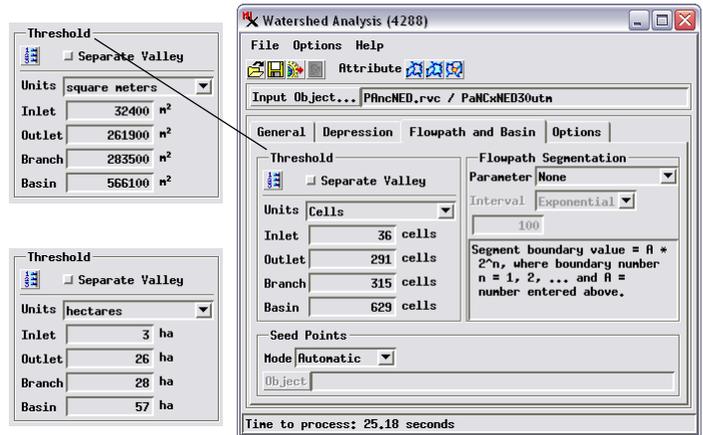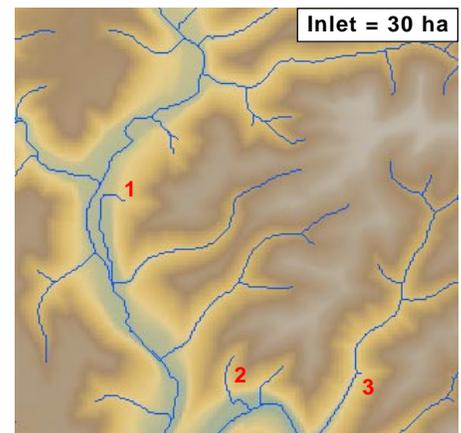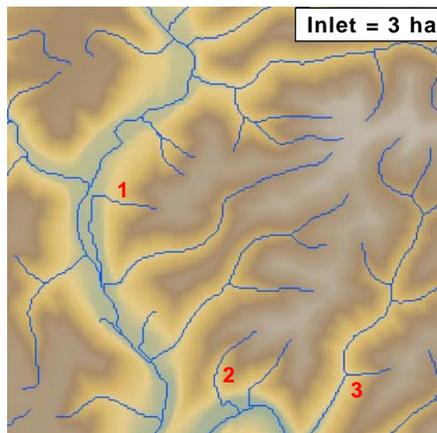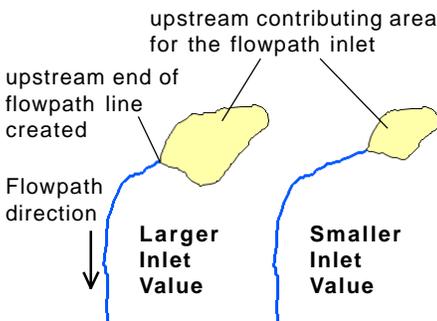# Watershed Flowpath and Basin Thresholds

The generation of stream flowpath lines and basin polygons from a digital elevation model raster (DEM) in the Watershed process in TNTmips is governed by several threshold value settings: Inlet, Outlet, Branch, and Basin. You can adjust these thresholds to produce flowpath and basin vector objects with the level of detail required for the scale of your map presentation or project analysis while eliminating unneeded features. Controls for setting these parameter values are found in the Threshold section of the Flowpath and Basin tabbed panel. The Watershed process computes default values for each threshold based on the dimensions of the input DEM. All of these thresholds are area values related to "flow accumulation": for each DEM cell, the size of the upstream area that contributes flow to that cell. You can use the Units menu on the Threshold panel to set the area units in which to show and enter these values (see illustration to the right).
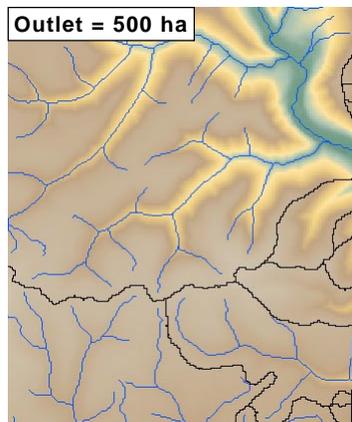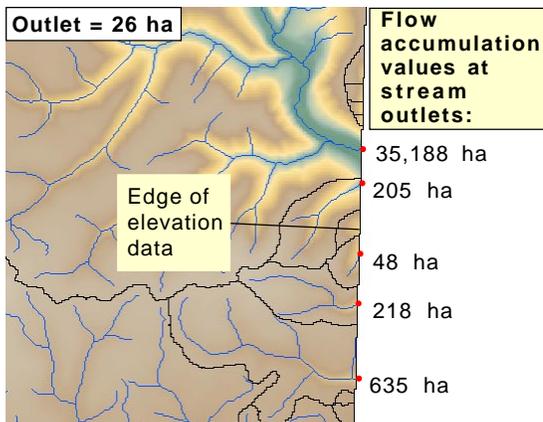
Use the Units menu to choose the area units for the Flowpath and Basin threshold values (cells, square meters, square kilometers, hectares, and others).

Inlet Threshold

The Inlet threshold determines how far upstream each flowpath line extends toward its drainage divide. The upstream end (inlet) of each flowpath is set at the last cell at which the upstream area contributing flow to that location exceeds the Inlet threshold value (see illustration below). A smaller inlet area value allows flowpath lines to extend farther upslope toward the drainage divides (see illustration to the right).

upstream contributing area for the flowpath inlet

upstream end of flowpath line created

Flowpath direction

Larger Inlet Value   **Smaller Inlet Value**

Standard flowpaths (blue lines) created in the Watershed process for a DEM with 30-meter cell size using different values for the Inlet threshold. Left, Inlet value = 3 hectares; right, Inlet value = 30 hectares. A smaller value for the inlet area causes flowpath lines to extend farther upstream toward the drainage divides (left example), as shown by the tributaries numbered 1 through 3 in each result, among others. A small Inlet threshold is appropriate for local studies emphasizing stream headwaters, but may produce an excessively detailed stream network for regional projects and maps.

Outlet = 26 ha   Outlet = 500 ha

Flow accumulation values at stream outlets:

35,188 ha
205 ha
48 ha
218 ha
635 ha

Edge of elevation data

Outlet Threshold

Flowpath lines are traced upstream beginning with the location where the stream intersects the edge of the DEM or the boundary of an area with null cells. This location is the stream outlet. The Outlet parameter sets a lower limit on the size of watersheds and their flowpath networks. Only boundary cells with flow accumulation values greater than the Outlet threshold are used to generate flowpath lines. Increasing the Outlet threshold value therefore reduces the number of flowpath lines that are generated around the edges of the input DEM (see illustrations to the left). You can adjust this threshold to eliminate flowpath lines in small edge watersheds that are not relevant to the purpose of your project.   (over)
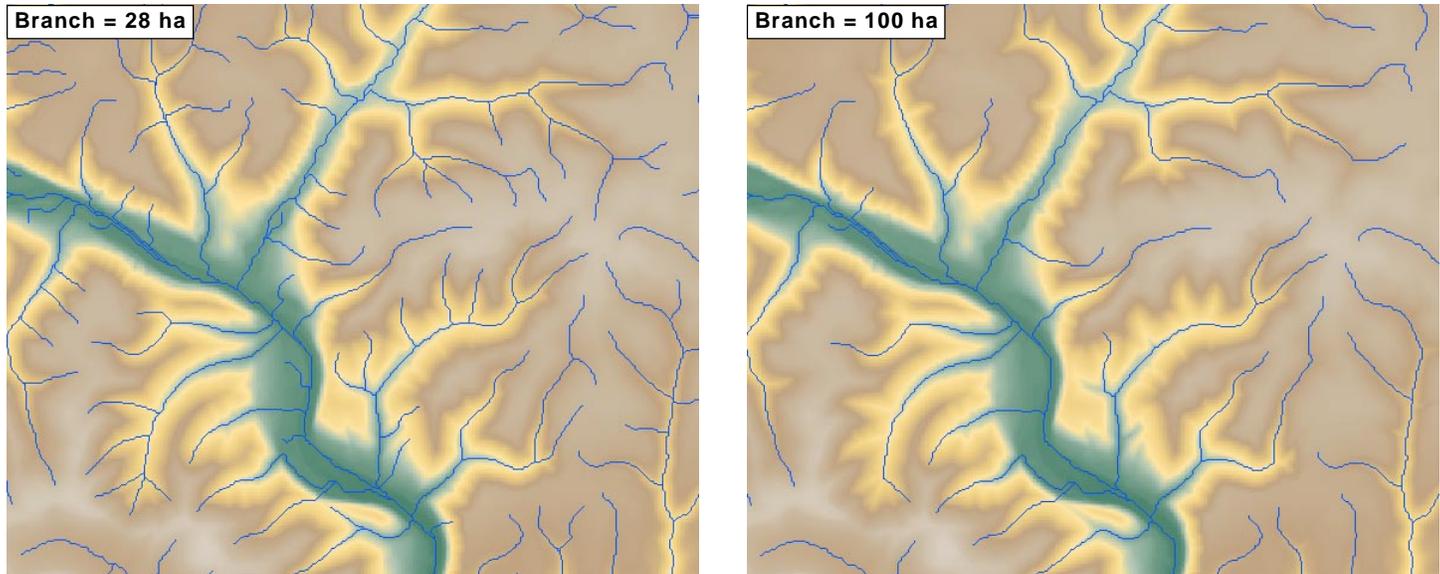
Standard flowpaths produced using different values for the Outlet threshold: left, 26 hectares; right, 500 hectares. Increasing the Outlet threshold value eliminates flowpath lines in small watersheds around the edges of the DEM which may not be part of your area of interest or significant for the purpose of your project.

Branch Threshold

The Branch threshold controls the upstream splitting of flowpath lines at potential junctions with tributary streams (branches). A branch flowpath is generated when the flow accumulation value at the tributary mouth (upstream area draining to the branch point) is greater than the Branch threshold value. A smaller Branch value allows the Watershed process to create many short tributary flowpaths joining the larger streams, producing a denser stream network appropriate for detailed local studies. Increasing the Branch value eliminates the shorter tributary flowpaths, leaving flowpath lines for the main stream and larger tributaries. A reduced flowpath density would be more appropriate for less-detailed regional watershed projects and map presentations. The Branch threshold therefore is a major control on the overall density of the flowpath line network produced (see illustrations below).
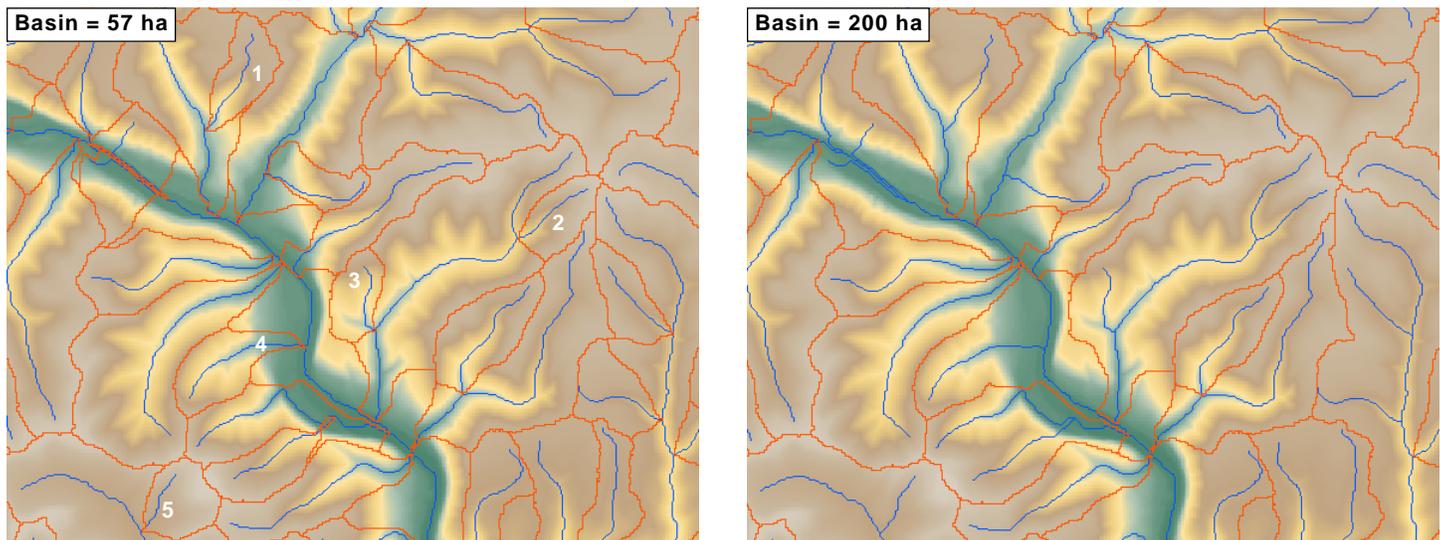

Standard flowpaths (blue lines) produced in the Watershed process using different values for the Branch parameter: left, 28 hectares; right, 100 hectares. Larger values for the Branch threshold eliminate shorter tributary flowpath lines, producing a sparser flowpath network.

Basin Threshold

Polygons in the Standard Basins vector object created by the Watershed process show subdivisions within larger watersheds. Each basin is the area drained by a particular flowpath branch or branch network of the main flowpath. (If you turn on the Separate Valley toggle, basin polygons are also generated for each segment of the main stream between branch junctions.)

The Basin threshold controls the generation of standard basin polygons. A basin polygon is generated for each branch system that drains an area equal to or greater than the Basin threshold value. A smaller value for the Basin threshold allows the process to produce separate basin polygons for smaller tributary systems, producing a basin object appropriate for local detailed studies. Setting a larger value for the Basin threshold eliminates basins associated with smaller flowpath branches (see illustrations below), producing a more generalized basin vector object more appropriate for less detailed projects covering larger areas.

Standard flowpaths (blue lines) and basins (orange polygons) produced in the Watershed process using different values for the Basin threshold: left, 57 hectares; right, 200 hectares. Larger values for the Basin threshold eliminate the basin polygons associated with the smaller stream branches (such as the polygons numbered 1 through 5 on the left illustration, among others).