



Flood Flow Calculation

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WHITEPAPER

Table of Contents

Chapter I About the whitepaper

1 Purpose.....	4
2 Software.....	4

Chapter II Steps

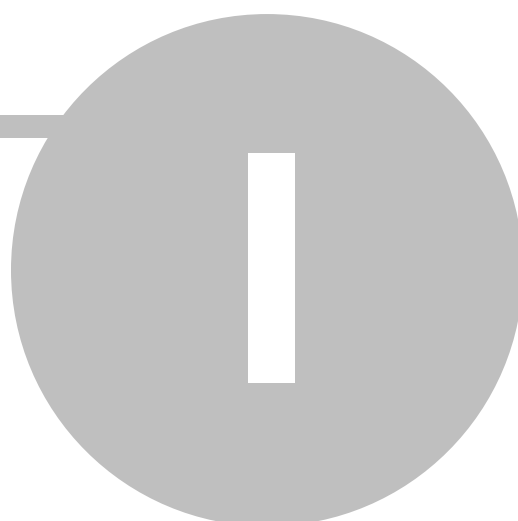
1 Step 01: New Project.....	6
2 Step 02: Data Input.....	6
3 Step 03: Calculations.....	9
4 Step 04: Printing.....	10

Chapter III Help

1 Technical support.....	12
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Keyword Index	0
----------------------	----------

Chapter



1 About the whitepaper

1.1 Purpose

The purpose of this example is to calculate the flood flow of a catchment basin for the construction of a water drainage collector.

The basin is located near the Ellassona area and has low hills and permeable ground with dense vegetation.

The basin data are as follows:

Basin data	Value
Area of the basin	155 ha
Length of main basin river	2.17 km
Average surface slope	3.5%
Average basin elevation	450 m
Elevation of basin outlet	56 m
Runoff coefficient	0.30
Mean annual accumulated rainfall	1.2 m
Impervious ground percentage	35%
SCS curve number	86

The flood flow will be calculated using the rational method and the concentration time using the Giandotti formula.

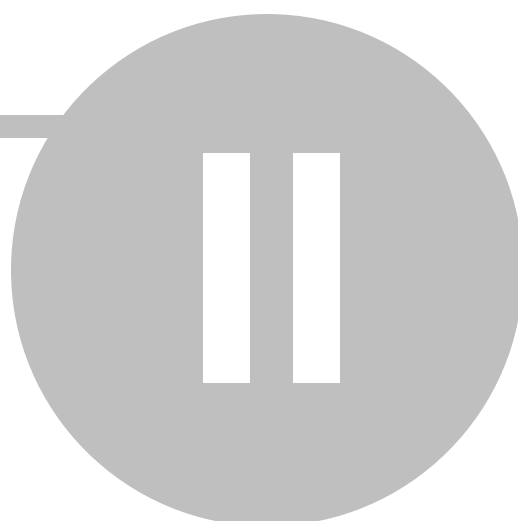
1.2 Software

In order to complete the example successfully, the following software is required:

- Flood Flows v11.0.

Later versions of the aforementioned software may be incompatible with the structure of the example as it is presented herein.

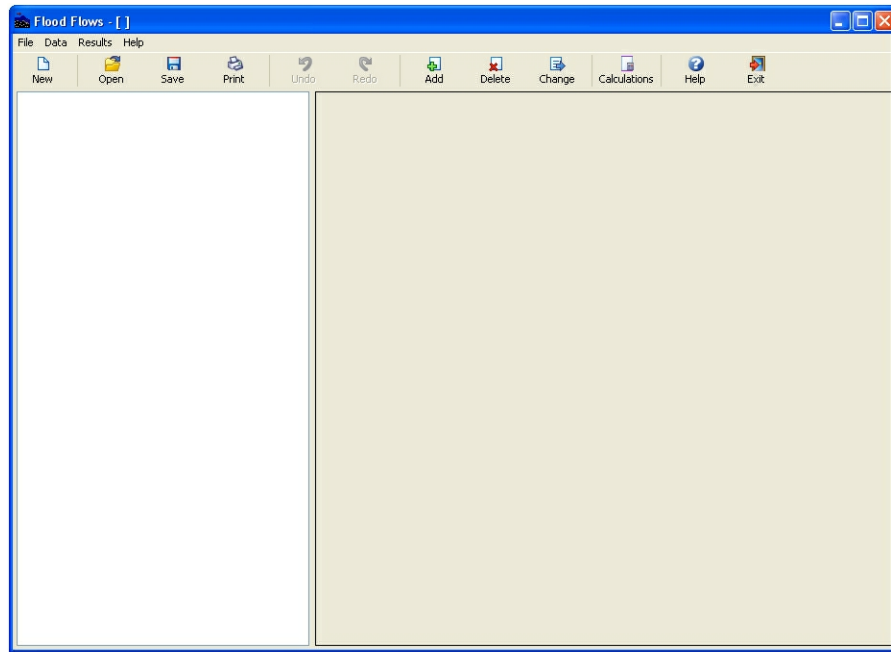
Chapter



2 Steps

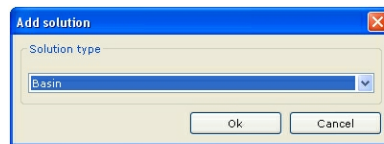
2.1 Step 01: New Project

Select **New Project** from the **File** menu. The program will remove any data from memory and prepare to start a new project:



2.2 Step 02: Data Input

Select **Data > Add Solution**:



Select **Basin** from the **Solution type** drop-down list and hit **Ok**.

Select **Data > Basins > IDF Curve**:

IDF curves...

Settings

☒ Intensity duration curve

Constant numerator coefficient c: 54.7800

Constant denominator coefficient b: 0.0000

Constant denominator coefficient n: 0.6760

$$i = \frac{c}{(t+b)^n}$$

Database...

☐ Constant rainfall intensity

Rainfall intensity (mm/h): 0

☐ Rainfall duration - intensity correlation

Time (min)	Rate (mm/h)
------------	-------------

Add, Remove, Insert, Import, Export

Ok, Cancel

The IDF coefficients are unknown so press the **Database...** button:

Intense - Duration - Frequency curves...

Area	Description	T (years)	Coefficient...	Coefficient...	Coeff...
Lamia	Sperxeios	20	25.3	0	0.56
Lamia	Sperxeios	50	32.25	0	0.56
Lamia	Sperxeios	100	38.75	0	0.56
Larissa	Skopia	50	36.49	0	0.504
Larissa	Skopia	5	18.12	0	0.504
Larissa	Skopia	20	27.62	0	0.504
Larissa	Skopia	2	13.71	0	0.504
Larissa	Skopia	100	45.05	0	0.504
Larissa	Skopia	10	22.37	0	0.504
Larissa	Larissa	5	38	0.333	1
Larissa	Larissa	10	43	0.25	1
Larissa	Elassona	50	54.78	0	0.676
Larissa	Elassona	5	28.2	0	0.676
Larissa	Elassona	20	42.06	0	0.676
Larissa	Elassona	2	21.65	0	0.676
Larissa	Elassona	100	66.9	0	0.676
Larissa	Elassona	10	34.44	0	0.676

Add, Remove, Modify, Ok, Cancel

The basin is near Ellassona so select the Ellassona curve for a return period (**T**) of 50 years (which is an adequate period for a water drainage collector). Press **Ok** twice to close the open forms.

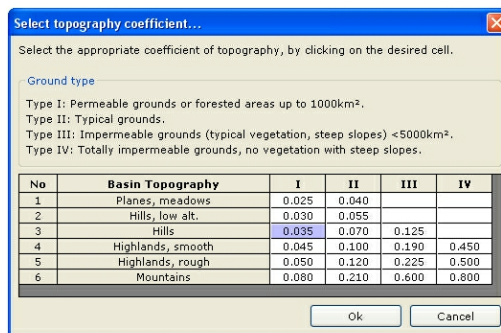
Select **Data > Basins > Basin Properties**:

Property	Value
General Data	
Name	Basin 1
Comments	
Solver	Rational method
Calculation formula	Giandotti
Concentration time (h)	0
Basin Geometry	
Area of the basin (km ²)	1.55
Length of the main basin river (km)	2.17
Average surface slope (m/m)	.035
Average basin elevation (m)	450
Elevation of basin outlet (m)	56
Ground Information	
Runoff coefficient	0.30
Manning friction factor	0
Hydraulic radius (m)	0
Impervious ground (%)	35
Espey canalization factor	0
Water traveling velocity (m/s)	0
SCS curve number (CN)	86
Empirical Formulas Data	
Return period T (years)	50
Mean annual accumulated rainfall H (m)	1.2
Topography coefficient	0.035

Enter the following properties:

- Type "**Basin 1**" in the **Name** cell.
- Click on the **Solver** cell and select **Rational method** from the drop-down list.
- Click on the **Calculation formula** cell and select **Giandotti** from the drop-down list.
- Double click on the **Area of the basin (km²)** and click on the unit converter button (U). On the unit converter form select **hectare (ha)** from the drop-down list, type "**155**" in the field next to it and press **Ok**.

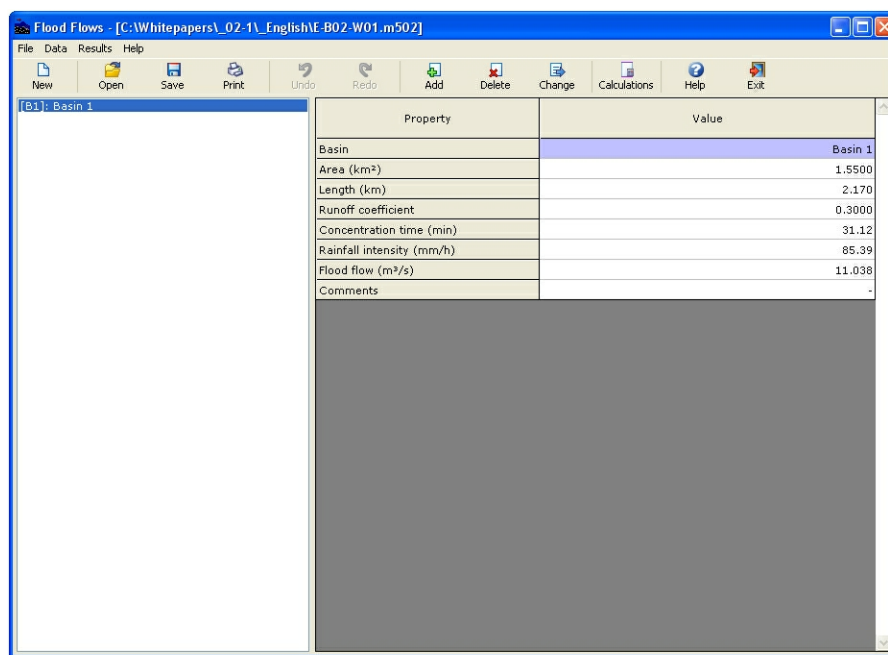
- Type "**2.17**" in the **Length of the main basin river** cell.
- Type "**0.035**" in the **Average surface slope** cell.
- Type "**450**" in the **Average basin elevation** cell.
- Type "**56**" in the **Elevation of basin outlet** cell.
- Type "**0.30**" in the **Runnoff coefficient** cell.
- Type "**35**" in the **Impervious ground (%)** cell.
- Type "**86**" in the **SCS curve number (CN)** cell.
- Type "**50**" in the **Return period T** cell.
- Type "**1.2**" in the **Mean annual accumulated rainfall H** cell.
- Click on the **Topography coefficient** cell, press the ellipses button (...), and in the following form select the value **0.035**, which corresponds to Hills and permeable ground or forested areas, and click **Ok**.



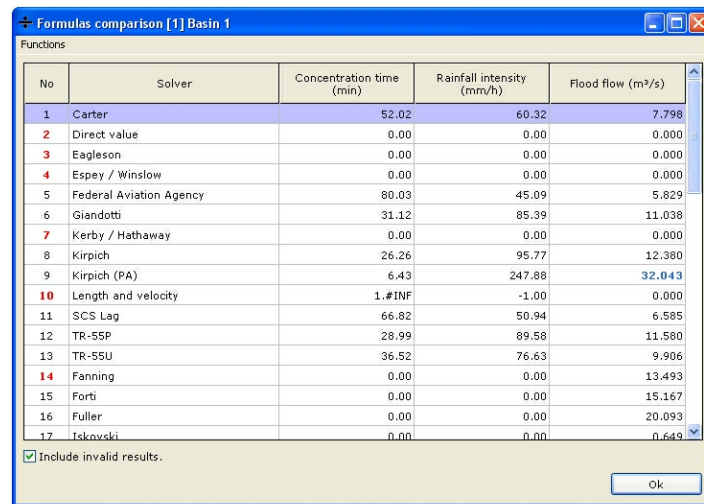
Press the **Ok** button on the basin properties form to close it.

2.3 Step 03: Calculations

The calculations are performed automatically. The results are displayed in the right grid of the main form:



In order to compare the results of the selected calculation method with the results of all the other methods for calculating concentration times and flood flows, select **Results > Basins > Comparative Analysis** or hit **F3**:



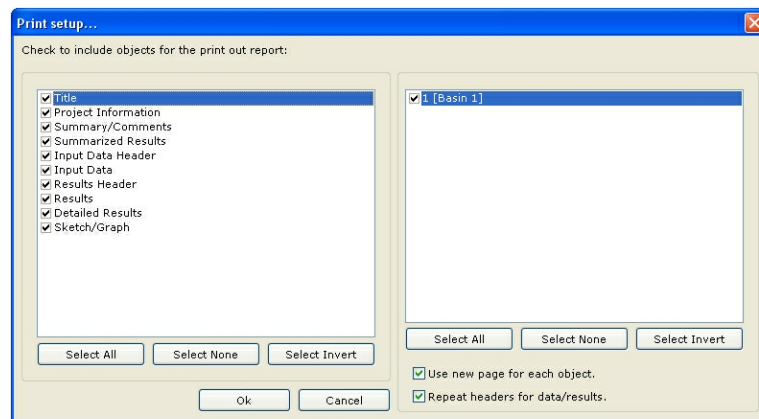
The image shows a 'Formulas comparison [1] Basin 1' dialog box. It contains a table with 5 columns: No, Solver, Concentration time (min), Rainfall intensity (mm/h), and Flood flow (m³/s). The table lists 17 different solvers. Solvers 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, and 17 are listed. Solver 10, 'Length and velocity', is marked with a red 'X' in the 'No' column. Solver 12, 'TR-SSP', is marked with a red 'X' in the 'No' column. Solver 13, 'TR-SSU', is marked with a red 'X' in the 'No' column. Solver 14, 'Fanning', is marked with a red 'X' in the 'No' column. Solver 15, 'Forti', is marked with a red 'X' in the 'No' column. Solver 16, 'Fuller', is marked with a red 'X' in the 'No' column. Solver 17, 'Iskovski', is marked with a red 'X' in the 'No' column. The 'Flood flow (m³/s)' column shows values for each solver, with the highest value, 32.043, highlighted in blue for the 'Kirpich (PA)' solver. At the bottom, there is a checkbox 'Include invalid results.' which is checked, and an 'Ok' button.

No	Solver	Concentration time (min)	Rainfall intensity (mm/h)	Flood flow (m³/s)
1	Carter	52.02	60.32	7.798
2	Direct value	0.00	0.00	0.000
3	Eagleson	0.00	0.00	0.000
4	Espey / Winslow	0.00	0.00	0.000
5	Federal Aviation Agency	80.03	45.09	5.829
6	Giandotti	31.12	85.39	11.038
7	Kerby / Hathaway	0.00	0.00	0.000
8	Kirpich	26.26	95.77	12.380
9	Kirpich (PA)	6.43	247.88	32.043
10	Length and velocity	1.#INF	-1.00	0.000
11	SCS Lag	66.82	50.94	6.585
12	TR-SSP	28.99	89.58	11.580
13	TR-SSU	36.52	76.63	9.906
14	Fanning	0.00	0.00	13.493
15	Forti	0.00	0.00	15.167
16	Fuller	0.00	0.00	20.093
17	Iskovski	0.00	0.00	0.649

The methods that could not be solved due to insufficient data are marked with red. The highest value for the flood flow, regardless of the calculation method used, is marked with blue.

2.4 Step 04: Printing

Optionally, you may want to print the results to a printer, to Microsoft Word or Microsoft Excel. From the **File** menu select **Print setup**:



The image shows a 'Print setup...' dialog box. It has a title bar 'Print setup...' and a close button. Below the title bar, it says 'Check to include objects for the print out report:'. There are two lists of objects. The left list contains: Title, Project Information, Summary/Comments, Summarized Results, Input Data Header, Input Data, Results Header, Results, Detailed Results, and Sketch/Graph. The right list contains: 1 [Basin 1]. Both lists have checkboxes next to them, and all are checked. Below the lists are three buttons: 'Select All', 'Select None', and 'Select Invert'. At the bottom, there are two checkboxes: 'Use new page for each object.' and 'Repeat headers for data/results.', both of which are checked. At the very bottom are 'Ok' and 'Cancel' buttons.

Select the solution "EXAMPLE" from the list on the right and select **Ok**.

From the **File** menu select **Print** or **Print To > Word** or **Print To > Excel** to invoke the corresponding print engine.

Chapter



3 Help

3.1 Technical support

Technical Support

TechnoLogismiki offers technical support 24 hours per day, 365 days per year, through the Web site where you can get information on the latest programs and services.

Support by e-mail

Please use the dedicated e-mail addresses for better customer service:

- for questions regarding sales: sales@technologismiki.com
- for questions regarding the usage of programs: support@technologismiki.com
- for any other question or comment: info@technologismiki.com

The normal response time is within two business days. If your inquiry cannot be answered via e-mail, a customer service representative will contact you via telephone.

Interactive Support

Business days, 09:00 - 17:00 Eastern European Time:

- Telephone [3 lines]: ++30-210-656-4147
- FAX: ++30-210-654-8461
- Address: 5, Imitou str, Cholargos, 15561, Athens, Greece.