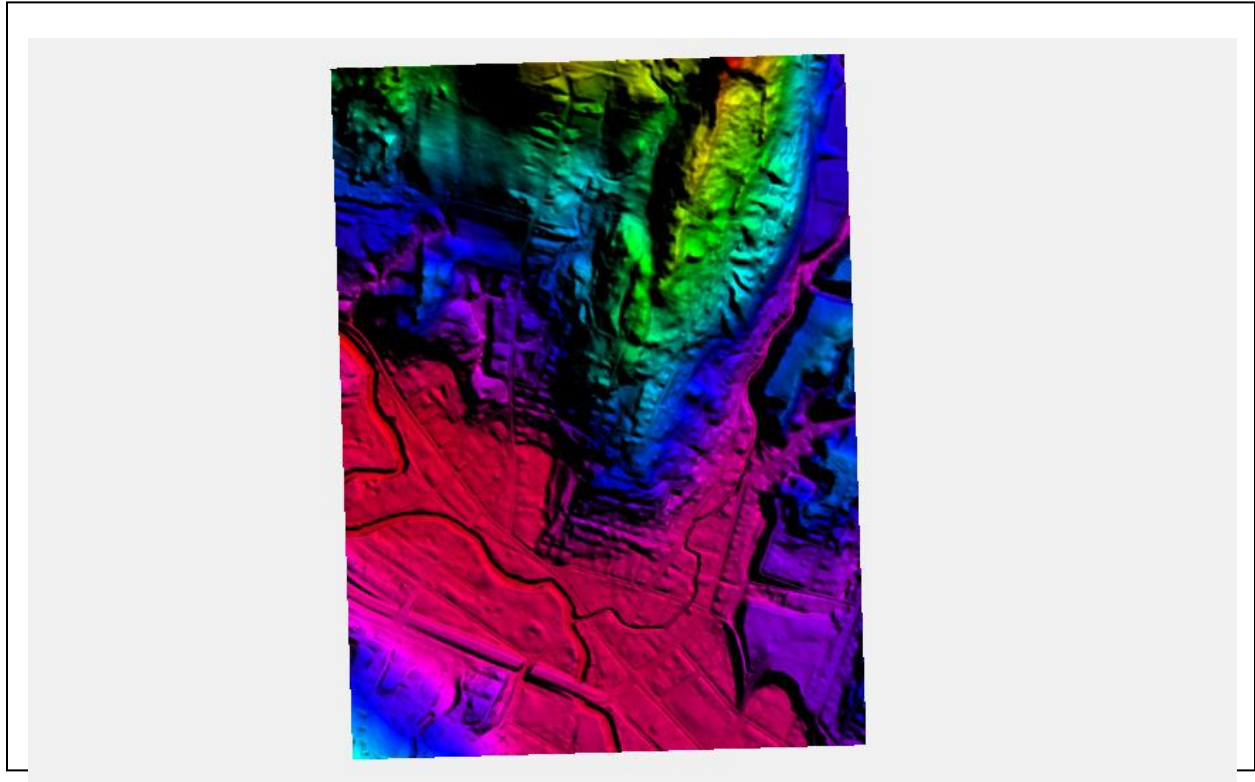*SMS 12.2 Tutorial*
Working with Rasters

Objectives

Learn how to import a Raster, view elevations at individual points, change display options for multiple views of the data, show the 2D profile plots, and interpolate data to a mesh.

Prerequisites

- Overview Tutorial

Requirements

- Raster Module
- Map Module
- Mesh Module

Time

- 20–30 minutes

1   Introduction

A raster consists of a matrix of pixels or cells stored and displayed in a grid formation (rows and columns). Each cell contains a value representing a type of information such as elevation or land use.

In this example, the raster is a surface map containing elevation data. However, rasters can also be used as base maps (usually scanned maps and images or satellite imagery) and thematic maps (usually containing information such as land use or vegetation).

2   Importing the Raster

To start, import a Digital Elevation Model (DEM) file into SMS. SMS creates a raster object in the GIS module to represent this DEM.

To open a raster in SMS,

1. Select *File* / **Open...** to bring up the *Open* dialog.

2. Select "TIFF Image Files (*.tif;*.tiff)" from the *Files of type* drop-down.

3. Browse to the *SMS_Rasters\Data Files* folder and select "GunnersBrook.tif".

4. Click **Open** to import the raster and exit the *Open* dialog.

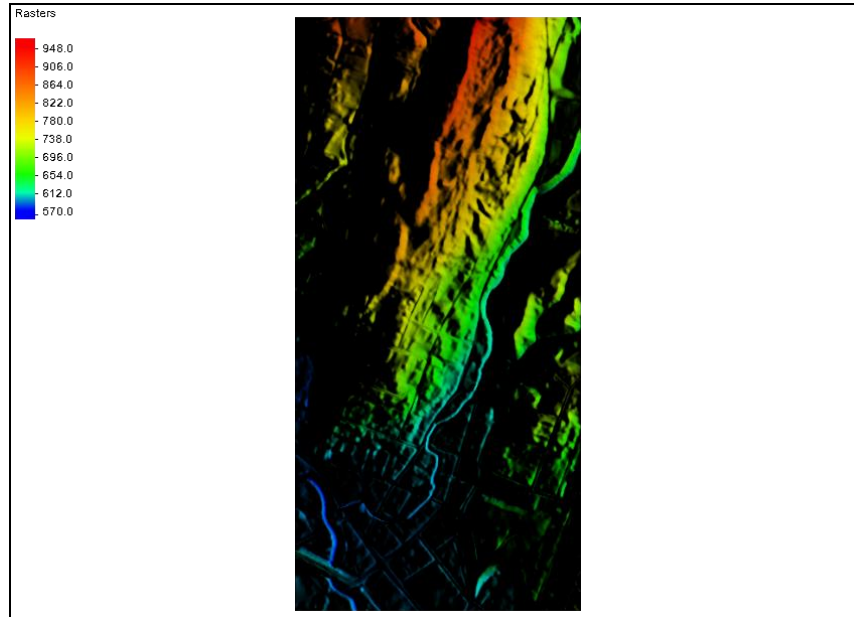The project should appear similar to Figure 1.

Figure 1   Imported raster

3   Setting the Projection

Like all objects in SMS, rasters should be referenced to a projection to locate the data in the physical world. The projection may come from the raster file or from an associated file. In this tutorial, the imported geotif file contains the projection within the file and has been set to State Plane Coordinates, with the zone set to Vermont. The units are set to feet.

To verify this:

1. Select *Display |* **Projection…** to bring up the *Display Projections* dialog.

2. In the *Horizontal* section, in the field below *Global projection*, notice that it contains the following:

    - State Plane Coordinate System, Zone: Vermont (FIPS 4400), Datum from system 0: NAD83, feet

3. In the *Vertical* section, notice that the *Units* drop-down has "Feet (U.S. Survey)" selected.

4. Click **OK** to close the *Display Projection* dialog.

4   Changing the Display

SMS offers two methods for displaying the data contained within the raster (elevations, in this case). These include an image of the shaded surface (this is a 2D display visible only in plan view) and a display of a sampling of the points that make up the surface. The default is a 2D image as shown in Figure 1.

The shading method employed to generate the image can be controlled by the user. SMS allows the user to choose between Atlas, Color Ramp, Global and HSV shaders. To change the shader:

1. Select *Display* | **Display Options…** or click **Display Options** 🔵 to bring up the *Display Options* dialog.

2. Select "GIS" from the list on the left.

3. In the *Rasters* section, select "Color Ramp Shader" from the *Shader* drop-down.

4. Click **OK** to close the *Display Options* dialog.

SMS updates the display of the image to use a different set of colors (Figure 2).
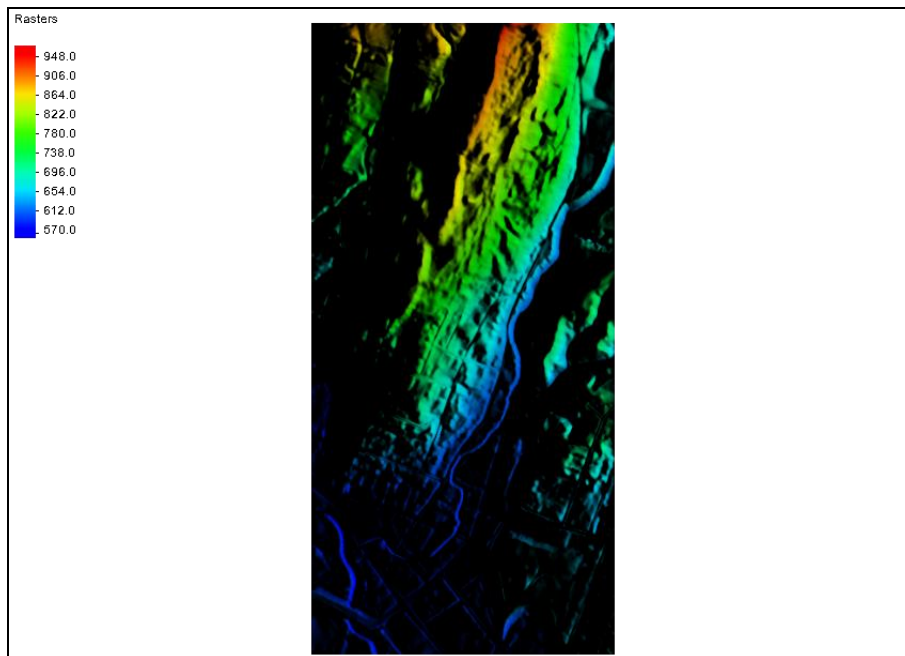
Figure 2   Using the Color Ramp Shader

The 2D image display of the raster is only visible in plan view. In order to view the data in three dimensions and display the raster data as point cloud, do the following:

5. Click **Display Options** 🔵 to bring up the *Display Options* dialog.

6. Select "GIS" from the list on the left.

7. In the *Raster* section, select *Display as 3D points*.

8. Select "General" from the list on the left.

9. In the *Drawing Options* section, turn off *Auto z-mag* and enter "10.0" as the *Z magnification*.

10. Click **OK** to close the *Display Options* dialog.

11. Using the **Rotate** 🔄 tool, click and drag in the Graphics Window. Notice how the elevation can now be seen (Figure 3).

The rest of the tutorial uses the 2D plan view of the raster. Change back to that view by doing the following:

12. Click **Plan View** to return to the original view.

13. Click **Display Options** to bring up the *Display Options* dialog.

14. Select "GIS" from the list on the left.

15. In the *Rasters* section, select *Display as 2D image.*

16. Select "HSV Shader" from the *Shader* drop-down.
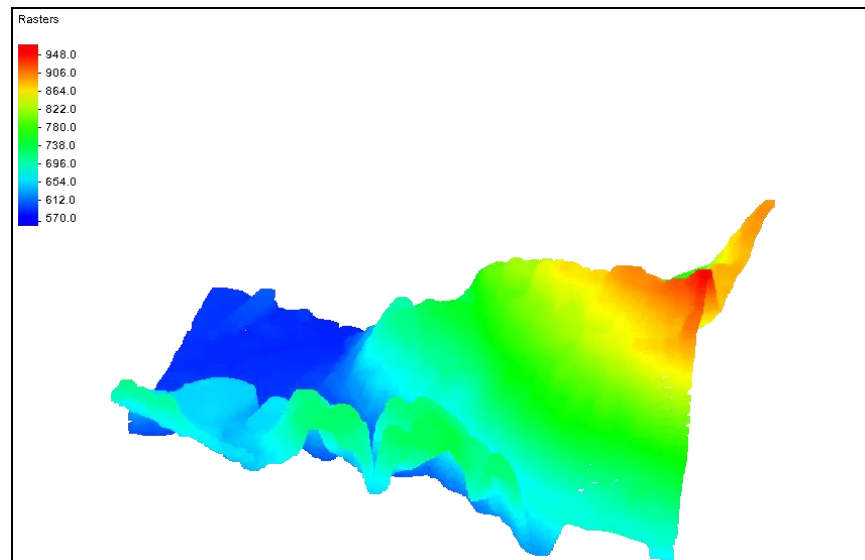
17. Click **OK** to close the *Display Options* dialog.

Figure 3   Rotated view with 3D points

5   2D Profile Plot

SMS can show 2D profile plots using an observation coverage. This is done by doing the following:

1. Right-click on " Map Data" and select **New Coverage** to open the *New Coverage* dialog.

2. In the *Coverage Type* section, select *Generic* | **Observation**.

3. Enter "Observation" as the *Coverage Name*.

4. Click **OK** to create the new coverage and close the *New Coverage* dialog.

5. Select " Observation" to make it active.

6. Using the **Create Feature Arc** tool, create two arcs from left to right across the channel as if facing downstream as shown in Figure 4. Feel free to **Zoom** in if needed.
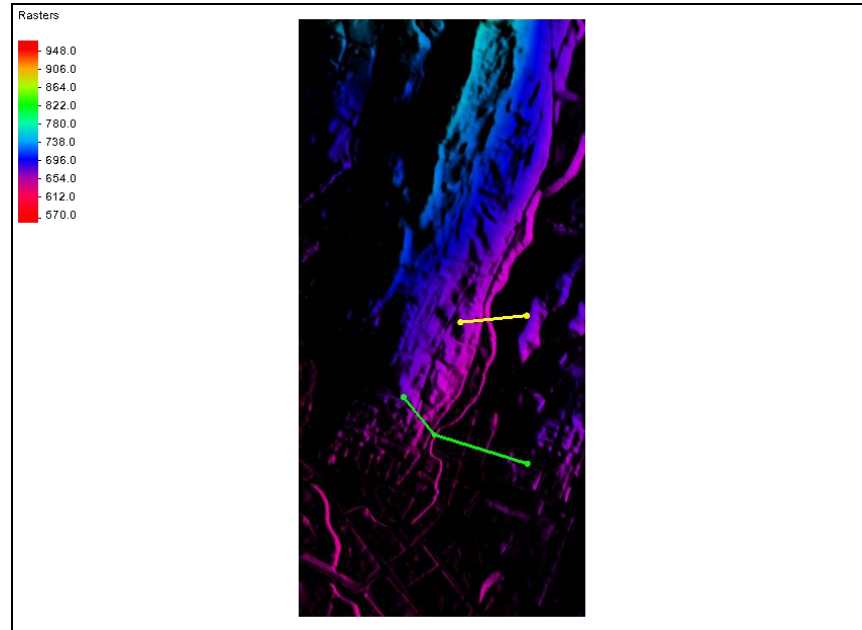
Figure 4   Observation arcs

7. Select *Display* | **Plot Wizard…** to bring up the *Step 1 of 2* page of the *Plot Wizard* dialog.

8. In the *Plot Type* section, select "Observation Profile" from the list on the left.

9. Click **Next** to go to the *Step 2 of 2* page of the *Plot Wizard* dialog.

10. In the *Coverage* section, check both boxes in the *Show* column of the first spreadsheet.

11. In the *Dataset(s)* section, select *Specified*.

12. Select "GunnersBrook.tif" from the tree list.

13. Leave the *Plot tolerance* at "0.0" m.

The plot tolerance allows for points to become clearer in the plot as it puts a tolerance on how many points can be displayed.

14. Click **Finish** to close the *Plot Wizard* dialog and display the profile plots in the *Plot 1* dialog.

Notice that each observation arc has a different plot (Figure 5).

15. Leave the *Plot 1* dialog open and move it to the side so the Graphics Window is visible.

16. In the Graphics Window, use the **Select Feature Point** /* tool to select one of the nodes of either arc and drag it to a new location.

Notice that the plot changes once the node has been moved.

17. Right-click in the plot window and select **Plot Data…** from the menu to open the *Step 2 of 2* tab of the *Data Options* dialog.

18. In the *Dataset(s)* section, enter "1.0" as the *Plot tolerance*.

19. Click **OK** to close the *Data Options* dialog.

Notice how the points displayed on the plots are now coarser (spaced further apart) because the tolerance was increased.

20. Close the *Plot 1* window by clicking on the [x] button in the top right corner.
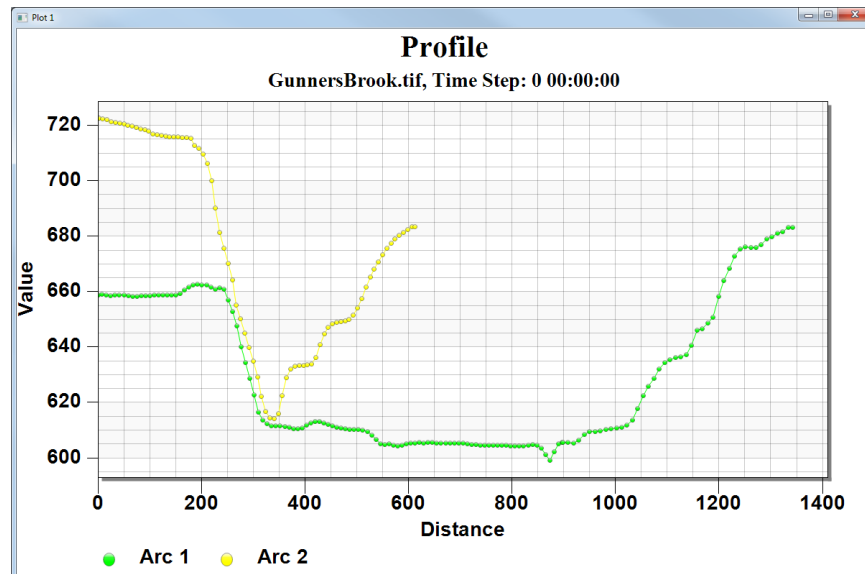
21. **Frame** 🔍 the project.

Figure 5   Profile plot for observation arcs

6   Raster to Mesh Interpolation

The Raster data can also be interpolated to other geometric objects in an SMS project such as a mesh.

6.1   Reading a Mesh

Refer to other tutorials to create a mesh. For this tutorial, to read in a previously created mesh:

1. Select *File* / **Open...** to bring up the *Open* dialog.

2. Select "GunnersBrook_mesh.h5" and click **Open** to import the file and exit the *Open* dialog.
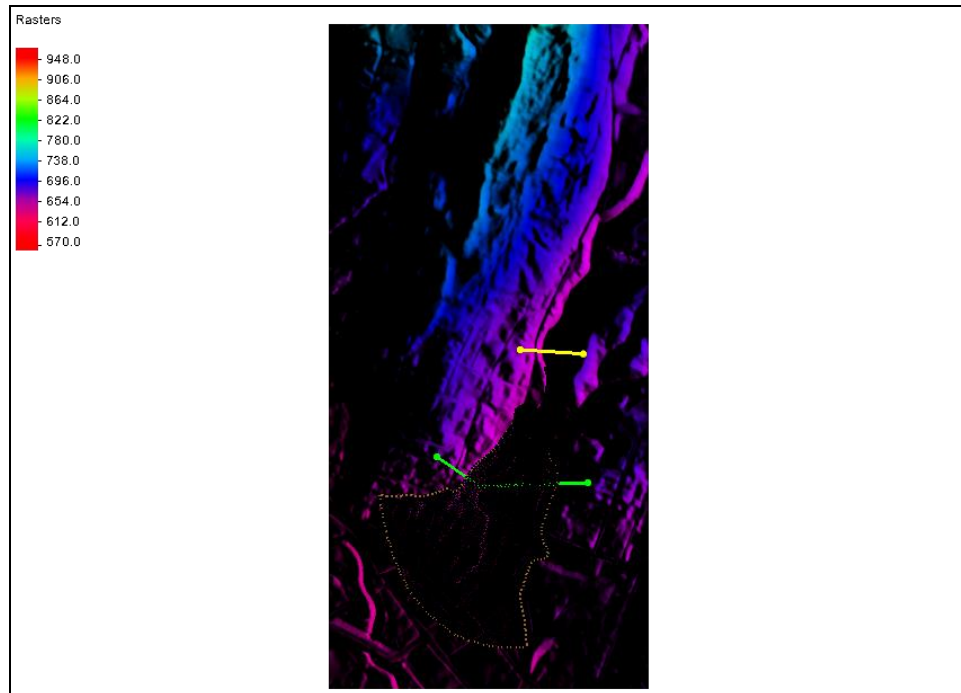
The project should appear similar to Figure 6.

Figure 6   Mesh over the raster

3.   Select "🏠 GunnersBrook" under "🟦 Mesh Data" to make it active and switch to the 🏠 **Mesh Module**.

4.   **Zoom** 🔍 in on any area of the mesh.

5.   Using the **Select Mesh Node** ⋅ℵ tool, select any node in the mesh.

Notice that the elevation for the node is "0.0".

6.   Select several other mesh nodes one at a time.

Note that the elevation is "0.0" for all the nodes in the mesh.

6.2   Interpolating Raster Elevations to Mesh

Now that a mesh exists, interpolate elevations to that mesh using the elevations stored as raster data.

1.   Right-click on "📊 GunnersBrook.tif" under "🌐 GIS Data" and select *Interpolate to* | **2D Mesh**.

A new dataset, "📋 GunnersBrook.tif", has been created under the "🏠 GunnersBrook" mesh item.

2.   Select "🏠 GunnersBrook" to make the 🏠 **Mesh Module** active.

3.   Select *Data* | **Map Elevation…** to bring up the *Select Dataset* dialog.

4. In the *Select section*, select "GunnersBrook.tif" and click **Select** to close the *Select Dataset* dialog and open the *New Function* dialog.

5. Accept the default "new_elevation" as the *Name* and click **OK** to close the *New Function* dialog.

The raster elevations have now been assigned to the mesh. There are multiple ways to view the elevation in the mesh. Two of those ways are illustrated below.

- **Select Mesh Point** tool:

    - Using the **Select Mesh Point** tool, select individual nodes to see the assigned elevation.

- Adjust the display options and use the **Rotate** tool:

    1. Click **Display Options** to bring up the *Display Options* dialog.

    2. Select "2D Mesh" from the list on the left.

    3. On the *2D Mesh* tab, turn on *Contours*.

    4. On the *Contours* tab, in the *Contour Method* section, select "Color Fill" from the first drop-down.

    5. Click **OK** to close the *Display Options* dialog.

    6. Use the **Rotate** tool to view how the elevations were mapped to the mesh.

7   Operating on a Raster

SMS contains options to perform other operations using a raster object. To experiment with these options, begin by doing the following:

1. Turn off " Mesh Data" in the Project Explorer.

2. Switch to **Plan View** .

7.1   Trimming a Raster

The available raster may be larger than what is needed for a project. Such is the case in this exercise. Trimming a raster results in a smaller region to work with and can improve efficiency.

To trim the raster, do the following:

1. Select " Area Property" to make it active.

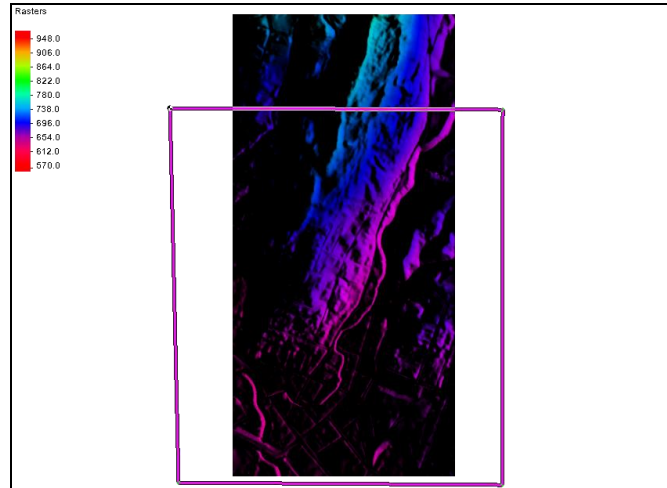2. Using the **Create Feature Arc** tool, click out a simple polygon similar to the one in Figure 7.

Figure 7   Simple polygon for trimming a raster

3.   Select *Feature Objects | **Build Polygons***.

4.   Using the **Select Feature Polygon** tool, select the polygon.

5.   Right-click on " GunnersBrook.tif" and select *Convert To | **Trimmed Raster*** to
      bring up the *Save As* dialog.

6.   Enter "GunnersBrook_trim.tif" as the *File name*.

7.   Select "GeoTIFF Files (*.tif)" from the *Save as type* drop-down.

8.   Click **Save** to save the new TIFF and close the *Save As* dialog.

9.   Click anywhere outside the polygon to deselect the polygon.

10. Turn off " Area Property" and " GunnersBrook.tif" in the Project Explorer.

The trimmed raster should be visible in the Main Graphics Window (Figure 8).
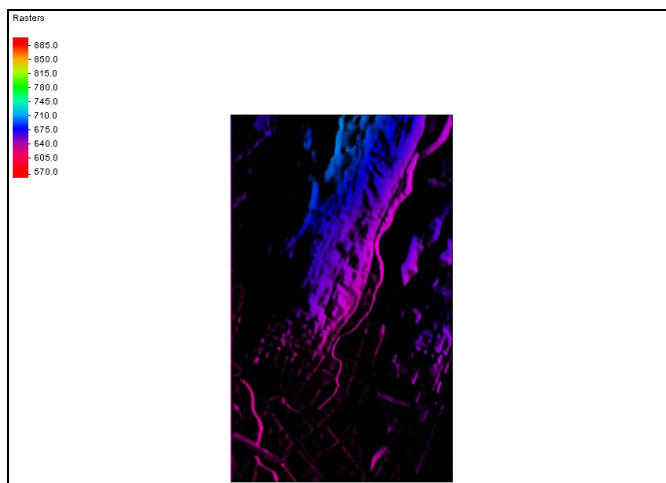

Figure 8   Trimmed raster

7.2 Merging Rasters

SMS allows rasters to be merged together. Do this by:

1. Select *File* / **Open…** to bring up the *Open* dialog.

2. Select "TIFF Image Files (*.tif;*.tiff)" from the *Files of type* drop-down.

3. Select "StevensBranch.tif" and click **Open** to import the TIFF and exit the *Open* dialog.

4. **Frame** 🔍 the project.
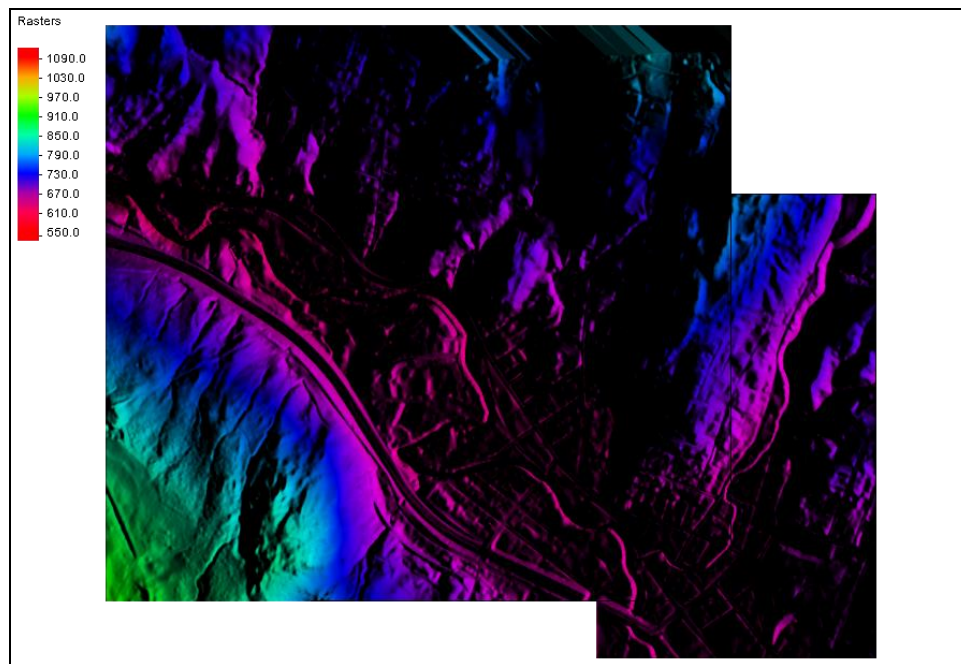
The Graphics Window should appear similar to Figure 9.

Figure 9   Raster objects to be merged

5. Select " 🔳 GunnersBrook_trim.tif" to make it active, then press the *Ctrl* key and select " 🔳 StevensBranch.tif".

6. Right-click on either selected item and select *Convert To* | **Merged Raster** to bring up the *Save As* dialog.

7. Select "GeoTIFF Files (*.tif)" from the *Save as type* drop-down.

8. Enter "Barre.tif" as the *File name* and click **Save** to export the new TIFF and close the *Save As* dialog.

9. Turn off all items under " 🌐 GIS Data" except for " 🔳 Barre.tif".

The merged raster should appear similar to Figure 10.
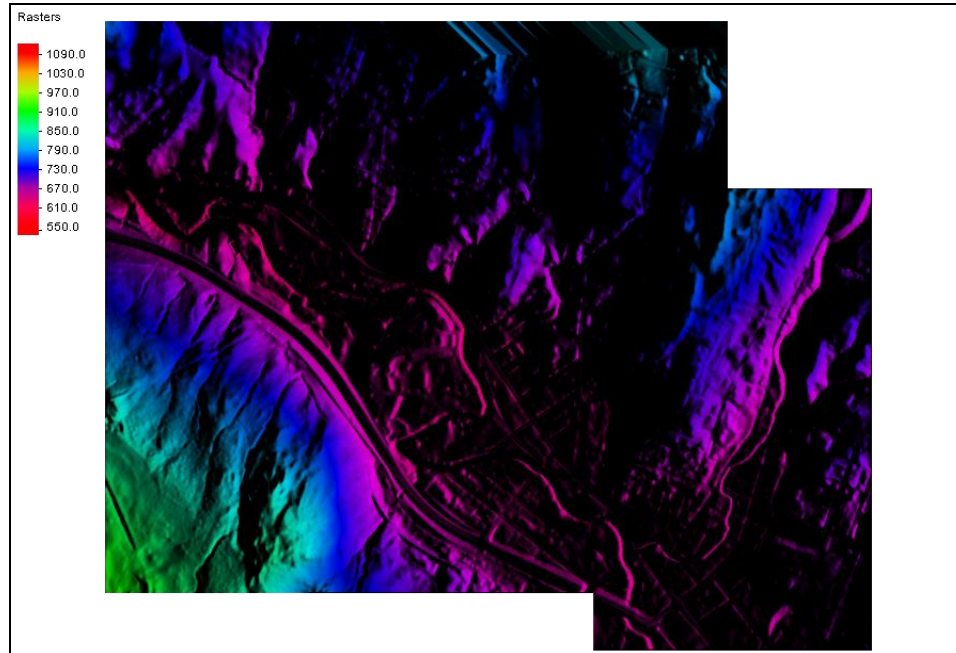

Figure 10   After merging the TIFFs

7.3   Converting a Raster to Feature Contours

There are two options for converting raster contours to feature arcs. For this tutorial, use the option to create an arc at a specified contour value (elevation).

To do so, do the following:

1. Right-click on "🔭 Barre.tif" and select *Convert To* | **Feature Contours at Given Elevation** to bring up the *Create Contour Arc(s)* dialog.

2. Enter "615.0" as the *Elevation for contour arc(s)*.

3. Click **OK** to close the *Create Contour Arc(s)* dialog.

A new map coverage, "🗺 Barre.tif Contours", will appear in the Project Explorer, and a set of arcs will appear along the 615 foot contour elevation (Figure 11).
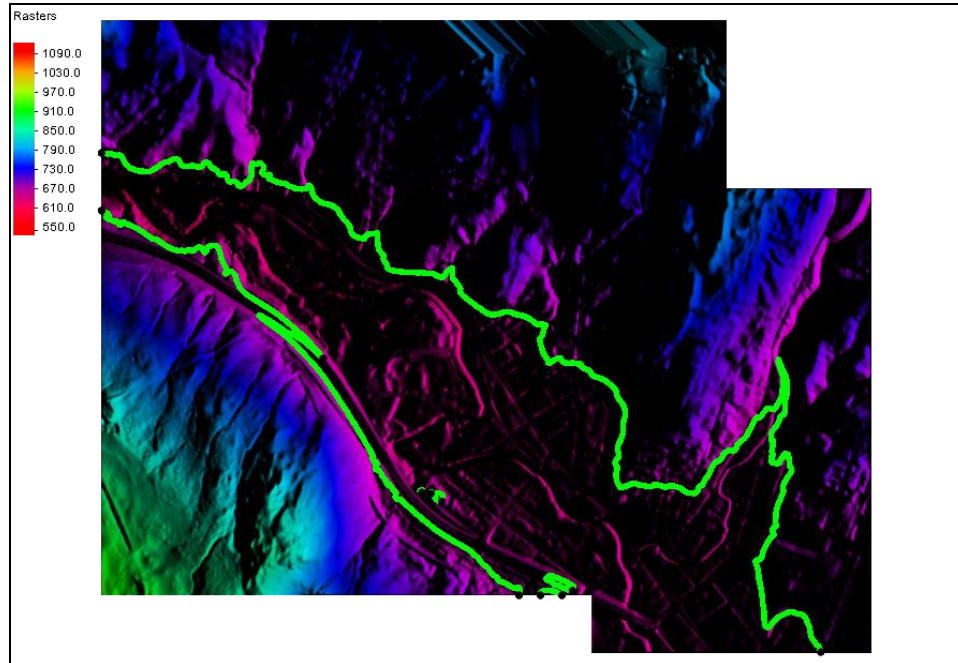
Figure 11   Contours generated from a raster

8   Conclusion

This concludes the "Working with Rasters" tutorial. Feel free to continue to experiment with additional features in SMS, or exit the program.