HR Wallingford
Working with water

Freely available software
US Federal Highways Agency Toolkit

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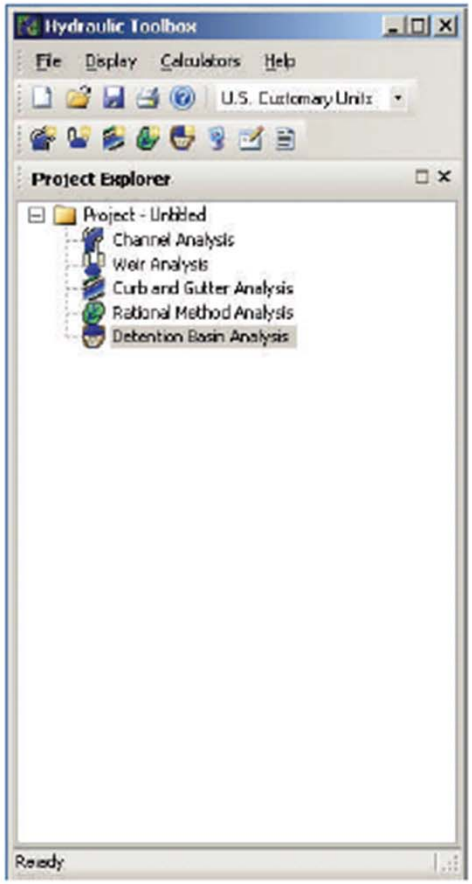
US Federal Highways Administration Toolbox



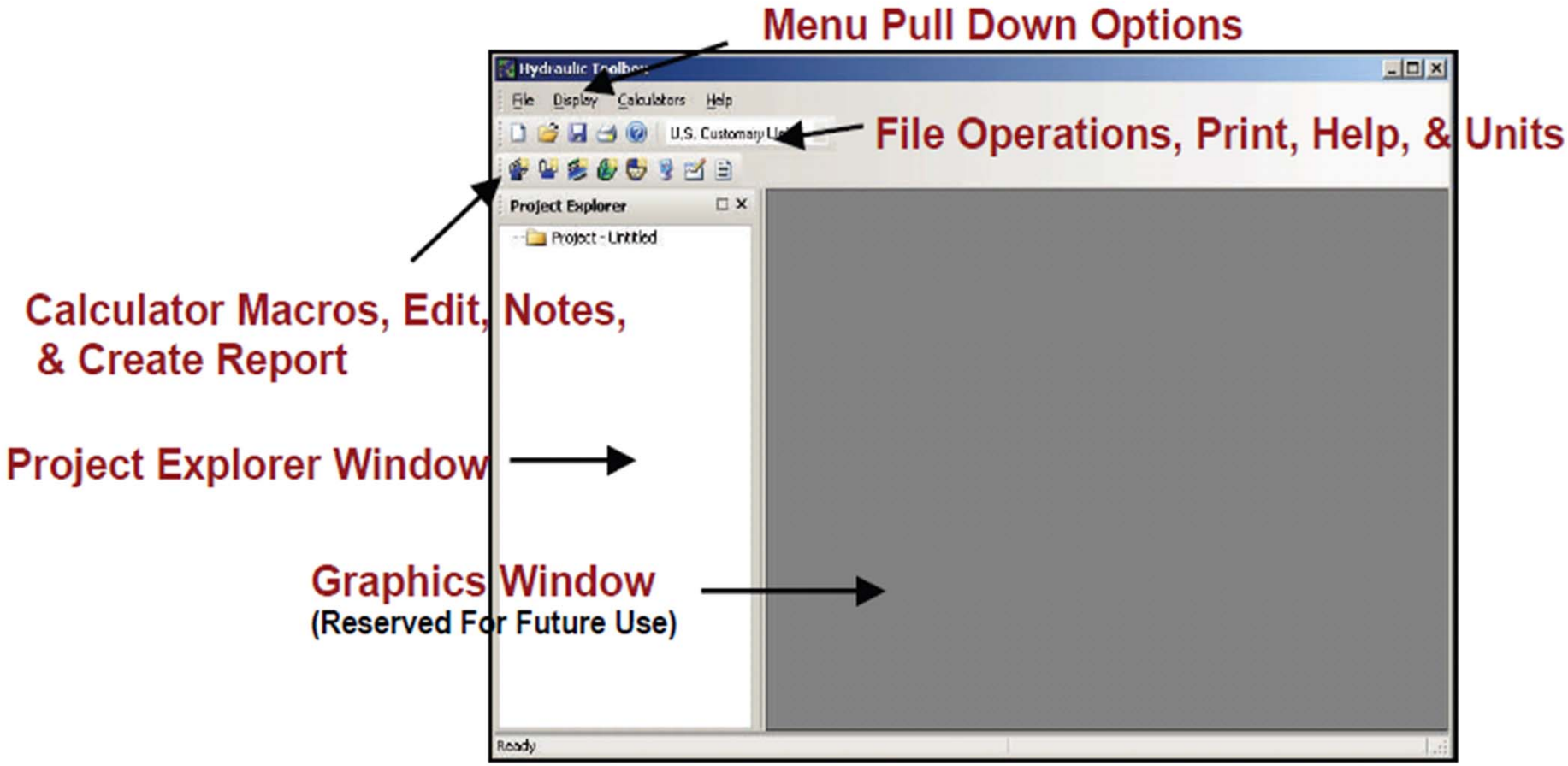
FHWA Hydraulic Toolbox Version 1.0 Desktop Reference Guide

Reference Guide Version 1.0.0

Software layout

All calculators can use SI and English units

Hydraulic Toolbox Interface



Hydraulic Toolbox Interface

FHWA Hydraulic Toolbox

5

Channel analysis calculator

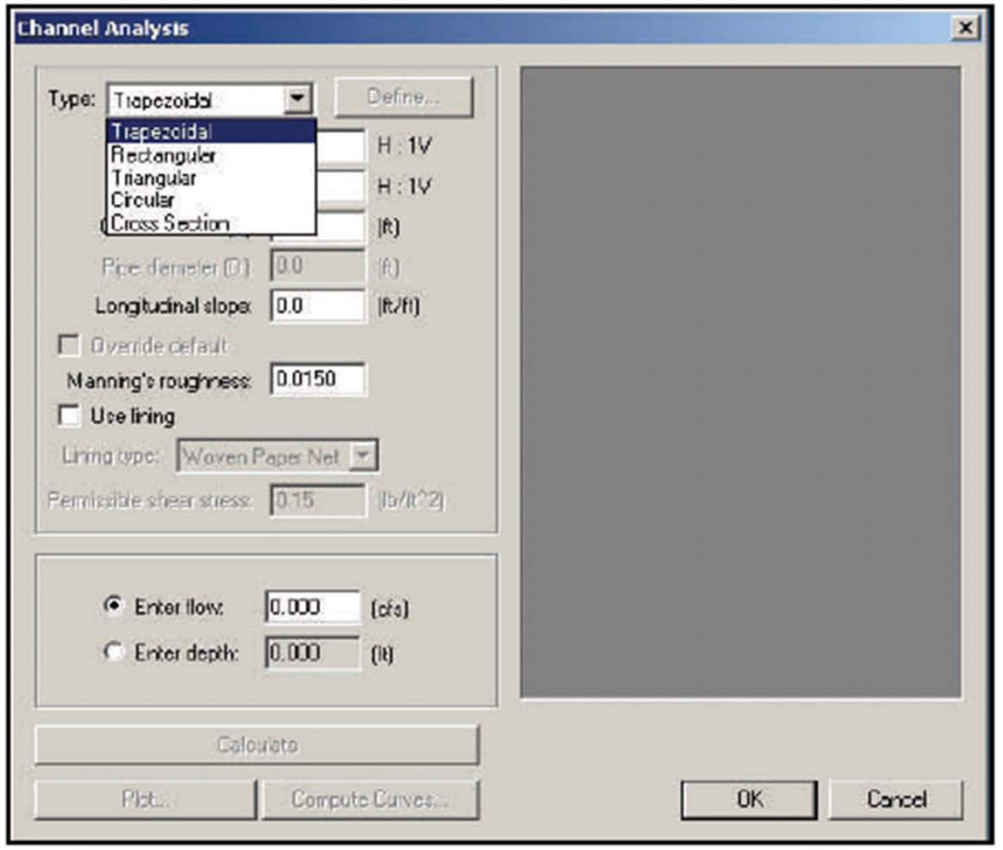
Channel Analysis Calculator

The **Channel Analysis Calculator** can compute the full range of hydraulic parameters for trapezoidal, rectangular, triangular, circular, or user defined (irregular) channel shapes for a given depth or discharge. For a selected cross section, the user is prompted for necessary input including channel side slopes, bottom width, diameter, channel slope, and Manning's n value. Hydraulic parameters are computed using the Manning Equation shown below.

Manning Equation

$$Q = \frac{1.486}{n} AR^{2/3} S^{1/2}$$

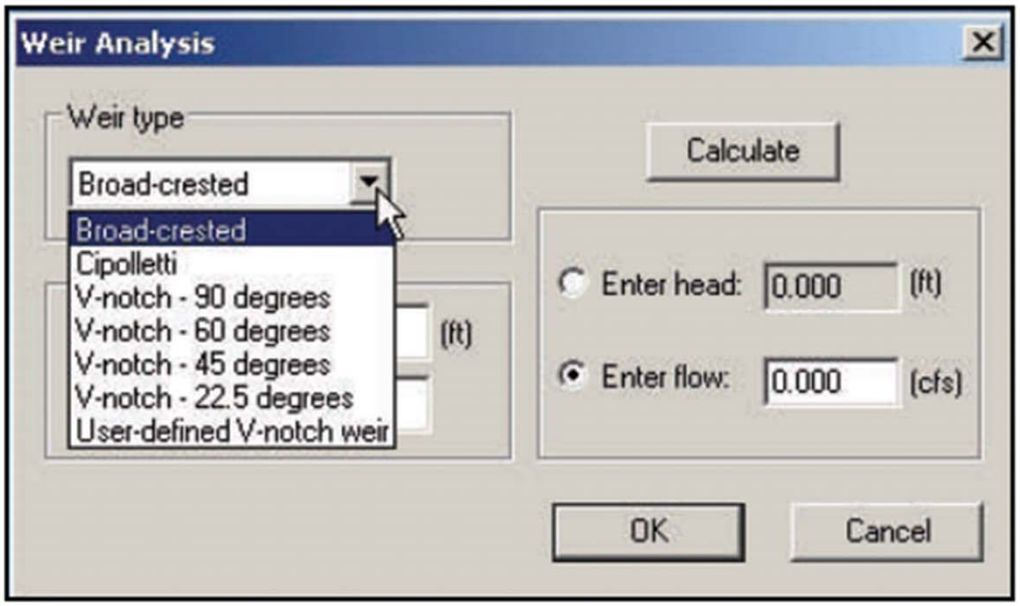
Q = Discharge
n = Manning Roughness Coefficient
A = Area
R = Hydraulic Radius, A/P
P = Wetted Perimeter



Channel Types

Weir analysis calculator

Weir Analysis Calculator



Weir Equation

$$Q = CLH^{3/2}$$

Where:

Q = Discharge
C = Weir Discharge Coefficient
L = Weir Length
H = Head

Weir Analysis Calculator Menu

The **Weir Analysis Calculator** offers 7 types of weir for analysis: broad crested, cipolleti (trapezoidal), v-notch (90 degrees) v-notch (60 degrees), v-notch (45 degrees), v-notch (22.5 degrees), and v-notch (user defined coefficient). The weir analysis window requires the user to enter the type of weir, weir length, the weir coefficient (if the default value is not acceptable) and either the head or the amount of flow. The tool-box will then calculate the missing variable.

Curb and gutter calculator

Curb and Gutter Calculator

The inlet capacity calculator contains five inlet types:

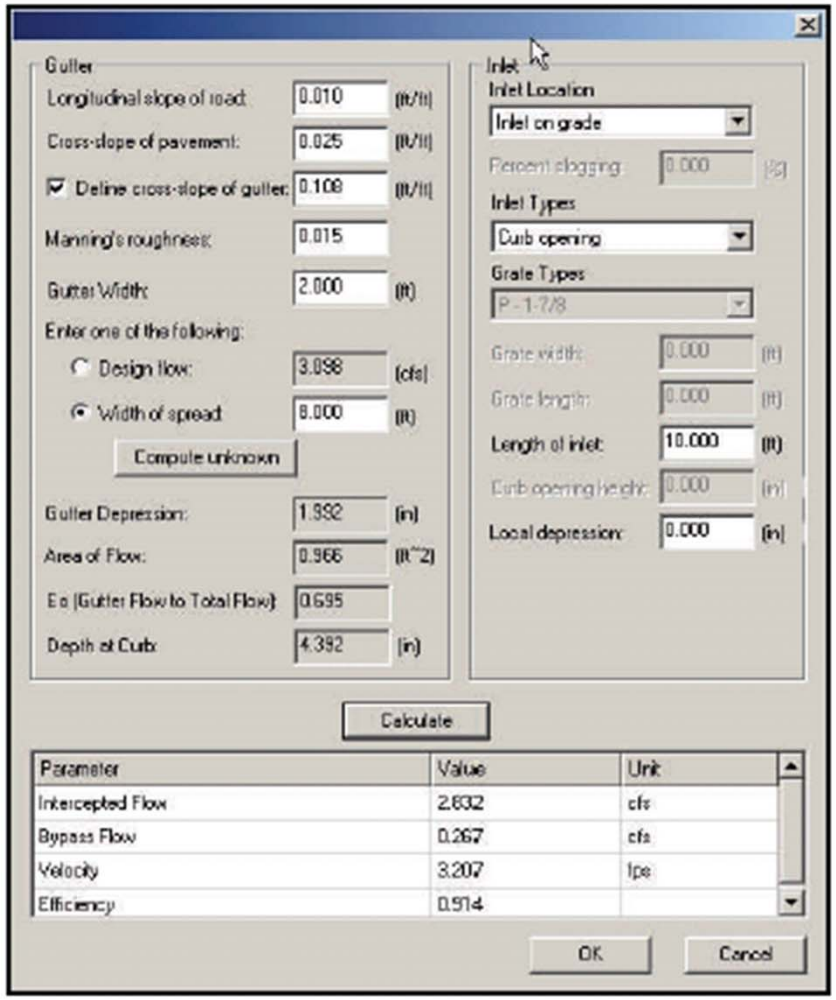
- Grate Only (P-1-7/8, P-1-7/8-4, P-1-1/8, Curved Vane, 45 Degree Tilt Bar 2-1/4", 45 Degree Tilt Bar 3-1/4", 30 Degree Tilt bar, Reticuline)
- Curb Opening
- Slotted Drain
- Sweeper Combination
- Equal Length Combination

Typical computed results for on-grade inlets include:

- Area of Flow
- Intercepted Flow
- Bypass Flow
- Velocity
- Splash-over Velocity
- Efficiency

Typical computed results for inlets in sags include:

- Flow Type
- Effective Perimeter (accounting for clogging)
- Effective Area (accounting for clogging)
- Depth at Curb Face
- Width of Spread



Gutter and Inlet

Rational method calculator

Rational Method Calculator

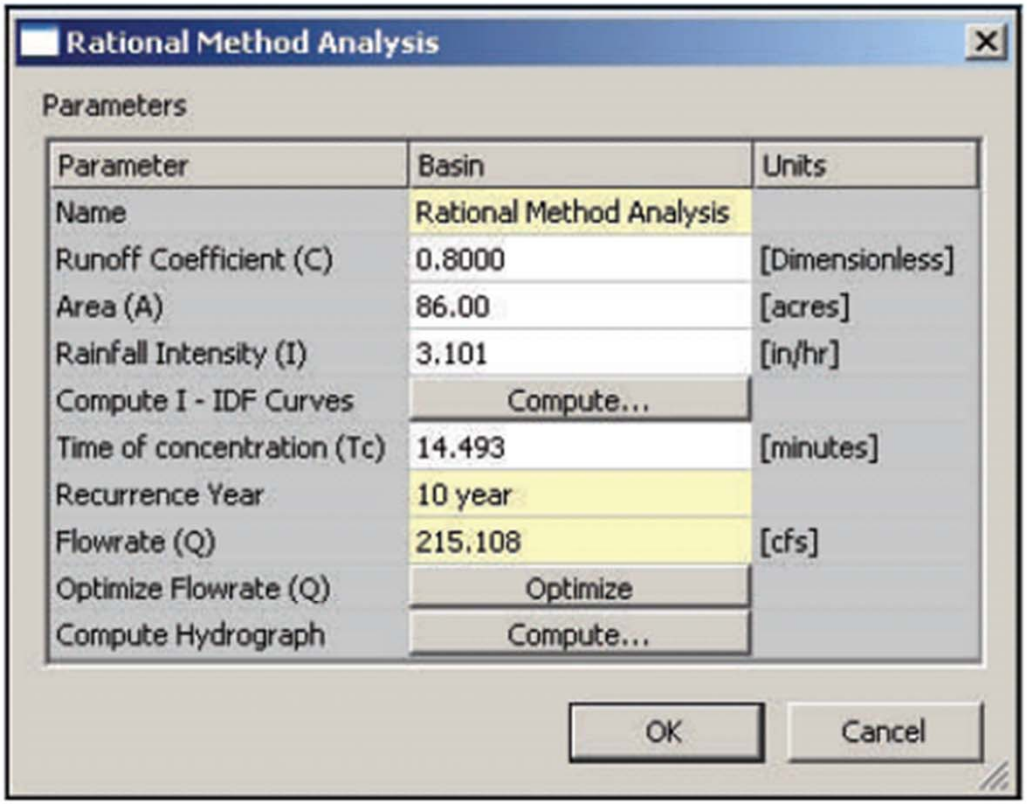
The **Rational Method Calculator** can be used to enter the variables required to compute discharge rate by the Rational Method. The calculator can also compute the total time of concentration, t_c, and plot the intensity-duration-frequency (IDF) curves. Once discharge has been determined, a hydrograph can be computed by various methods and displayed.

Rational Method

$$Q = CIA$$

Where:

Q = Discharge
C = Rational Method Runoff Coefficient
I = Rainfall Intensity
A = Area



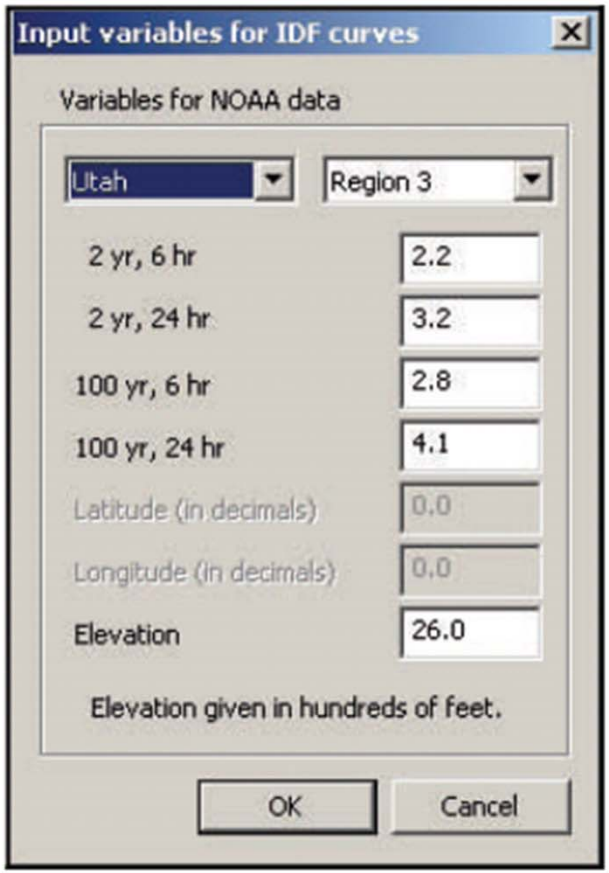
Rational Method Analysis

Estimated rainfall intensities (mm/hour) from Mauritian Met Service

Return period	Duration minutes: mm/hr	1	**5**	**10**	**15**	**30**	**60**	120
	T2	125	**103**	**85**	**69**	**56**	**38**	22
	T5	175	**136**	**110**	**87**	**74**	**56**	37
	T10	208	**157**	**127**	**99**	**85**	**67**	46
	T25	250	**185**	**149**	**114**	**100**	**81**	59
	T50	281	**205**	**165**	**125**	**111**	**92**	68
	T100	312	**225**	**180**	**136**	**122**	**102**	77

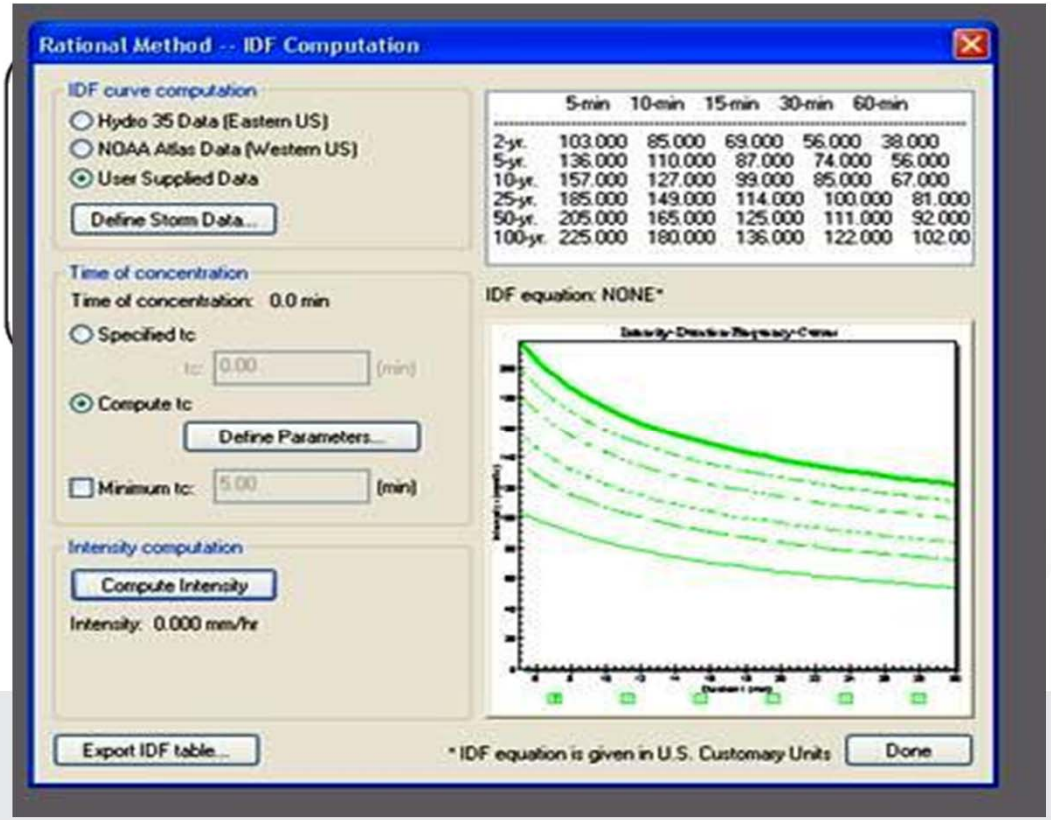
Mauritius Met Service data can be imported into the Rational Method Calculator

Rational Method Calculator—IDF Curve Generator



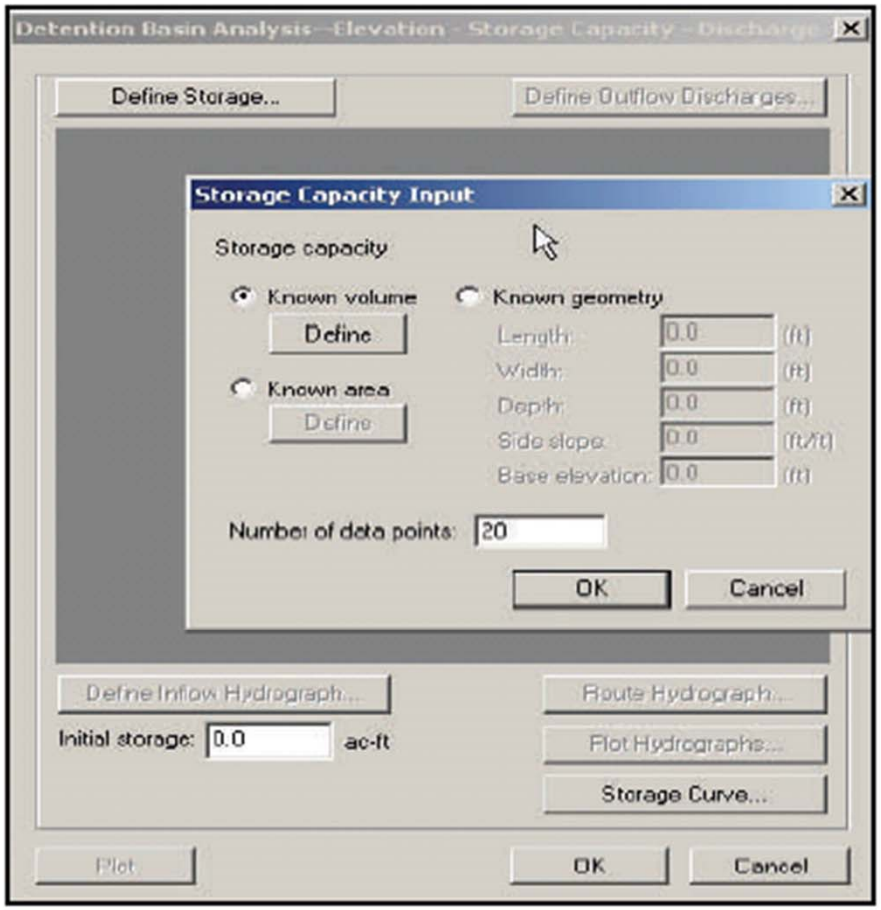
IDF Curve Input Variables

The **Rational Method Calculator** allows the input of precipitation information from a variety of sources. Hydro-35 for the Eastern United States, NOAA Atlas 2 for the Western United States, and user defined precipitation values from other sources such as NOAA Atlas 14 (various regions of the United States).



Detention basin calculator

Detention Basin Calculator



Detention Basin Storage Capacity

One of the fundamental objectives of storm water management is to maintain the peak runoff rate in a developed area at or below the predevelopment rate. The **Detention Basin Calculator** uses the basin storage, the inflow hydrograph and the outflow discharge to achieve this goal.

The volume of storage must be estimated to reduce the basin peak discharge. The calculator subtracts the volume of water that can be stored in the basin from the volume of water entering the basin based on the inflow hydrograph. When the entering volume of water exceeds the storage volume of the basin, the excess water is discharged through the user defined structure.

The detention basin analysis begins by selecting the "Define Storage" button and entering the volume, geometry, or area of the basin. By selecting the "Define" button for the known volume, a new window opens and the user enters the acre-ft of storage below its corresponding elevation. If the "Known area" option is selected, the user enters the elevation and area of the surface in acres. Up to 200 data pairs are allowed. If the geometry is known, the user enters the dimensions of the basin.

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Any questions?

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