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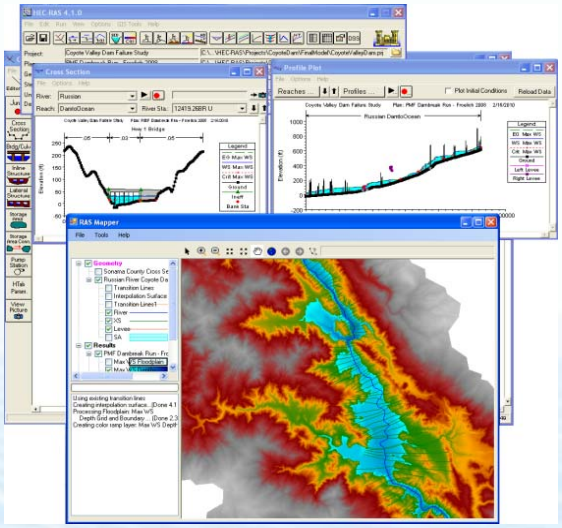
Black Sea CROSS BORDER COOPERATION

Common borders. Common solutions.

HEC-RAS for local scale Hydraulic Analysis



Dr Eleni A. Tzanou

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Assessment on local scale….WHY?

- Prevention flood disasters in **particular locations-sites**
- Adjustment of developmental programs regarding **planning of buildings and facilities** concerning safety….**Safety comes first**
- **Targeted measures** for flood hazard elimination
- **Preparedness** of authorities dealing with **crisis situations** in potential flooding
- Assessment of **Flash Flooding** by worst-case precipitation scenarios
- **Compliance** with the EU and National Guidelines and Legislation.

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To Whom It May Concern……?

Common borders. Common solutions.

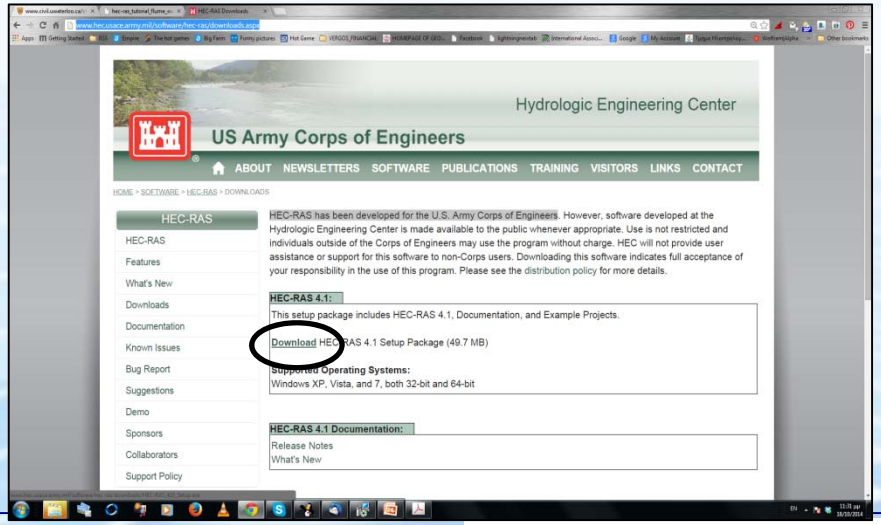
- **Public Sector**, **Regional Authorities, Public services etc** dealing with hydraulic analyses, water management, environmental control, natural disaster assessment, decision making and support systems, urban planning…..
- **Private sector and Construction sector** for the correct dimensioning of hydraulic works

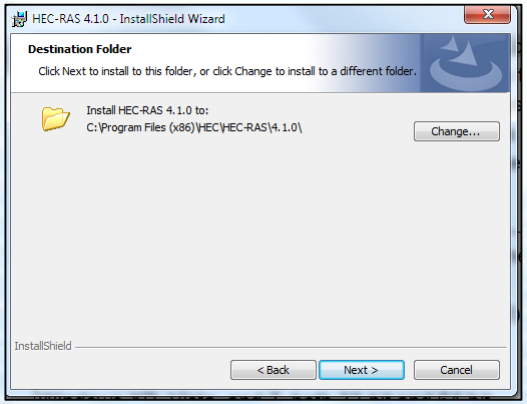
Regional to local…..difference

1. Local scale analysis requires knowledge and experience in hydraulic analysis.

Multi-purpose use of results. The same results may be used by a large number organizations and people.

- HEC-RAS has been developed for the U.S. Army Corps of Engineers.
- Download from http://www.hec.usace.army.mil/software/hec-ras/downloads.aspx and.... follow installation instructions





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Hydraulic Analysis

- **HEC-RAS** performs one-dimensional hydraulic calculations for a full network of natural and constructed channels

Capabilities of **HEC-RAS**:

- Hydraulic Analysis
- Data Storage and Management
- Graphics and Reporting
- RAS Mapper
- HEC-RAS 4.1(among others…new Mapper and Sediment Transport Model)

This software is free, widely used and scientifically accepted
Large documentation and technical background on its use

HEC-RAS. How it was done…..

Common borders. Common solutions.

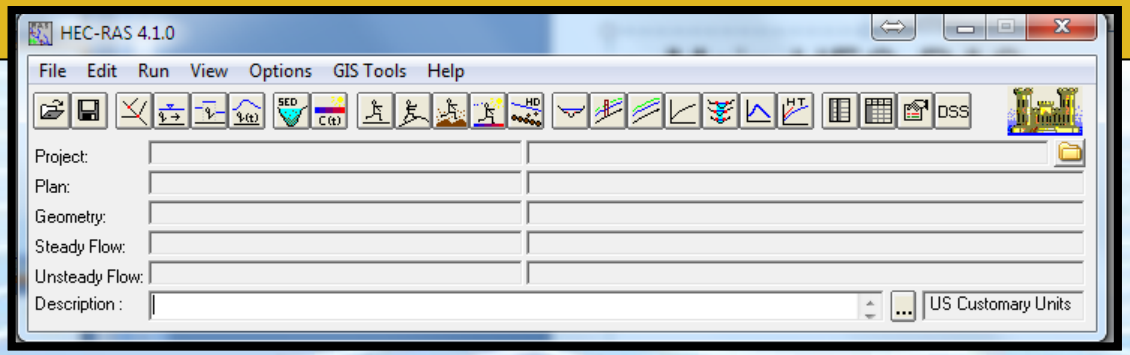
Structure of HEC-RAS

- Creates and saves project files(.**prj** file)

Each project includes:

1. Unit system (SI/US customary)
2. Geometry (XS, bridges, weirs, etc.) (.g file)
3. Flow Data (steady, unsteady) (.f file)
4. Plan data (combination of flow/geometry to use for the analysis) (.p file)

Many files of geometry flow and plan data can be created!!!!!!!



Dealing with geometry and Cross Sections

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- Cross sections define the channel geometry
- Cross sections are defined by Station(x) and Elevation (y)
- Cross sections (among other parameters) define the channel slope
- Overbank stations differentiate channel and floodplain characteristics
- Manning n coefficients define resistance to flow
- Expansion and contraction coefficients define energy losses associated with velocity head changes between cross sections
- Ineffective flow areas can store but not convey water downstream
- Obstruction areas block flow completely
- Levee elevations confine flow to channel until the levees are overtopped

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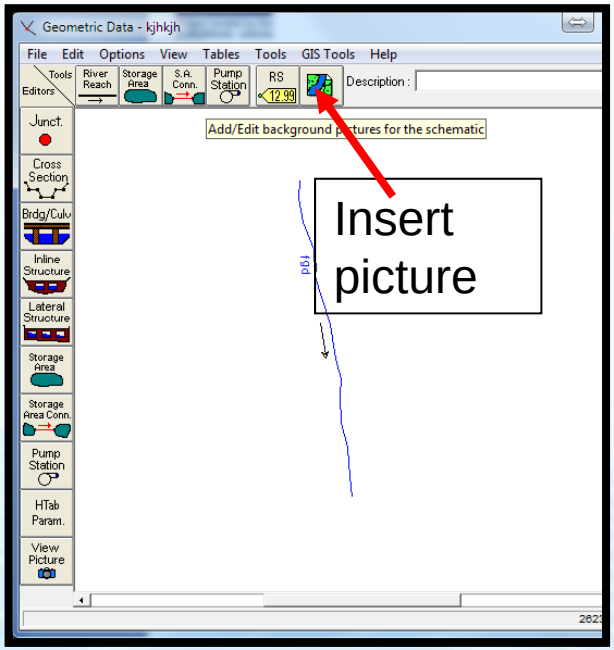
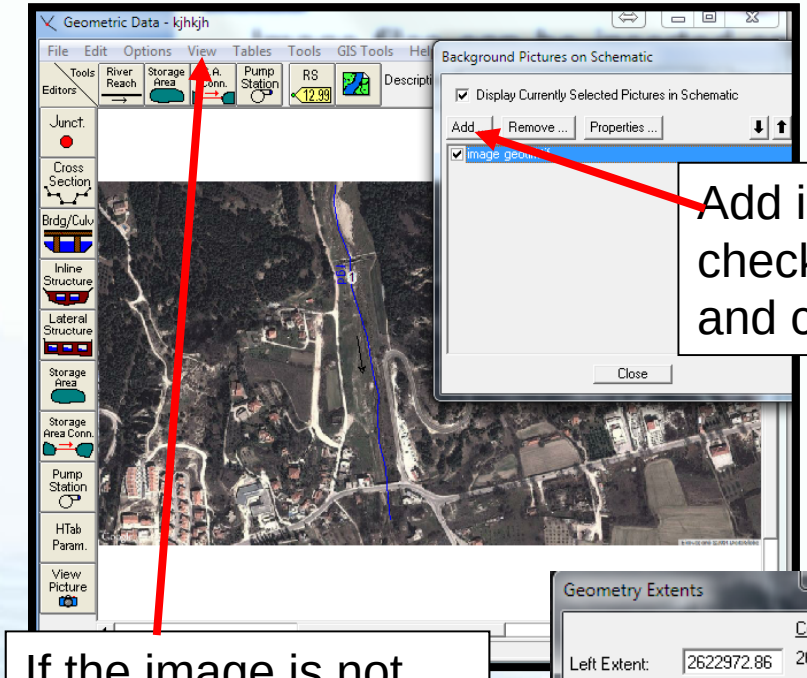
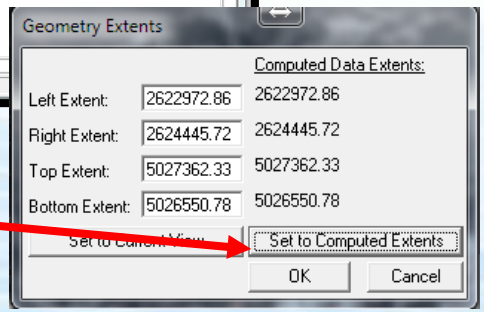
Easy-to- use multiple window Interface







If the image is not visible set image computed extends from schematic plot extend in view menu

Cross sections may be also added through a .csv file format

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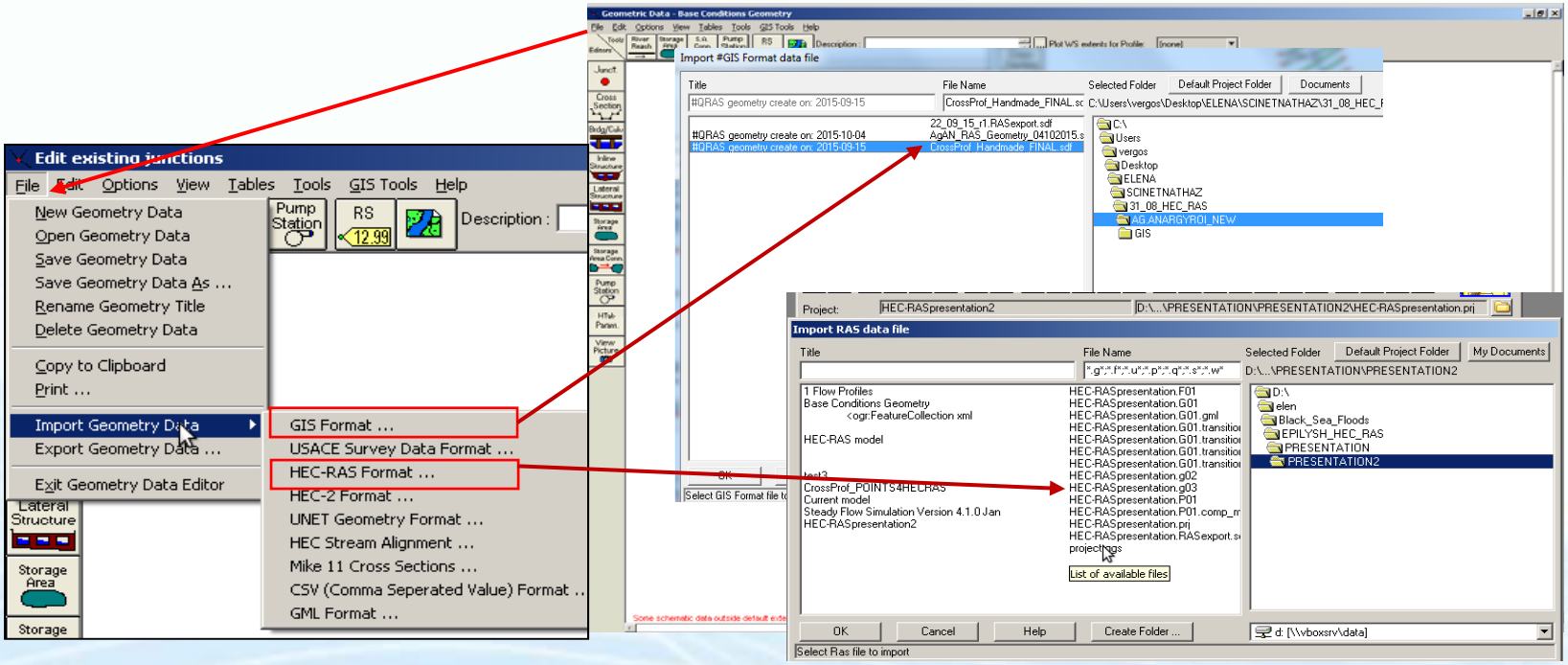
- **Import Geometry →*.sdf files from QGIS**



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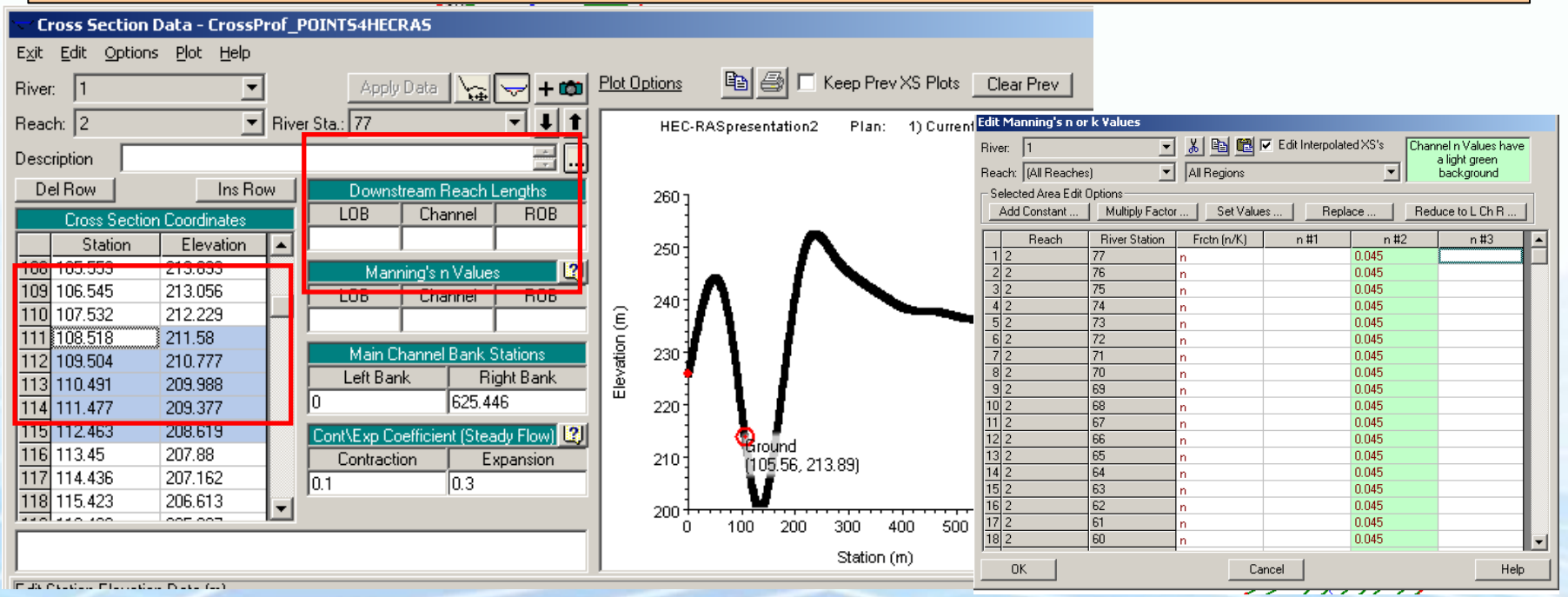
- **Geometry check!!!!**
- Add necessary data (banks, levees, obstructions, inefficient areas etc, Input coefficients…..
- Manning Values, Con/Exp coefficients, boundary conditions !!!!!



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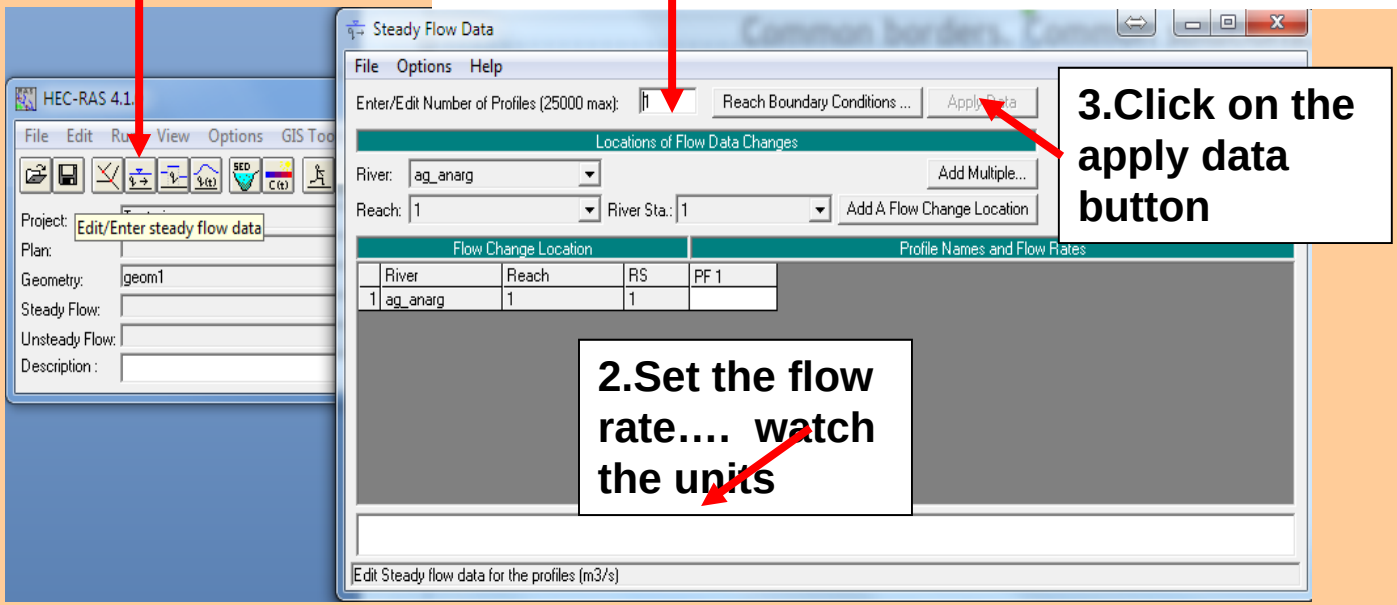
Flow data Input in flow data window….many profiles-flows were assessed.

1.Set the number of profiles…for different flow rates



3.Click on the apply data button

2.Set the flow rate…. watch the units

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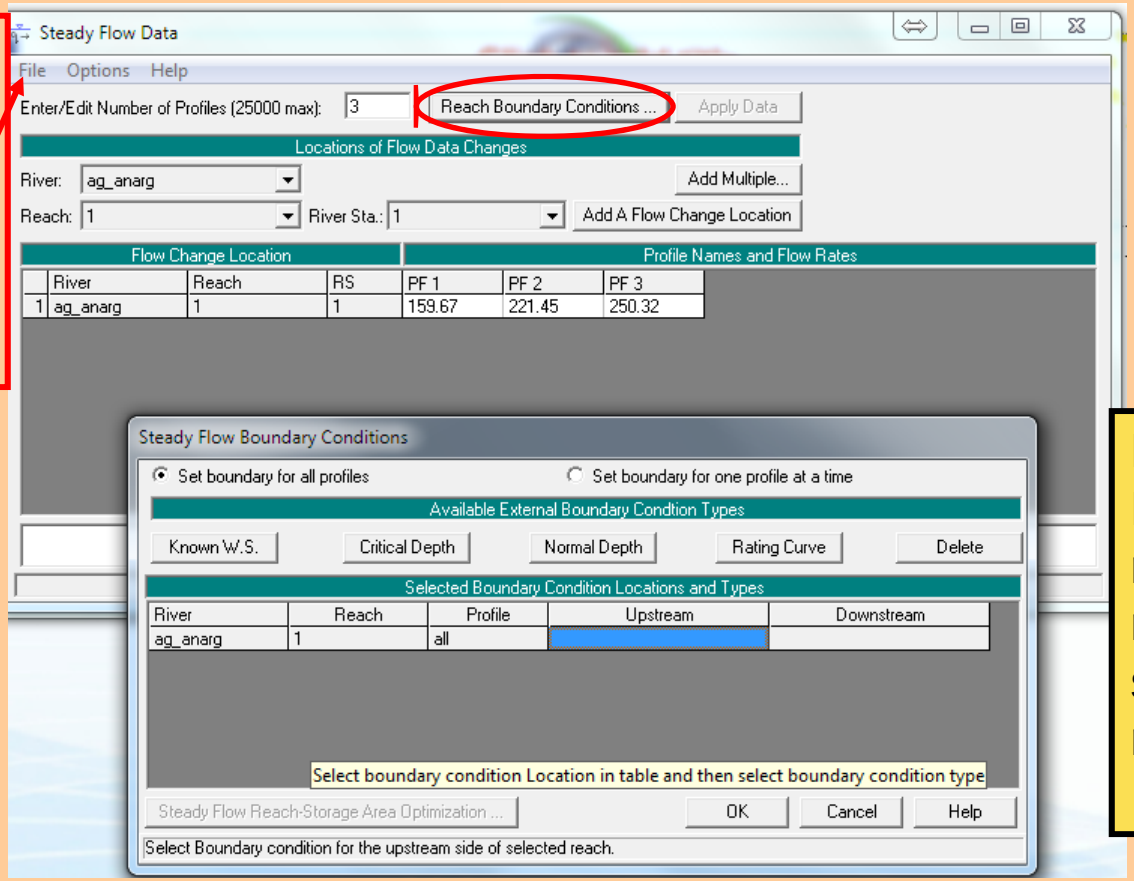
Set the boundary conditions

Save the flow Data, (the first time use the "save as" option



From the main HEC-RAS menu a plan may by saved…but not necessary.

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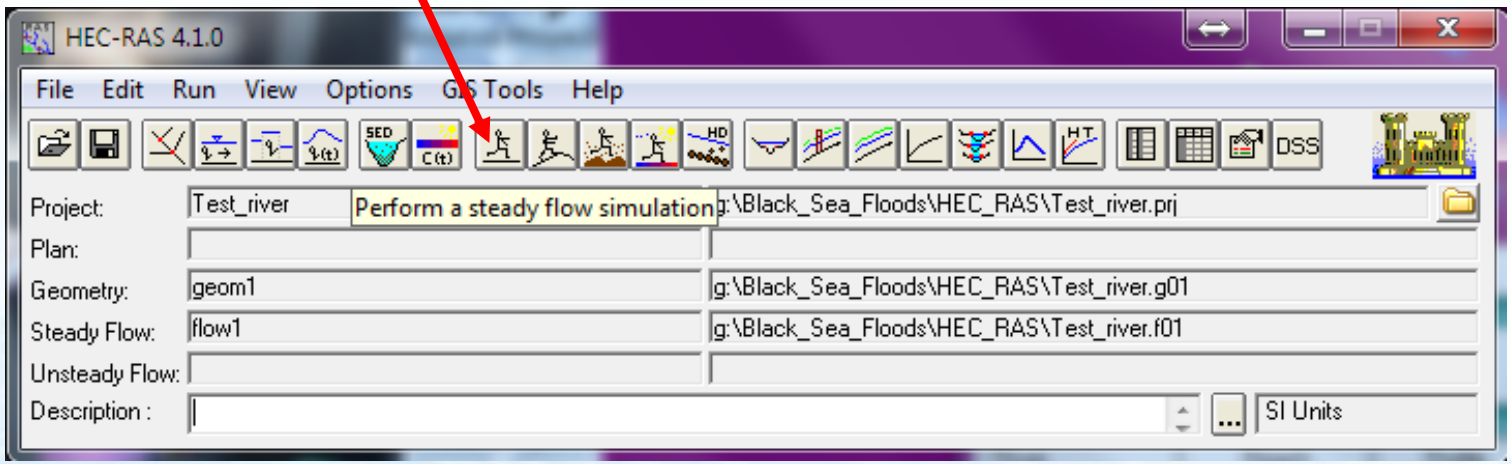
ALL parameters have been checked for a successful analysis.



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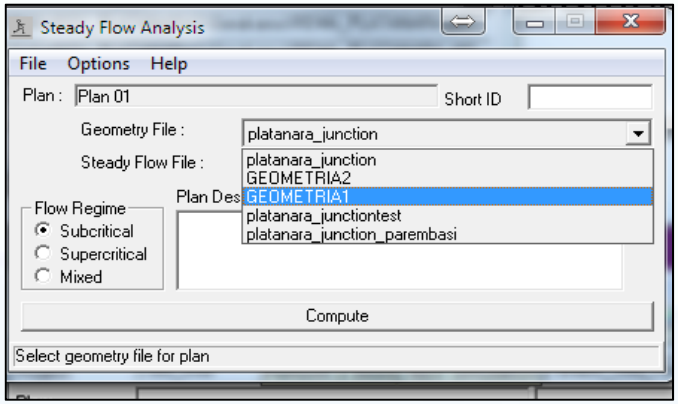
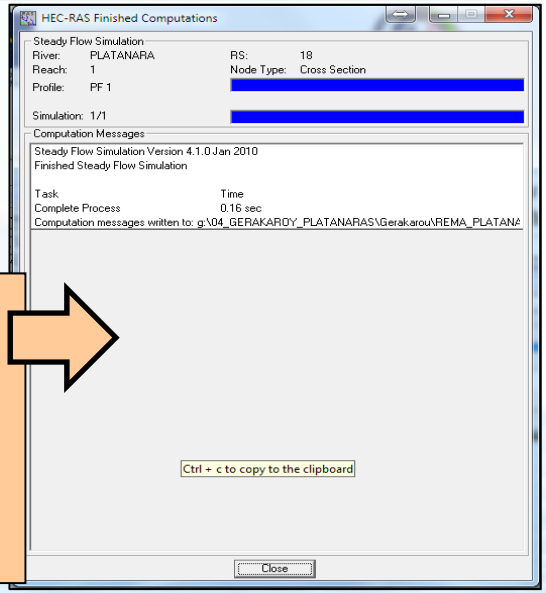


If computations are successful the following window appears, otherwise…

Congrats , you did it!



Errors and problems' reports appear in this area and everything should be corrected… then run the simulation again

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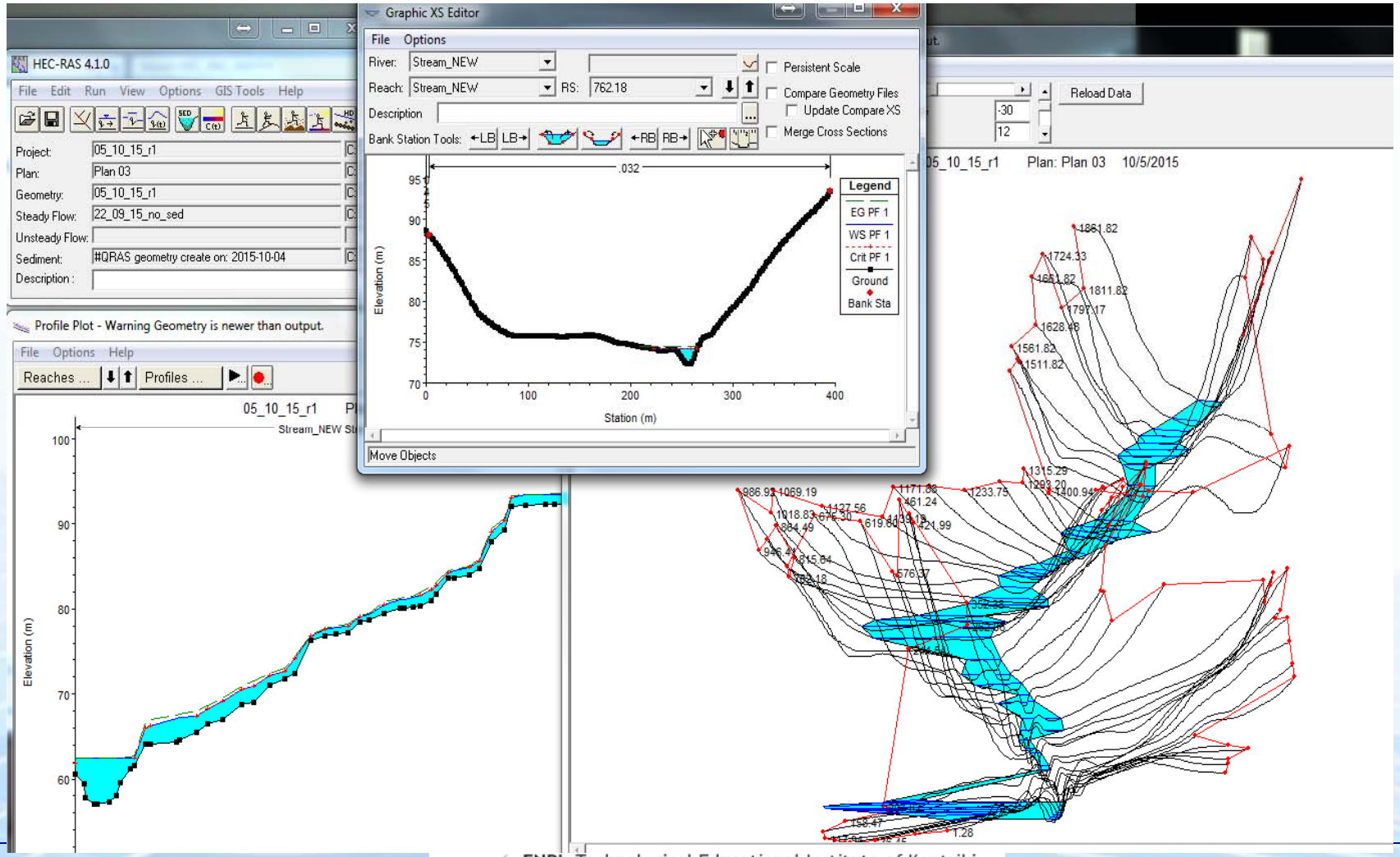
Hydraulic Analysis Results.



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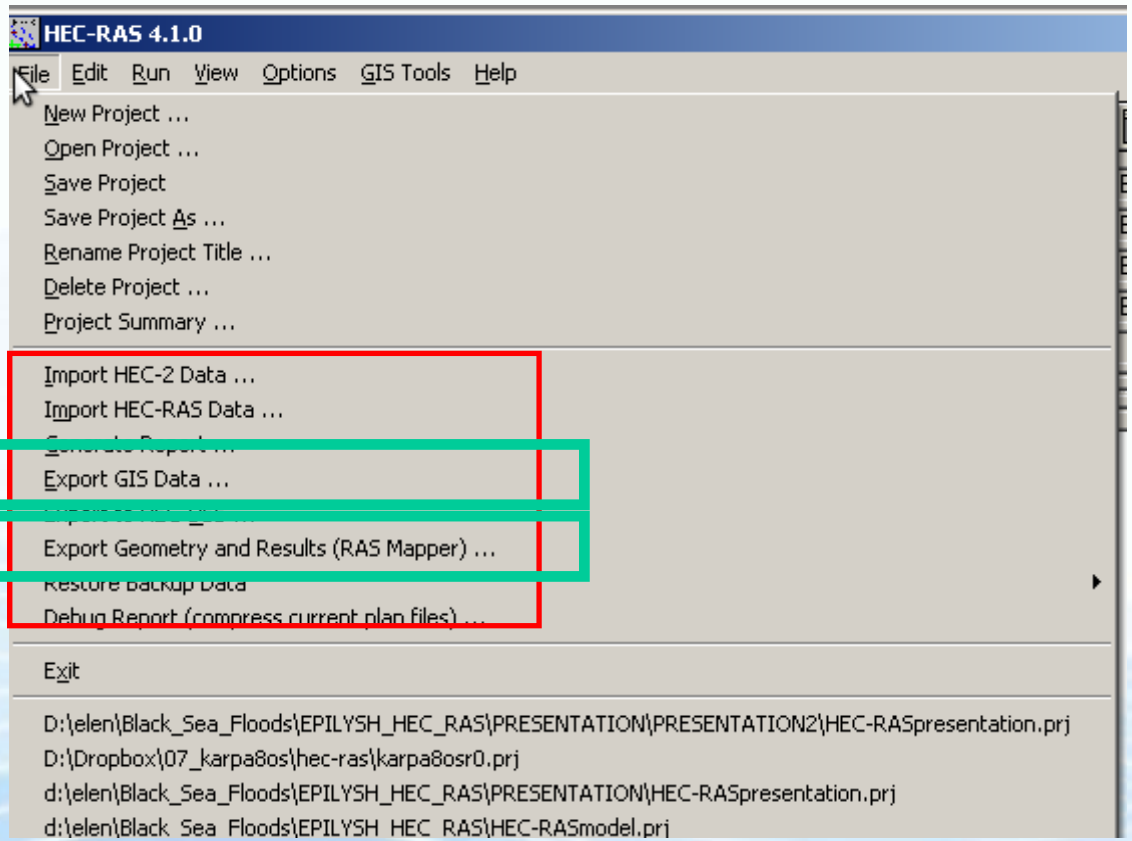
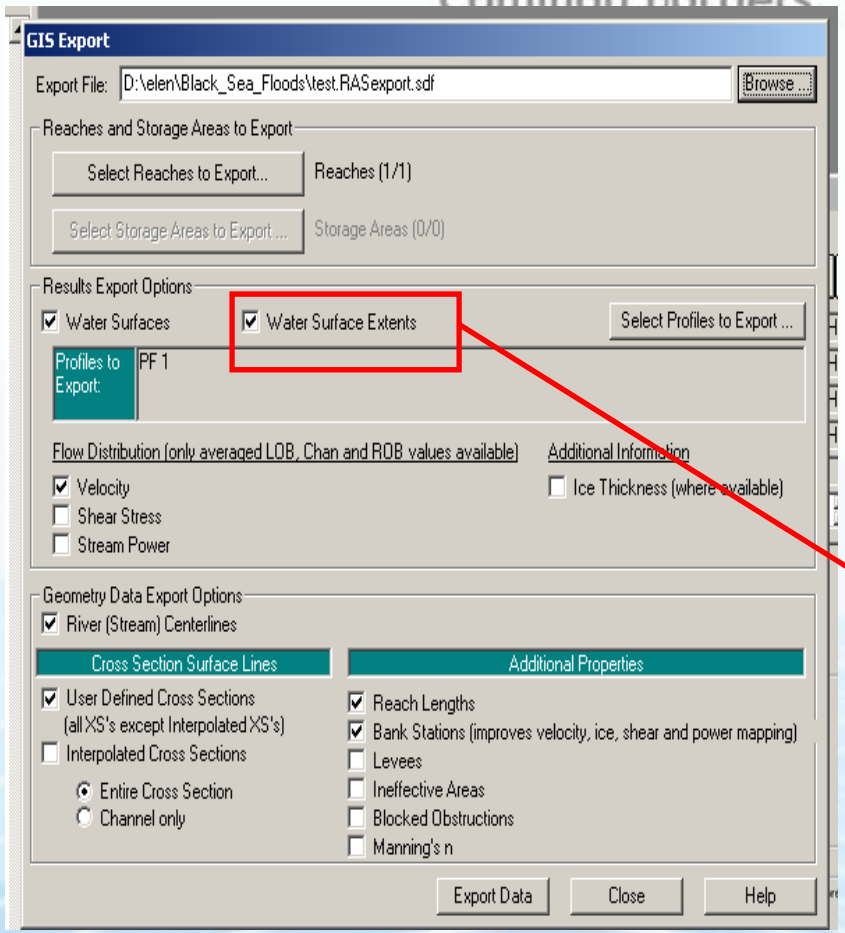
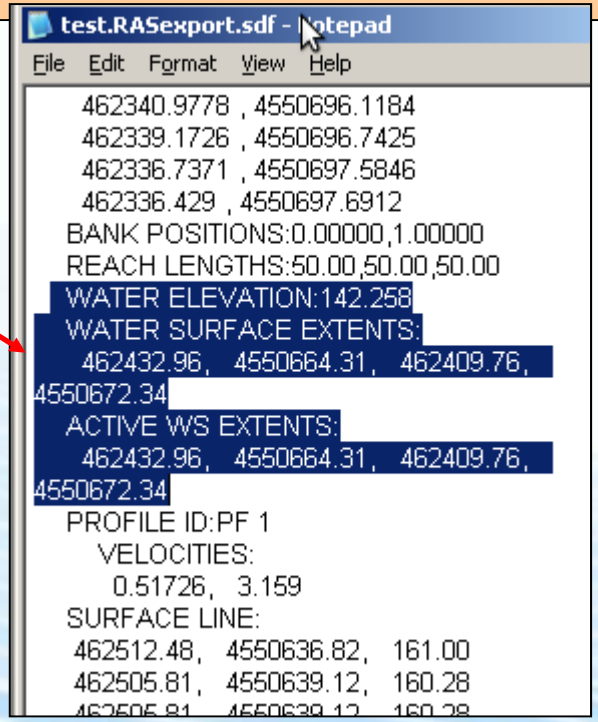
From HEC-RAS back to QGIS





- **HEC-RAS creates .sdf files containing all information necessary**



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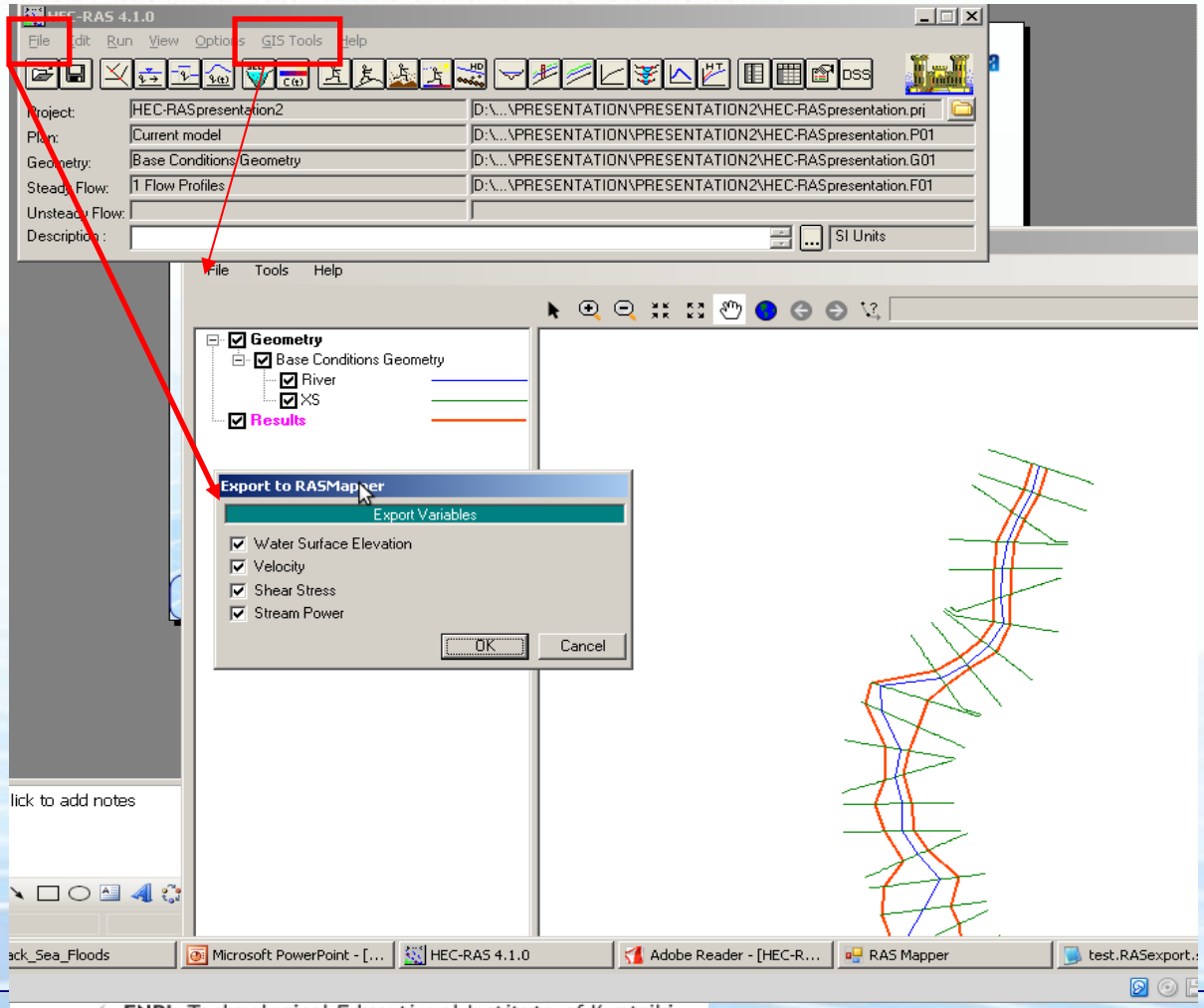
RAS Mapper



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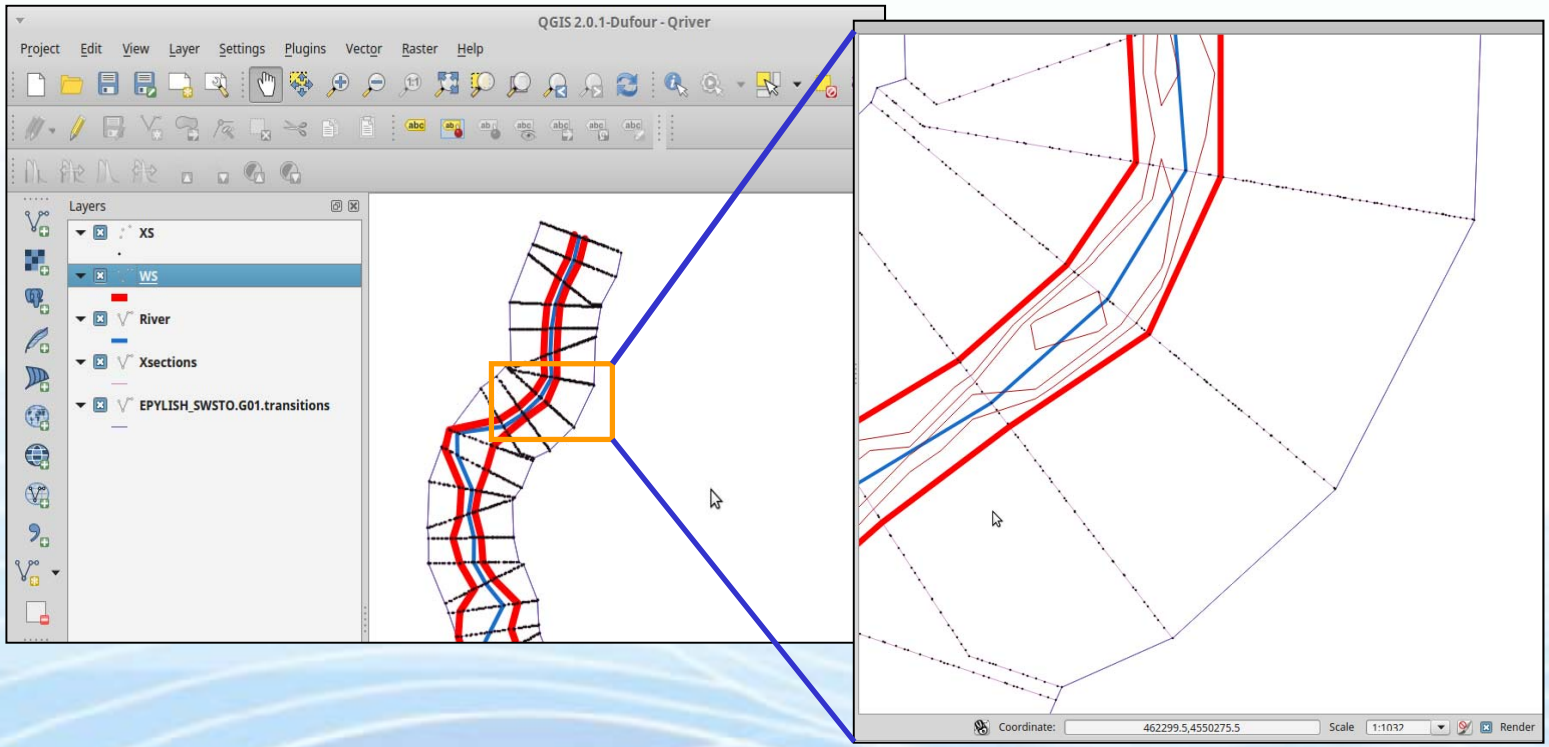
By georeferencing the HEC_RAS image output one can create (digitize) flooding areas.



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Results in tabular format

Profile Output Table - Standard Table 1

File Options Std. Tables Locations Help

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Stream_NEW	1861.82	64.50	95.94	96.97	96.97	97.31	0.01160	2.55	25.33	38.41	1.00
Stream_NEW	1811.82	64.50	93.63	94.59	94.59	94.89	0.01225	2.42	26.69	45.65	1.01
Stream_NEW	1797.17	64.50	92.55	93.71		93.81	0.00220	1.40	45.95	48.78	0.46
Stream_NEW	1724.33	64.50	92.46	93.57		93.66	0.00190	1.28	50.42	55.23	0.43
Stream_NEW	1661.82	64.50	92.36	93.45		93.53	0.00197	1.31	49.07	53.02	0.44
Stream_NEW	1628.48	64.50	92.26	93.46		93.49	0.00052	0.74	86.64	81.04	0.23
Stream_NEW	1561.82	64.50	92.17	93.42		93.45	0.00055	0.77	83.68	77.17	0.24
Stream_NEW	1511.82	64.50	92.08	93.03	93.03	93.35	0.01196	2.50	25.78	41.09	1.01
Stream_NEW	1487.04	64.50	89.30	90.39	90.39	90.74	0.01150	2.62	24.58	35.38	1.00
Stream_NEW	1441.01	64.50	87.94	89.08	89.08	89.44	0.01132	2.66	24.28	33.87	1.00
Stream_NEW	1400.94	64.50	84.75	85.66	85.66	85.95	0.01208	2.40	26.89	45.98	1.00
Stream_NEW	1366.34	64.50	83.97	84.86	84.86	85.06	0.01389	1.96	32.97	85.11	1.00
Stream_NEW	1315.29	64.50	83.66	84.55		84.63	0.00369	1.24	52.08	98.74	0.54
Stream_NEW	1293.20	64.50	83.63	84.28	84.28	84.48	0.01380	1.99	32.46	81.43	1.00
Stream_NEW	1251.74	64.50	81.69	82.74	82.74	83.08	0.01166	2.60	24.84	36.68	1.01
Stream_NEW	1233.75	64.50	81.01	82.19	82.19	82.56	0.01143	2.72	23.75	32.30	1.01
Stream_NEW	1194.79	64.50	80.38	81.61	81.61	82.00	0.01118	2.79	23.14	29.73	1.01
Stream_NEW	1171.88	64.50	80.20	81.39		81.53	0.00417	1.69	38.16	49.65	0.62
Stream_NEW	1139.19	64.50	80.16	81.17		81.36	0.00659	1.95	33.09	48.99	0.76
Stream_NEW	1127.56	64.50	80.11	81.14		81.28	0.00471	1.67	38.57	55.94	0.64
Stream_NEW	1069.19	64.50	79.50	80.52	80.52	80.85	0.01179	2.56	25.23	38.48	1.01
Stream_NEW	1018.83	64.50	78.75	79.38		79.47	0.00467	1.36	47.52	93.67	0.61
Stream_NEW	986.92	64.50	78.51	79.05	79.05	79.22	0.01473	1.85	34.96	103.02	1.01

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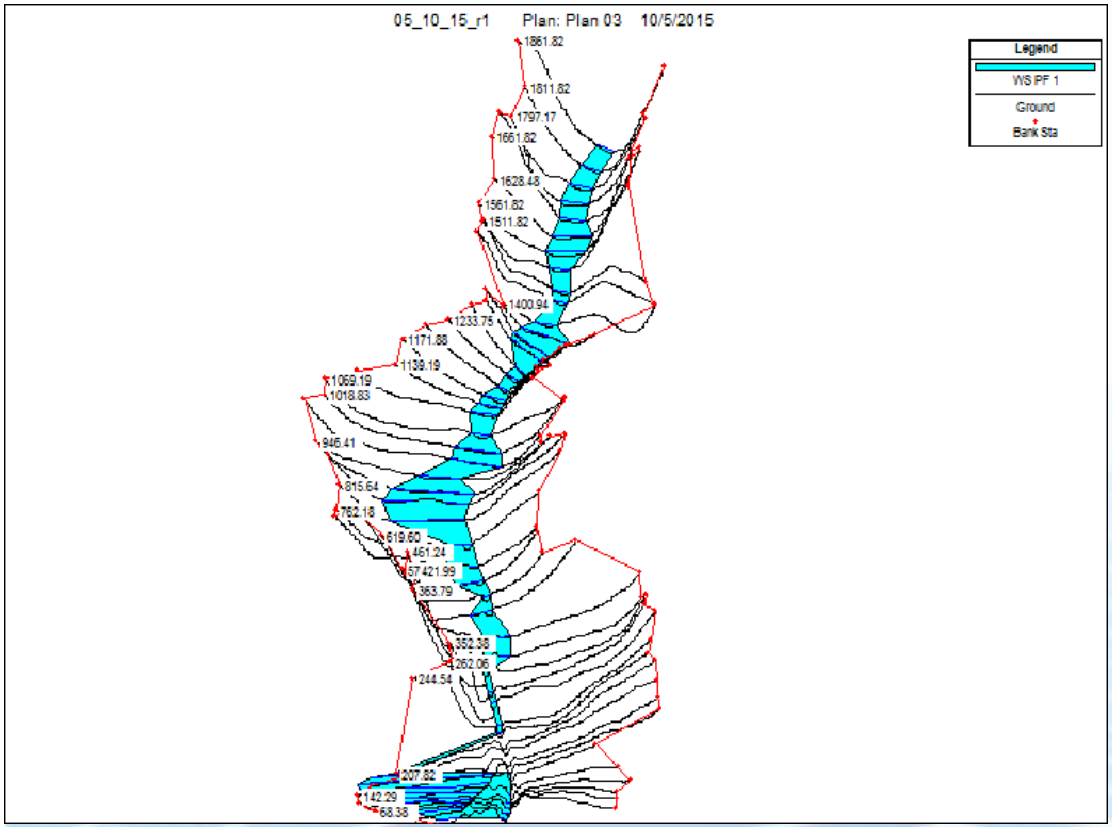
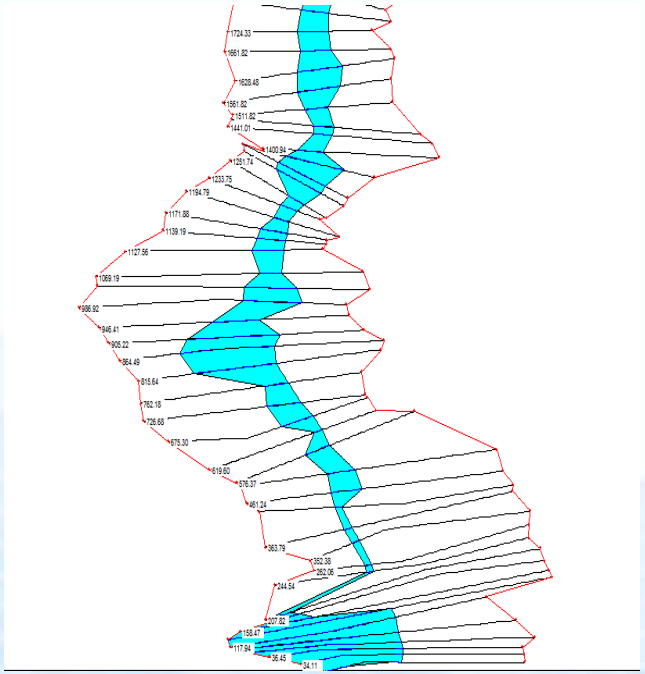
Ag. Anargyroi Stream, Serres





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AI-GIORGIS stream-Serres

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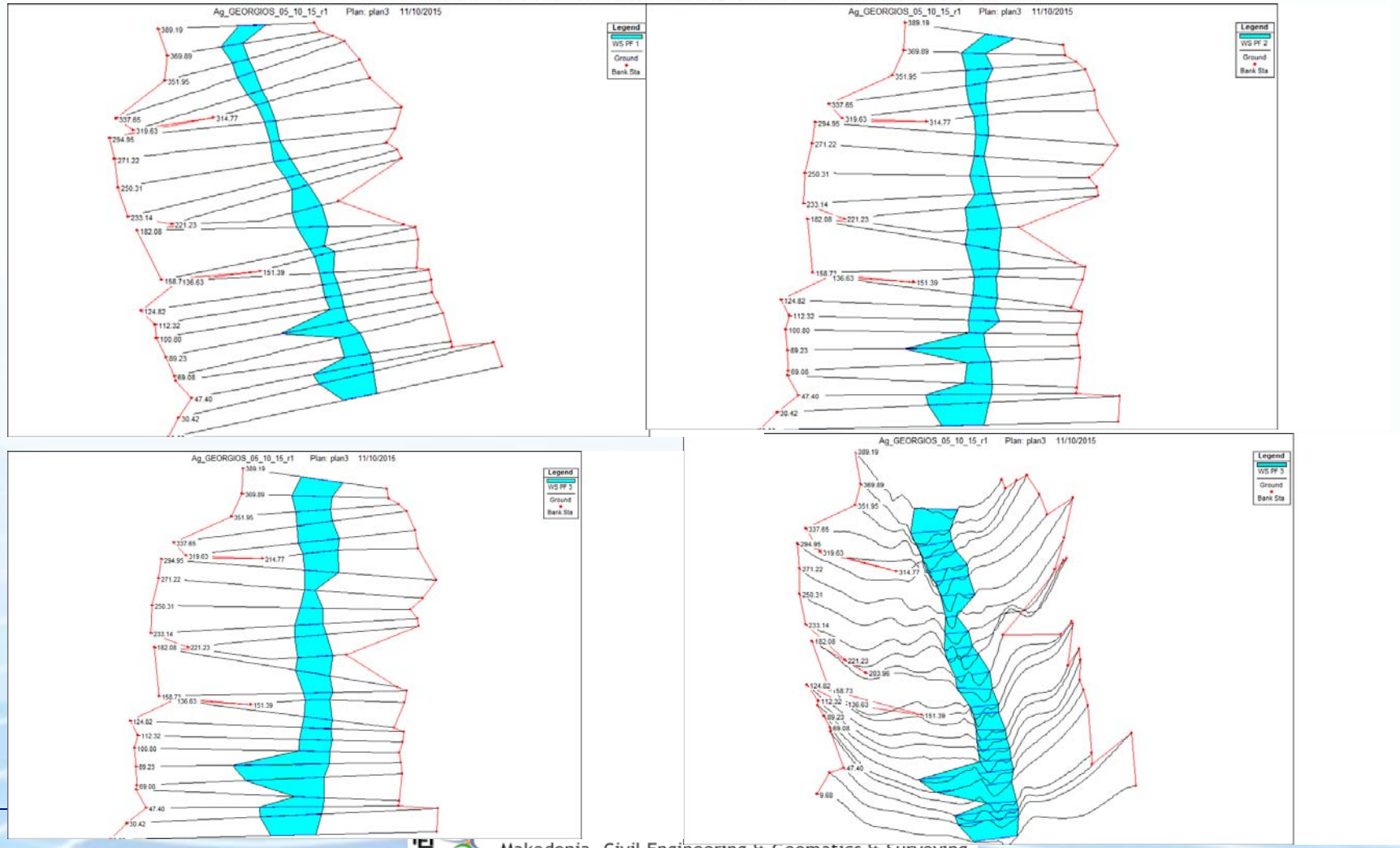

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Thank you!

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