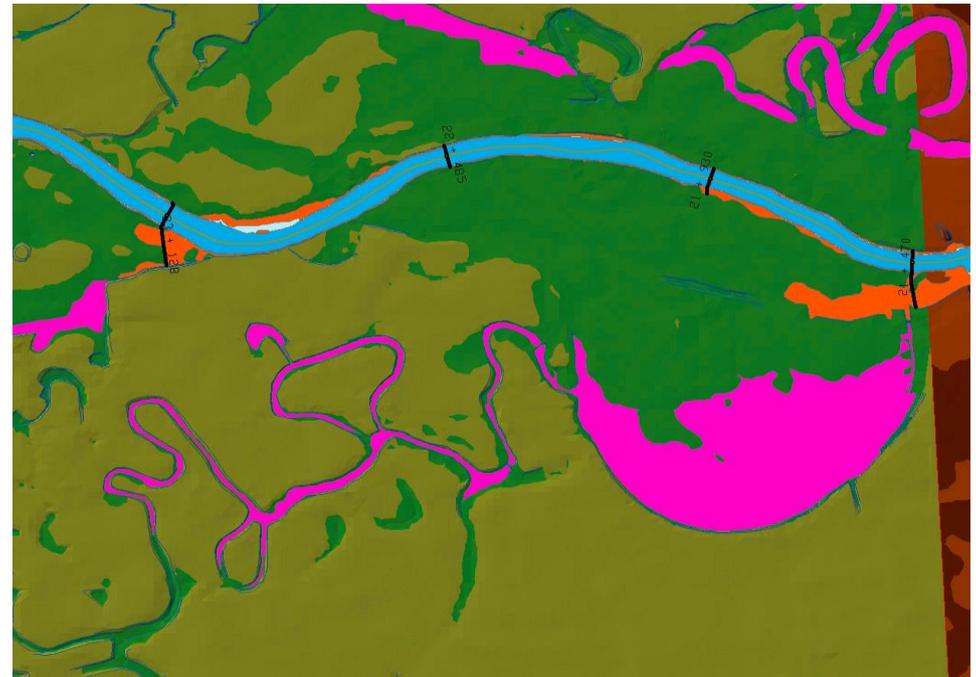
## Results and verification

### Layers:

- flood\_plain\_Q%
- cross-sections
- flood plains without runoff

### Verification in places:

- compatibility of flood-plain range with modelling results
- backwater zones
- verification of the range for flood-plains
- linking channels to the water reservoirs





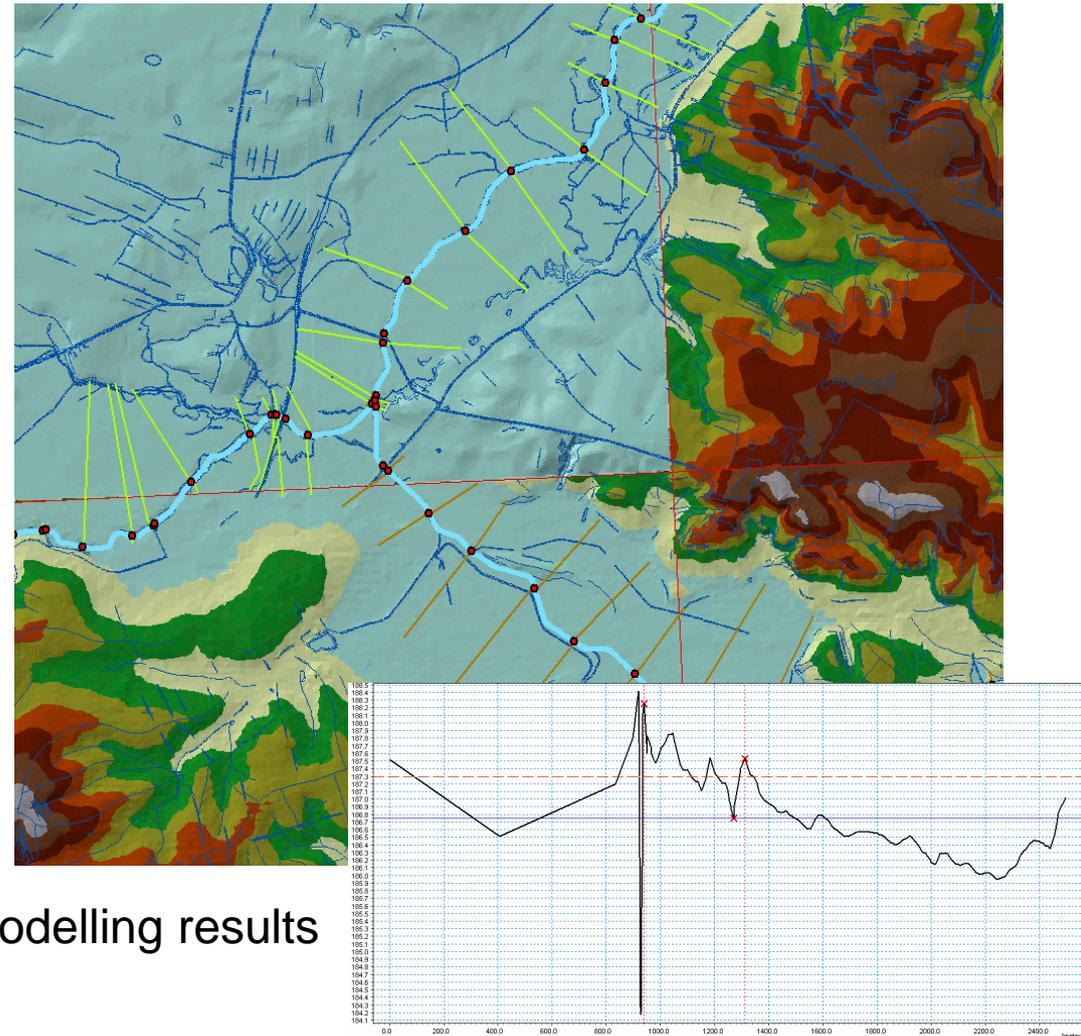
## Results and verification

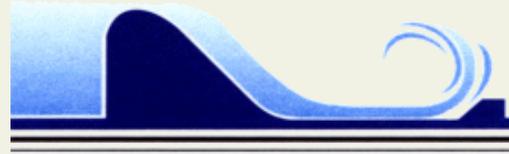
### Layers:

- flood\_plain\_Q%
- flood\_plain (for the whole Wisłok)
- cross-sections

### Verification in places:

- rivers – tributary (river junctions)
- river mouths
- compatibility of flood-plain range with modelling results
- verification of the range for flood-plains
- verification of shape of the cross-sections





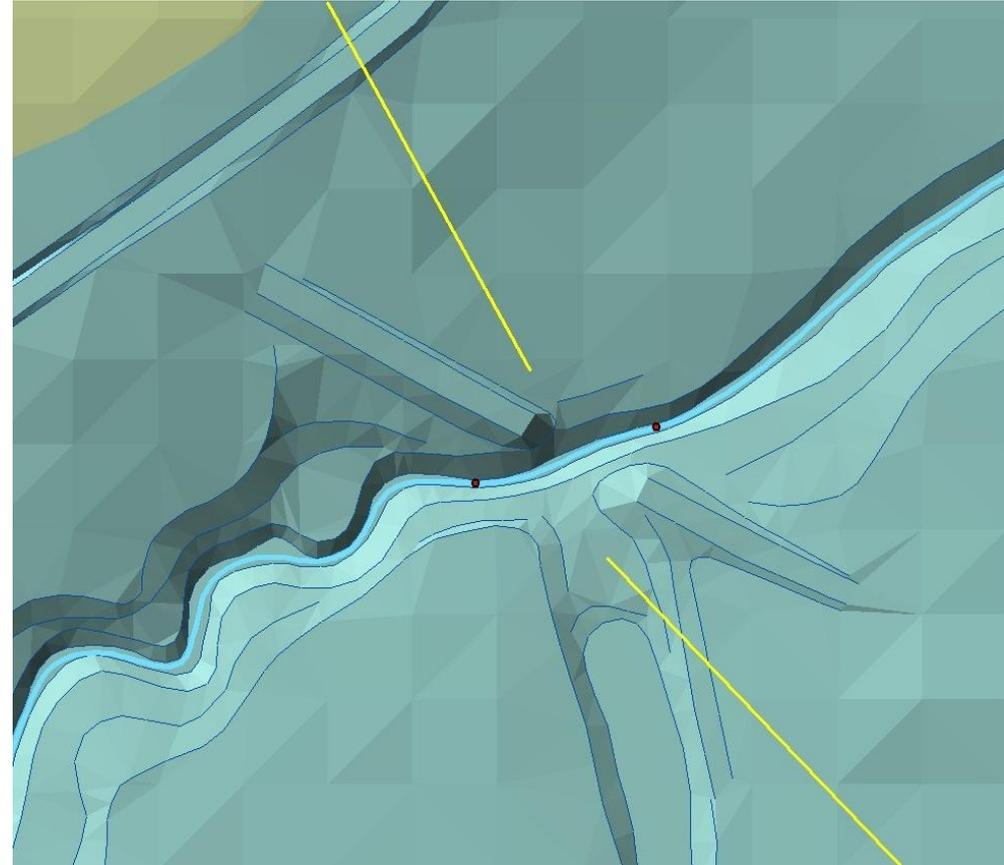
## Results and verification

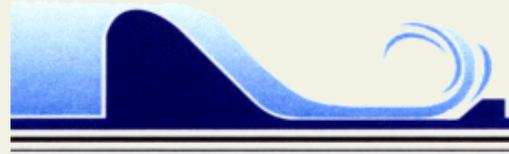
### Layers:

- flood\_plain\_Q%
- cross-sections

### Verification in places:

- compatibility of flood-plain range with modelling results
- verification of the range for flood-plains
- verification of shape of the cross-sections





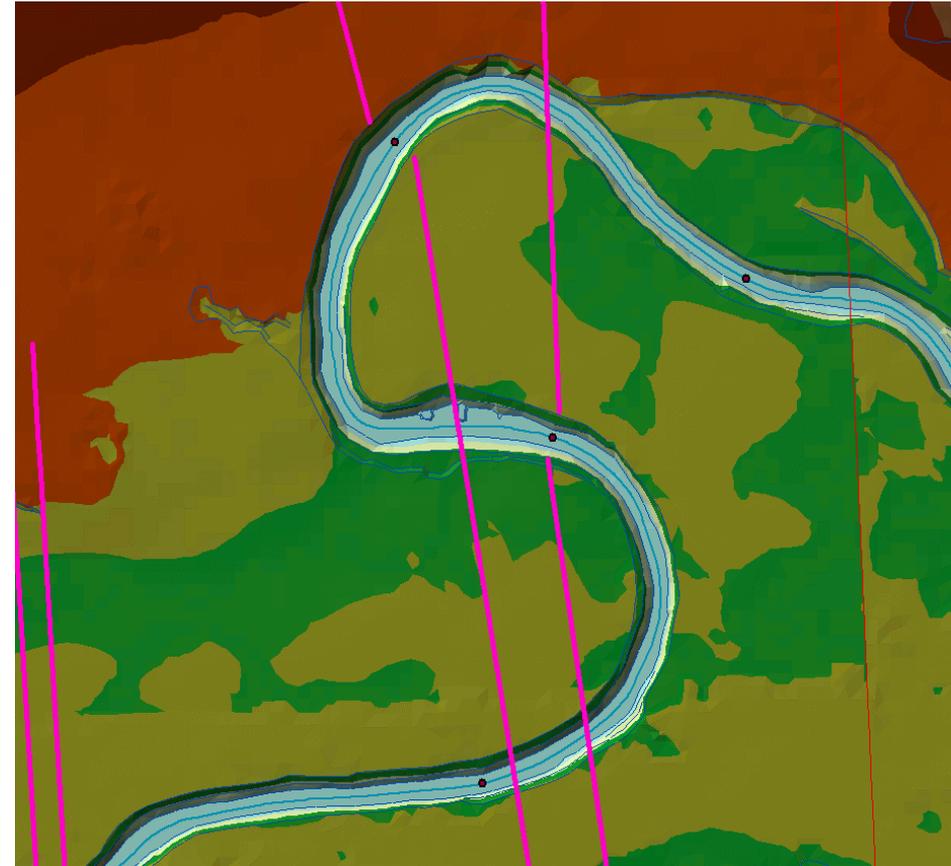
## Results and verification

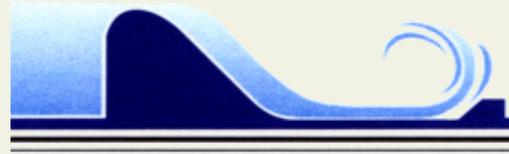
### Layers:

- cross-sections

### Verification in places:

- verification of shape of the cross-sections





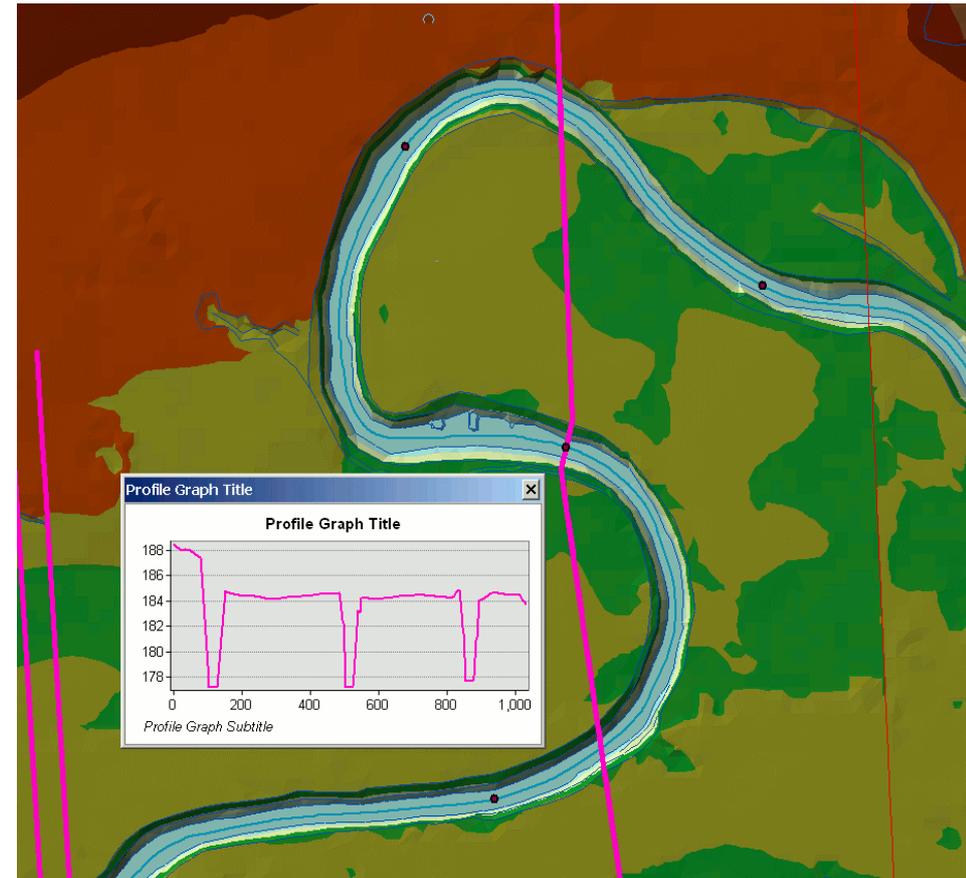
## Results and verification

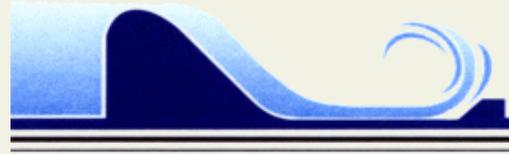
Layers:

- cross-sections

Verification in places:

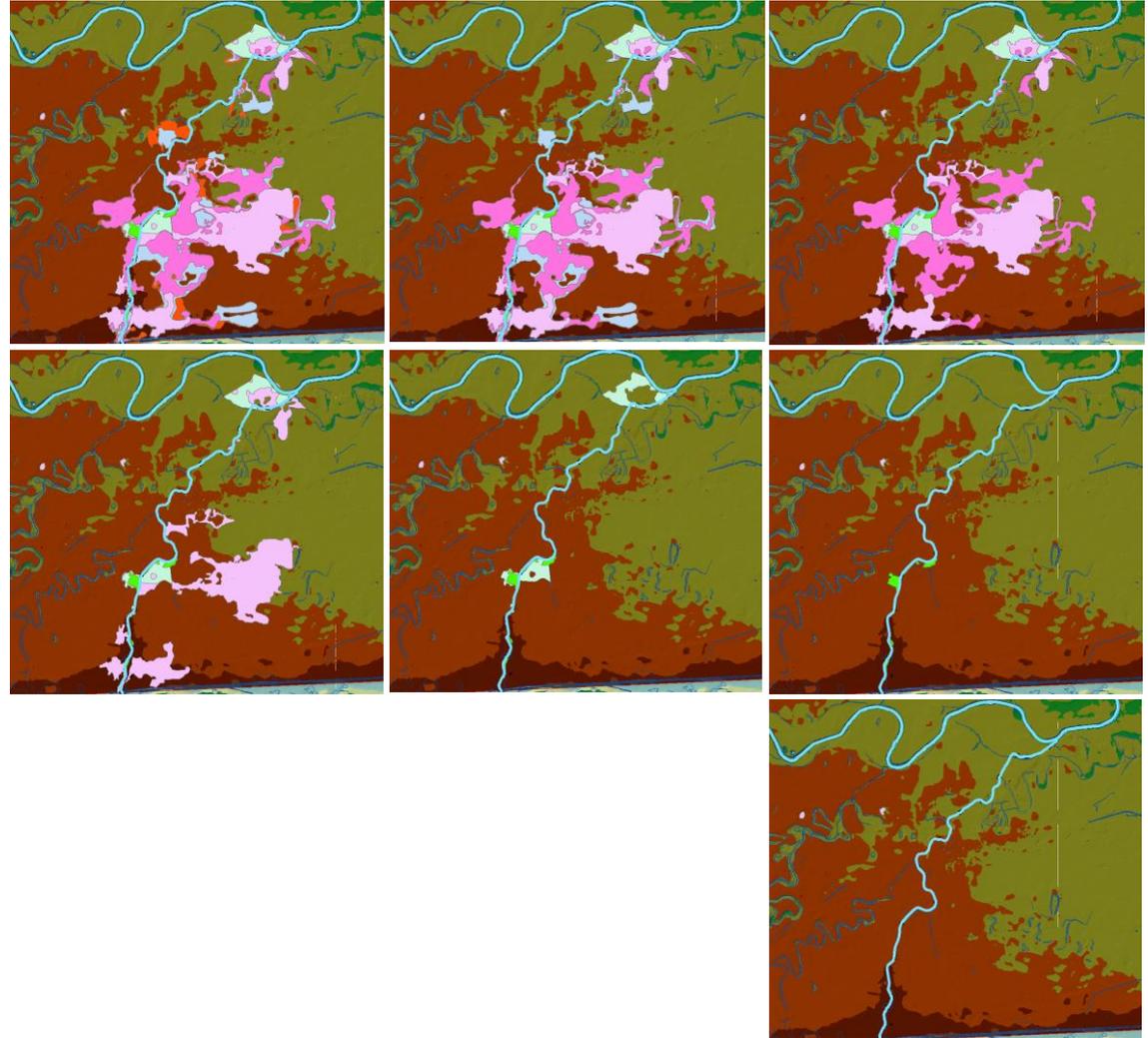
- verification of shape of the cross-sections





## Results and verification

- flood\_plain\_Q%

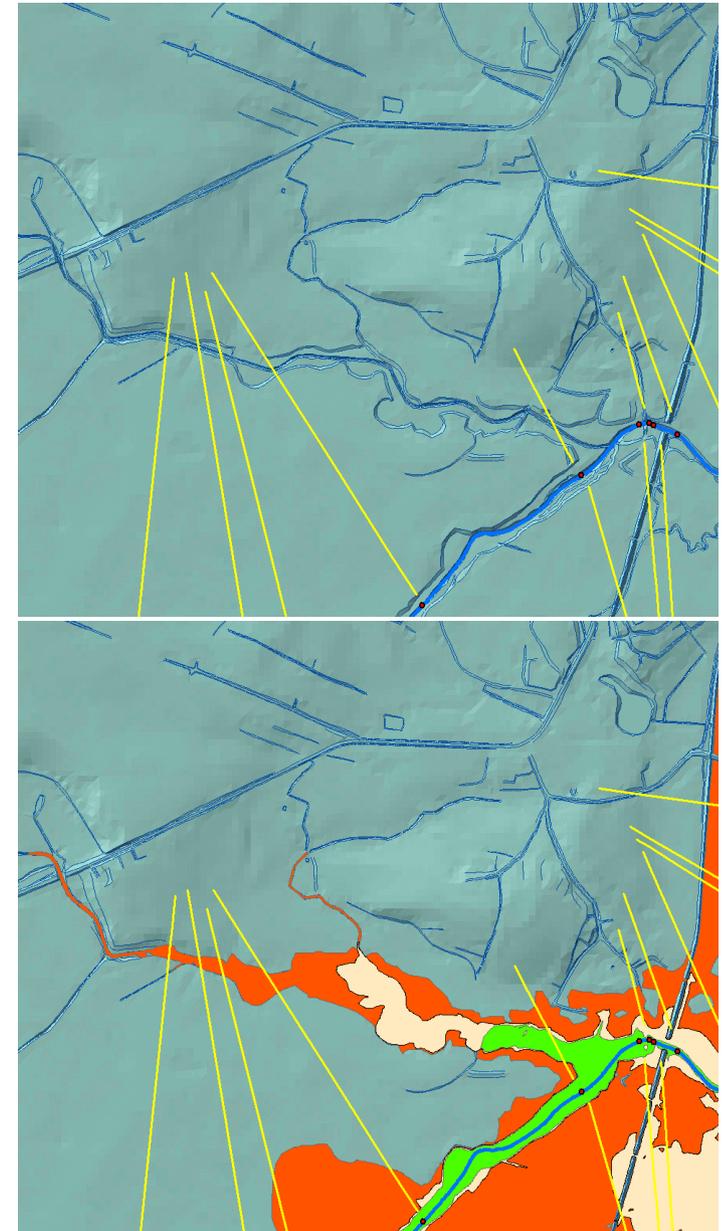
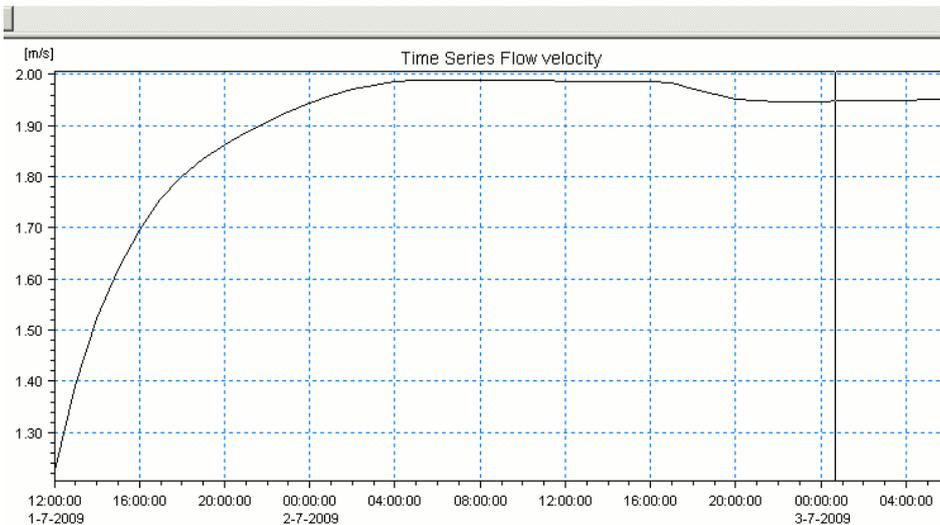
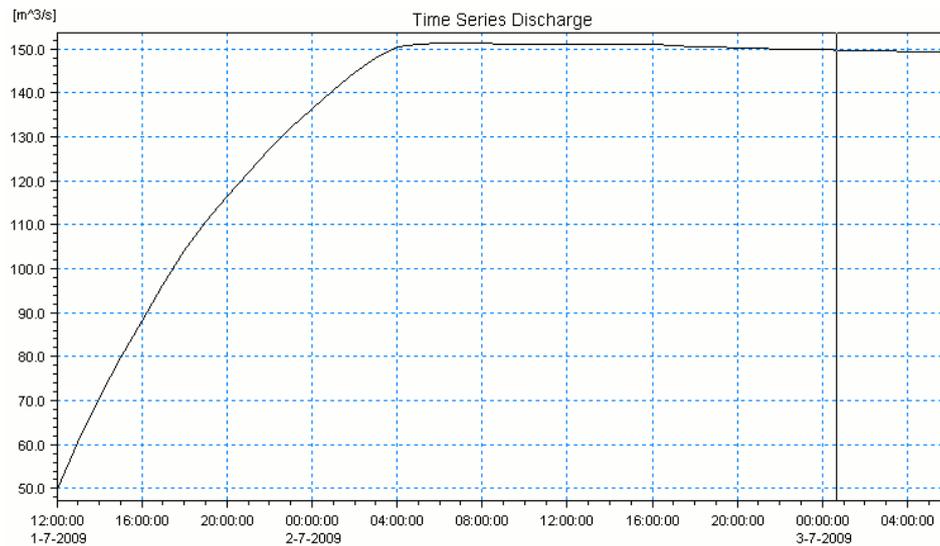


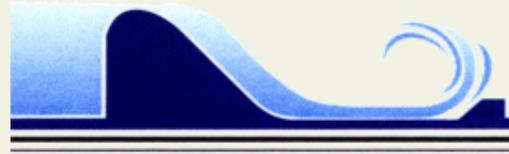


## Results and verification

### Backwater zones

#### Discharge and the velocity





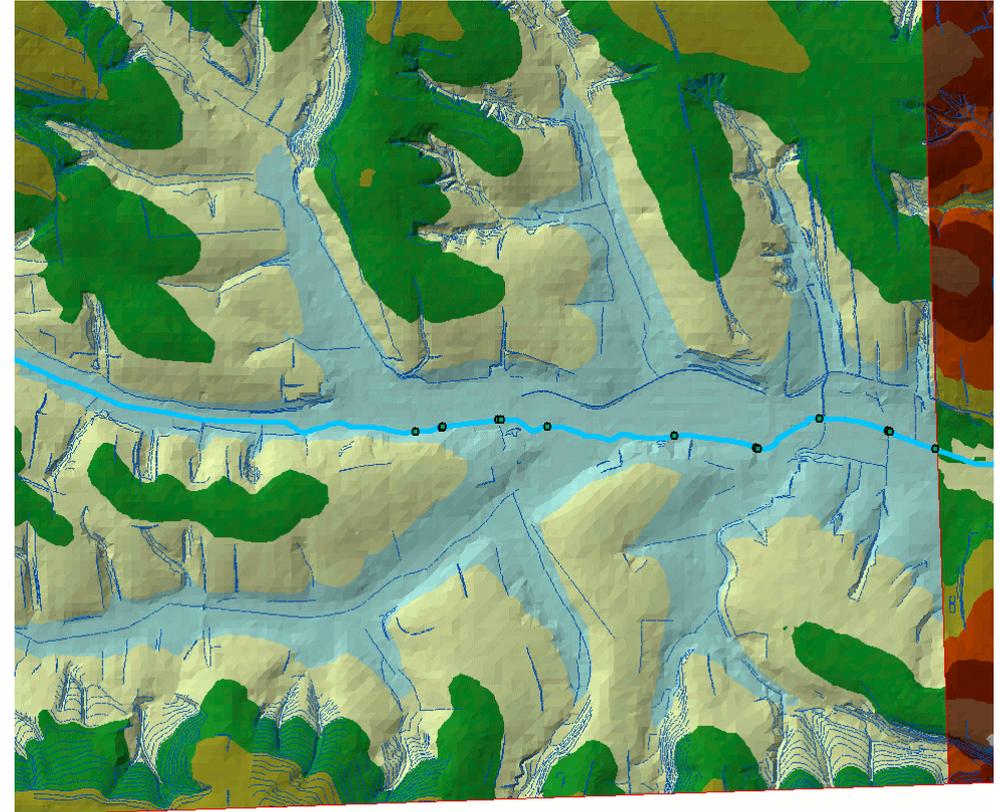
## Results and verification

### Layers:

- flood\_plain\_Q%
- flood\_plain (for the whole Wisłok)
- modelling points
- cross-sections
- flood plains without runoff

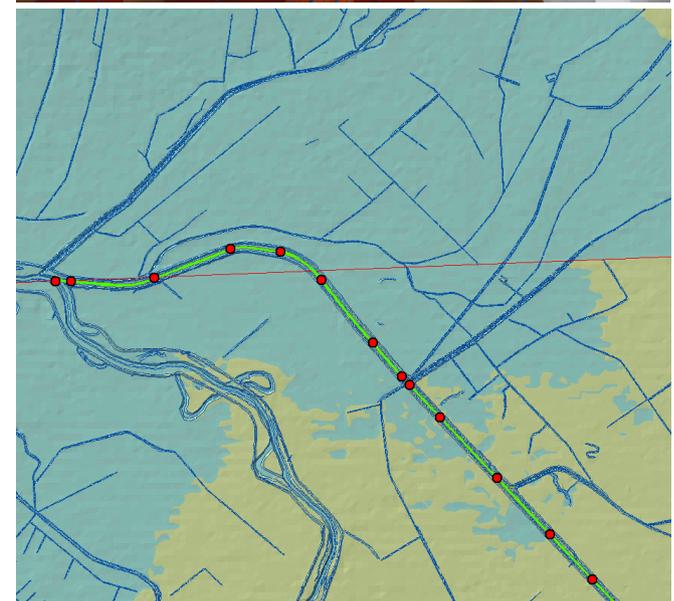
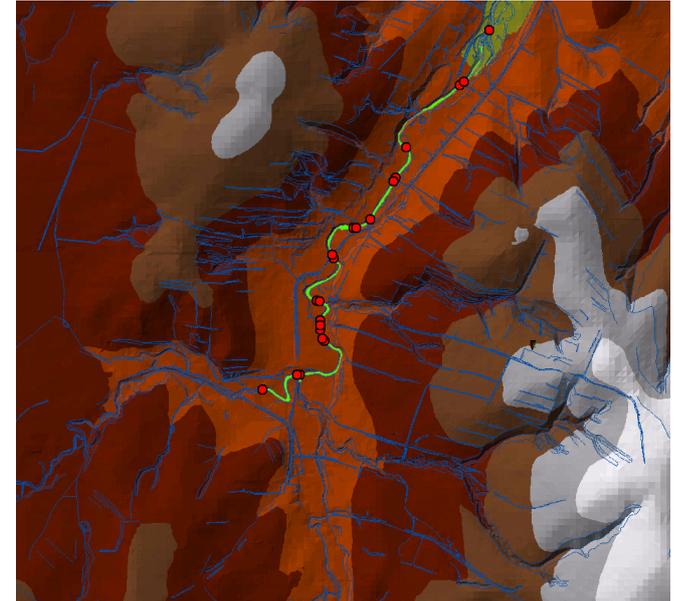
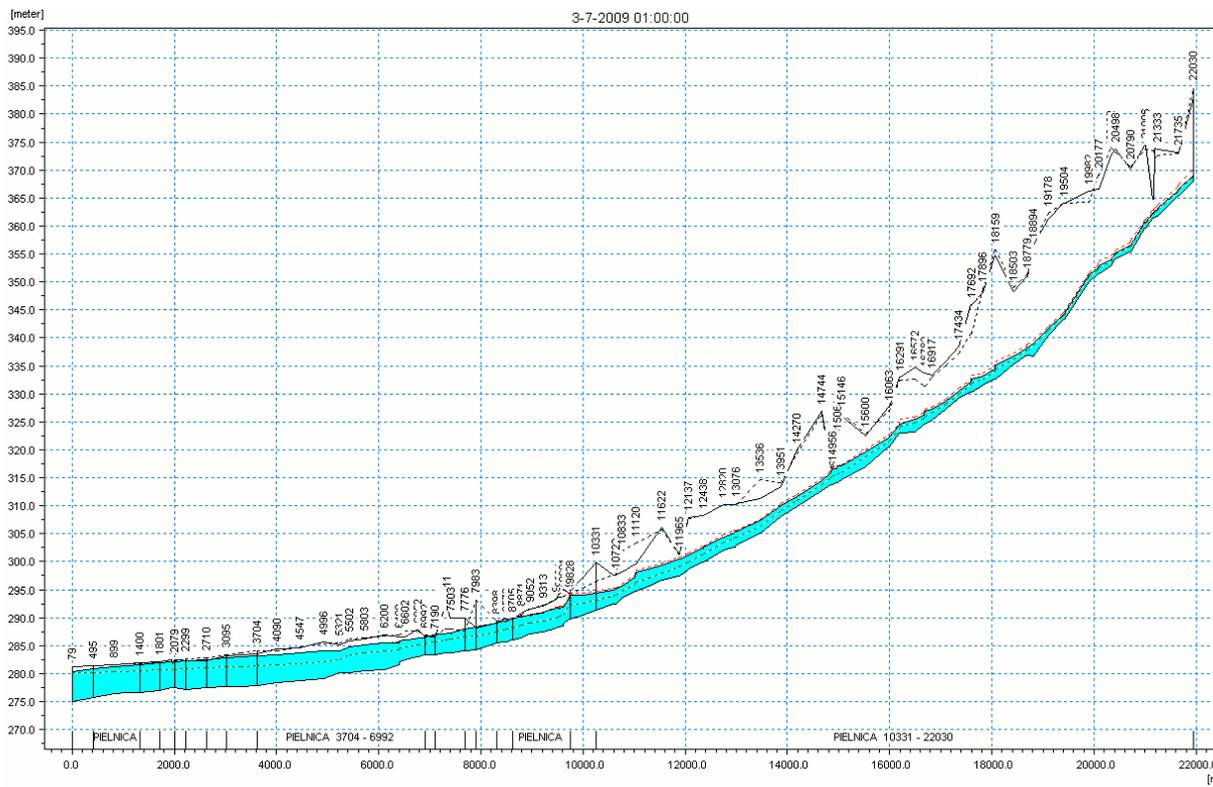
### Verification in places:

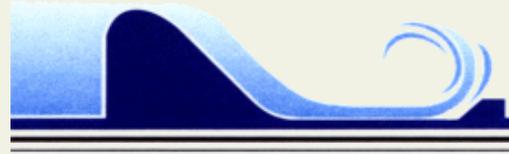
- rivers – tributary (river junctions)
- river mouths
- compatibility of flood-plain range with modelling results
- backwater zones
  
- verification of the range for flood-plains
- verification of shape of the cross-sections
- linking channels to the water reservoirs





## Results and verification – upper and down-part

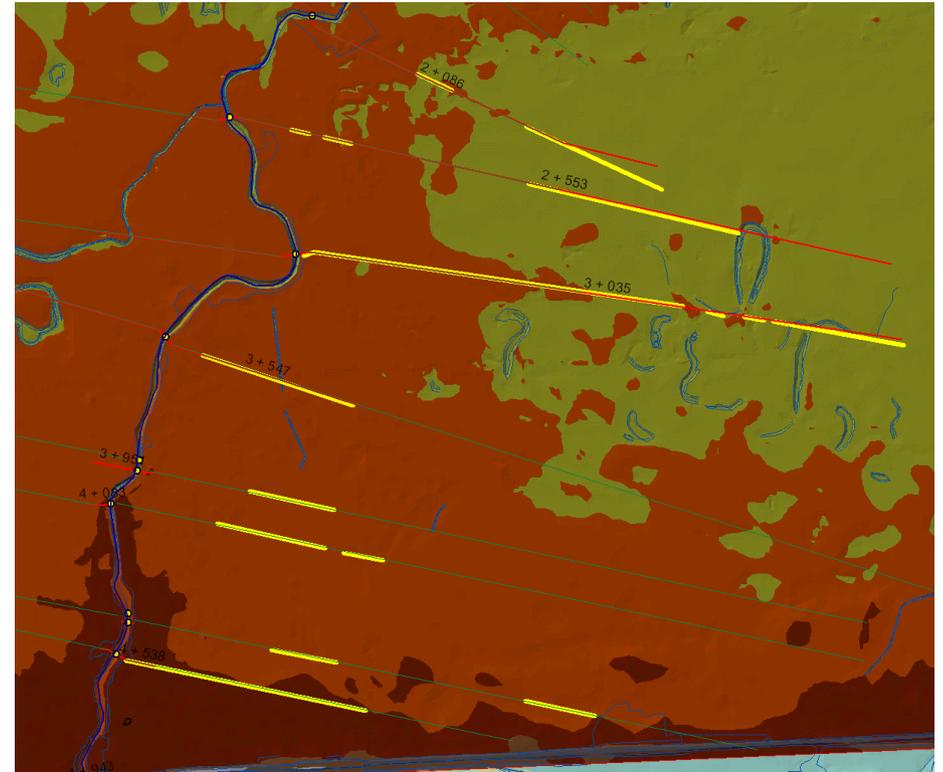




## Results and verification

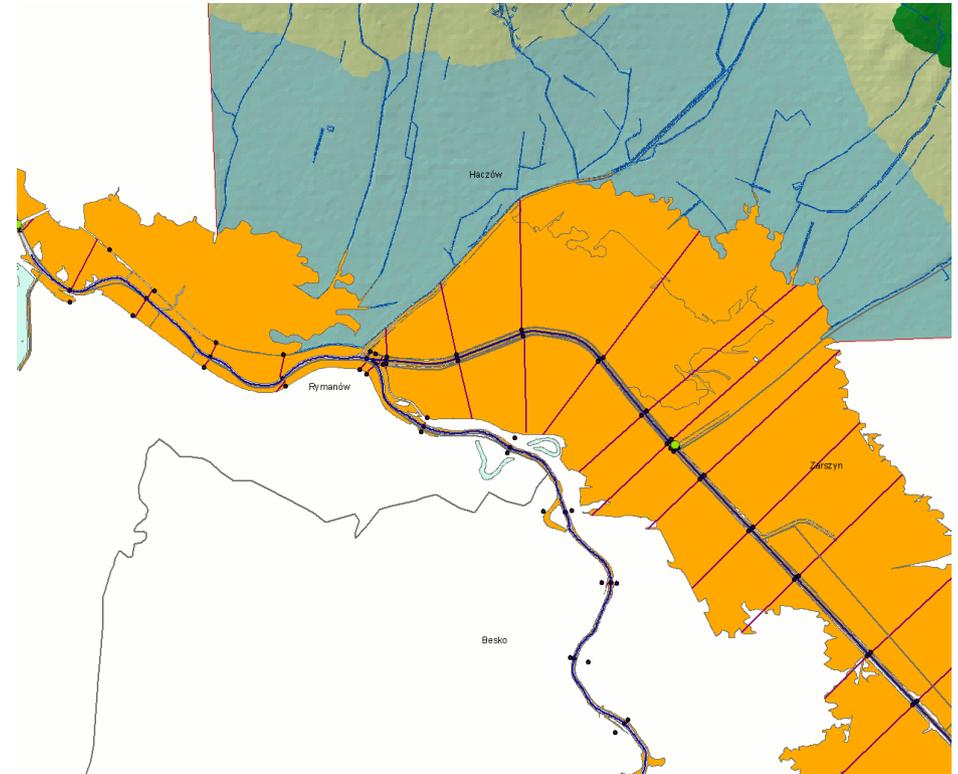


Backwater, flow direction





## Results and verification



Finding the boundary lines to the  
flood-plain area



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Thank you very much for your attention