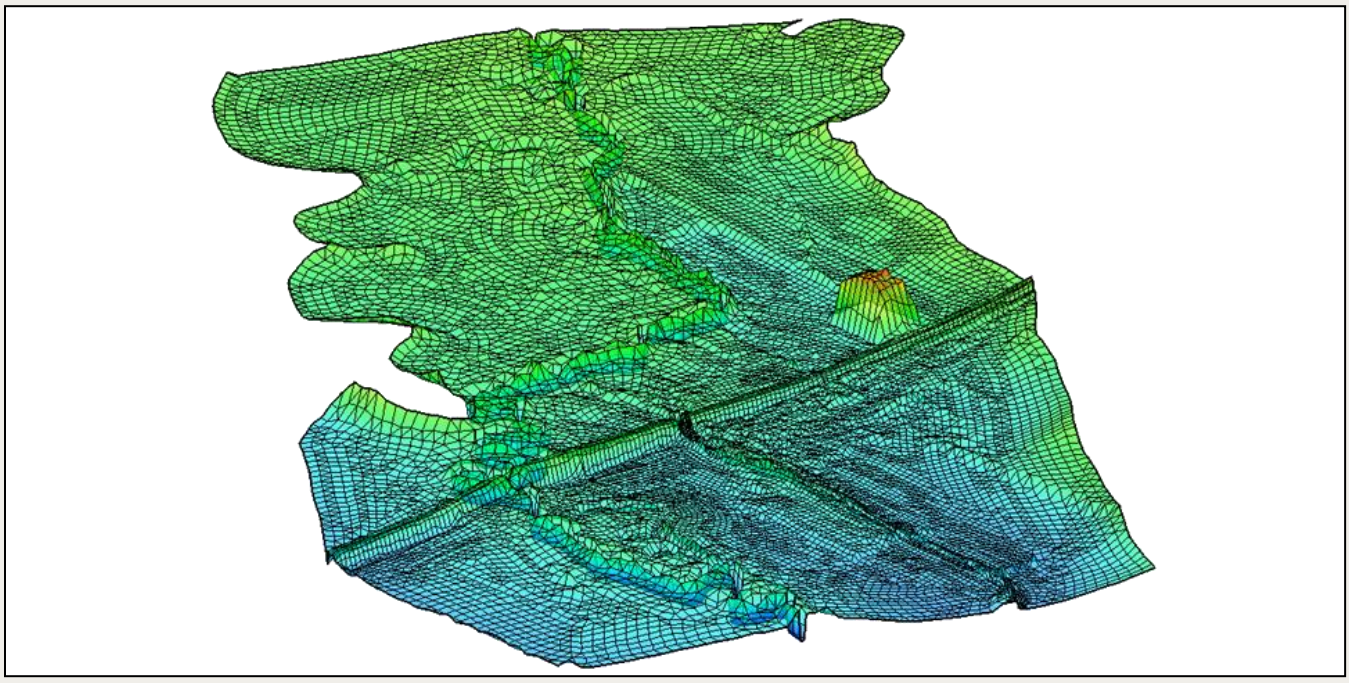
SMS 14.0 Tutorial

Interpolation from Multiple Elevation Sources

Using multiple elevation sources for mesh elevation



Objectives

This tutorial demonstrates the fundamental tools used to generate a mesh in SMS.

Prerequisite Tutorials

- Overview

Required Components

- SMS Core

Time

- 15–30 minutes

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1 Introduction

This tutorial will demonstrate how to apply multiple elevations to a single mesh. Elevations contained on multiple raster files will be blended and trimmed in preparation for interpolating over to a mesh. The tutorial uses a location on Shell Creek near Platte Center, Nebraska.

To open the image:

1. Select *File* | **Open...** to bring up the *Open* dialog.
2. Select “All Files (*.*)” from the *Files of type* drop-down.
3. Browse to the *MultipleElevationSources\data files* folder for this tutorial and select “MultiSrcTutorialInput.sms”.
4. Click **Open** to import the image and exit the *Open* dialog.

SMS will display multiple rasters as seen in Figure 1.

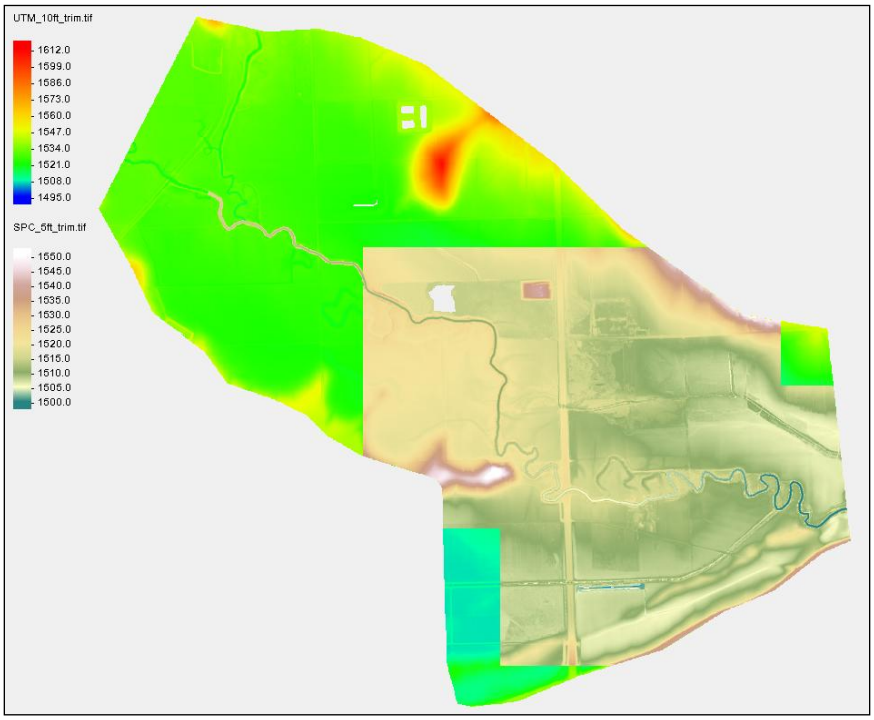

Figure 1 Raster of Shell Creek near Platte Center, Nebraska

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The project contains three elevations rasters that are as follows:

- The "SPC_5ft_trim.tif" is a higher resolution raster (3273 X 2999 pixels with a 5 ft pixel size) that covers the area of interest and some of the surrounding area.
- The "Shell Creek Trap_5ft.tif" raster is a higher resolution raster (2788 X 1471 pixels with a 5 ft pixel size) constructed to show a low flow channel along the creek.
- The "UTM_10ft_trim.tif" raster is a lower resolution (1637 X 1499 with a 10 ft pixel size) covering a larger area.

The starting project also contains an image file for reference and several map coverages that will also be used for reference. A mesh of the area was included to use for interpolating the raster elevations.

2 Blend Raster Resolution

The rasters in the project are at different resolutions. SMS contains a tool that allows using multiple rasters but eliminates local discontinuities between rasters. The tool creates a new raster that matches the primary raster in pixel size and location, but blends the active edges of this raster into the secondary raster over a user specified distance.

To use this tool, complete the following:

1. Click the **Toolbox** macro to open the *Toolbox* dialog.
2. Expand the "Rasters" option to see the available raster tools.
3. Double-click the **Blend Raster to Edges** tool to open the *Blend Raster to Edges* dialog.
4. Set the *Primary raster* to "GIS Data/SPC_5ft_trim.tif".
5. Set the *Secondary raster* to "GIS Data/UTM_10ft_trim.tif".
6. Set *Blend width along edge* to "100.0".

This is in the coordinate projections units, so in this case the unit of measurement is feet.

7. For *Output raster* enter "SPC_5ft_blended".
8. Click **OK** to run the tool and close the *Blend Raster to Edges* dialog.

A progress dialog showing the tool output will appear.

9. Click **OK** to close the *Blend Raster to Edges* progress dialog.
10. Under "GIS Data", turn off all rasters except the "SPC_5ft_blended.tif" raster.

The blended raster should appear similar to Figure 2. Note that the *Toolbox* dialog does not need to be closed in order to keep working in SMS.

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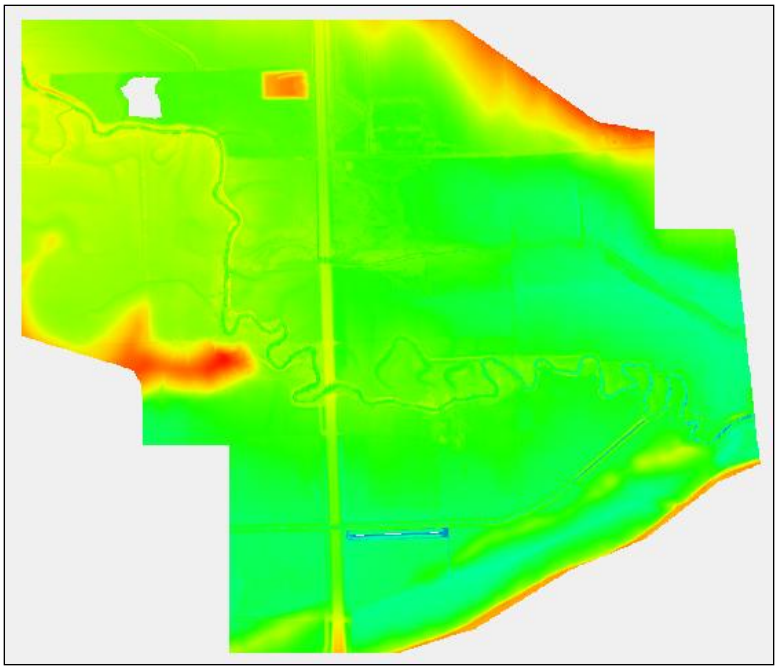

Figure 2 Blended raster

3 Trim Channel Raster to Higher Resolution

Next, use the **Clip Raster from Elevations** tool to trim the channel raster to only include regions with elevation below the survey. This tool dredges the channel, without creating a lip or discontinuity where the stamp may have gone above the terrain.

To use the **Clip Raster from Elevations** tool, do the following:

1. In the **Toolbox** , double-click the **Clip Raster from Elevations** tool to open the *Clip Raster from Elevations* dialog.
2. Set the *Raster to clip* to “GIS Data/Shell Creek Trap_5ft”.
3. Set the *Elevation raster* to “GIS Data/SPC_5ft_blended.tif”.
4. Set *Clip elevations above or below elevation raster* to “Clip elevations above”.
5. For *Output raster* enter “Shell Creek Trap_partial_clipped”.
6. Click **OK** to run the tool and close the *Clip Raster from Elevations* dialog and open a progress dialog showing the tool output.
7. Click **OK** to close the *Clip Raster from Elevations* progress dialog.
8. Under “ GIS Data”, turn off all rasters except the “ Shell Creek Trap_partial_clipped.tif” raster.

The trimmed raster should appear similar to Figure 3.

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Figure 3 Trimmed raster

4 Trim Channel Raster to Lower Resolution

Next use the **Clip Raster from Elevations** tool again to trim the channel raster to a lower resolution raster. This time, the toolbox *History* feature will be used. The History feature allows reusing previous runs from the toolbox tools.

To use the History feature to run the **Clip Raster from Elevations** tool again, do the following:

1. In the SMS *Toolbox* window, switch to *History* tab and open the date folder with the most recent date.
2. Double-click on the **Clip Raster from Elevations** tool to open the *Clip Raster from Elevation* dialog.
3. Change *Raster to clip* to “GIS Data/Shell Creek Trap_partial_clipped.tif”.
4. Set *Elevation raster* to “GIS Data/UTM_10ft_trim.tif”.
5. For *Output raster* enter “Shell Creek Trap_clipped”.
6. Click **OK** to run the tool and close the *Clip Raster from Elevation* dialog.

A progress dialog showing the tool output will appear.

7. Click **OK** to close the *Clip Raster from Elevations* progress dialog.

The resulting trimmed raster should appear similar to the previously trimmed raster, but this is at a lower resolution. Zooming in on the rasters and examining the differences will show the change in resolution.

Before continuing, remove “Shell Creek Trap_partial_clipped.tif” as the raster is no longer needed. This can be done without closing the toolbox.

8. In the Project Explorer, right-click on “Shell Creek Trap_partial_clipped.tif” and select **Remove**.
9. Click **Yes** when asked to delete selected items.

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5 Interpolate Raster Elevation to the Mesh

With the rasters blended and trimmed, they can now be interpolated to the mesh. The **Interpolate Priority Rasters** tool allows interpolating to a geometry (mesh, scatter set, UGrid, etc.) from multiple sources. Each source is added to the list in priority order. If a value is not obtained when interpolating from the highest priority source, the tool looks for a value in the next source until either a value is found or all sources are exhausted.

To interpolate the raster elevations to the mesh, do the following:

1. In the SMS *Toolbox* dialog, select the *Tools* tab.
2. Double-click on the **Interpolate Priority Rasters** tool to open the *Interpolate Priority Rasters* dialog.
3. Set *Grid* to “Mesh Data/Tutorial”.
4. Set *Default dataset* to “Mesh Data/Tutorial/Z”.
5. For *Output dataset name*, enter "multisource elevations".
6. Set *Raster 1 (highest priority)* to “GIS Data/Shell Creek Trap_clipped.tif”.
7. Set *Raster 2* to “GIS Data/SPC_5ft_blended.tif”.
8. Set *Raster 3* to “GIS Data/UTM_10ft_trim.tif”.
9. Click **OK** to run the tool and close the *Interpolate Priority Rasters* dialog.

A progress window will appear.

10. Click **OK** to close the *Interpolate Priority Rasters* progress window.

Now review the data on the mesh by doing the following:

11. Under “ GIS Data”, turn off all rasters.
12. Turn on the “ Tutorial” mesh.
13. Click the **Display Options** macro to open the *Display Options* dialog.
14. From the list on the left select *2D Mesh*.
15. Turn off *Elements* and turn on *Contours*.
16. Switch to the *Contours* tab and change the *Contour Method* to “Color Fill”.
17. Under *Data range*, turn on *Specify a range*.
18. For *Min* value enter “1500”, and make sure *Max* value is set to “1543”.
19. Click **OK** to close the *Display Options* dialog.
20. Select the “multisource elevations” dataset.

The mesh should appear similar to Figure 4.

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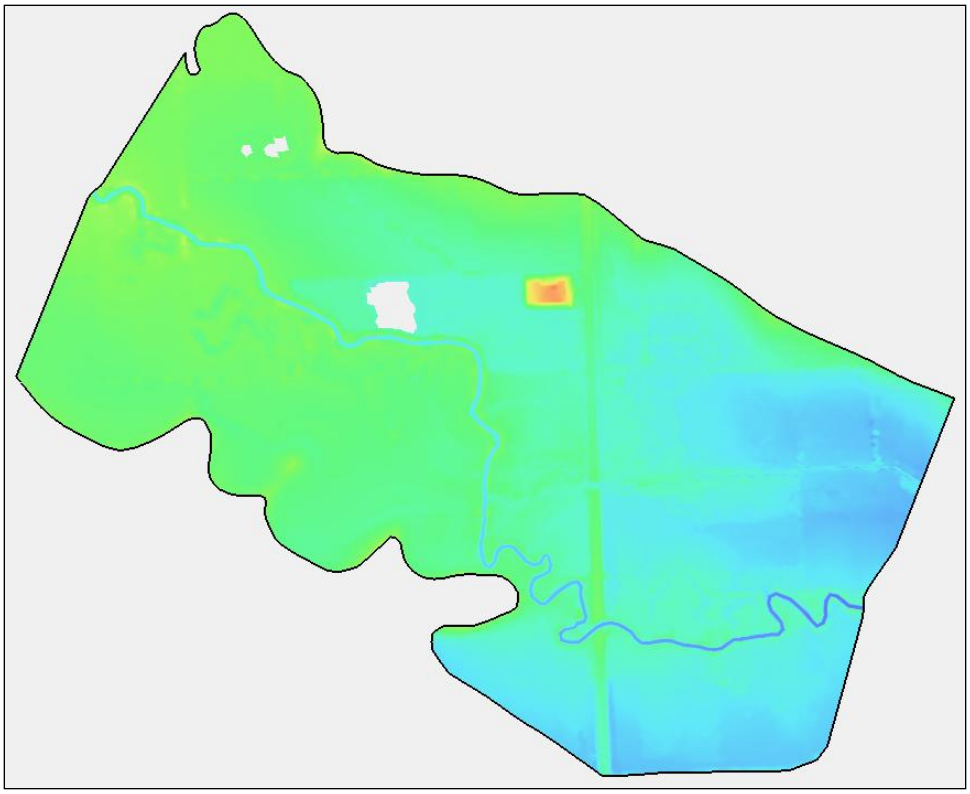

Figure 4 The multisource elevation applied to the mesh

21. When done, click **Close** to exit the SMS *Toolbox* dialog as it is no longer needed.

6 Map Dataset to Mesh

With the raster elevations interpolated to the mesh, the new dataset needs to be assigned to be the map elevation dataset. To do this, complete the following:

1. Switch to the **Mesh** module.
2. Select *Data* | **Map Elevation...** to open the *Select Dataset* dialog.
3. Select "multisource elevations".
4. Click **Select** to close the *Select Dataset* dialog.
5. Select **OK** on the message that appears.
6. Select the *Display* | *View* | **Oblique** command.
7. Click the **Display Options** macro to open the *Display Options* dialog.
8. From the list on the left select *2D Mesh*.
9. Select the *Contours* tab.
10. Under *Data range*, turn off *Specify a range*.
11. Click **OK** to close the *Display Options* dialog.

The mesh should appear similar to Figure 5. Note that the elevation has updated, but not in all locations.

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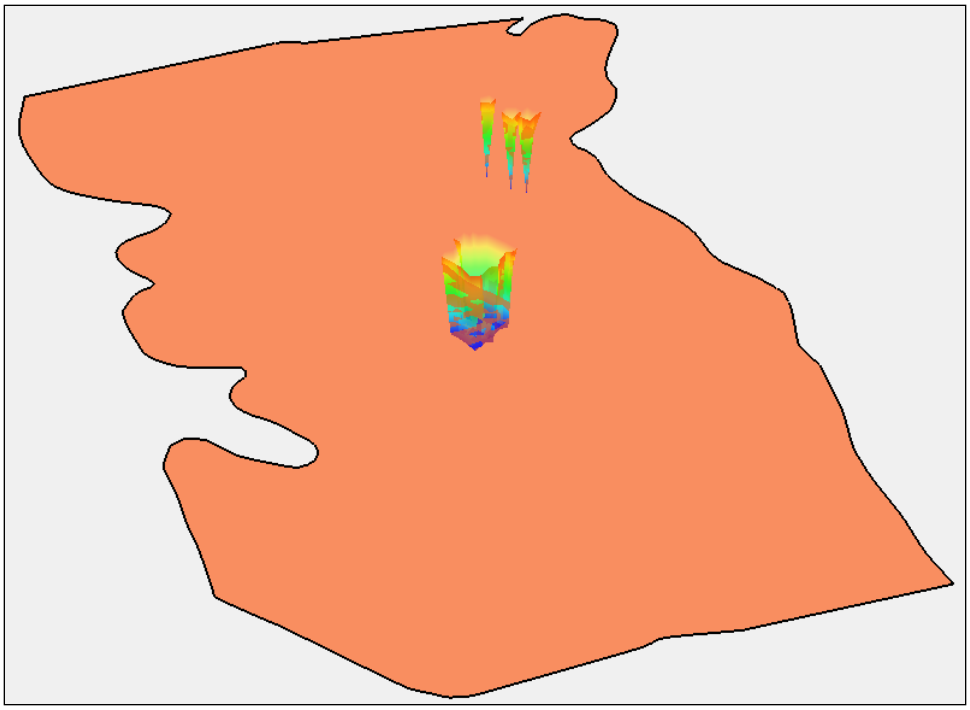

Figure 5 Mapped elevation with unassigned nodes

7 Set Unassigned Node Values

There are a few nodes on the mesh that didn't get assigned elevations. This happened because there is a sparse area in the lidar data. To set the value for nodes that didn't get assigned, complete the following:

1. In the **Mesh** module, **Zoom** to the area in the middle of the domain with no values.
2. In the Project Explorer, right-click on "Tutorial" and select *Convert* | **Mesh** → **2D Scatter** to bring up the *Convert Mesh to Scatter Points* dialog.
3. Click **OK** to accept the defaults and close the *Convert Mesh to Scatter Points* dialog.
4. In the Project Explorer, select "Tutorial Scatter" to make it active.
5. Make the **Select Scatter Point** tool active.
6. Select *Edit* | *Select By* | **Dataset Value…** to open the *Select by Dataset Value* dialog.
7. Turn on the *Less Than* option and ensure it is set to "0.0001".
8. Click **OK** to close the *Select by Dataset Value* dialog.

Around 41 points should be selected.

9. Select the *Delete* key and click **Yes** on the warning message to remove these vertices.
10. Select *Triangles* | **Triangulate** to triangulate the remaining scatter points.

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11. In the Project Explorer, select "Tutorial" to make it active.
12. Make the **Select Mesh Node** tool active.
13. Select *Edit* | *Select By* | **Dataset Value…** to open the *Select by Dataset Value* dialog.
14. Turn on the *Less Than* option and make certain it is set to "0.0001".
15. Click **OK** to close the *Select by Dataset Value* dialog.
16. In the Graphics Window, right-click and select **Interpolate elevation…** to open the *Interpolation* dialog.
17. Under *Scatter Set to Interpolate From* section, under the "Tutorial Scatter (active)" scatter set select the "Z" dataset.
18. Click **OK** to close the *Interpolation* dialog.
19. **Frame** the project.

The mesh should appear similar to Figure 6.

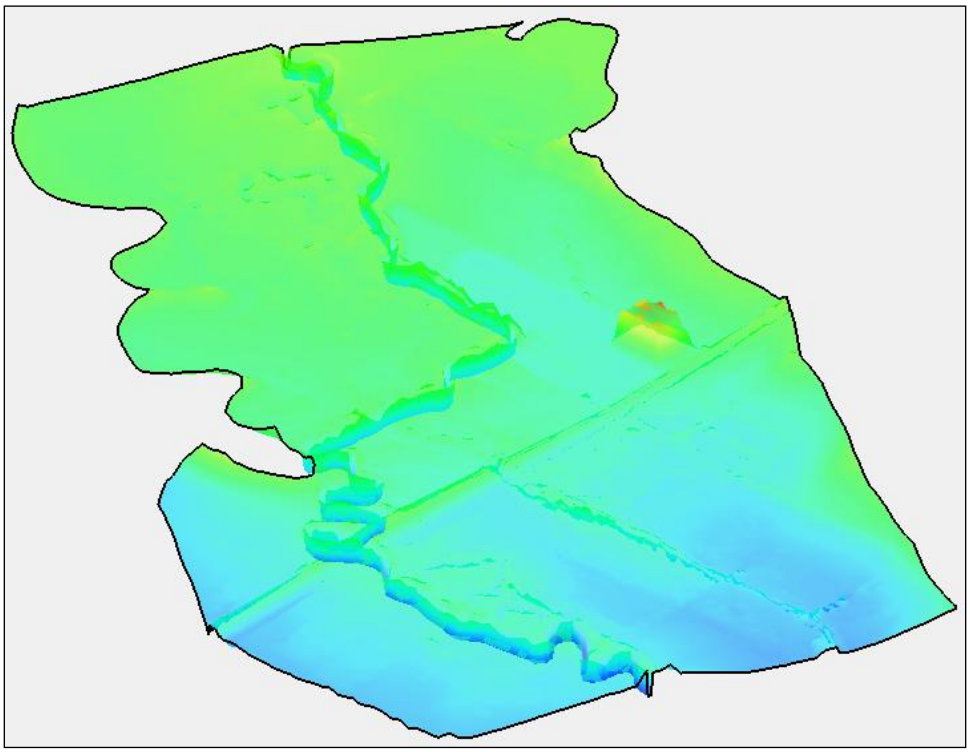

Figure 6 Mesh with corrected elevation values

8 Change Display Options

Now to adjust the display to better see how the tool changed the rasters.

1. Switch to **Plan View**.
2. Hide the "Tutorial" mesh.

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3. In the Project Explorer under "GIS Data", turn on all of the rasters excluding "Shell Creek World Image_exported".
4. While holding the *Shift* key, click on each raster just turned on to select all except "Shell Creek World Image_exported".
5. Right-click on the selected rasters and select the **Display Options...** menu command to open the *Raster Display Options* dialog.
6. If a *Raster Contour Options* dialog with a message regarding how the contour options will be applied appears, click **OK** to close it and open the *Raster Display Options* dialog.
7. Click **Contour Options...** to open the *Raster Contour Options* dialog.
8. Click **Color Ramp...** to open the *Choose color ramp* dialog.
9. Expand the *FHWA* color palette options.
10. Select "Topography".
11. Click the **OK** button to close the *Choose color ramp* dialog.
12. Turn on *Specify a range*.
13. Set the *Min* value to "1500" and the *Max* value to "1550".
14. Select **OK** to close the *Raster Contour Options* dialog.
15. Select **OK** to close the *Raster Display Options* dialog.

The rasters should appear similar to Figure 7.

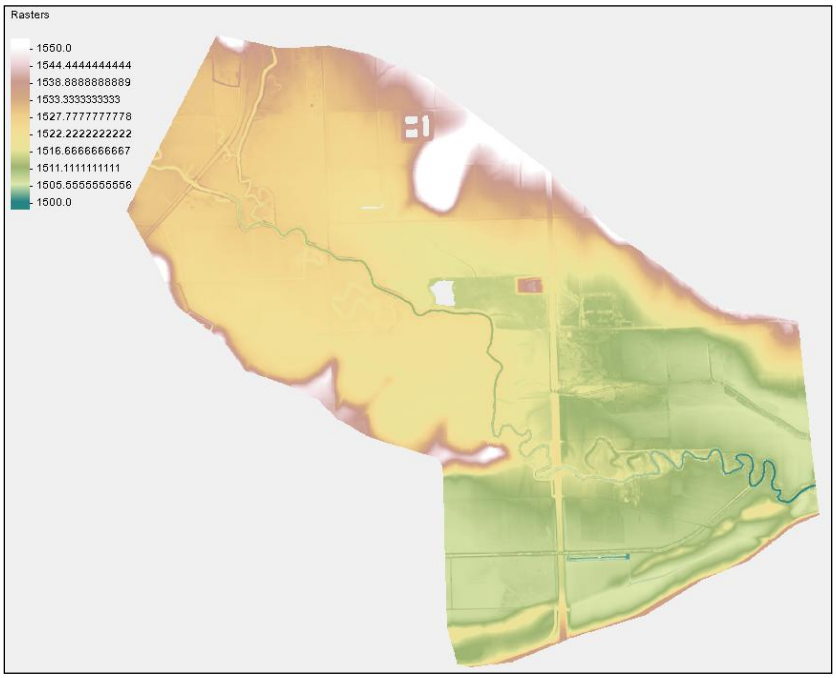

Figure 7 Rasters with adjusted display

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9 Conclusion

This concludes the “Interpolating from Multiple Elevation Sources” tutorial. The following key concepts were discussed and demonstrated:

- Blending resolutions for multiple rasters
- Trimming a raster to a higher or lower resolution
- Interpolating multiple rasters to a mesh using priority
- Correcting node elevation values

If desired, experiment with some of these other options.

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