WEPP Watershed
**WEPP Watershed Model**

- Includes channel routing and optional impoundments
- Three additional WEPP input files:
  - Channel parameters
  - Impoundment parameters (optional)
  - Watershed structure (channel connectivity)
## Channel Parameters

**Channel Database**

<table>
<thead>
<tr>
<th>Num</th>
<th>Parameter - <em>Read Only</em></th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Channel Shape</td>
<td>Naturally Eroded</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Control Section at Cutlet</td>
<td>Critical Flow</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Friction Slope Calculation Method</td>
<td>CREAMS</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Inverse Slope of the channel banks</td>
<td>18.5990</td>
<td>ft/ft</td>
</tr>
<tr>
<td>5</td>
<td>Manning roughness coefficient for bare soil in channel</td>
<td>0.0400</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Total Manning roughness coefficient allowing for veg</td>
<td>0.3000</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Channel erodibility factor</td>
<td>0.000183</td>
<td>ft/ft</td>
</tr>
<tr>
<td>8</td>
<td>Channel critical shear stress</td>
<td>2.0884</td>
<td>ft/ft</td>
</tr>
<tr>
<td>9</td>
<td>Depth to nonerodible layer in mid-channel</td>
<td>1.8404</td>
<td>feet</td>
</tr>
<tr>
<td>10</td>
<td>Depth to nonerodible layer on sides</td>
<td>0.3281</td>
<td>feet</td>
</tr>
<tr>
<td>11</td>
<td>Control structure slope</td>
<td>2.0000</td>
<td>%</td>
</tr>
<tr>
<td>12</td>
<td>Control structure average inverse side slope</td>
<td>4.0000</td>
<td>ft/ft</td>
</tr>
<tr>
<td>13</td>
<td>Control structure Manning roughness coefficient</td>
<td>0.3400</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Rating curve coefficient</td>
<td>0.0000</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Rating curve exponent</td>
<td>0.0000</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Minimum depth required for discharge</td>
<td>0.0008</td>
<td>feet</td>
</tr>
<tr>
<td>17</td>
<td>Management</td>
<td>fallow</td>
<td></td>
</tr>
</tbody>
</table>

**Channel**

Rock Channel

**Description:**

Waterway channel with rock base

**Data Source:**

**Comment:**

**Bill Elliot based on L. Tysdal 2/98**

[Image of Channel Database window]

[Image of Channel Parameters table]

[Image of Save As, Save, Cancel, Help buttons]
Impoundment Parameters
## Impoundment Parameters

### Culvert #1

<table>
<thead>
<tr>
<th>Num</th>
<th>Description</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Number of identical culverts (ncv)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Cross-sectional area of culvert (arcv)</td>
<td>0.2497</td>
<td>sq. ft</td>
</tr>
<tr>
<td>3</td>
<td>Cross-sectional height of culvert (hictcv)</td>
<td>1.0000</td>
<td>feet</td>
</tr>
<tr>
<td>4</td>
<td>Stage of culvert inlet (hcvi)</td>
<td>7.9997</td>
<td>feet</td>
</tr>
<tr>
<td>5</td>
<td>Flow length of culvert (lcv)</td>
<td>328.0840</td>
<td>feet</td>
</tr>
<tr>
<td>6</td>
<td>Slope of culvert (scv)</td>
<td>0.0100</td>
<td>ft/ft</td>
</tr>
<tr>
<td>7</td>
<td>Height of culvert outlet above exit channel bottom (hcvot)</td>
<td>16.4042</td>
<td>feet</td>
</tr>
<tr>
<td>8</td>
<td>Entrance head loss coefficient for culverts (ke)</td>
<td>0.5000</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Bend head loss coefficient for culverts (kb)</td>
<td>1.0000</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Friction head loss coefficient for culverts (kc)</td>
<td>0.0621</td>
<td></td>
</tr>
</tbody>
</table>

### Misc. Parameter

<table>
<thead>
<tr>
<th>Num</th>
<th>Description</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stage at which the overtop flag goes off (htop)</td>
<td>16.4042</td>
<td>feet</td>
</tr>
<tr>
<td>2</td>
<td>Stage at which the full of sediment flag goes off (hfull)</td>
<td>1.3123</td>
<td>feet</td>
</tr>
<tr>
<td>3</td>
<td>Stage at the beginning of the simulation (h)</td>
<td>7.9507</td>
<td>feet</td>
</tr>
<tr>
<td>4</td>
<td>Initial time step (dtial)</td>
<td>0.0100</td>
<td>hr</td>
</tr>
<tr>
<td>5</td>
<td>Infiltration rate (qi/ft)</td>
<td>0.0263</td>
<td>ft/day</td>
</tr>
<tr>
<td>6</td>
<td>Structure size (size)</td>
<td>large</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Number of particle size subclass divisions (ndiv)</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>
Watershed Structure

- Defines how channels, hillslopes and impoundments are connected. Can become very complex with large watersheds.

3 hillslopes draining to 1 channel routed to an impoundment
Watershed Interfaces

- **Windows** – Allows access to all model parameters, includes impoundments. All inputs entered (no DEM processing). Limited to very small watersheds of a few channels.
- **GeoWEPP** – ArcGIS extension. ASCII grid files for land use, soils. DEM analysis with TOPAZ. Access to most model parameters.
- **Online WEPP GIS** – Web browser interface. Land use, soils, DEM automatically processed. Very limited access to model parameters.
Flowpaths – All cells in the watershed are used in WEPP profile simulations – hundreds of runs. No channel routing.

Representative Hillslopes – Cells within a subcatchment are analyzed to determine one hillslope per subcatchment. Includes full channel routing.
Flowpaths

Watershed (grid based DEM)

Flowpath

Channel

Slope profile for WEPP run

Outlet
Windows Example

- User diagrams all components
- All slope inputs are manually setup using WEPP slope files.
- All model parameters can be adjusted
- Areas are rectangular regions

Difficult to setup and manage more than a few channels.
GeoWEPP Examples

Representative Hillslope Method

Flowpath Method
• Flowpaths are combined to create a “representative” hillslope.
• Each subcatchment area has 1 representative hillslope.
• 35 WEPP runs to cover the area
Flowpaths are determined by TOPAZ model.
Each grid cell mapped to WEPP soil loss value on the profiles.
518 WEPP runs cover this area.
WEPP GIS Watershed Inputs

- **Topography** – Derived from USGS 30 meter DEM using TOPAZ model.
- **Land Use** – From USGS Landcover map, general types are associated with WEPP management.
- **Soil** – Built from SSURGO spatial and tabular data for area of interest. Can also use local forest soils.
- **Climate** – Generated from CLIGEN, can be adjusted with PRISM grids to account for elevation differences.
- **Watershed channel structure** – Determined from TOPAZ.
Online WEPP GIS Steps (1)

- Step 1: Zoom in to an area of interest. The search field can be used to find a city or use a longitude, latitude.
- Step 2: Click the Build Channel Network button to run TOPAZ channel delineation.
- Step 3: Use the minimum source channel length and critical source area fields to rerun TOPAZ channel delineation as needed.
Channel Network Delineation

Minimum Source Channel Length (m): 100
Critical Source Area (ha): 15
Build Channel Network

Minimum Source Channel Length (m): 60
Critical Source Area (ha): 4
Build Channel Network
Online WEPP GIS Steps (2)

- Step 4: Choose a watershed outlet point
  - Must be on a channel cell
  - Can not be on a junction where multiple channel cells are found.
  - The expected watershed area should be within the existing view of the area of interest.

- Step 5: Click the Build Subcatchments button to do a watershed delineation
Online WEPP GIS Steps (3)

- Step 6: Click the Review Watershed Summary button to get SSURGO soils and summarize inputs.
- Step 7: Click the Setup WEPP Model button to display the run options for WEPP.
- Step 8: Change the Landuse Processing and Soil Processing choices to “Determine by individual grid cells”.
### Watershed Summary

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area (ha):</td>
<td>140 (cells: 1550)</td>
</tr>
<tr>
<td>Number of Representative Hillslopes:</td>
<td>27</td>
</tr>
<tr>
<td>Number of Channels:</td>
<td>11</td>
</tr>
<tr>
<td>Number of Impoundments:</td>
<td>0</td>
</tr>
<tr>
<td>Outlet Location:</td>
<td>-86.1093, 39.2007</td>
</tr>
<tr>
<td>Reference Point:</td>
<td>0</td>
</tr>
<tr>
<td>Minimum Source Channel Length (m):</td>
<td>60</td>
</tr>
<tr>
<td>Critical Source Area (ha):</td>
<td>4</td>
</tr>
<tr>
<td>Session Timeout(s):</td>
<td>1440</td>
</tr>
<tr>
<td>Longest Flowpath (m):</td>
<td>2858.78 [Details]</td>
</tr>
<tr>
<td>Longest Flowpath Slope (m/m):</td>
<td>0.02</td>
</tr>
</tbody>
</table>

[Forest Service Peak Flow Calculator]
### Landuse Summary

The watershed contains the following landuse as determined by the USGS National Land Cover Database 2001 - [http://www.mrlc.gov/nlcd.php](http://www.mrlc.gov/nlcd.php)

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>WEPP File</th>
<th>Number of Cells</th>
<th>Area (ha)</th>
<th>Percent Watershed</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td>Deciduous Forest</td>
<td>Mature forest.rot</td>
<td>1477</td>
<td>132.93</td>
<td>95.3</td>
</tr>
<tr>
<td>52</td>
<td>Shrub/Scrub</td>
<td>Shrubs.rot</td>
<td>6</td>
<td>0.54</td>
<td>0.4</td>
</tr>
<tr>
<td>71</td>
<td>Grasslands/Herbaceous</td>
<td>Good grass.rot</td>
<td>29</td>
<td>2.61</td>
<td>1.9</td>
</tr>
<tr>
<td>82</td>
<td>Cultivated Crops</td>
<td>GeoWEPP/corn,soybean-fall mulch till rot</td>
<td>38</td>
<td>3.42</td>
<td>2.5</td>
</tr>
</tbody>
</table>

### Soils Summary

The watershed contains the following soils as determined by the NRCS Soil Survey. The data is requested directly from the NRCS soils database. Information on the NRCS Soils Data structure and how can be accessed are found at: [http://smdataaccess.nrcs.usda.gov/](http://smdataaccess.nrcs.usda.gov/)

<table>
<thead>
<tr>
<th>MuKey</th>
<th>Soil Name</th>
<th>Number of Cells</th>
<th>Area (ha)</th>
<th>Percent Watershed</th>
</tr>
</thead>
<tbody>
<tr>
<td>535582</td>
<td>Beanblossom channery silt loam, occasionally flooded</td>
<td>135</td>
<td>12.15</td>
<td>8.7</td>
</tr>
<tr>
<td>535583</td>
<td>Berks-Trevlac-Wellston complex, 20 to 70 percent slopes</td>
<td>980</td>
<td>88.2</td>
<td>63.2</td>
</tr>
<tr>
<td>535607</td>
<td>Tilisit silt loam, 2 to 6 percent slopes</td>
<td>19</td>
<td>1.71</td>
<td>1.2</td>
</tr>
<tr>
<td>535612</td>
<td>Wellston-Gilpin silt loams, 6 to 20 percent slopes, eroded</td>
<td>191</td>
<td>17.19</td>
<td>12.3</td>
</tr>
</tbody>
</table>
Setup WEPP Model

- Ion=86.0847 lat=39.1939 elev=287.01 (m)
- Nearest station: COLUMBUS IN 11.3 miles (IN121747)
- Climate Station: COLUMBUS
- Default Soil: Beanblossom channel silt loam, occasionally flooded
- Default Landuse: Shrubs
- Simulation Type: Watershed and Flowpaths
- Years to Simulate: 1 (10 years maximum for Watershed and Flowpath, 100 years maximum for Watershed Only)
- Soil Loss Tolerance (T Value): 5 (t/ha/yr)
- Run WEPP

Climate Processing Options
- Climate Generator: CLIGEN 4.3
- Adjust climate (precip, tmax, tmin) using PRISM data. View PRISM Adjustments for this location

Landuse Processing Options
- Landcover information is based on the NLCD 2001 coverage.
- Determine landuse by individual grid cells

Soils Processing Options
- Soils information is based on the NRCS SSURGO Soil Survey
- Determine soils by individual grid cells
Online WEPP GIS Steps (4)

- Step 9: Click the Run WEPP button.
- Step 10: After the run has completed click the View Erosion Maps button.
WEPP Outputs
## Output Summary

### 1 Year Average Annual Values for Watershed

**WEPP Watershed Simulation for Representative Hillslopes and Channels (watershed method)**

- **Watershed Area (ha)** = 130.1
- **Precipitation (mm)** = 1167
- **Runoff (mm)** = 117
- **Watershed Sediment Yield (tonnes/ha/yr)** = 5.8
- **Watershed Sediment Delivery Ratio** = 0.861

### Watershed Summary (watershed method, off-site assessment)

<table>
<thead>
<tr>
<th>Hillslope IDs</th>
<th>Landuse</th>
<th>Soil</th>
<th>Runoff Volume</th>
<th>Soil Loss</th>
<th>Sediment Yield</th>
<th>Area (ha)</th>
<th>Mapped Soil Loss</th>
<th>Sediment Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22 Deciduous Forest</td>
<td>Berks-Trevlac-Wellston complex, 20 to 70 percent slopes</td>
<td>64.42</td>
<td>3</td>
<td>3</td>
<td>8.6</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>2</td>
<td>23 Deciduous Forest</td>
<td>Berks-Trevlac-Wellston complex, 20 to 70 percent slopes</td>
<td>63.65</td>
<td>3.9</td>
<td>3.9</td>
<td>12.2</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>3</td>
<td>31 Deciduous Forest</td>
<td>Berks-Trevlac-Wellston complex, 20 to 70 percent slopes</td>
<td>61.53</td>
<td>1.1</td>
<td>1.1</td>
<td>4.1</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>4</td>
<td>32 Deciduous Forest</td>
<td>Berks-Trevlac-Wellston complex, 20 to 70 percent slopes</td>
<td>85.86</td>
<td>0.4</td>
<td>0.4</td>
<td>0.5</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>5</td>
<td>33 Deciduous Forest</td>
<td>Berks-Trevlac-Wellston complex, 20 to 70 percent slopes</td>
<td>71.74</td>
<td>1</td>
<td>1</td>
<td>1.7</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>6</td>
<td>42 Deciduous Forest</td>
<td>Berks-Trevlac-Wellston complex, 20 to 70 percent slopes</td>
<td>70.08</td>
<td>1.6</td>
<td>1.6</td>
<td>2.8</td>
<td>0.6</td>
<td>0.6</td>
</tr>
</tbody>
</table>
After making a run the links on the left can be used to change the inputs or reclassify the maps:

- Edit Soil or Landuse Properties
- Change Landuse Associations
- Change Channel Associations
- Change Freeze/Thaw Settings
- Add Restrictive Layer beneath all soils

- Change properties of one hillslope
- Add buffer to hillslope
- Show hillslope information

- Change soil properties of one channel
- Add/Change impoundment at end of channel
- Remove all impoundments

- Reclassify Output Maps
- Review Watershed
Save a run

- Use the links on the left to save your run. This can be later used to recreate the project:

```plaintext
Save WEPP Watershed Project

The following information can be entered directly when loading a project to return to the same watershed:

CSA: 4.000000
MSCL: 60.000000
EXTENT: -86.128173, 39.189315, -86.059508, 39.229218
ZOOM: 9.000000
OUTLET: -86.109307, 39.200715
YEARS: 1
STATE: in
STATION: COLUMBUS
DESCRIPTION:
DATE: 2014-07-25-07-34-33
```
Loading a Saved Run

Paste in the information from the save project window. The channel network and subcatchments will be recreated but can be modified.

Enter the information when project was saved:

```
CSA: 4.000000
MSCL: 60.000000
EXTENT: -86.961155, 40.432139, -86.922531, 40.455001
ZOOM: 11.000000
OUTLET: -86.940480: 40.442871
YEARS: 1
STATE: in
STATION: WEST LAFAYETTE 6 NW
ARCHIVE: 237b92673342269c4453bd9ad37368-2014-07-25-11-14-50.zip
DESCRIPTION:
DATE: 2014-07-25-11-14-50
```

submit
Load a Project Archive

All files for the project will be restored. The channel network and subcatchments can not be modified.

Enter the information when project was saved:

CSA: 4.000000
MSCL: 60.000000
EXTENT: -86.961155, 40.432139, -86.922531, 40.455001
ZOOM: 11.000000
OUTLET: -86.940480:40.442871
YEARS: 1
STATE: in
STATION: WEST LAFAYETTE 6 NW
ARCHIVE: 237b92673342269c4453bd94aad37368-2014-07-25-11-14-50.zip
DESCRIPTION:
DATE: 2014-07-25-11-14-50