EU Project

Integrated NBS-based Urban Planning Methodology for Enhancing the Health and Well-being of Citizens

euPOLIS Beyond the state of the art

Belgrade meeting, 28-30 September 2022.

Keynote Guest Lecture

Advanced Environmental Modelling Focusing Processes in Aquatic Habitats

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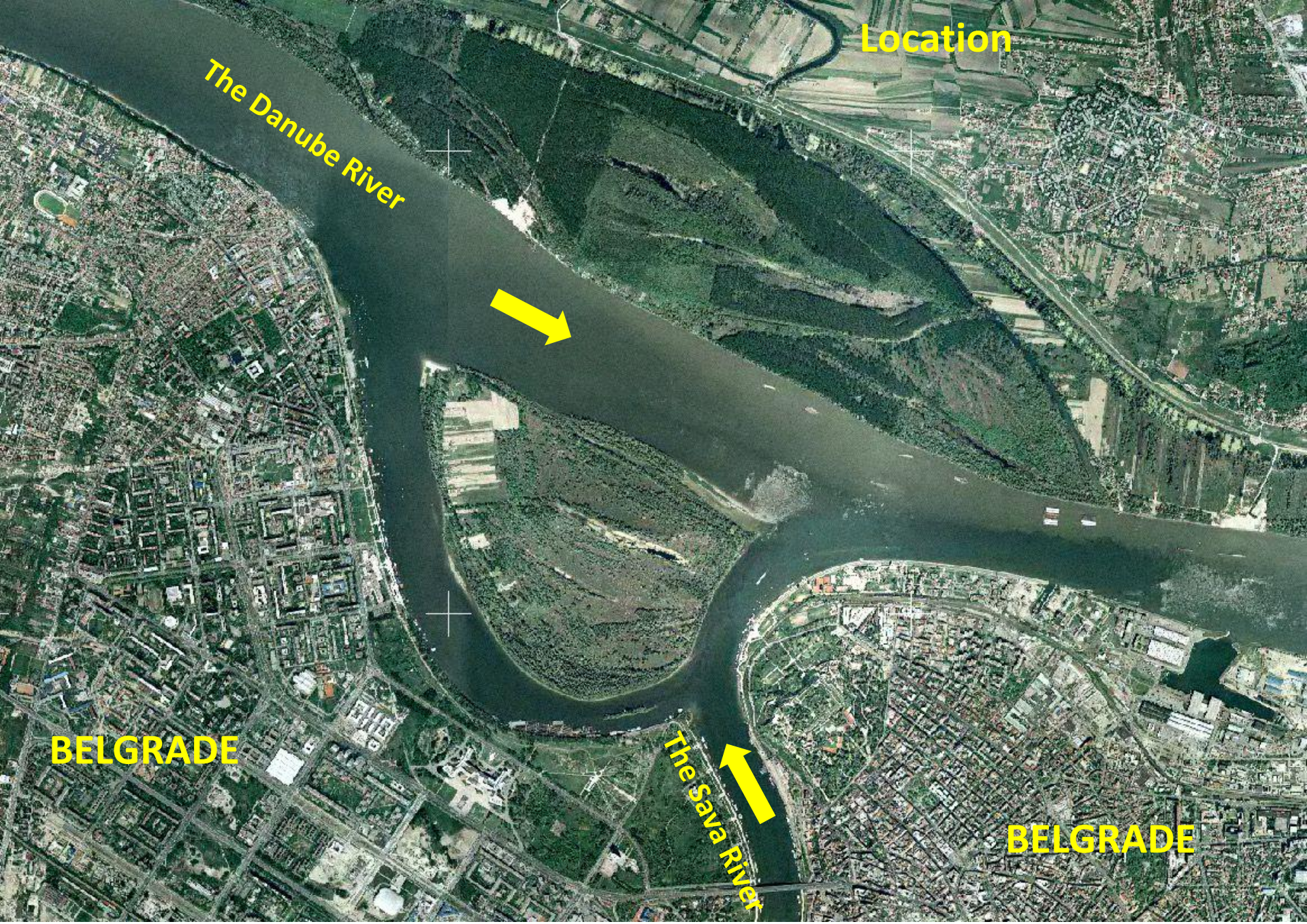
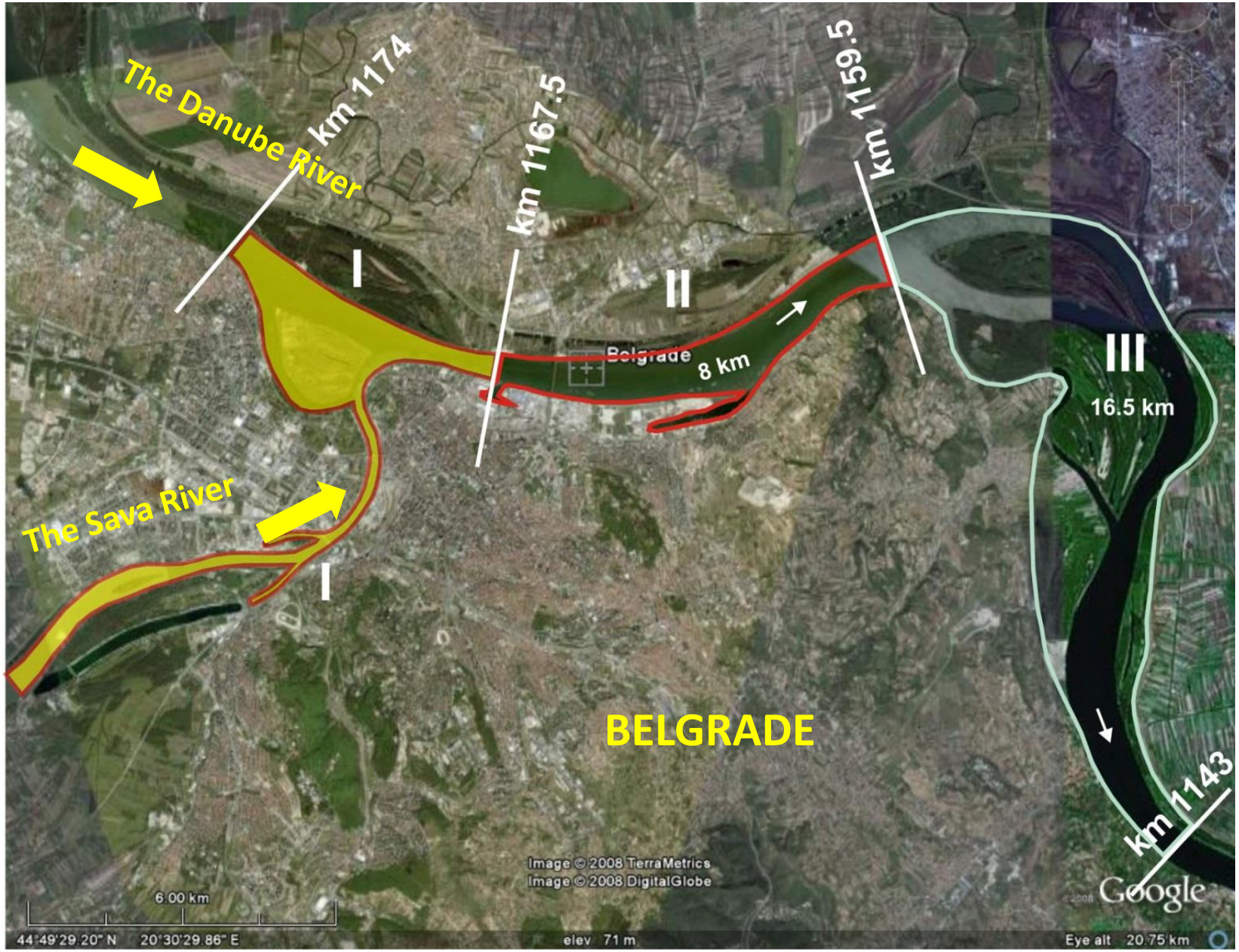

Location
The Danube River
BELGRADE
The Sava River
BELGRADE

Contents

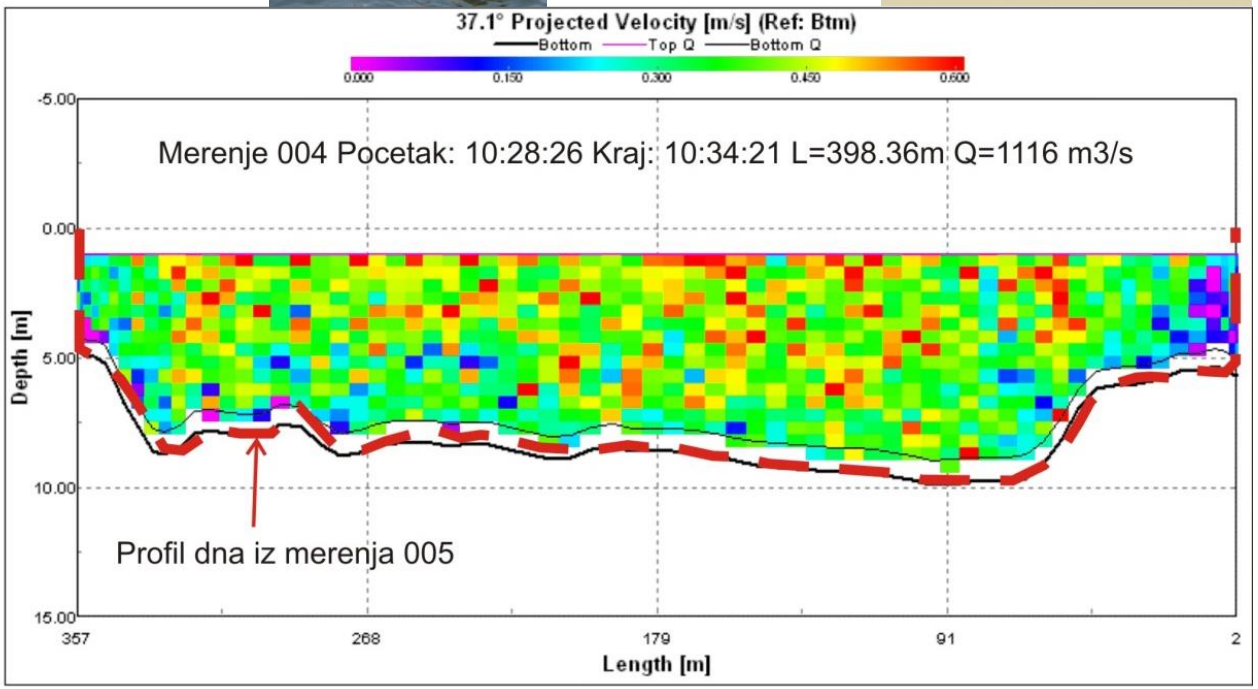
1. Study domain and environmental problems in context of the river engineering projects
2. Water supply
3. Sewage disposal
4. Morphological changes
5. Sediment control
6. Aquatic habitats
7. Conclusions

Study domain



Field measurements

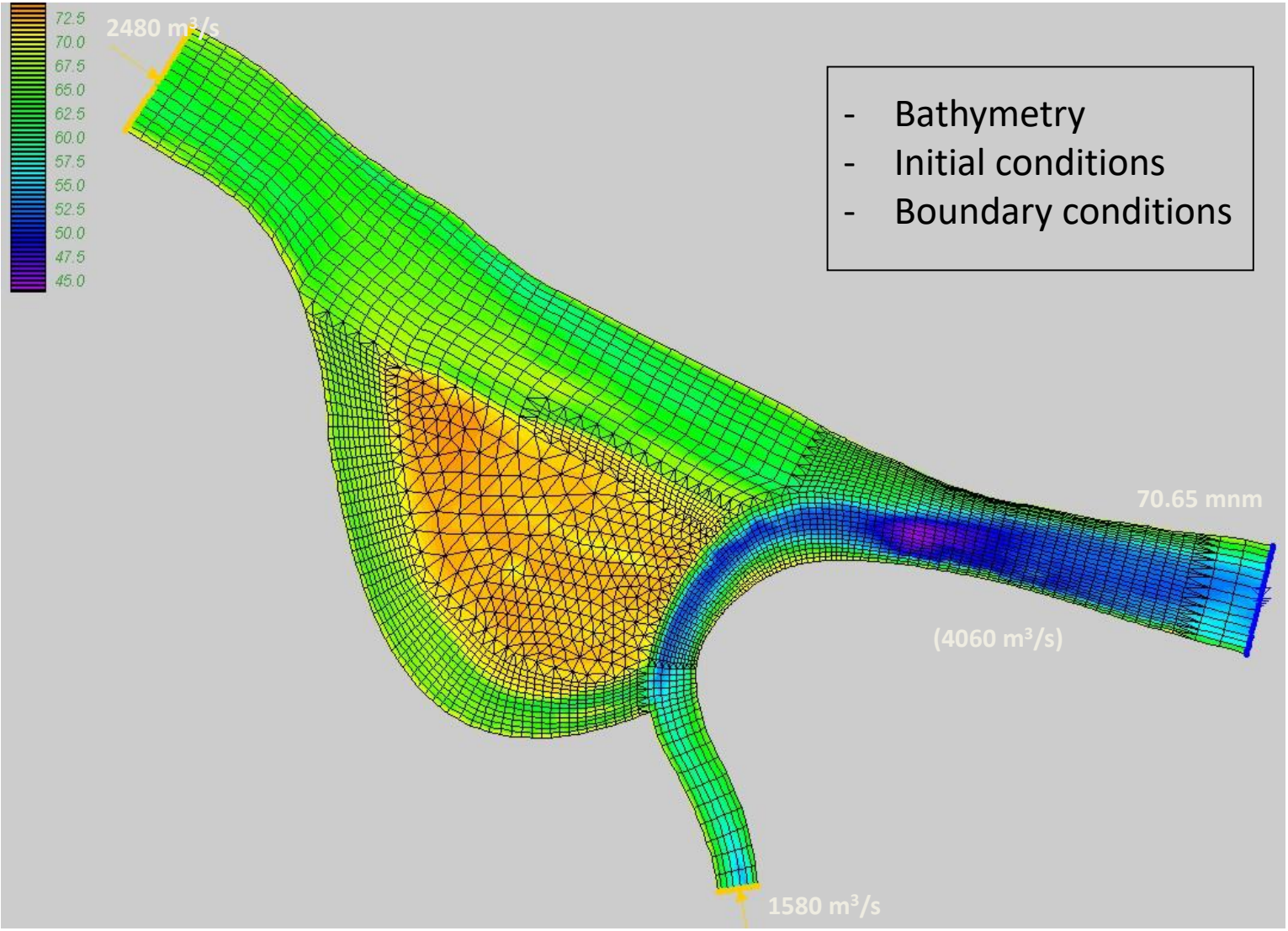
Flow filed (ADCP)



Sediment sampling

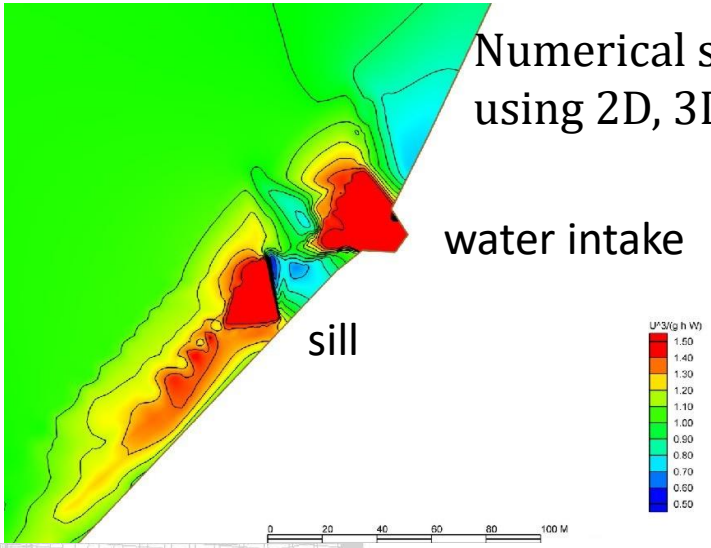
Multi dimensional 2D+3D numerical models

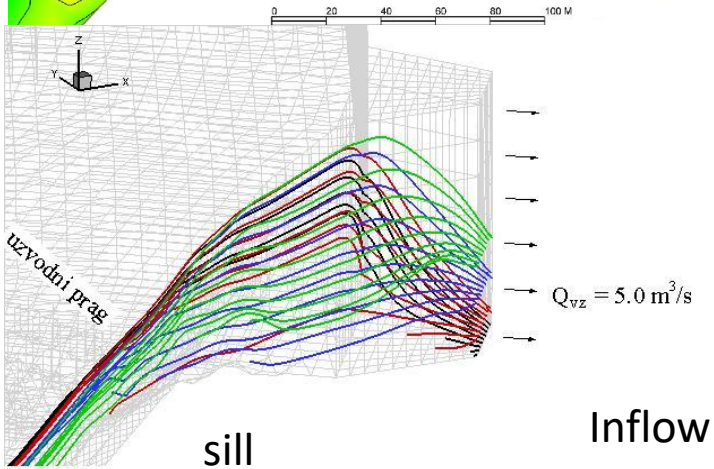
Finite element computational grid



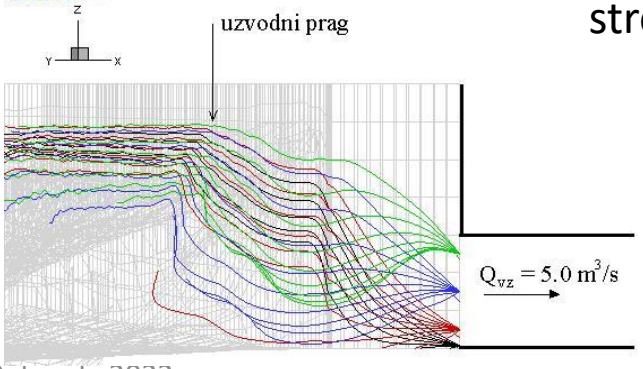
I. WATER SUPPLY

Numerical simulations using 2D, 3D models





Inflow current streamlines

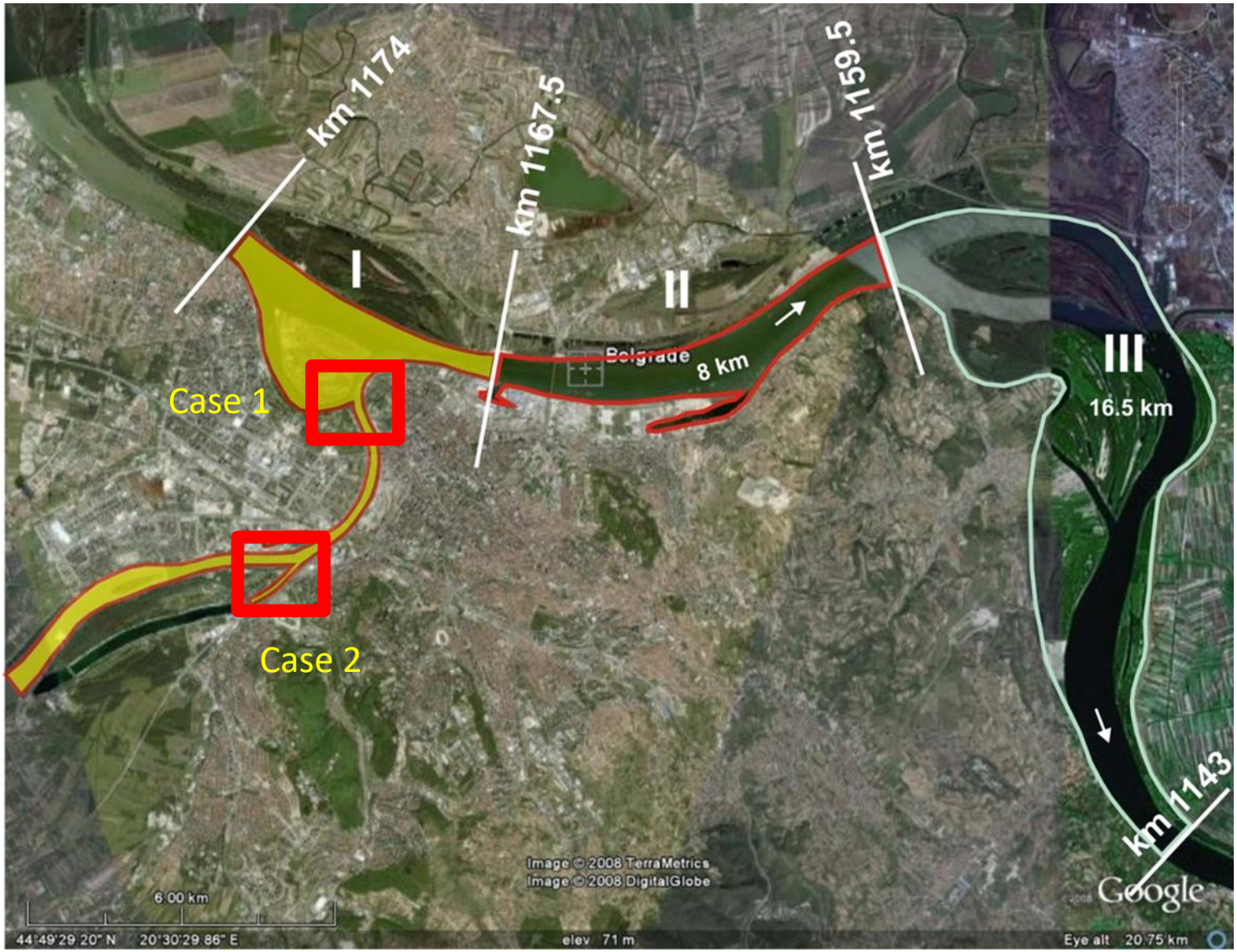


Ecological repercussion:
change of municipal legislation on raft location and mooring conditions

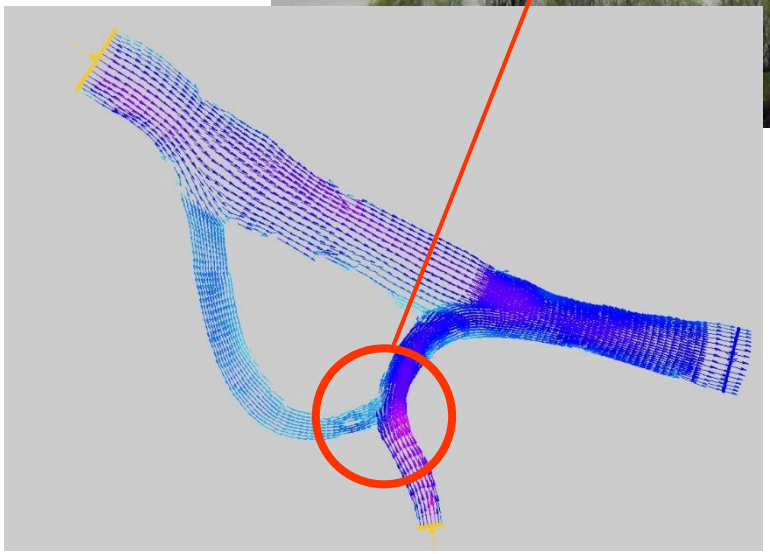
water quality sampling points

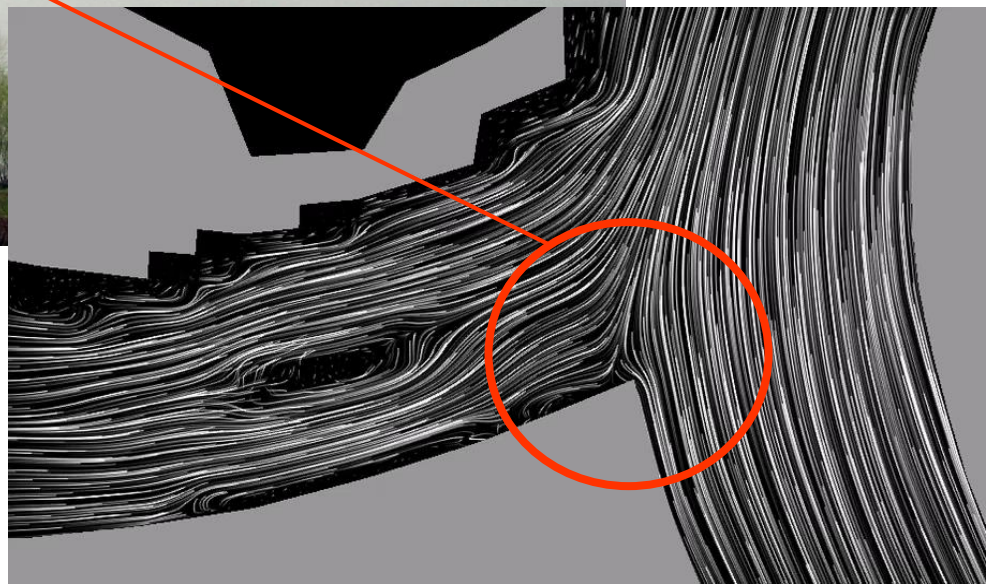
forbidden !!

II. SEWAGE DISPOSAL

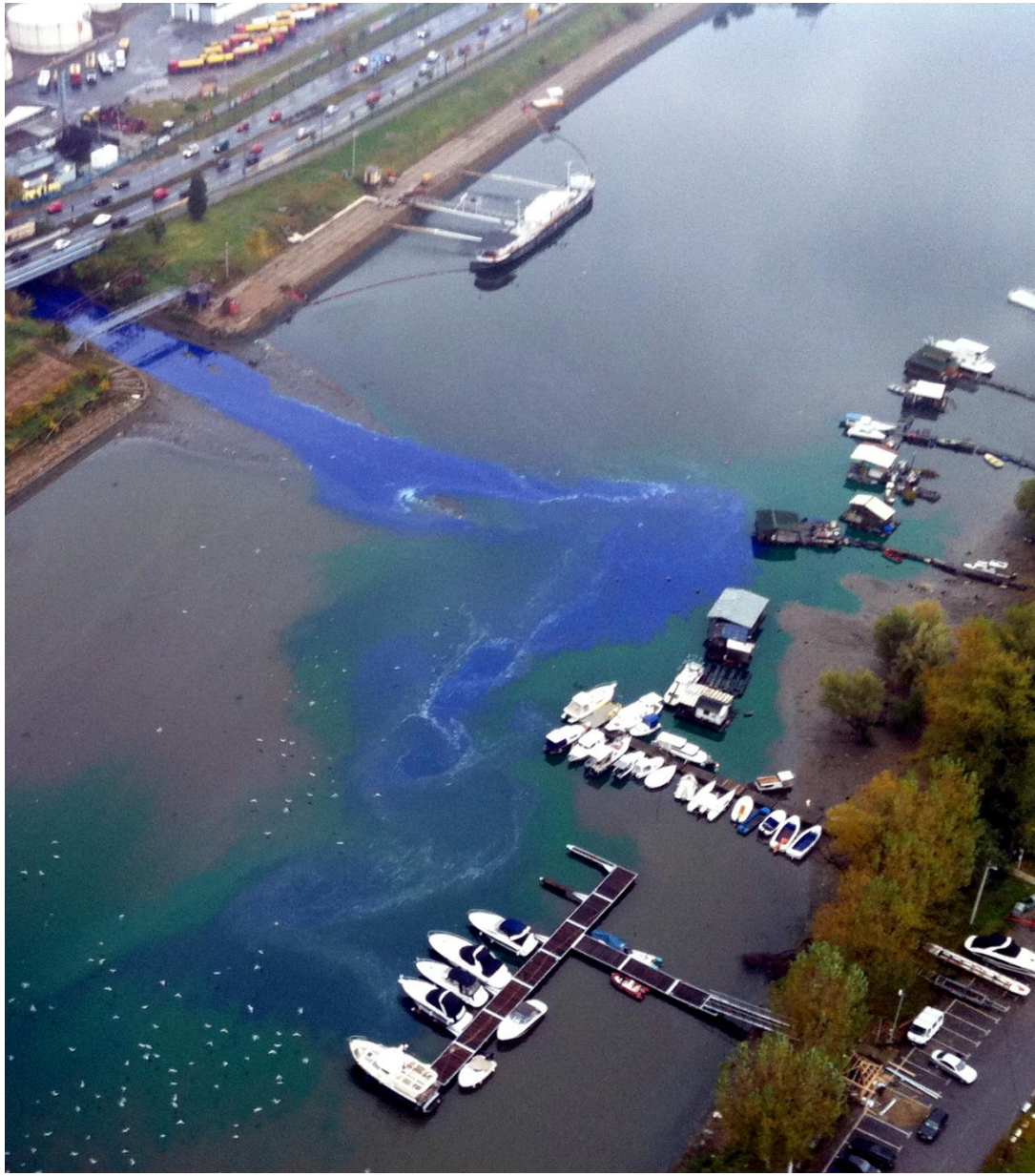


The Danube River: one of badly situated sewage disposal sites



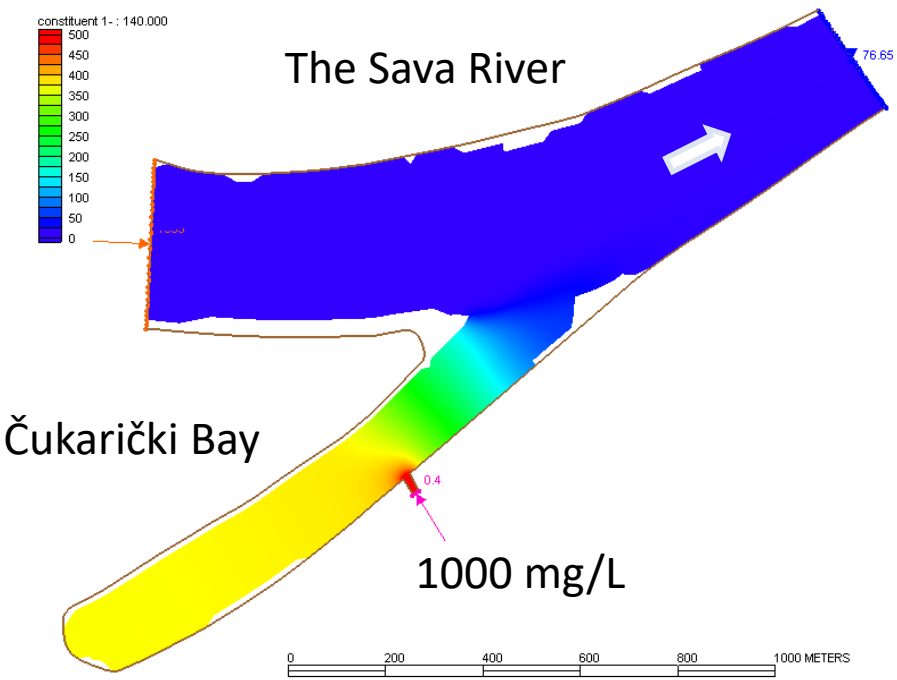


The Sava River: pollution of the Čukarički Bay

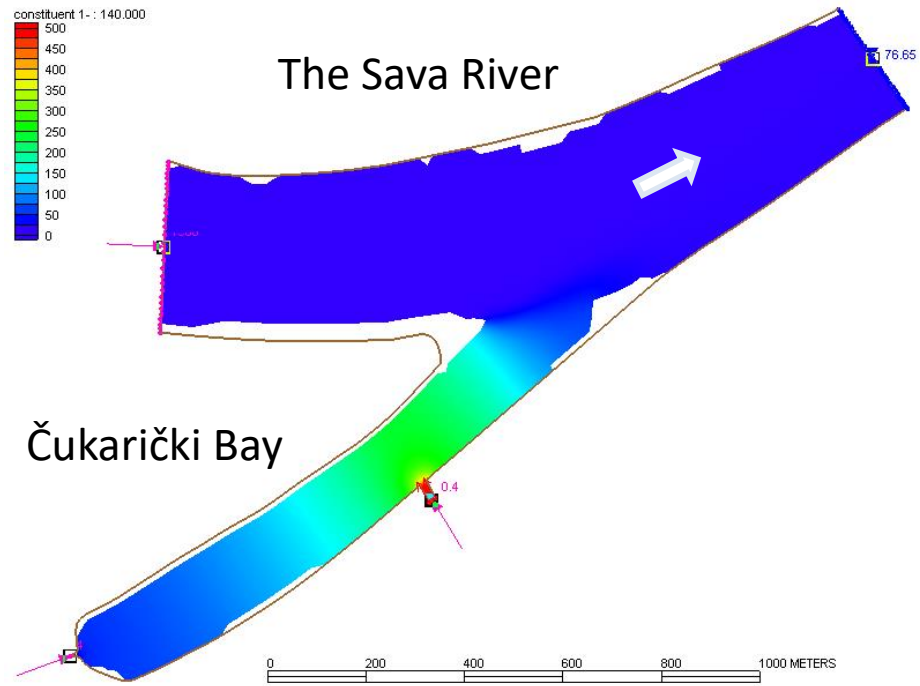


Simulated pollutant concentration field

without pumping fresh water

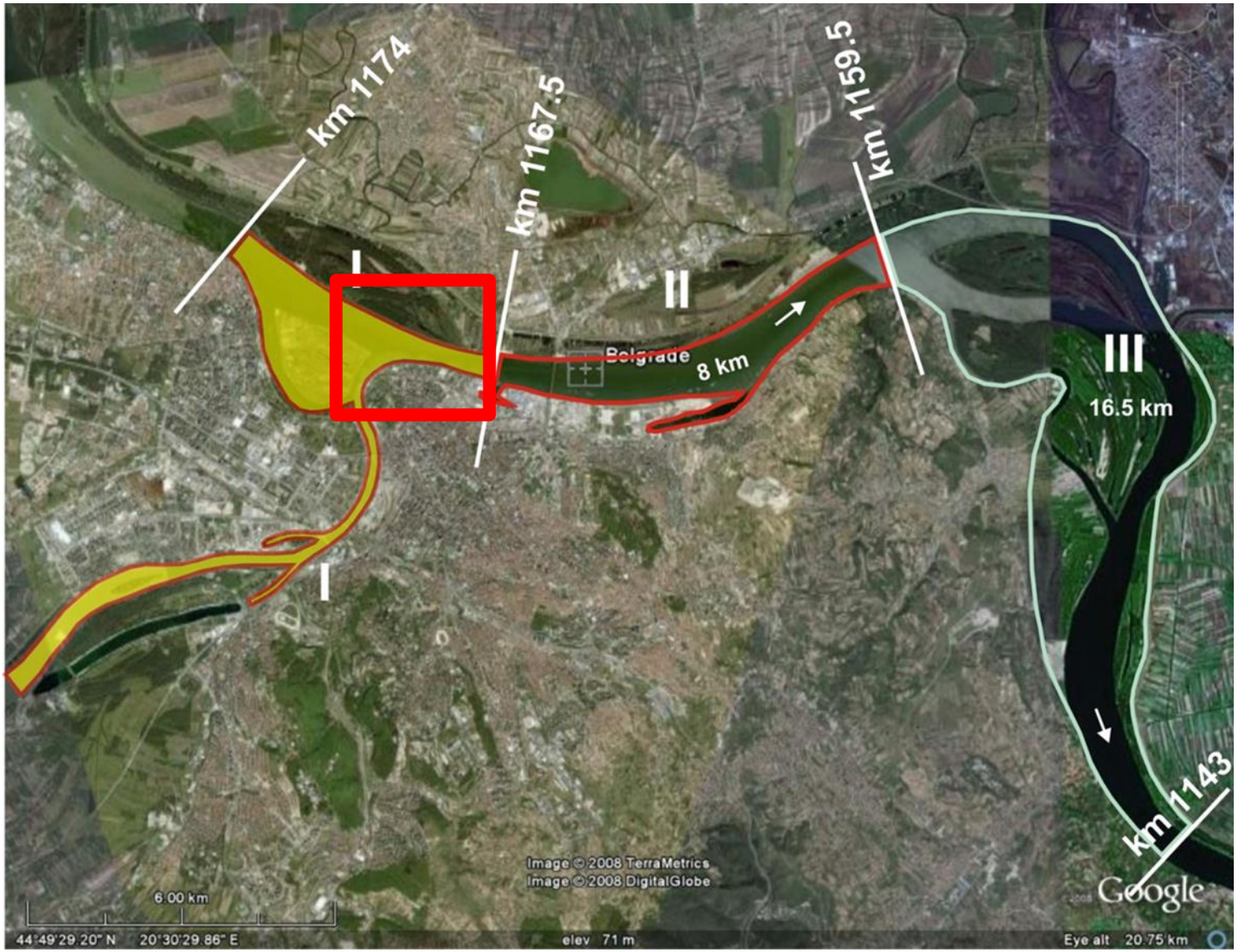


with pumping fresh water

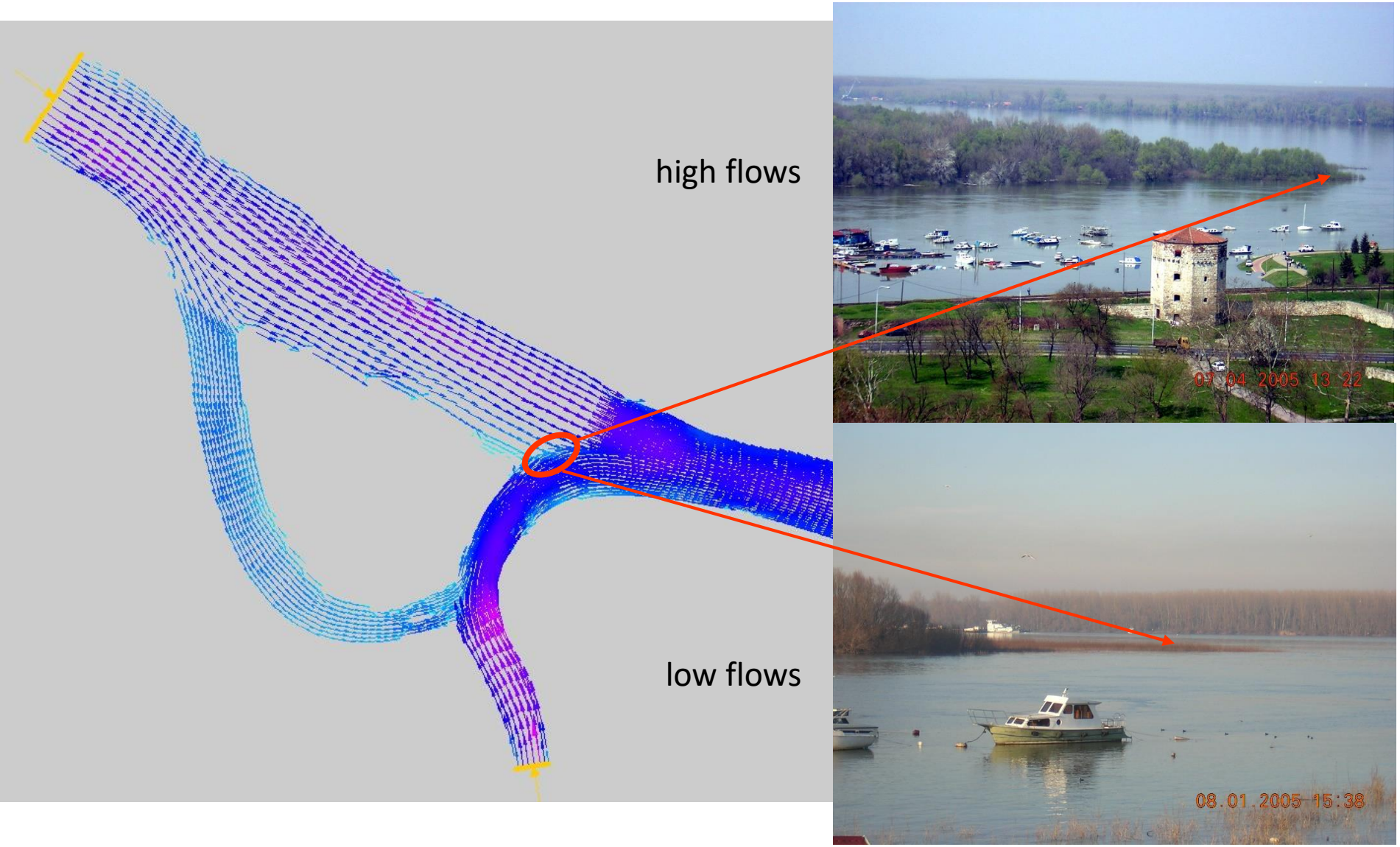


4 m^3/s

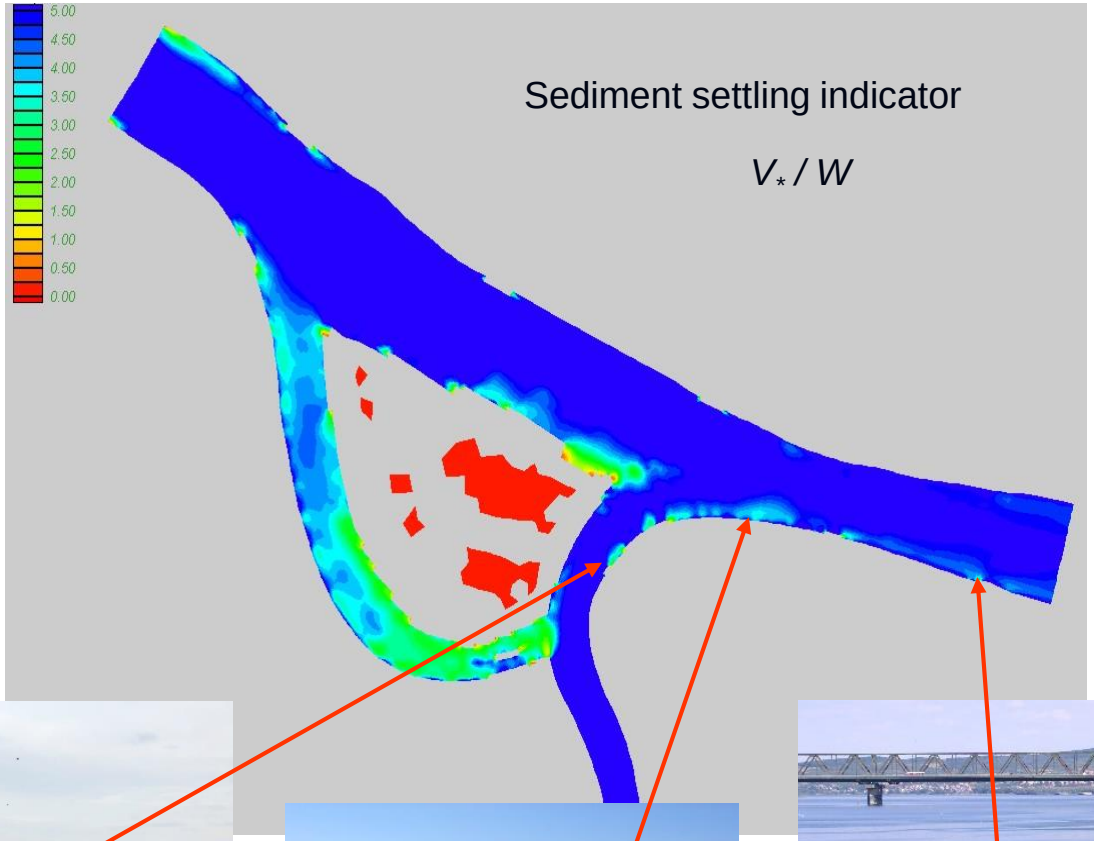
III. MORPHOLOGICAL CHANGES



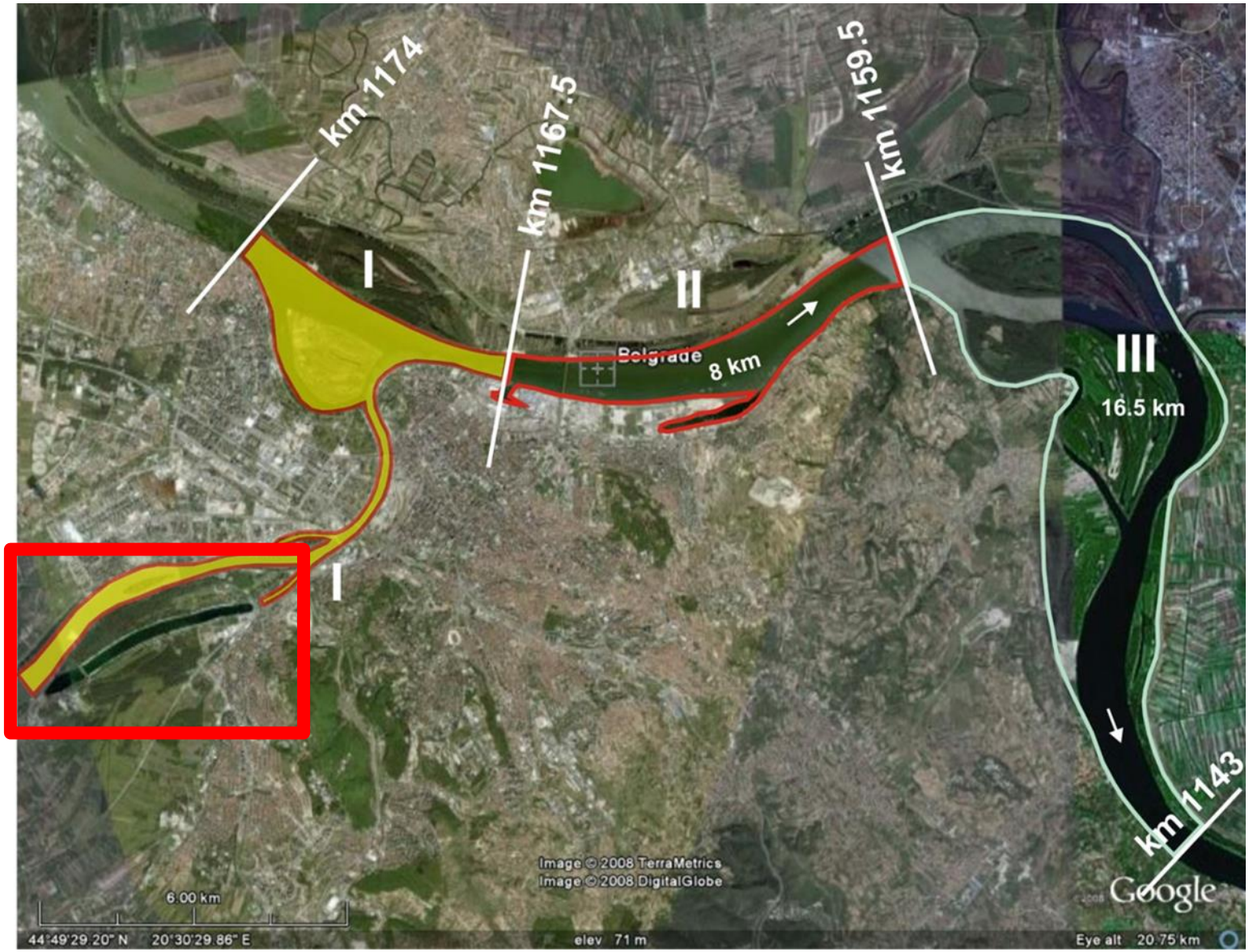
Sand bar dynamics (impact on the waterway)

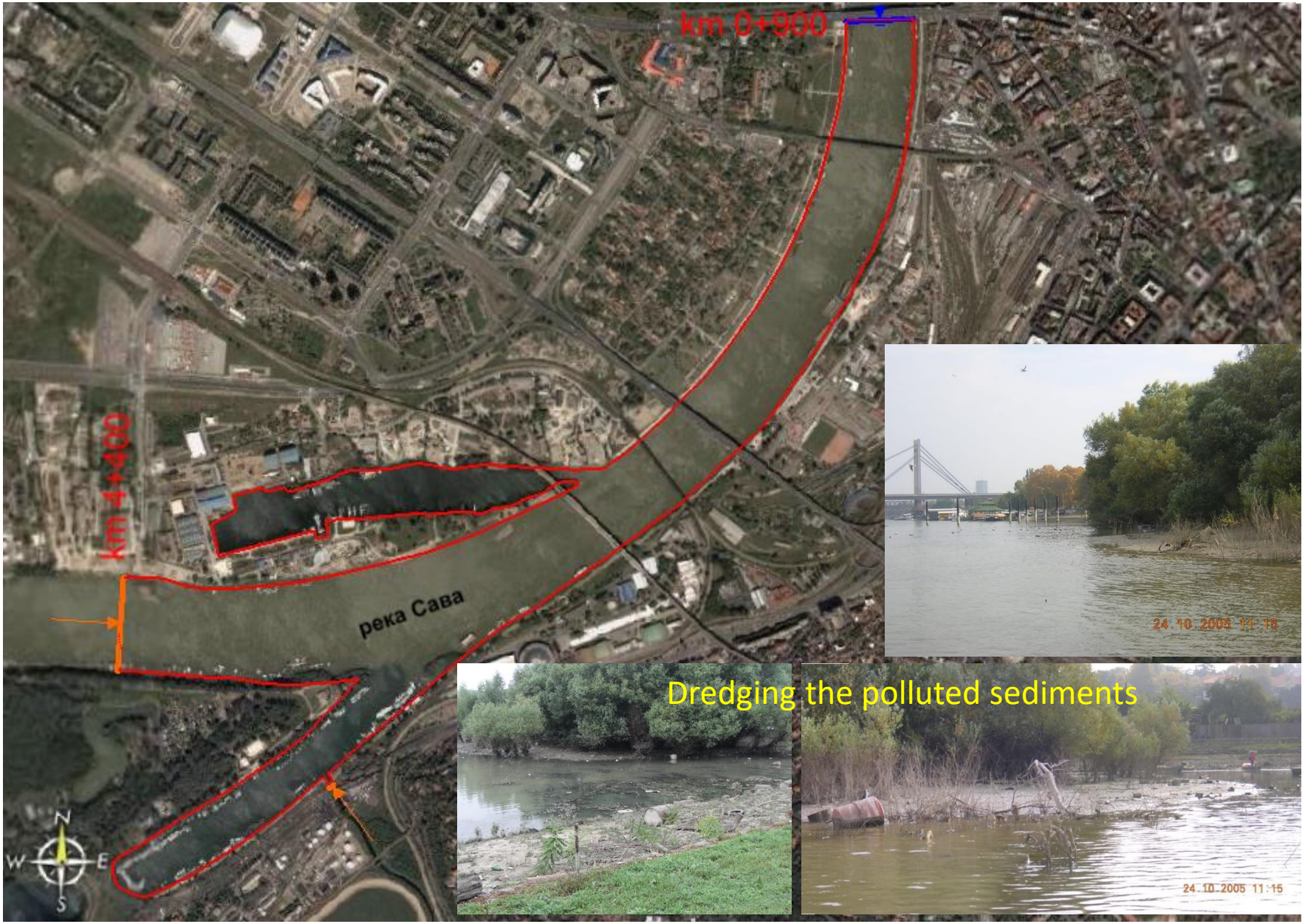


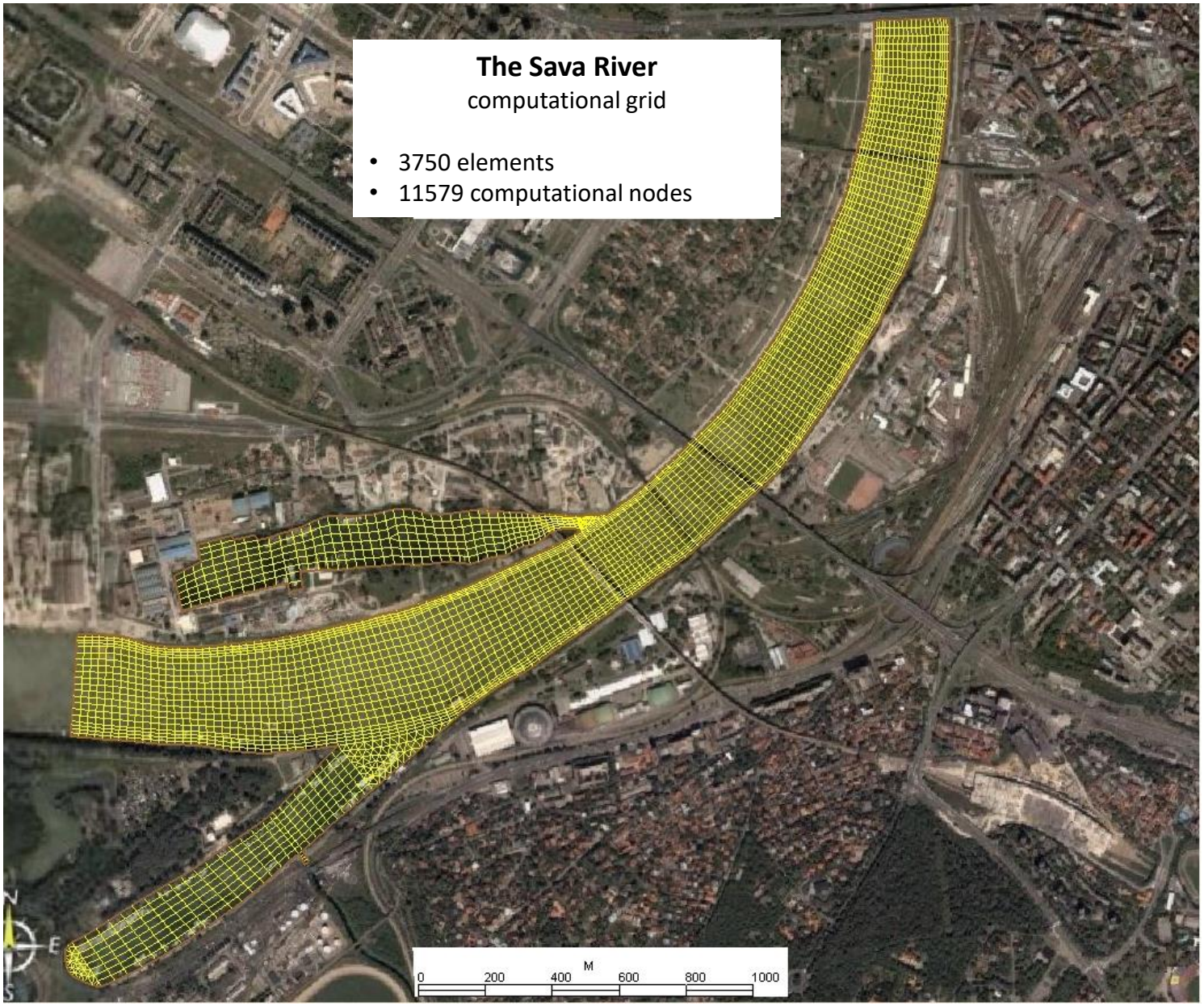
Sediment deposition zones (impact on ecology)

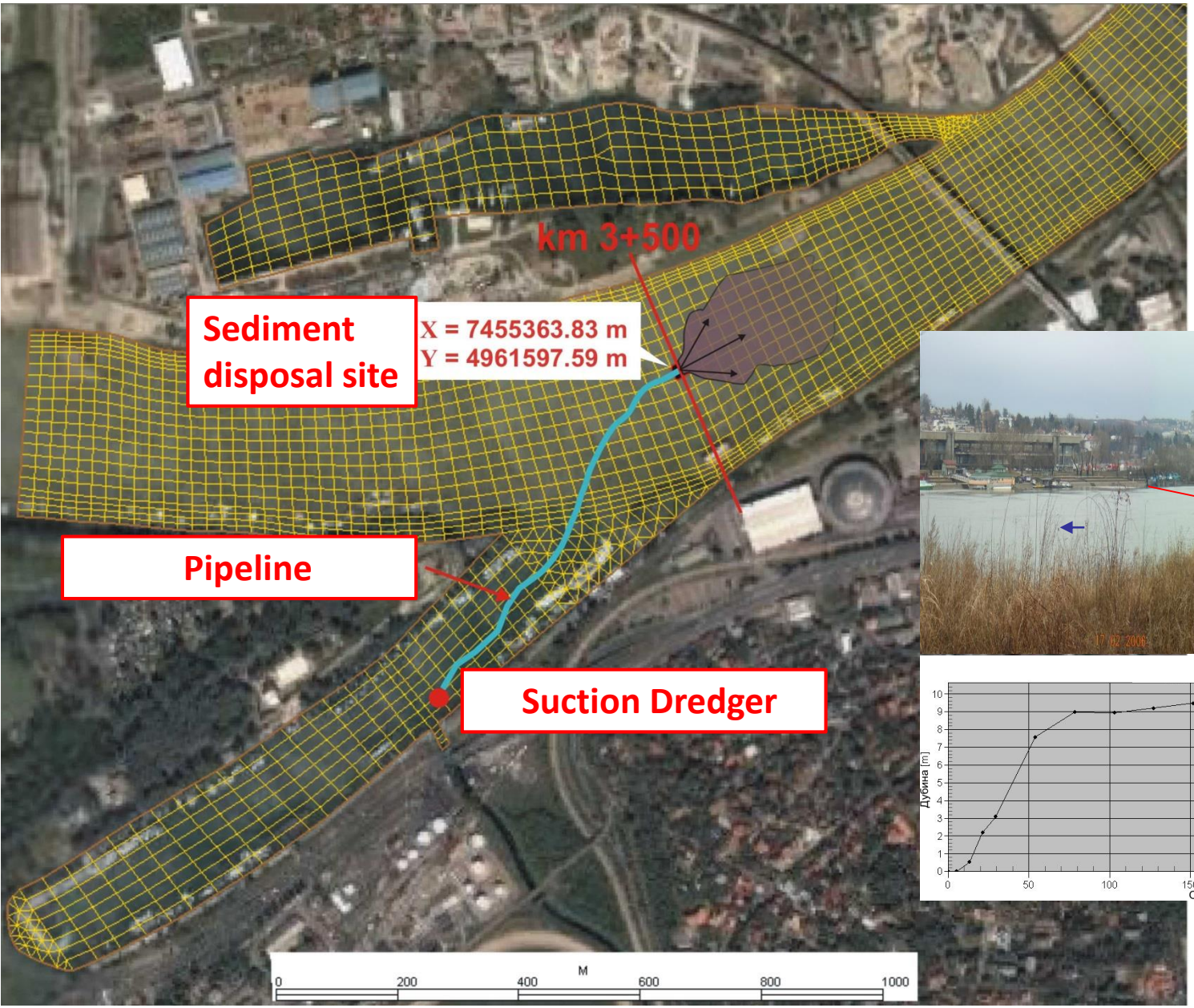


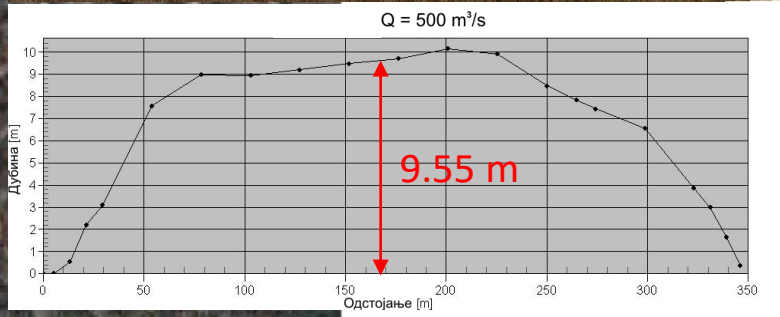
IV. SEDIMENT CONTROL




km 0+900
km 4+400
река Сава
24.10.2005 11:18
Dredging the polluted sediments
24.10.2005 11:15
N
W
E
S

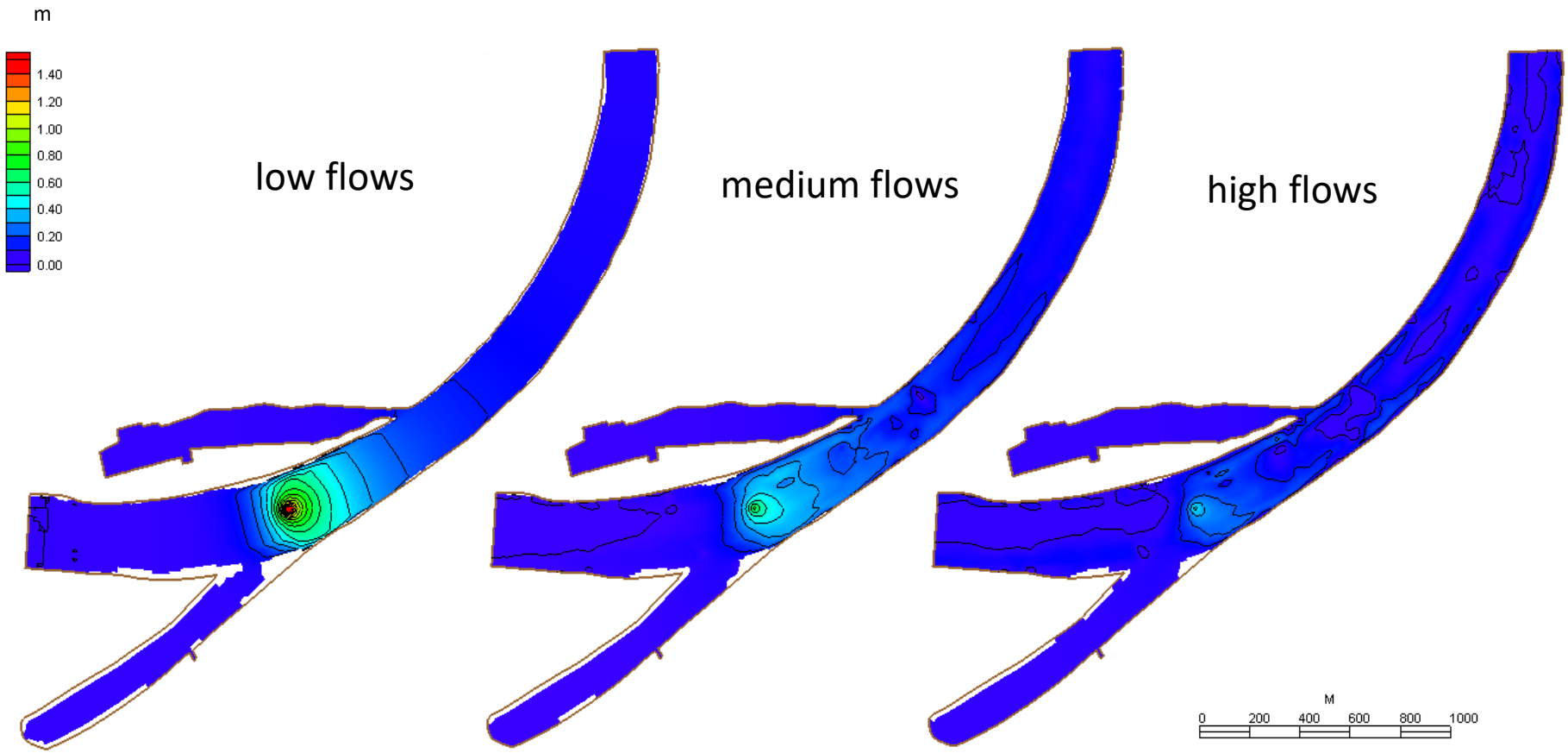

The Sava River
computational grid
• 3750 elements
• 11579 computational nodes
N
E
S
M
0
200
400
600
800
1000


km 3+500
Sediment disposal site
X = 7455363.83 m
Y = 4961597.59 m
Pipeline
Suction Dredger
M
0
200
400
600
800
1000

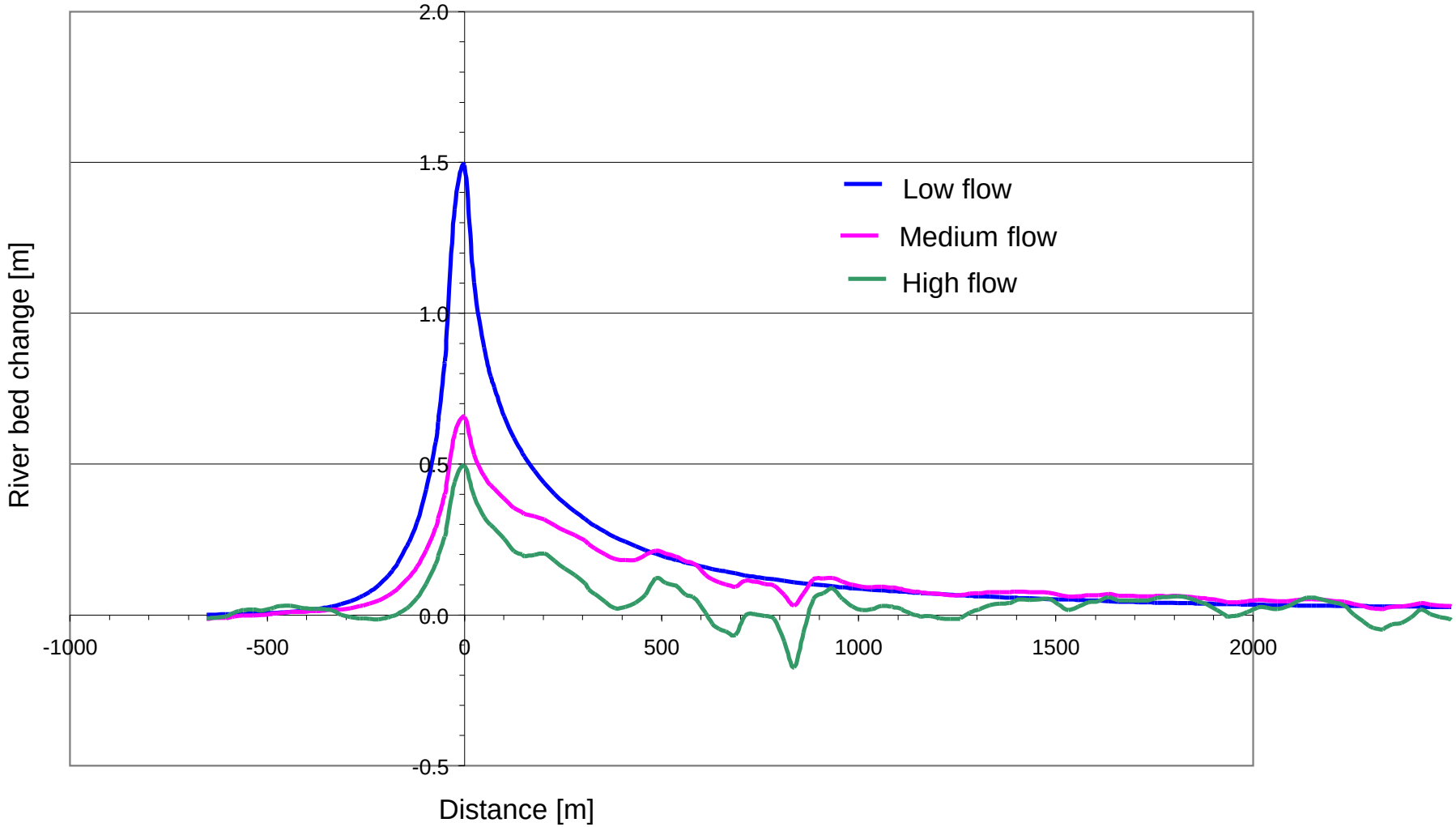

Q = 500 m³/s
Дубина [m]
Одстојање [m]
9.55 m
0
1
2
3
4
5
6
7
8
9
10
0
50
100
150
200
250
300
350

m
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00

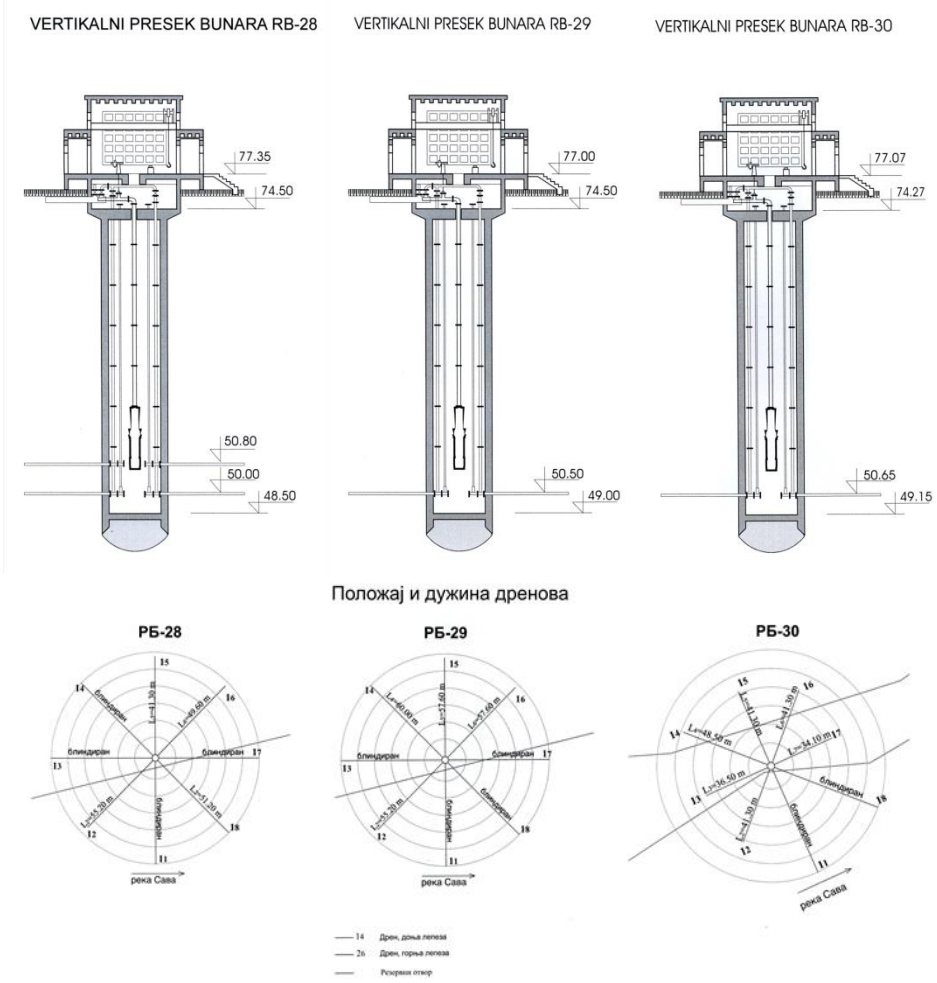
Comarative analysis of sediment deposition

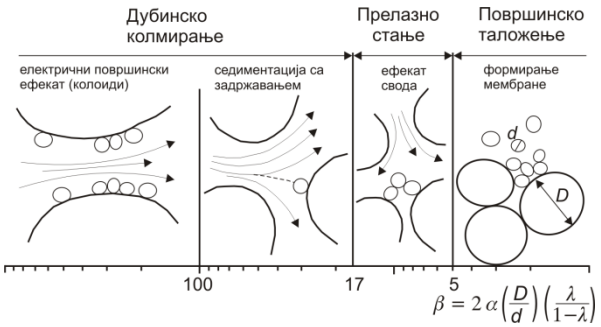


Logitudinal profile of the river bed deformation

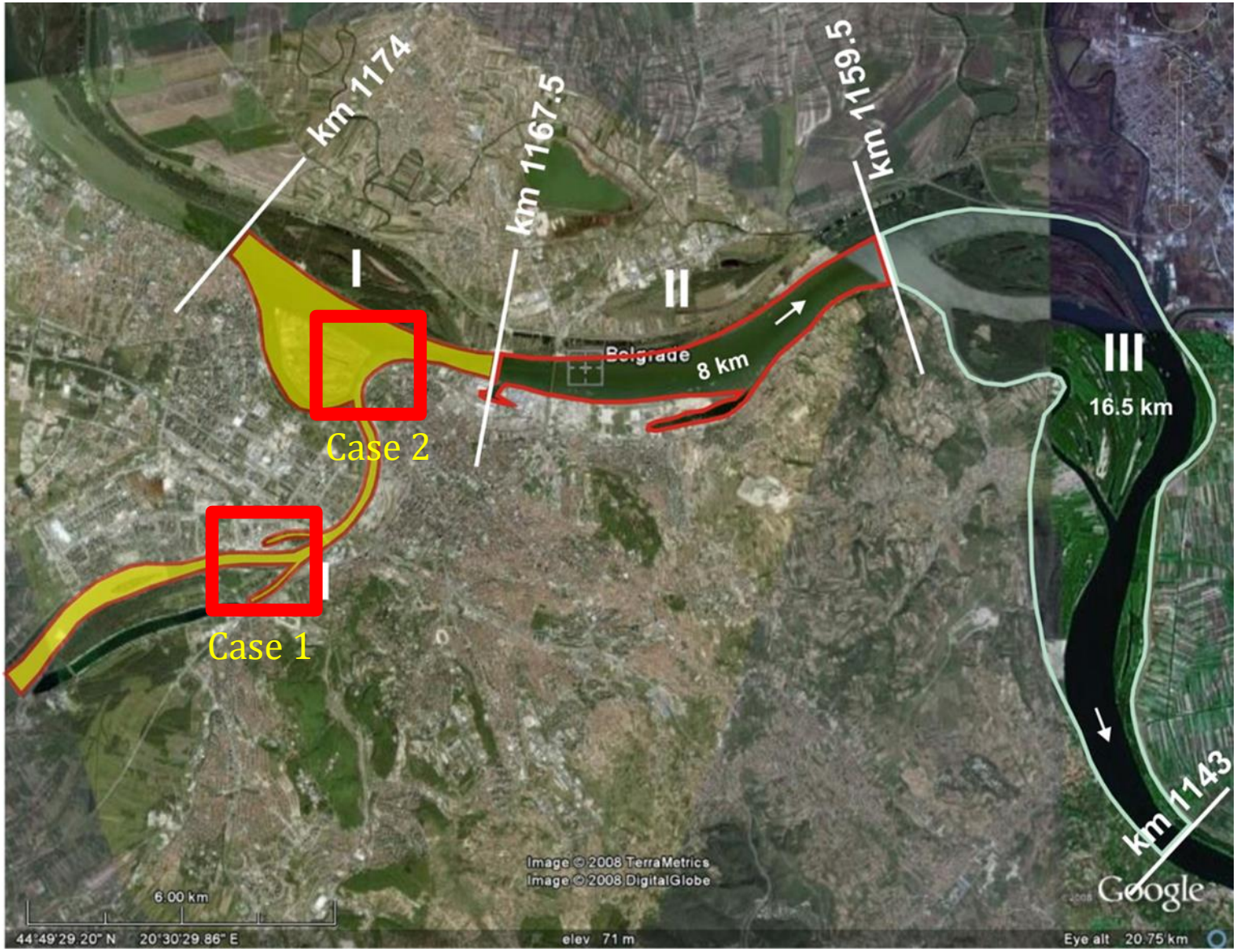


Impact on water supply wells



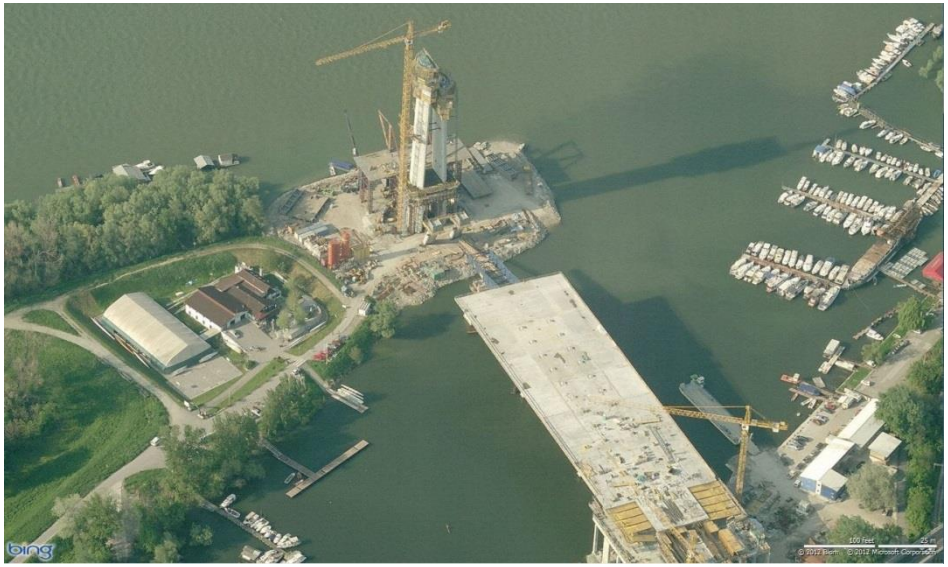


V. AQUATIC HABITATS

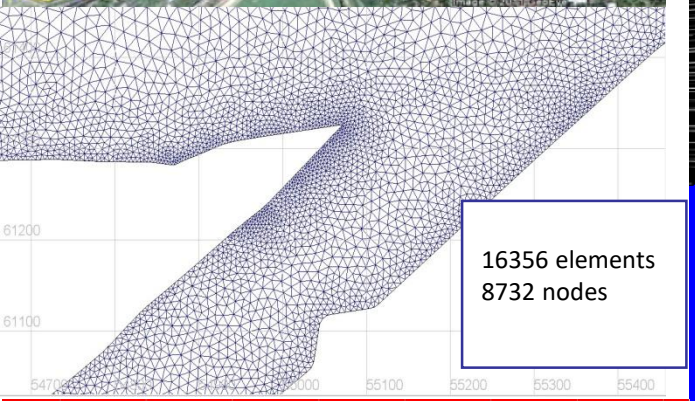


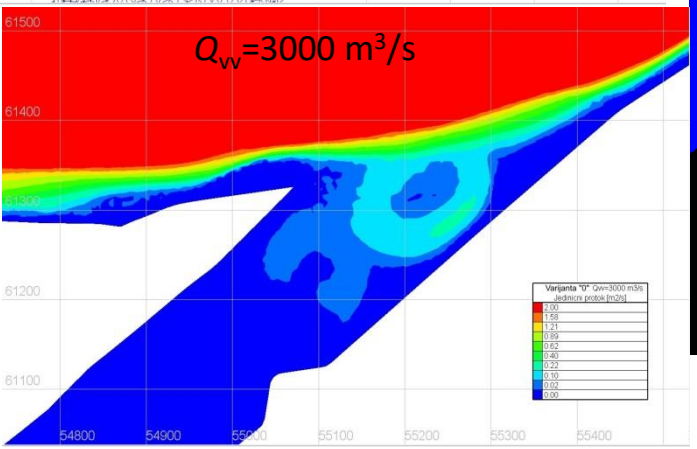
Aquatic habitats: Case 1

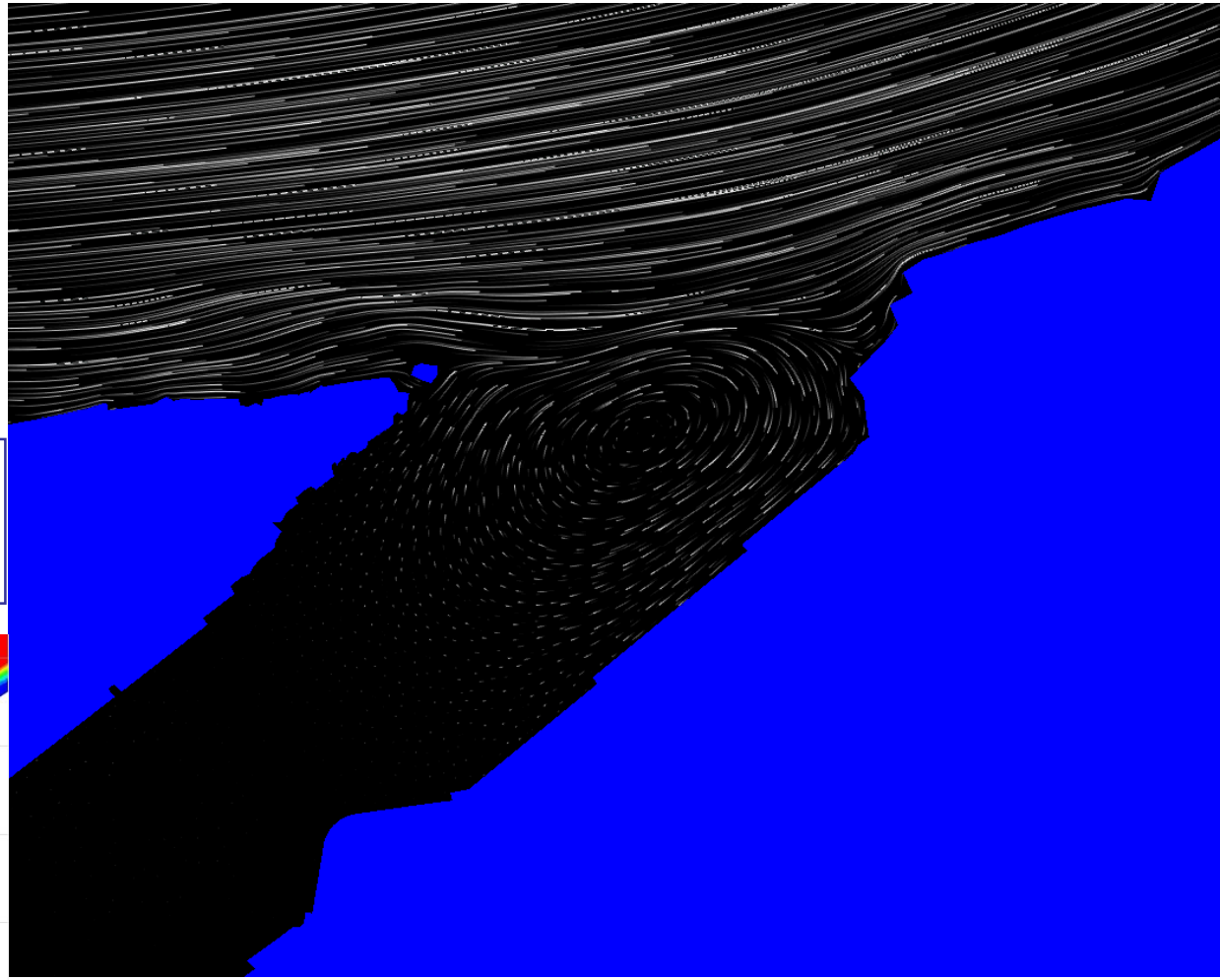
The Pygmy Cormorant (*Phalacro-corax pygmeus*)
„Near Threatened" (NT) status
on the IUCN (International Union for Conservation of Nature)
Red List of Threatened Species



Analysis of the strength of the primary gyre and the sedimentation processes



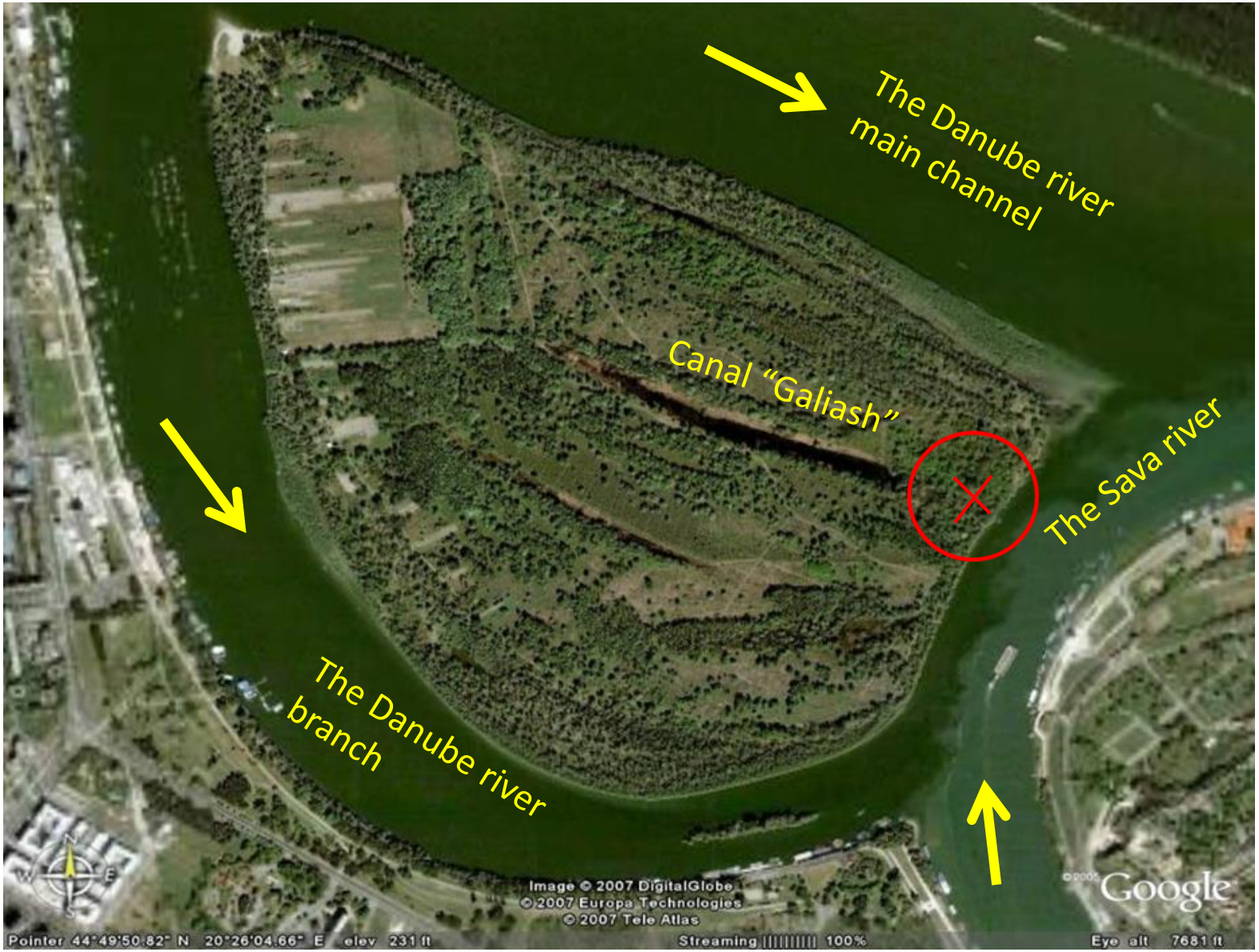




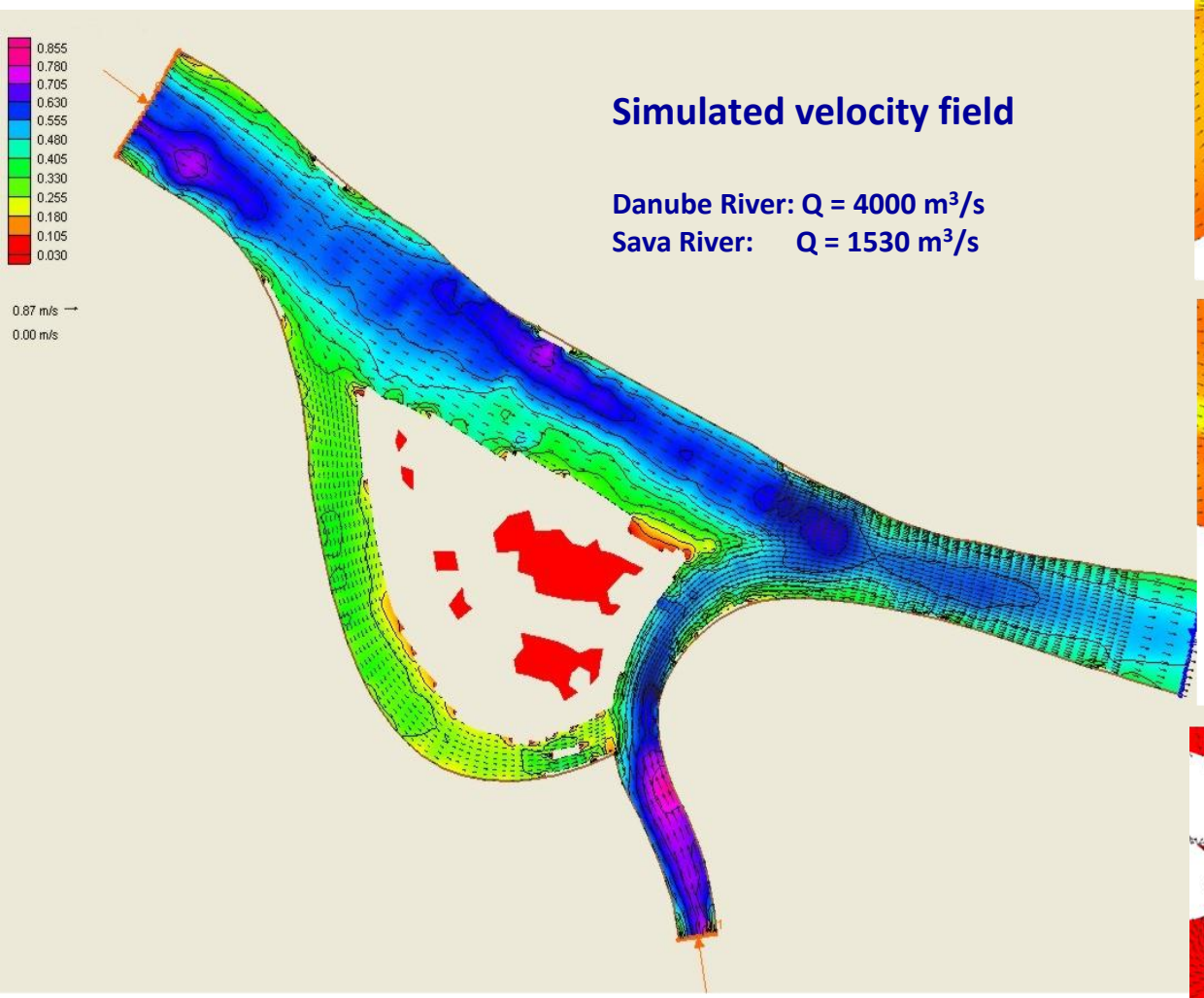
Result of hydraulic and sedimentation analyses: proposal of the new cormorant habitats location

Aquatic habitats: Case 2

2007.

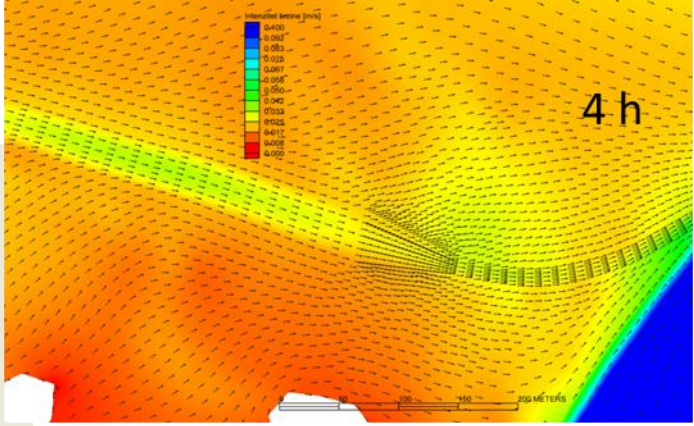


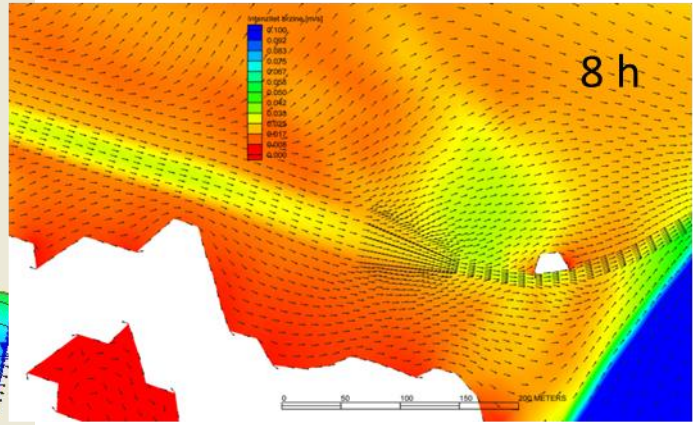
Rare birds
Clangula species

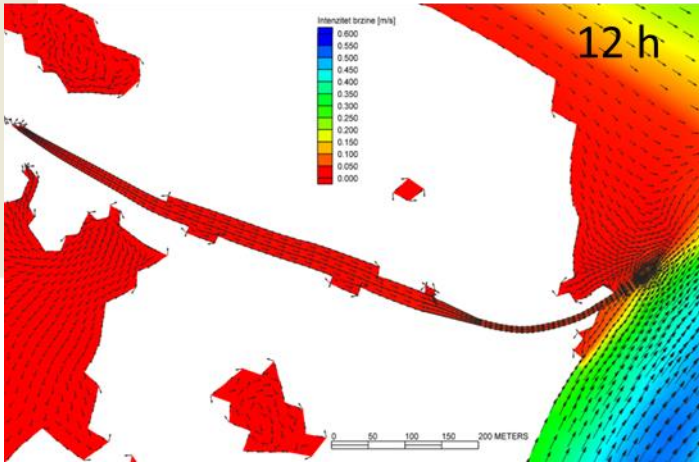


Simulated velocity field

Danube River: Q = 4000 m³/s
Sava River: Q = 1530 m³/s







checking the ability of the trapped fish to sustain the water velocity in the canal during the flood recession phase, and to safely reach the river channel.

CONCLUDING REMARKS

1. As it is obvious that the environmental protection has become the primary human activity on the global scale, the principal means of overcoming environmental challenges is **technology**, as this **hydraulic engineering** case study has demonstrated.

2. The fluvial environmental modelling should provide ground for interdisciplinary assessment of water quantity and quality, and sediment dynamics, in order to protect the **aquatic habitats**.

Thank you for attention !

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- Dušan Prodanović
- Dejana Đorđević
- Budo Zindović
- Nikola Rosić ...