

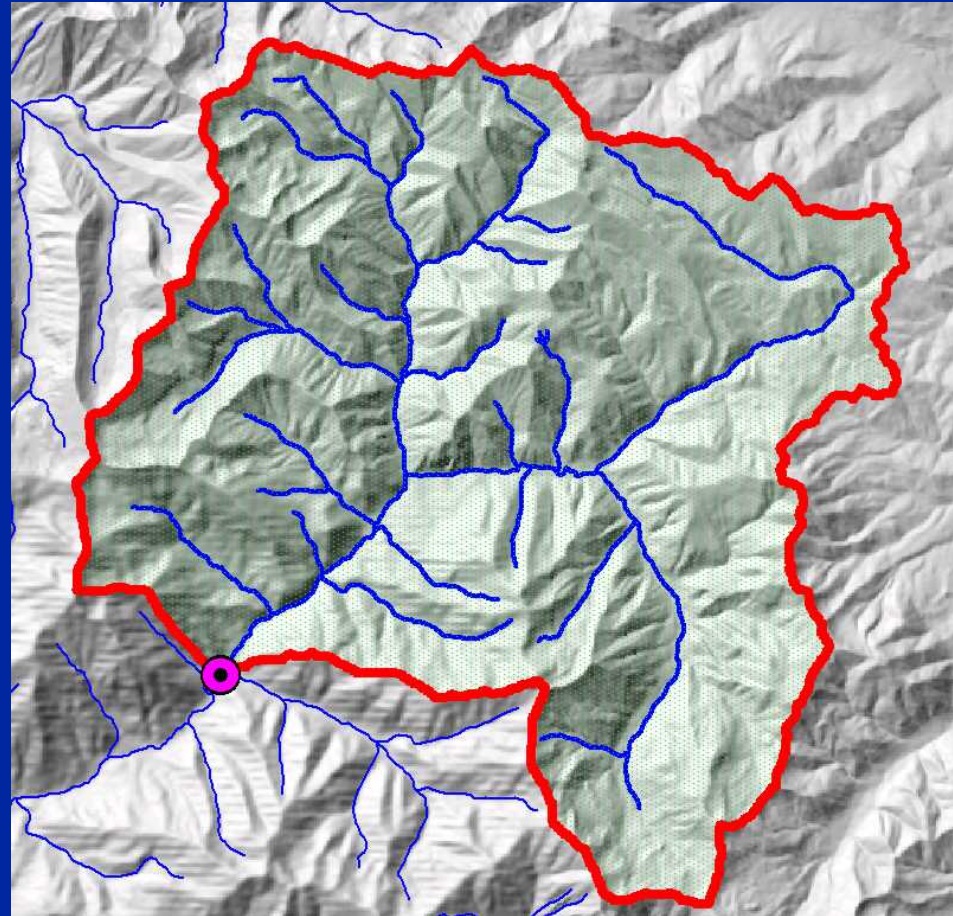
# LECTURE #3

## WATERSHED DELINEATION



# INTRODUCTION TO DELINEATION

- Creating a boundary that represents the contributing area for a particular control point or outlet
- Used to define boundaries of the study area, and/or to divide the study area into sub-areas



A photograph of a waterfall cascading over dark rocks, with water splashing and creating white foam at the base. The image is positioned on the left side of the slide.

## WHY DELINEATE

- Delineated watersheds are required for HSPF modeling and for BASINS watershed characterization reports
- So we can characterize and investigate what is going on in one portion of the study area versus another.
- Delineation is part of the process known as watershed segmentation, i.e., dividing the watershed into discrete land and channel segments to analyze watershed behavior

# DELINEATION METHODS

- DEM Based (Automatic Delineation)
  - Water flows downhill
  - Grid cell based approach
  - Boundaries created automatically by computer
- Manual Delineation
  - Drawing watersheds by clicking on the map
  - Requires underlying data for accuracy

# BASINS DELINEATION TOOLS

- Automatic (DEM based) delineation
  - DEM and NED grids
- Manual delineation
  - From existing watershed boundaries and stream layers

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# BASINS DELINEATION TOOLS

Create GIS layers required for setting up an HSPF model through BASINS/WinHSPF

- Streams
- Subbasins
- Outlets

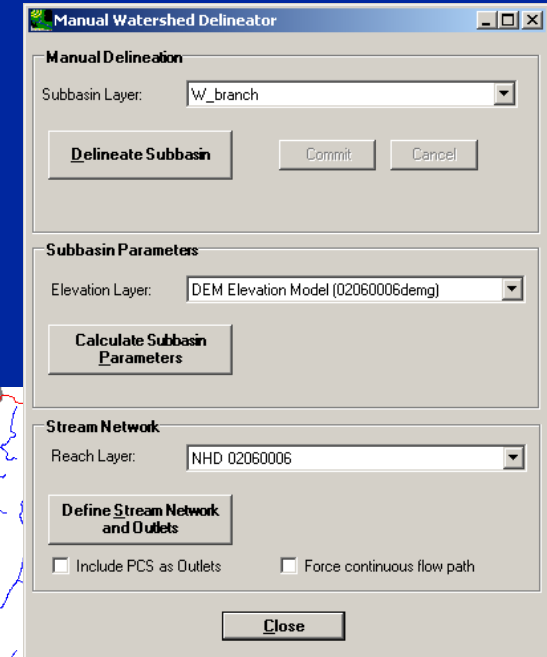
A photograph of a waterfall cascading over dark rocks, with water splashing and creating white foam at the base. The image is positioned on the left side of the slide.

## MANUAL DELINEATION

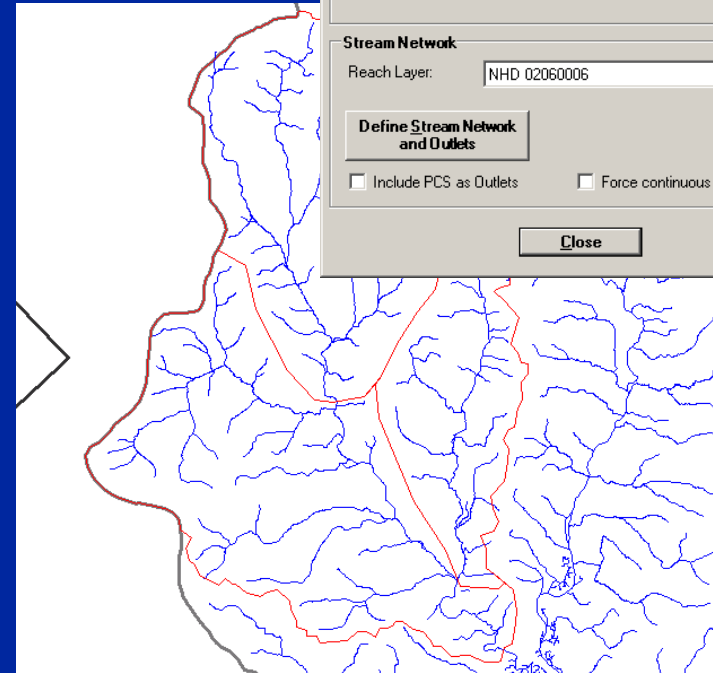
- User delineates watersheds using mouse
- Allows user to define the entire area contributing to flow at an outlet based on knowledge of topography
- Underlying data required
  - Shapefile or grid DEM
- Optional data for accuracy
  - USGS Topographic Map
  - Other GIS Layers

# MANUAL DELINEATION (CONT.)

- Operates on vector GIS data (shapefiles)
- Manual delineations are subsets of existing delineations (i.e., Cataloging Unit Boundary)
- Watersheds can be associated with RF1 or NHD reach files
- Can start with user-supplied subbasins



The screenshot shows the 'Manual Watershed Delineator' dialog box. It is divided into three sections: 'Manual Delineation', 'Subbasin Parameters', and 'Stream Network'. In the 'Manual Delineation' section, the 'Subbasin Layer' is set to 'w\_branch'. In the 'Subbasin Parameters' section, the 'Elevation Layer' is set to 'DEM Elevation Model (02060006demg)'. In the 'Stream Network' section, the 'Reach Layer' is set to 'NHD 02060006'. There are checkboxes for 'Include PCS as Outlets' and 'Force continuous flow path', both of which are currently unchecked. Buttons for 'Delineate Subbasin', 'Calculate Subbasin Parameters', 'Define Stream Network and Outlets', 'Commit', 'Cancel', and 'Close' are visible.



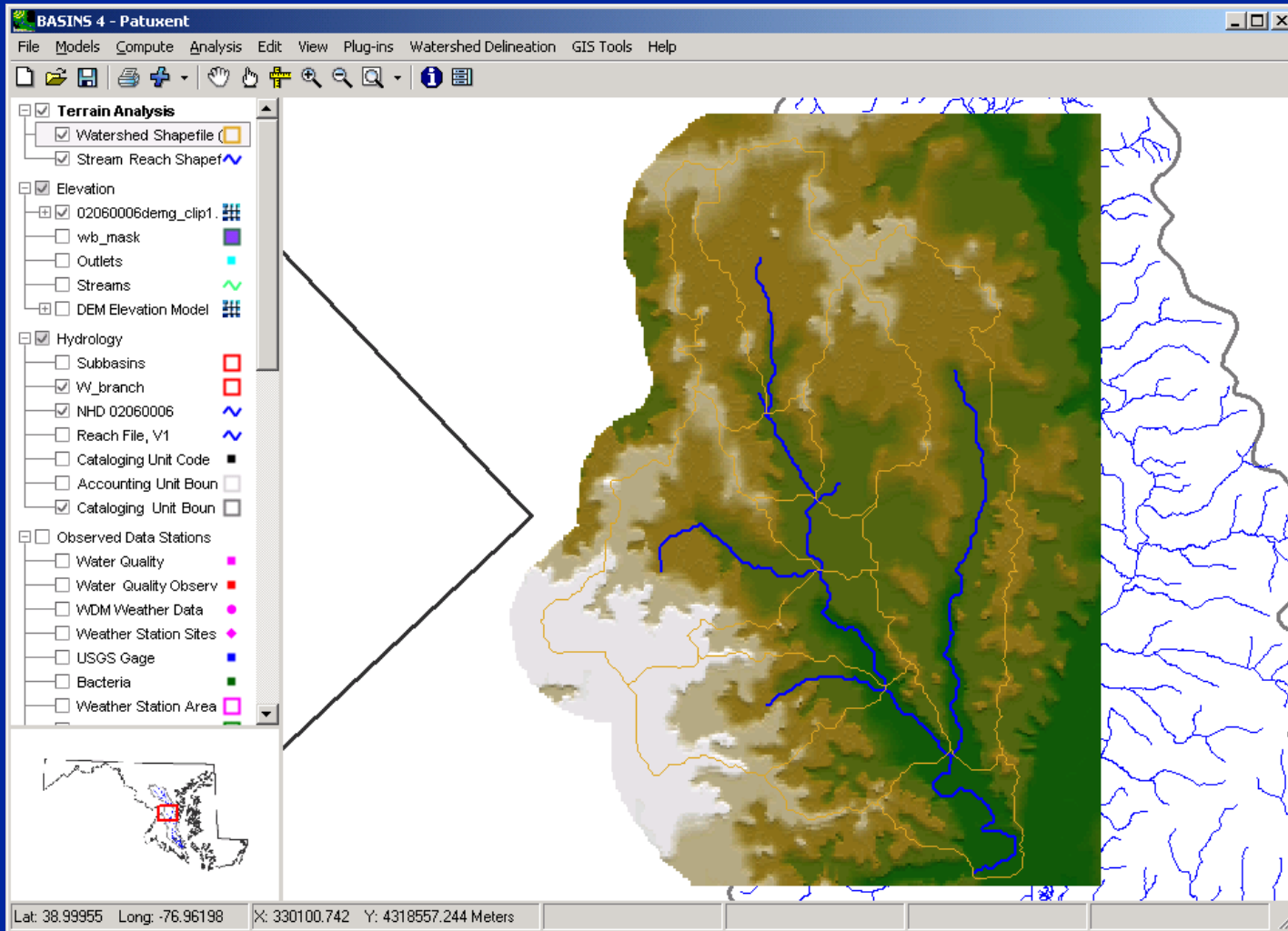


A vertical photograph of a waterfall cascading over dark rocks, with water splashing and creating white foam at the bottom. The image is positioned on the left side of the slide.

## MANUAL DELINEATION – FUNCTIONS

- Associate PCS point sources with subbasin outlet points
- Edit watershed boundaries
- Calculate subbasin slopes from DEMs
- Define stream network
- Create map layers required for setting up an HSPF model through BASINS

# AUTOMATIC DELINEATION



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# AUTOMATIC DELINEATION REQUIREMENTS

- DEM grid
- (Optional) pre-digitized stream network in shapefile format
  - Reach File, Version 1
  - National Hydrography Dataset (NHD)
  - User defined blue lines

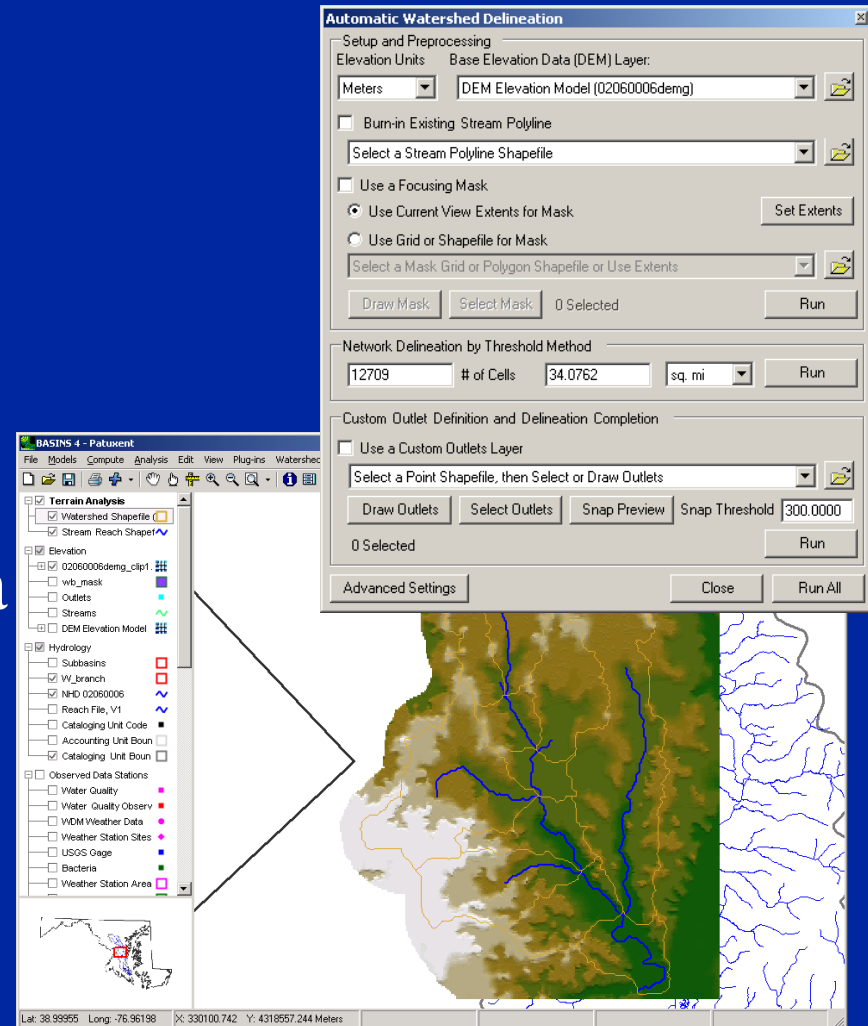
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## AUTOMATIC DELINEATION (CONT.)

- Creates GIS layers required for setting up an HSPF model through BASINS
- Subwatersheds may be used for watershed analysis
  - BASINS watershed characterization reports

# AUTOMATIC DELINEATION IN BASINS 4.0

- Based on TauDEM from USU
- Includes a tool to focus the area upon which BASINS will delineate



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# AUTOMATIC DELINEATION FEATURES

- Stream burn-in option
  - Define locations of stream networks by force
  - Solves some of the problems with inaccuracies of elevation data
  - Based on existing reach file
    - Reach file, version 1
    - National Hydrography Dataset (NHD)
    - User defined blue lines

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## AUTOMATIC DELINEATION FEATURES (CONT.)

- Stream definition
  - User may change minimum drainage area required to form the beginning of a stream
  - Determines size and number of subwatersheds
- Outlets layer
  - User may input a layer of watershed outlets, used to specify desired outlet locations

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# ANALYSIS AND MODELING USING DELINEATED WATERSHEDS

- BASINS watershed characterization reports
  - Landuse distribution
  - Point sources
  - Water quality data
  - Population and Sewerage by Census Tract
  - 303(d) Listed Segments
  - Point Source Discharge Concentrations and Loadings
- Watershed modeling (single or several subwatersheds)



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## DELINEATION TECHNIQUES FOR HSPF

- Size and number of watersheds must be consistent with objectives of your study
  - Define enough watersheds to capture site specific variability and simulate routing
  - Avoid unnecessary watersheds – parameters must be defined for each watershed
- Outlets of HSPF watersheds should potentially correspond with:
  - Stream confluences (pour points)
  - Gage or sampling locations for HSPF calibration
  - Specific locations at which you wish to view output of HSPF
  - Significant changes in channel characteristics