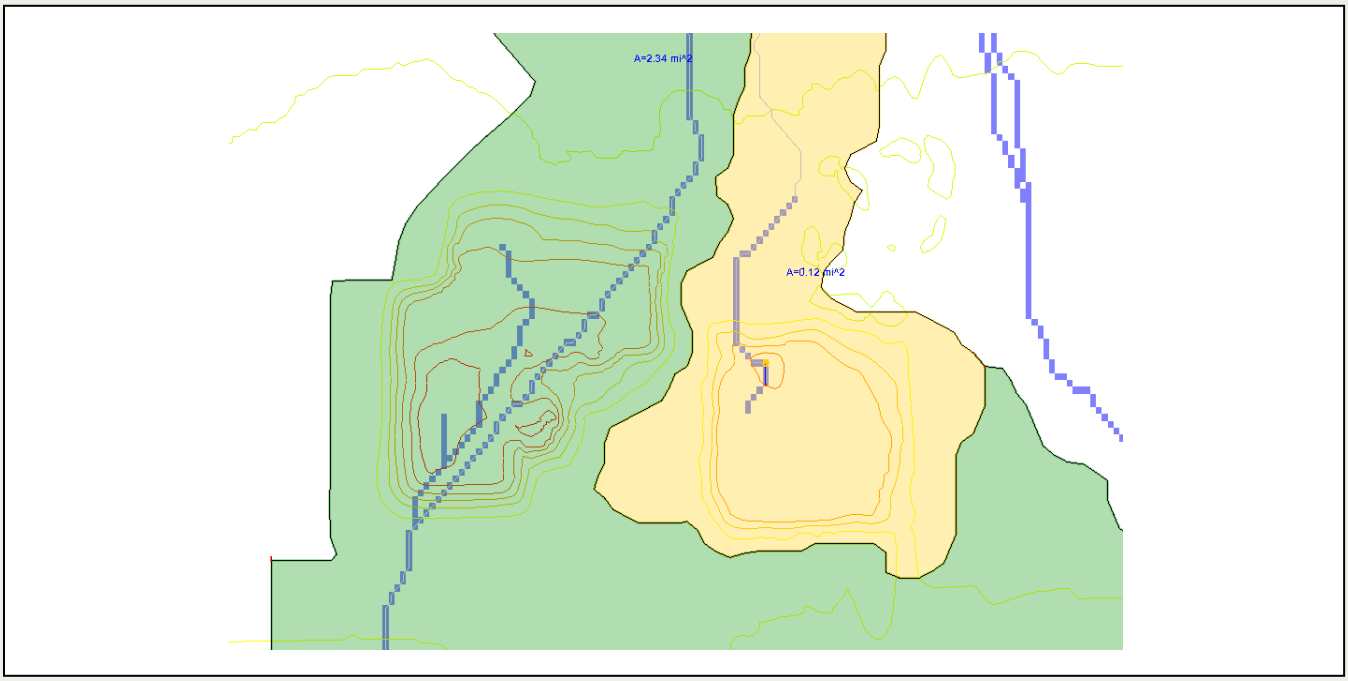
WMS 11.4 Tutorial

DEM Delineation – T_c, Basin IDs, and Smoothing

Model manmade and natural drainage features



Objectives

Learn to manipulate the default watershed boundaries by using time of concentration arcs, manually editing the boundaries, using shapefiles to delineate the boundaries, and smoothing the boundaries to make them more accurately represent the watershed.

Prerequisite Tutorials

- DEM Delineation

Required Components

- Data
- Drainage
- Map

Time

- 15–20 minutes

AQUAVEO™

1 Introduction **2**
2 Getting Started **2**
3 Time of Concentration Arcs **3**
4 Basin Boundary Delineation **4**
4.1 Importing a Shape File 4
4.2 Modifying Boundary Arcs 6
4.3 Rebuilding Basin Polygons 6
4.4 Update Drainage Basins 7
5 Smoothing Boundaries **7**
6 Conclusion **8**

1 Introduction

When working with Digital Elevation Model files (DEMs), determining time of concentration (Tc), delineating basin boundaries by hand or by importing shapefiles, and smoothing basin boundaries are all techniques and tools that can be used to create more realistic simulations. WMS has tools for manipulating DEM delineation results in order to accurately represent the actual watershed drainage basins.

This tutorial teaches how to manipulate DEM data for more accurate drainage analysis by discussing and demonstrating how to use time of concentration arcs, manual basin delineation, shapefiles, and boundary smoothing to manipulate basin delineation.

2 Getting Started

Starting WMS new at the beginning of each tutorial is recommended. This resets the data, display options, and other WMS settings to their defaults. To do this:

1. If necessary, launch WMS.
2. If WMS is already running, press the **Ctrl-N** key combination or select the *File* | **New** menu item to ensure that the program settings are restored to their default state.
3. A dialog may appear asking to save changes. Click the **Don't Save** button to clear all data.

The graphics window of WMS should refresh to show an empty space. Now open the project file by doing the following:

4. From the *Macro* bar, click the **Open** macro to bring up the *Open* dialog.
5. From the *Files of type* drop-down, select "WMS XMDF Project File (*.wms)".
6. Browse to the *demdel-tc-ids-smooth**demdel-tc-ids-smooth*\ directory.
7. Select the "stream-arcs-final.wms" file.
8. Click the **Open** button to exit the *Open* dialog import the project.

The project should appear similar to Figure 1.

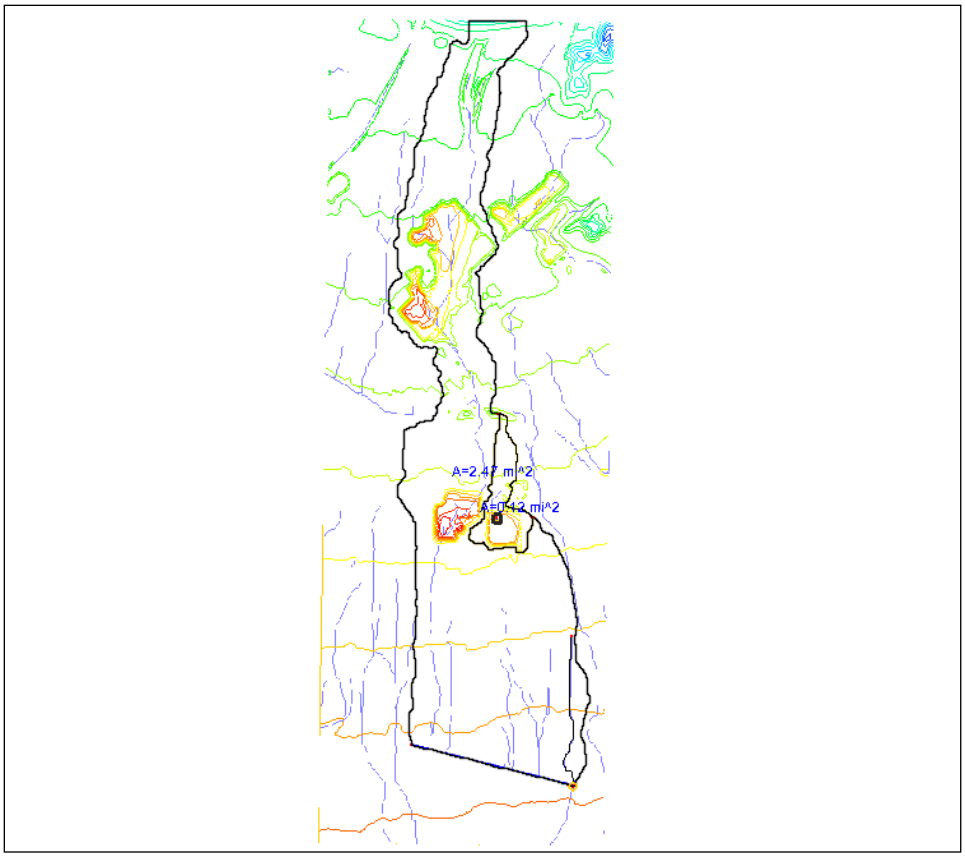


Figure 1: Initial project

3 Time of Concentration Arcs

After DEM cells are assigned to drainage basins, WMS can use the DEM flow directions to automatically create an arc in each basin that represents the longest flow path. This is especially useful for developing times of concentration (Tc).

1. From the *Modules* bar, switch to the **Drainage** module.
2. From the *Menu* bar, select the *DEM* **| Compute Basin Data** menu item to bring up the *Units* dialog.
3. Click the **Drain Data Compute Opts...** button to bring up the *Drainage Data Computation Options* dialog.
4. Below the list, turn on the *Create TC Coverage* checkbox.
5. Click the **OK** button to close the *Drainage Data Computation Options* dialog.
6. Click the **OK** button to close the *Units* dialog and run the calculations.

This process may take a few moments, depending on the speed of the computer.

7. In the *Project Explorer*, turn off the "86666671 (Converted)" terrain data checkbox.
8. In the *Project Explorer*, select the new "Time Computation" map data coverage to make it active.

The Tc arcs generated for each one of the drainage basins should be visible (Figure 2).

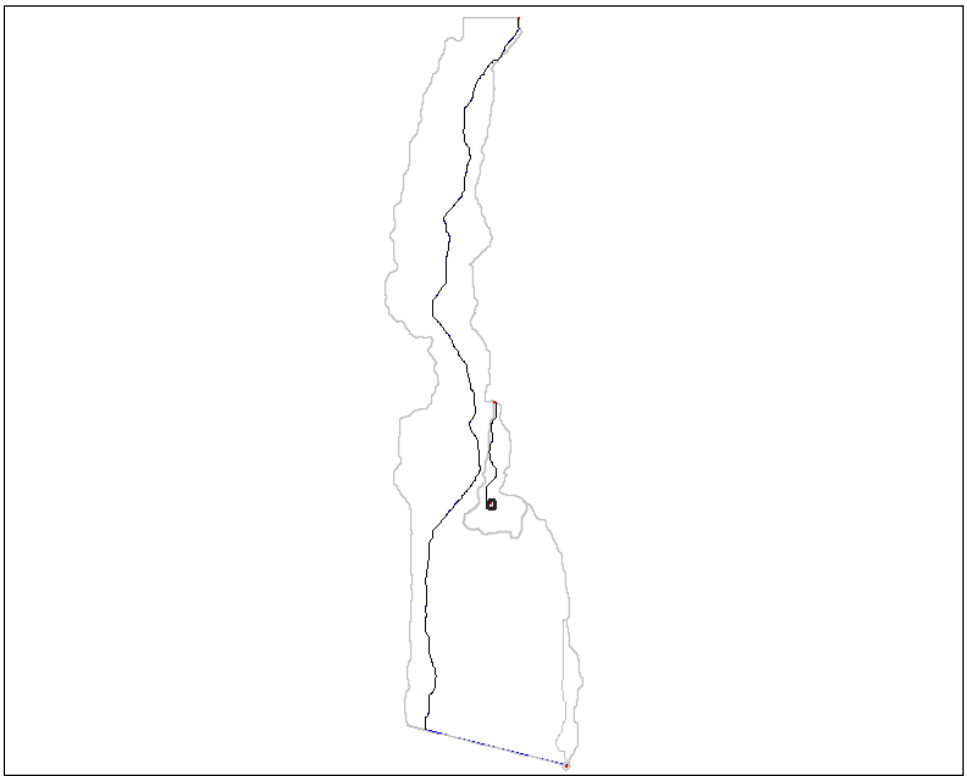


Figure 2: The Tc arcs are visible

4 Basin Boundary Delineation

In some situations, it is more effective to delineate drainage basins by hand or to import basin boundaries from a GIS or CAD file.\

4.1 Importing a Shape File

1. In the *Project Explorer,* select the "Drainage" map data coverage to make it active.
2. In the *Project Explorer,* right-click on the "GIS Data" folder and select the **Add Shapefile Data…** context menu item to bring up the *Select shapefile* dialog.
3. Select the "basin_poly.shp" file.
4. Click the **Open** button to import the shapefile and exit the *Select shapefile* dialog.
5. In the *Project Explorer,* turn on the "86666671 (Converted)" terrain data coverage checkbox .
6. From the *Static* tool bar, using the **Zoom** static tool, zoom into the area indicated by the blue box in Figure 3.

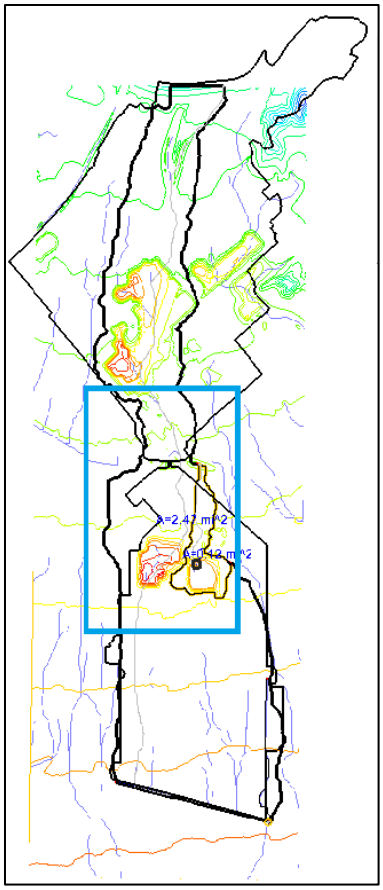


Figure 3: Zoom to Basin Boundary

This shapefile contains a more accurate representation of the drainage basin boundaries that exist in this urban area. Notice that the delineation does not exactly match the actual basin boundaries shown in the shapefile (Figure 4). The data from the shapefile can be used to manually update the basin boundaries.

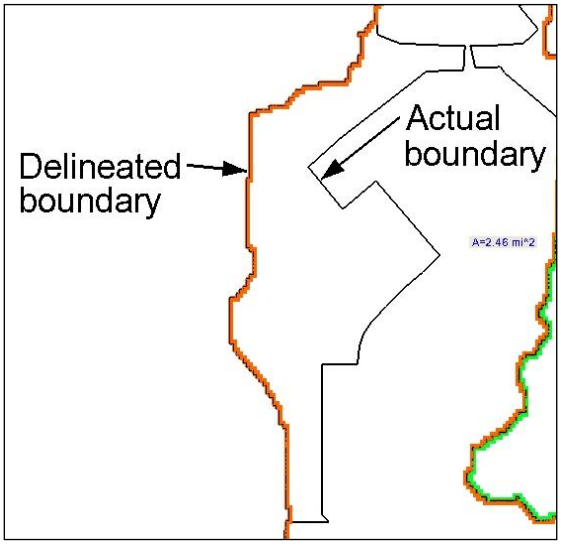


Figure 4: Discrepancy in basin boundaries

4.2 Modifying Boundary Arcs

1. From the *Modules* bar, switch to the **Map** module.
2. From the *Dynamic* tool bar, select the **Create Feature Arc** dynamic tool.
3. From the *Menu* bar, select the *Feature Objects* **| Attributes…** menu item to bring up the *Feature Arc Type* dialog.
4. In the *Type* section, select the *Generic* radio button.
5. Click the **OK** button to close the *Feature Arc Type* dialog.
6. Begin an arc by clicking on the vertex shown in Figure 5 (WMS will automatically snap to the existing arc).

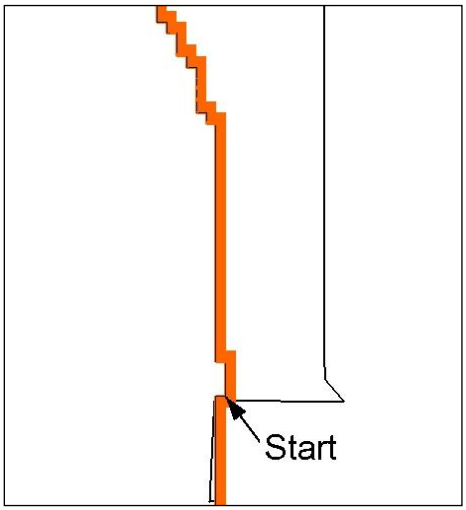


Figure 5: Start the boundary arc here

7. Digitize an arc along the *actual boundary arc* shown in the shapefile, ending the arc by double-clicking when the *actual boundary arc* intersects the *delineated boundary arc* again (Figure 6).

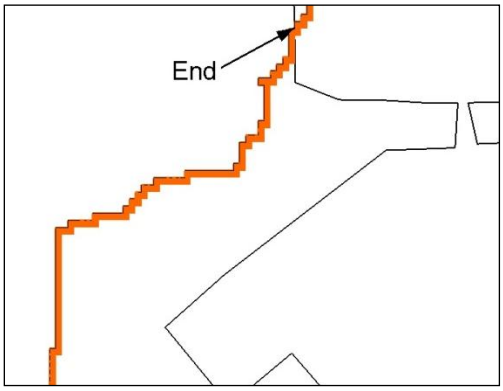


Figure 6: End the boundary arc here

4.3 Rebuilding Basin Polygons

1. In the *Project Explorer*, turn off the "GIS Data" checkbox.

2. Using the **Select Feature Arc** dynamic tool, select the arc segment representing the original delineated boundary.
3. Delete the arc segment by pressing the **Delete** key.
4. Right-click on the "Drainage" map data coverage and select the **Zoom to Layer** context menu item.
5. Right-click on the "Drainage" map data coverage and select the **Build Polygon** context menu item.
6. To use all arcs to build polygons, click the **OK** button.
7. In the *Project Explorer,* right-click on the "86666671 (Converted)" terrain data coverage and select the **Display Options…** context menu item to bring up the *Display Options* dialog.
8. From the list on the left, select the "DEM Data" item.
9. On the *DEM* tab, turn off the *Fill Basin Boundary Only* and turn on *Color Fill Drainage Basins* checkboxes.
10. Click the **OK** button to close the *Display Options* dialog.

4.4 Update Drainage Basins

Notice that the drainage basins assigned to DEM cells no longer match up with the new drainage basin boundary polygon that was created. This must be corrected in order to properly compute geometric properties of the drainage basin based on the DEM data by using the **Compute Basin Data** command.

1. Switch to the **Drainage** module.
2. Select the *DEM* **| Polygon Basin IDs** → **DEM** menu item.
3. Select the *DEM* **| Compute Basin Data** menu item to bring up the *Units* dialog.
4. Click the **Drain Data Compute Opts…** button to bring up the *Drainage Data Computation Options* dialog.
5. Below the list, turn off the *Create TC coverage* checkbox.
6. Click the **OK** button to close the *Drain Data Computation Options* window.
7. Click the **OK** button to close the *Units* window and compute the basin data.
8. If notice(s) appear regarding basin edges being encountered, click the **OK** button.

In this case, the messages do not indicate an actual problem because the drainage basin boundary was manually manipulated.

5 Smoothing Boundaries

1. Select the "Drainage" map data coverage to make it active.
2. Use the **Zoom** static tool to zoom into any section of the basin boundary.

Notice that the boundary arcs are not smooth because they are formed by tracing the square DEM cells. WMS allows redistribution of vertices to smooth these boundaries for reporting and presentation purposes.

3. Select the **Select Feature Arc** dynamic tool.
4. Select the *Edit* **|** **Select All** menu item.
5. Select the *Feature Objects* **|** **Redistribute…** menu item to bring up the *Redistribute Vertices* dialog.
6. In the *Arc Redistribution* section, for the *Average Spacing,* enter “30.0”.
7. Click the **OK** button to close the *Redistribute Vertices* dialog.

Notice that the basin boundaries are now much smoother (Figure 7).

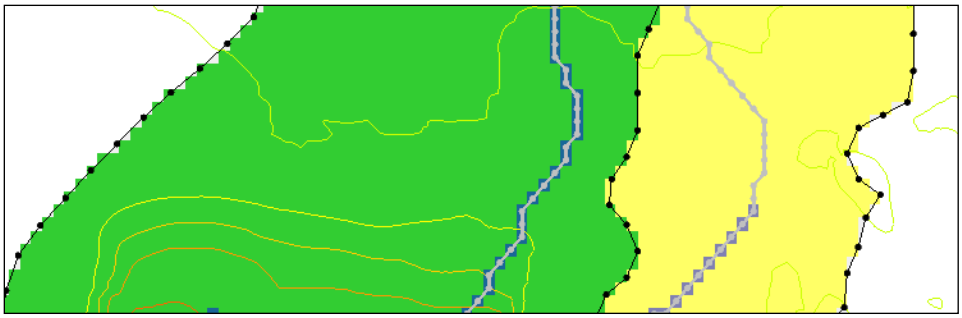


Figure 7: The basin boundaries are smoother

6 Conclusion

This concludes the “DEM Delineation – T_C, Basin IDs, and Smoothing” tutorial. Key topics discussed and demonstrated include:

- Developing time of concentration according to the longest flow path.
- Mapping polygons representing drainage basins to the DEMs.
- Manual basin delineation.
- Smoothing results for reporting and presentations.

These tools can be used for many different scenarios where the automated delineation does not yield the expected results. Feel free to continue to experiment, or exit the program.