

ArcGIS Spatial Analyst Extension (Contour, Slope, Hillshade)

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TIPS Tools in service to the SMCRA professional



Quick Guide

NOTE: You must have contours derived from imagery in order to carry out the tasks in this tutorial.

Chapter 1 – Prepare raster surfaces

1. Organize your data using ArcCatalog
2. Check out a Spatial Analyst License
3. Add 2 contour layers of interest
4. Clip an area of interest from each contour file
5. Create a raster surface from each clipped contour
6. Extract the clip area of interest from each raster
7. Now you have 2 raster surfaces which can be used for analysis

Chapter 2 – Perform Analysis on raster surfaces

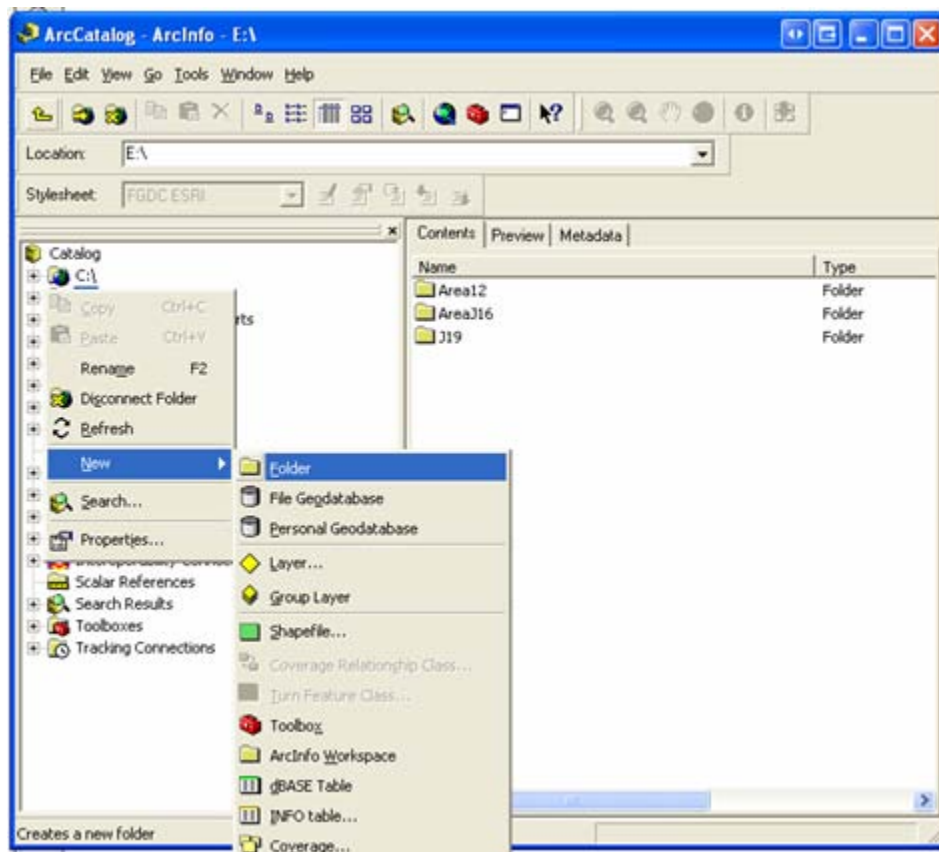
8. Contour
9. Slope
10. Hillshade

Chapter 1 - Step by Step Guide - Prepare raster surfaces

1. Organize your data using ArcCatalog

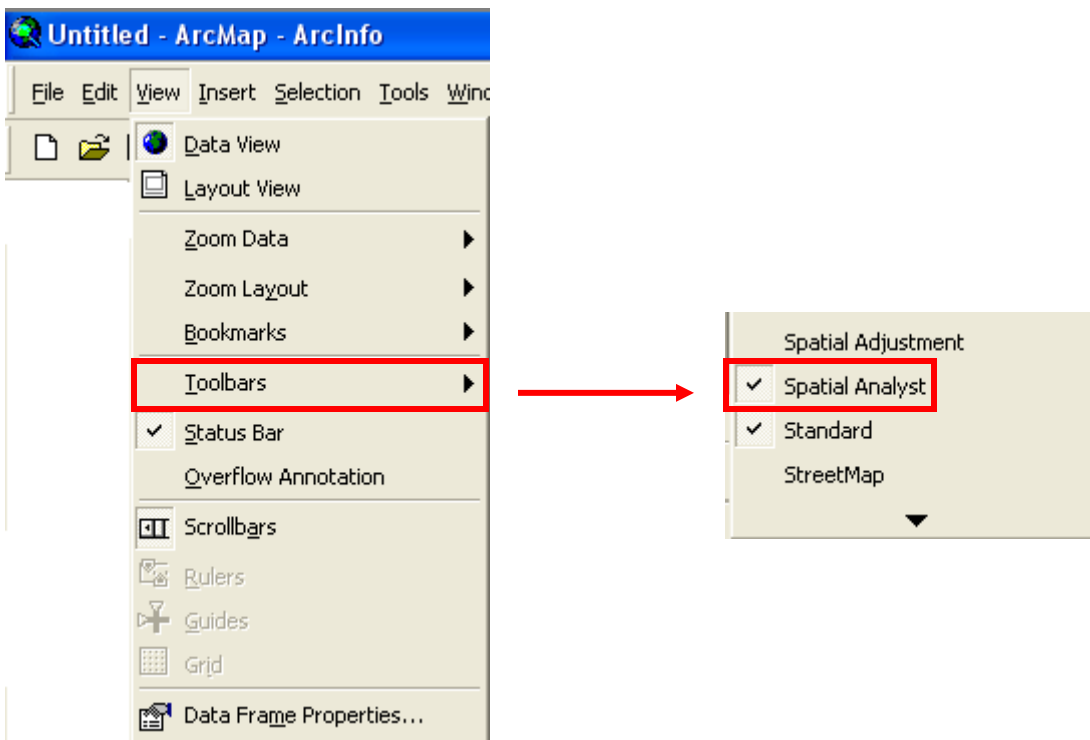
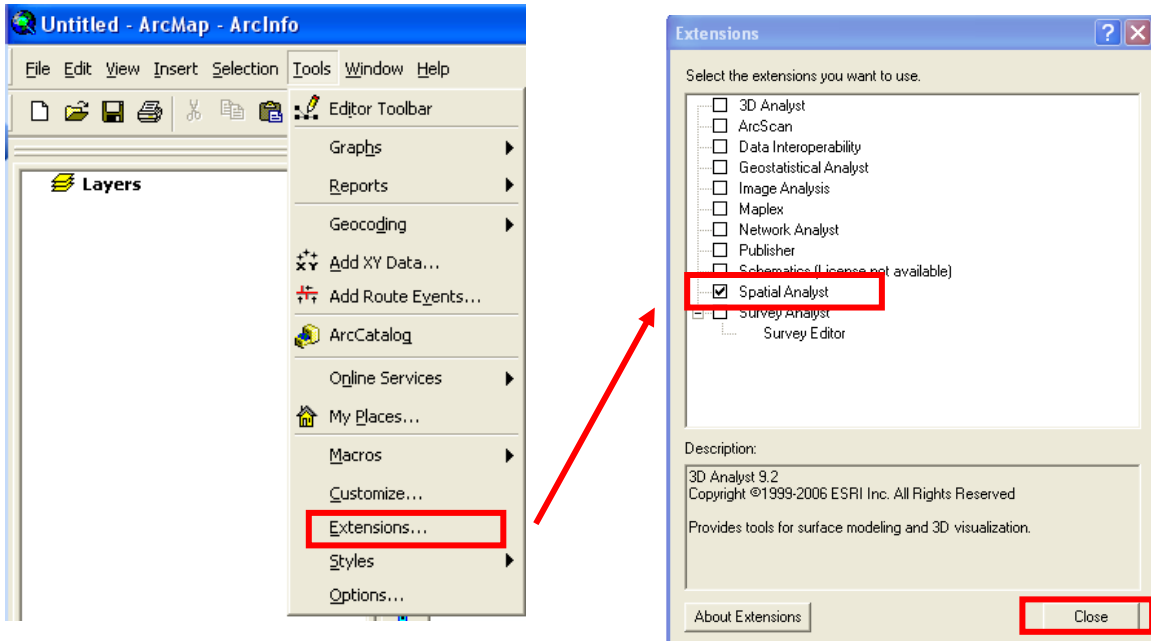
- Open ArcCatalog
- Create a new folder on your C: drive to hold files as you process
 - a. Right-click on C:\ | New... | Folder
 - b. Rename your new folder to something meaningful
- Close ArcCatalog

This Step 1 is not required but is strongly suggested in order to keep files organized.



2. Check out a Spatial Analyst License in ArcMap and open its Toolbar

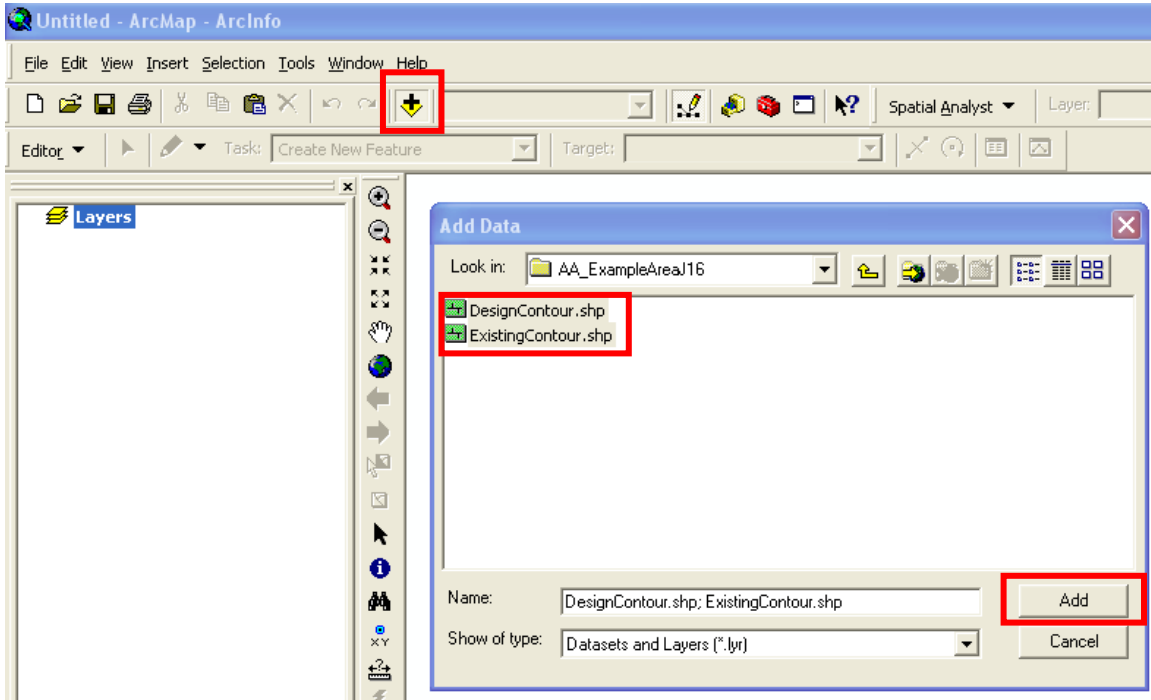
- Open ArcMap
- Click Tools | Extensions... | click box next to Spatial Analyst | Close
- Click View | Toolbars | click Spatial Analyst



3. Add 2 contour layers of interest to ArcMap

*For the purpose of this tutorial the contour data is located at:
R:\AFO Inspection Reports\AFOGISdata\AA_ExampleAreaJ16*

- Add to ArcMap the DesignContour shapefile
- Add to ArcMap the ExistingContour shapefile

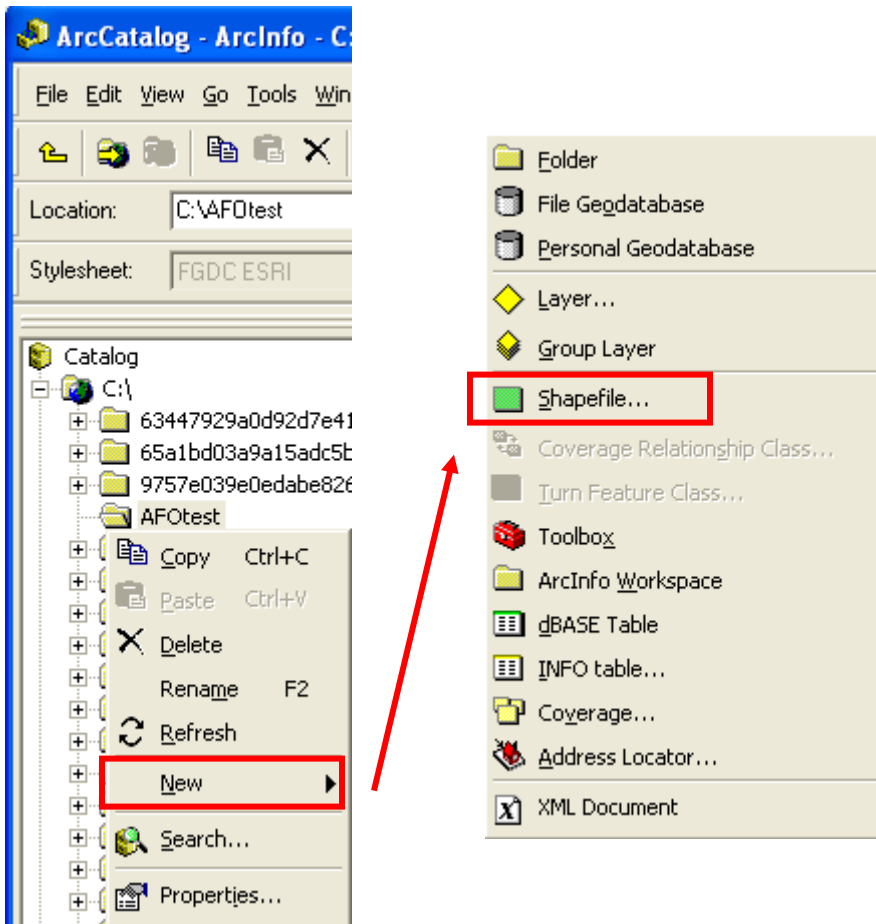


4. Clip an area of interest from each contour file

There are several steps to this process...

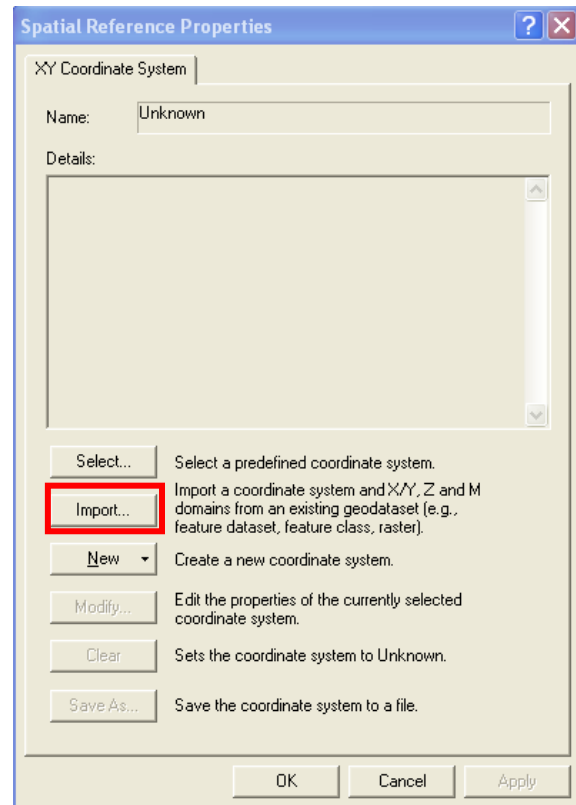
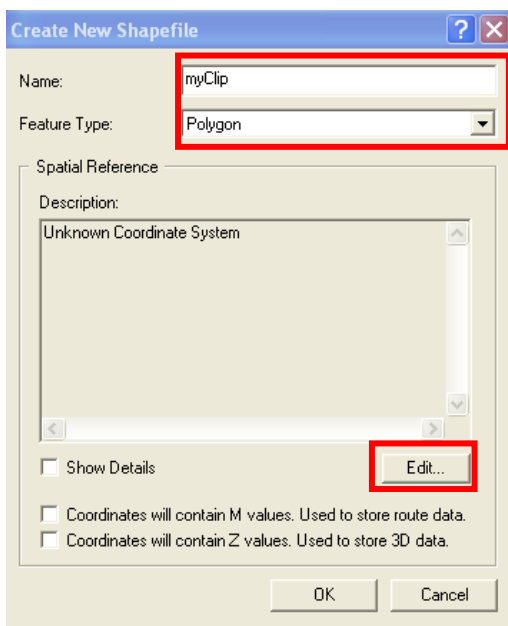
4a. Create a new shapefile of polygon geometry

- Open ArcCatalog
- Right-click on the Folder you created on your C:drive (from Step 1)
- Click New | Shapefile



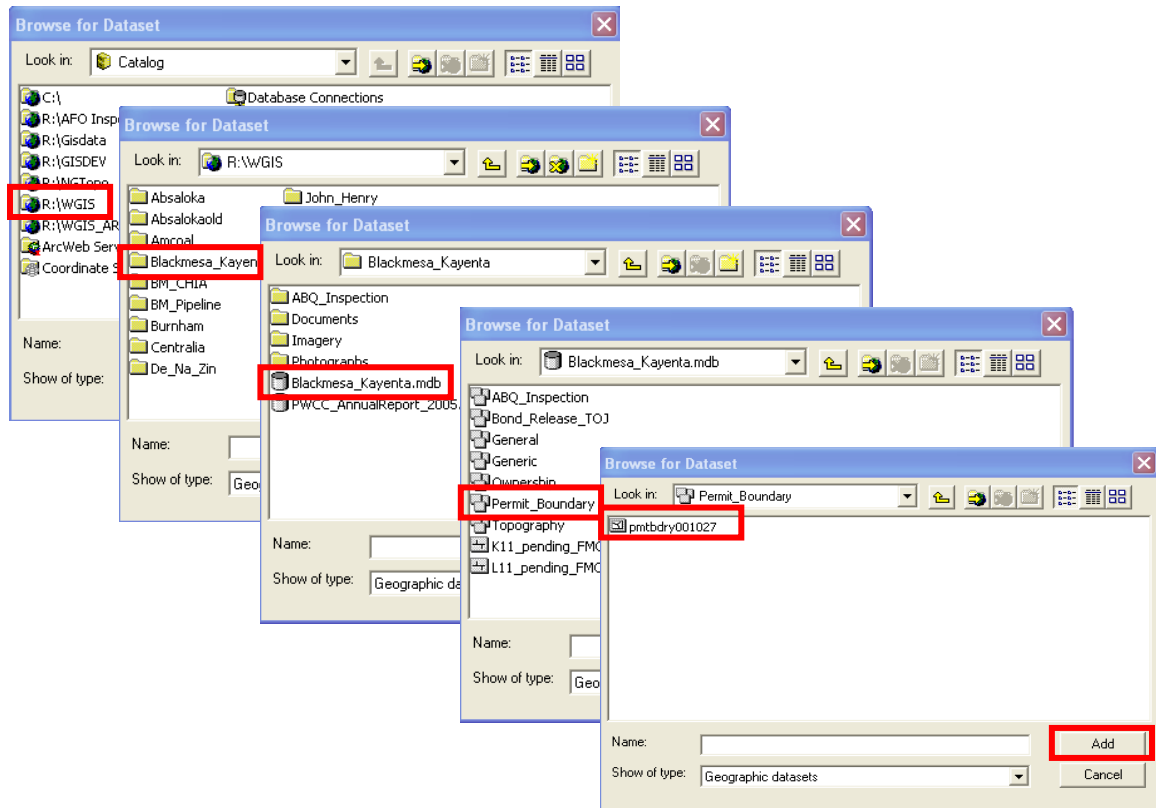
4b. Name the shapefile

- Name it myClip
- For Feature Type choose Polygon
- Click on Edit then Import



4c. Import the proper coordinate system

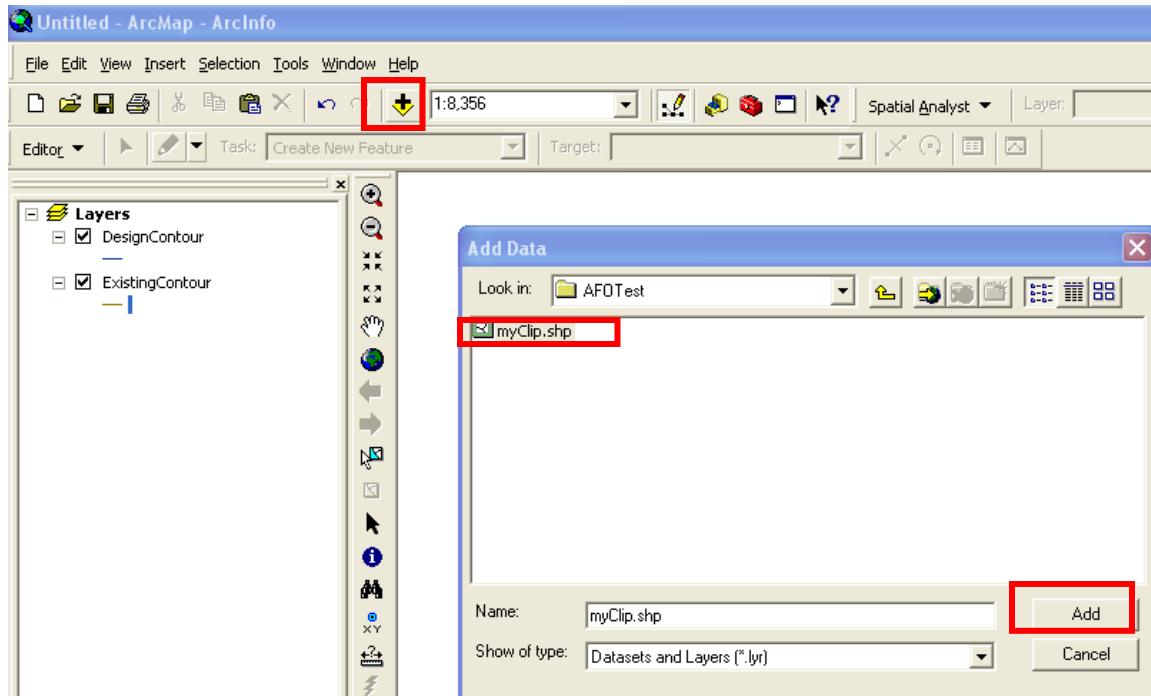
- In the WGIS browse to the Mine from which your contours are derived
- Browse to the Database then to the Permit Boundary dataset
- The permit boundary layer contains the proper coordinate system
- Click Add
- Click OK on the Spatial Reference Properties box
- Click OK on the Create New Shapefile box
- Close ArcCatalog



4d. Add the shapefile to ArcMap and start the Editor

This shapefile is empty now – but we will fill it up using the Editor Toolbar

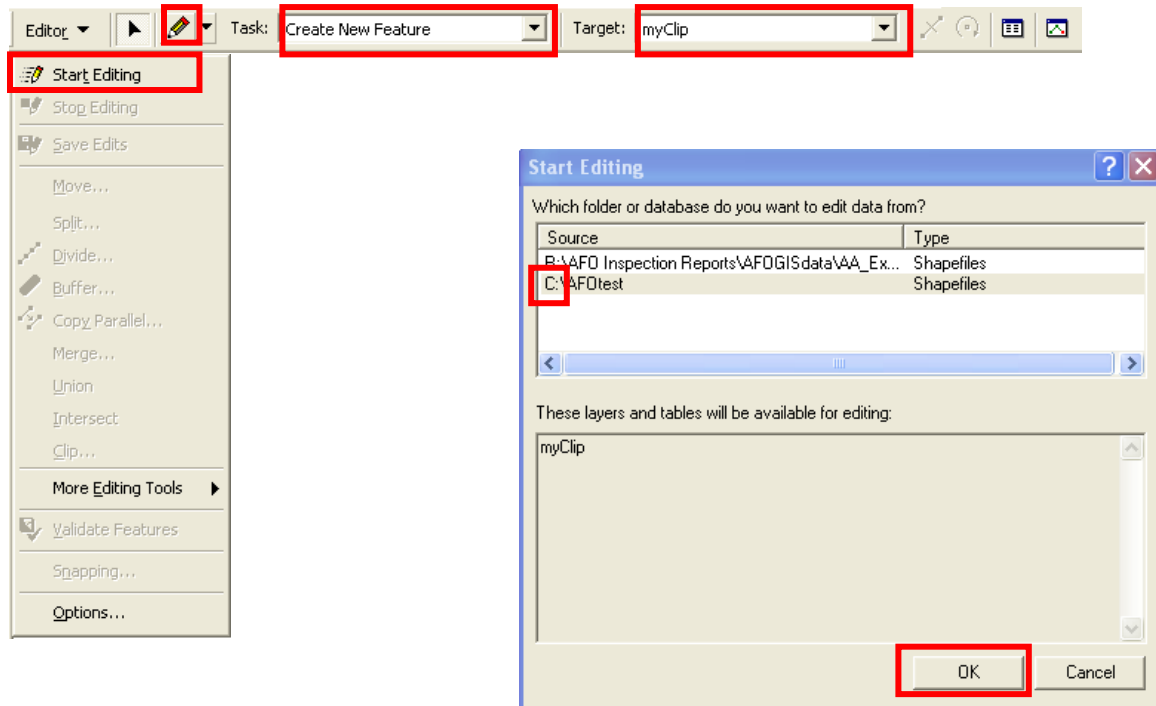
- Add to ArcMap the shapefile named myClip (it will be located in the Folder you created on the C: drive)



- Add the Editor Toolbar to ArcMap
 - a. Click View | Toolbars | click Editor
- (refer to Step 2 if you want to see a picture of adding toolbars to ArcMap)

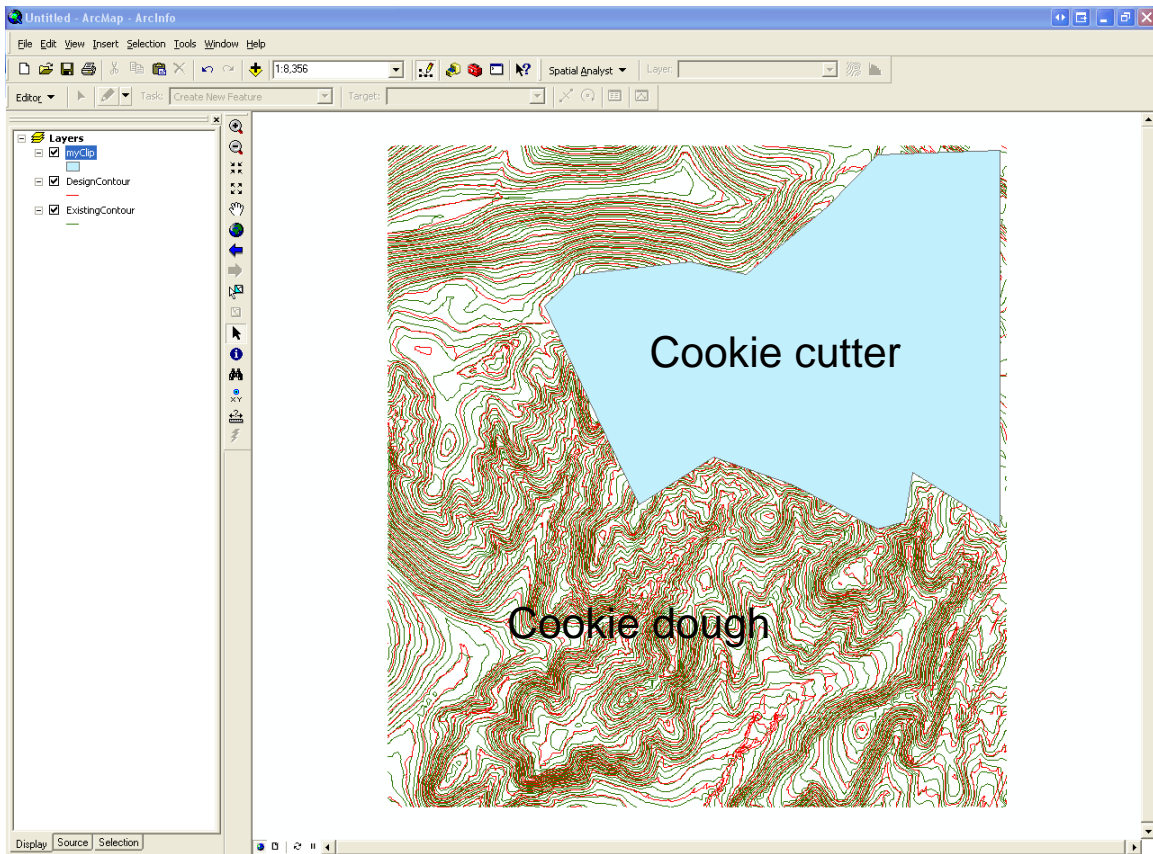
4e. Create a New Feature inside the myClip shapefile

- On the Editor toolbar click on Editor | Start Editing
- If you receive a message asking for which folder to edit from choose C:\
Note: We created the empty shapefile on the C:\ drive at Step 4a and we added the contour files from the R:\ drive at Step 3. So, ArcMap has no way of knowing which files we want to edit. That is why this dialog box comes up.
- Make sure the Task is set to Create New Feature
- Make sure the Target is myClip
- Click on the Editor Pencil icon
- Draw a polygon around the area of interest on the contours
- Click Editor | Save Edits
- Click Editor | Stop Editing
- *Think of the myClip file as a cookie-cutter and the contour files as the cookie dough. We will make two cookies since we have two contour files. We perform this clipping function to decrease the time it takes to process large raster files.*



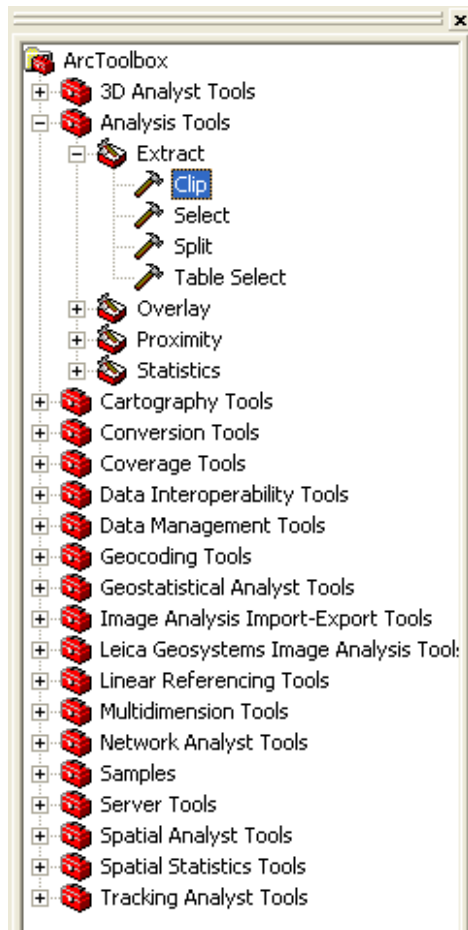
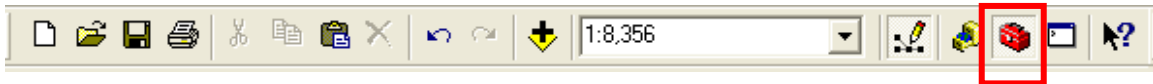
4f. At this point your ArcMap screen should look similar to this

- *Of course your myClip file will be a different shape and color than shown here and your contours may be a different color than shown here*



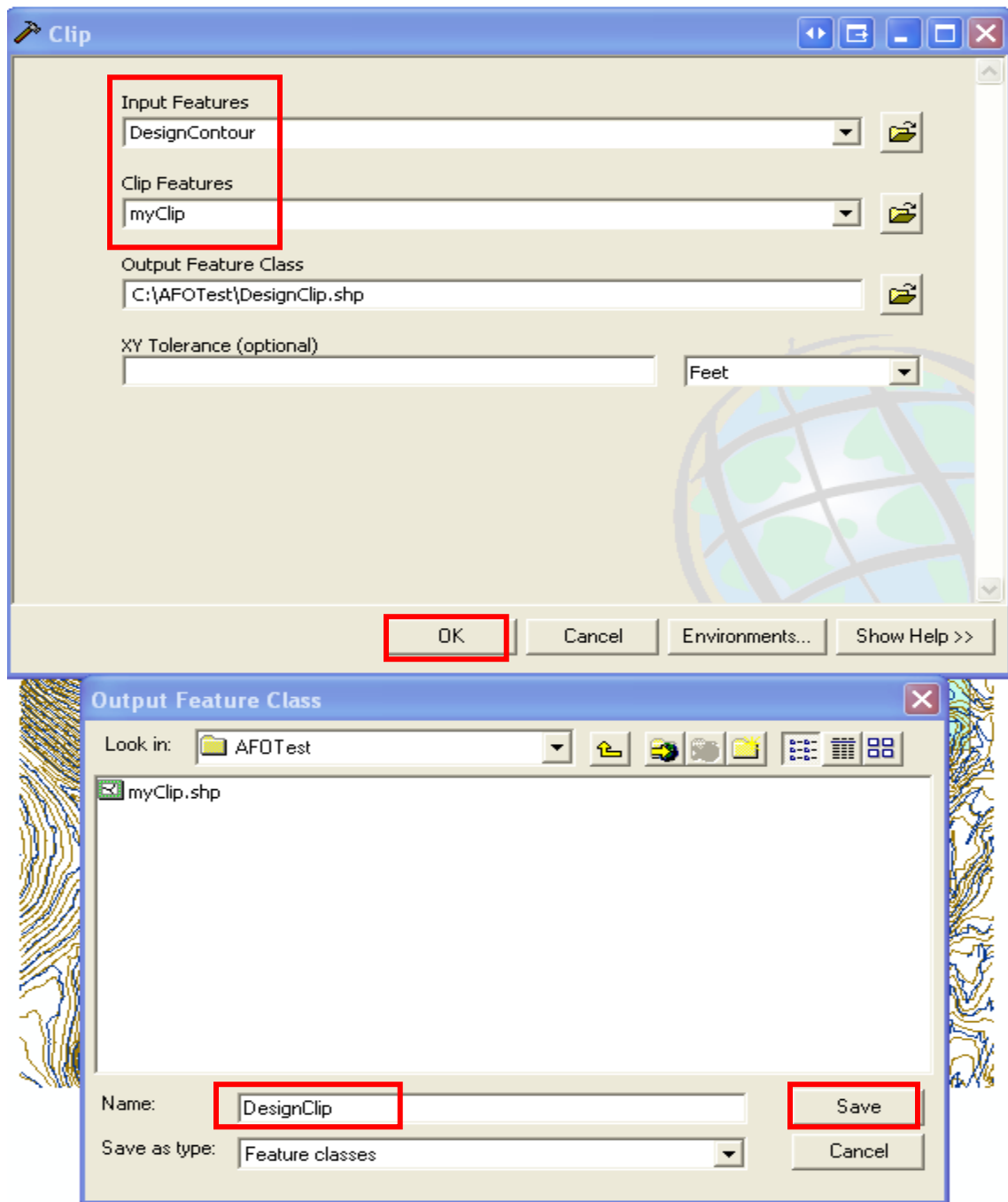
4g. Clip both contour files using the myClip file

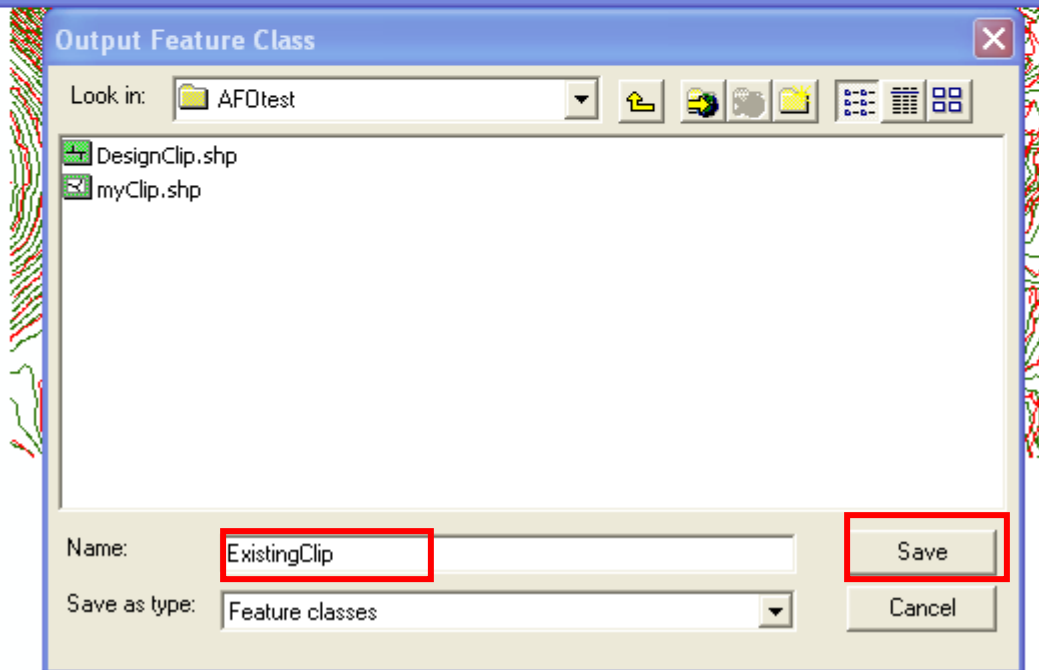
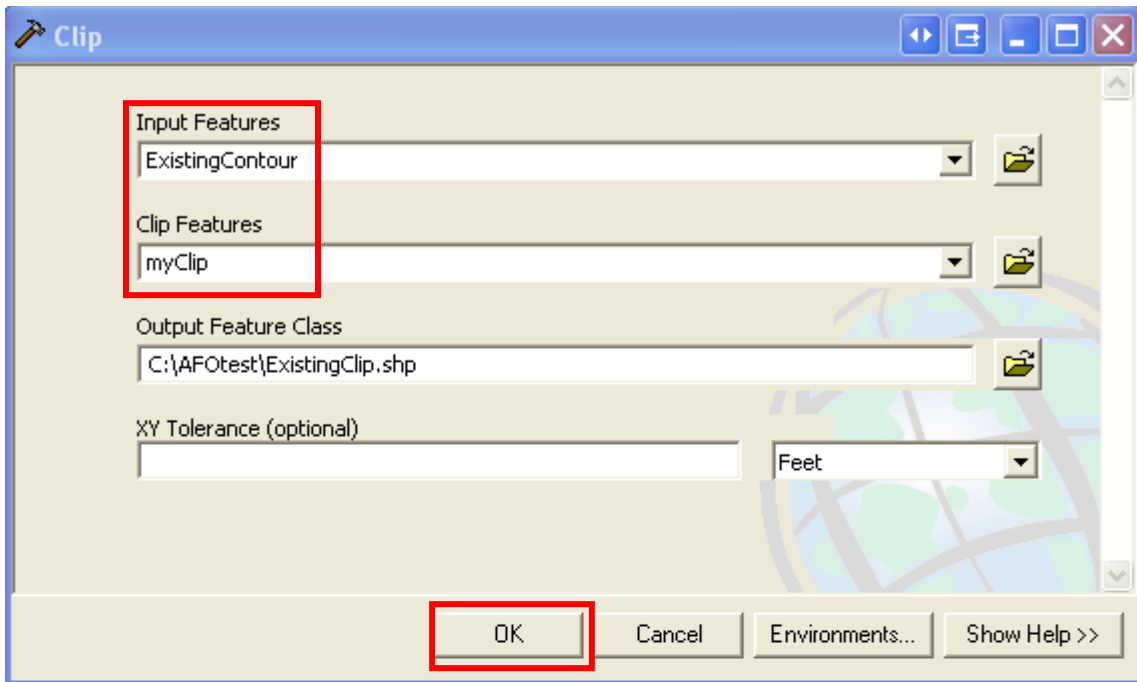
- Start ArcToolbox
- Navigate to Analysis Tools | Extract | double-click Clip



4g. (con't) Clip both contour files using the myClip file

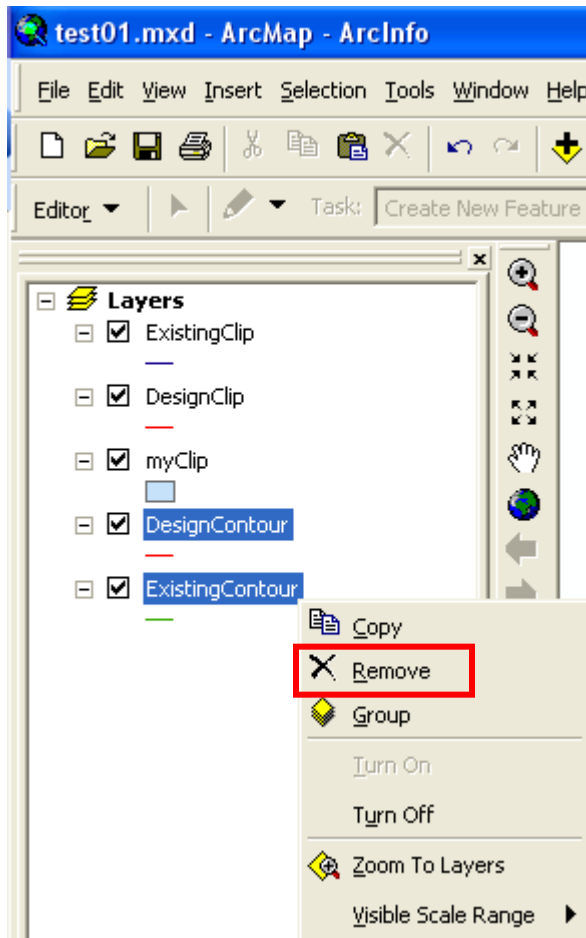
- For Input Features click the down arrow and choose DesignContour (it may appear to stall for a moment...be patient)
- For Clip Features click the down arrow and choose myClip
- For Output Feature Class browse to the Folder on C: created in Step 1
- Name the file DesignClip
- A process box will open, when the process box finishes click Close



4h. Repeat Step 4g for the ExistingContour file

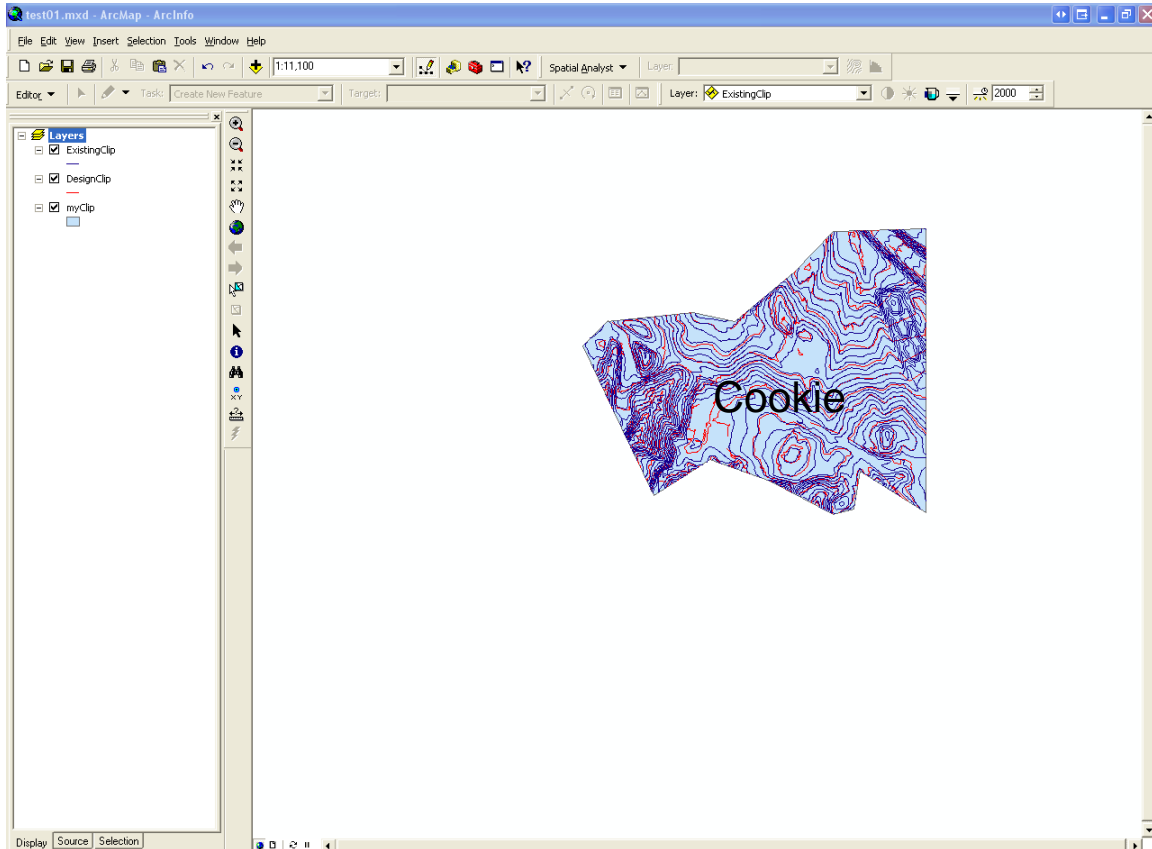
4i. Remove unnecessary files

- Close ArcToolbox
- In ArcMap Table of Contents click on DesignContour
- Hold down the Ctrl-key on the keyboard
- Click on ExistingContour
- Right-click and then click Remove



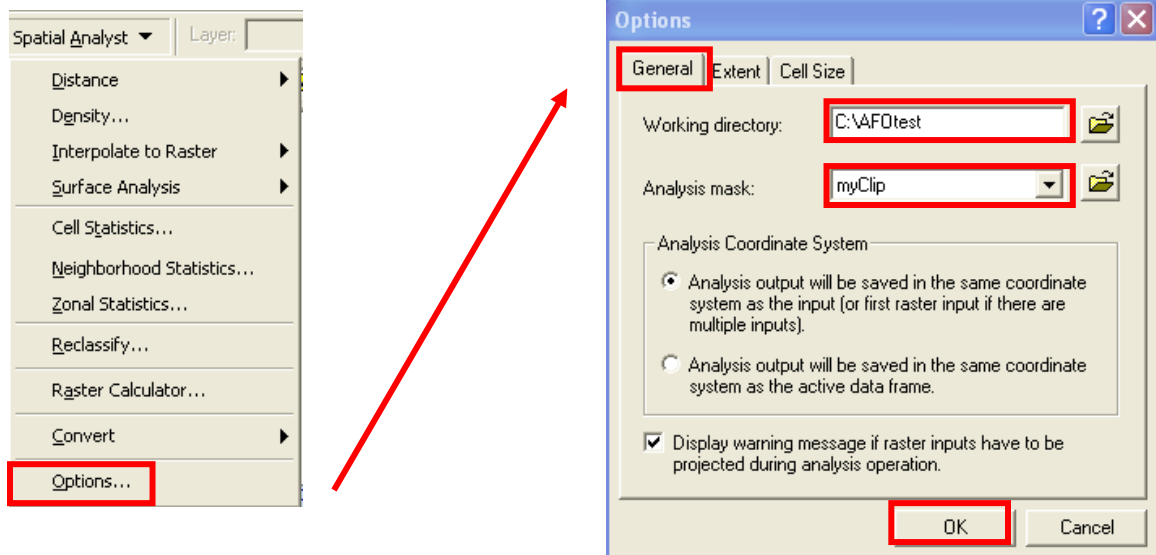
4j. At this point your ArcMap screen should look similar to this

- *Of course your contours may be a different color than shown here*



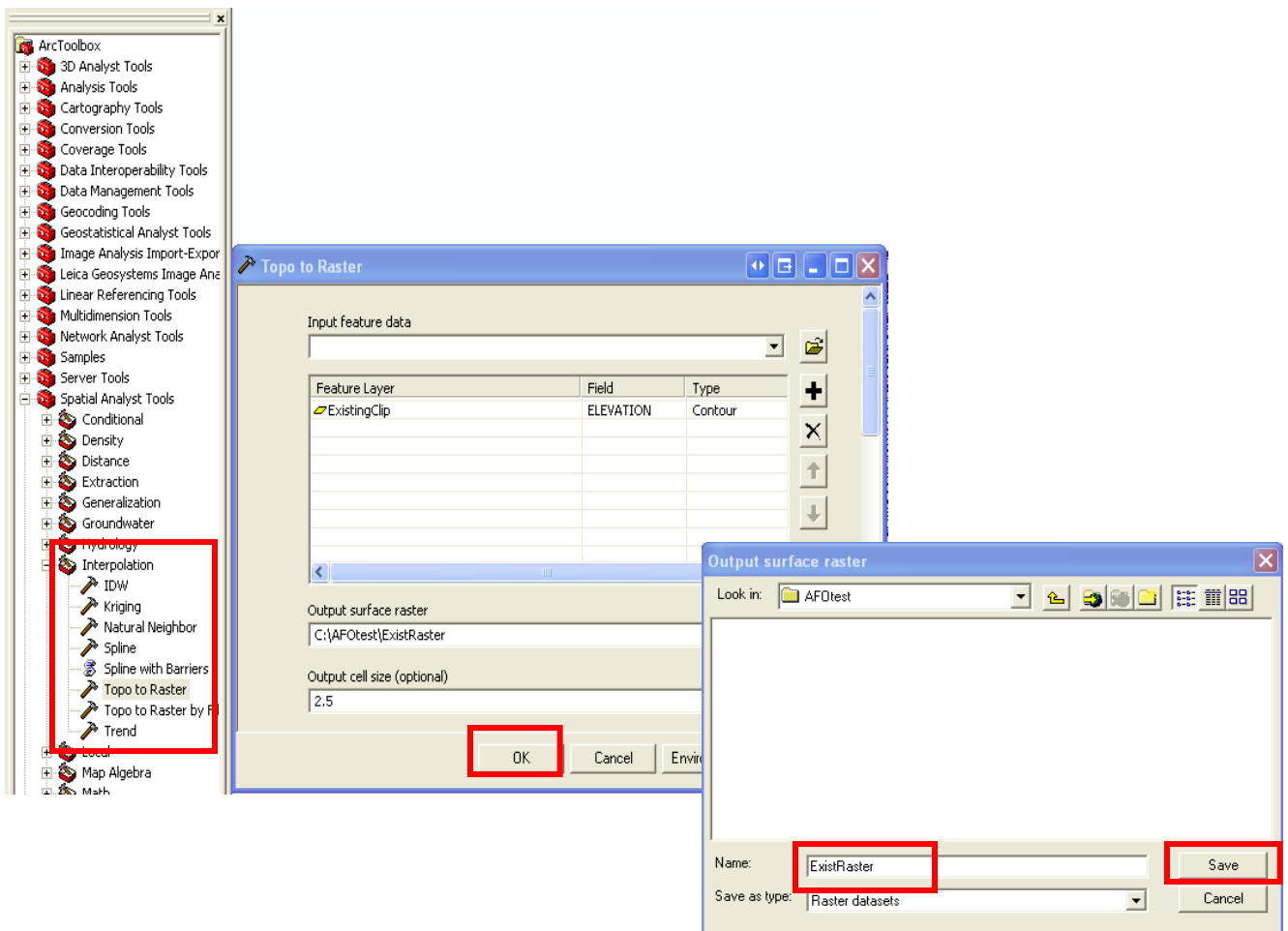
5. Set the Options for creating a GRID surface (raster) using Spatial Analyst

- On the Spatial Analyst toolbar click on Options...
- Click on the General Tab
- For Working directory browse to the Folder on C: created in Step 1
- For Analysis mask click on the down arrow and choose myClip
- Leave other options at their default
- Click OK



5a. Create a GRID surface (raster) from the clipped layers from Step 4

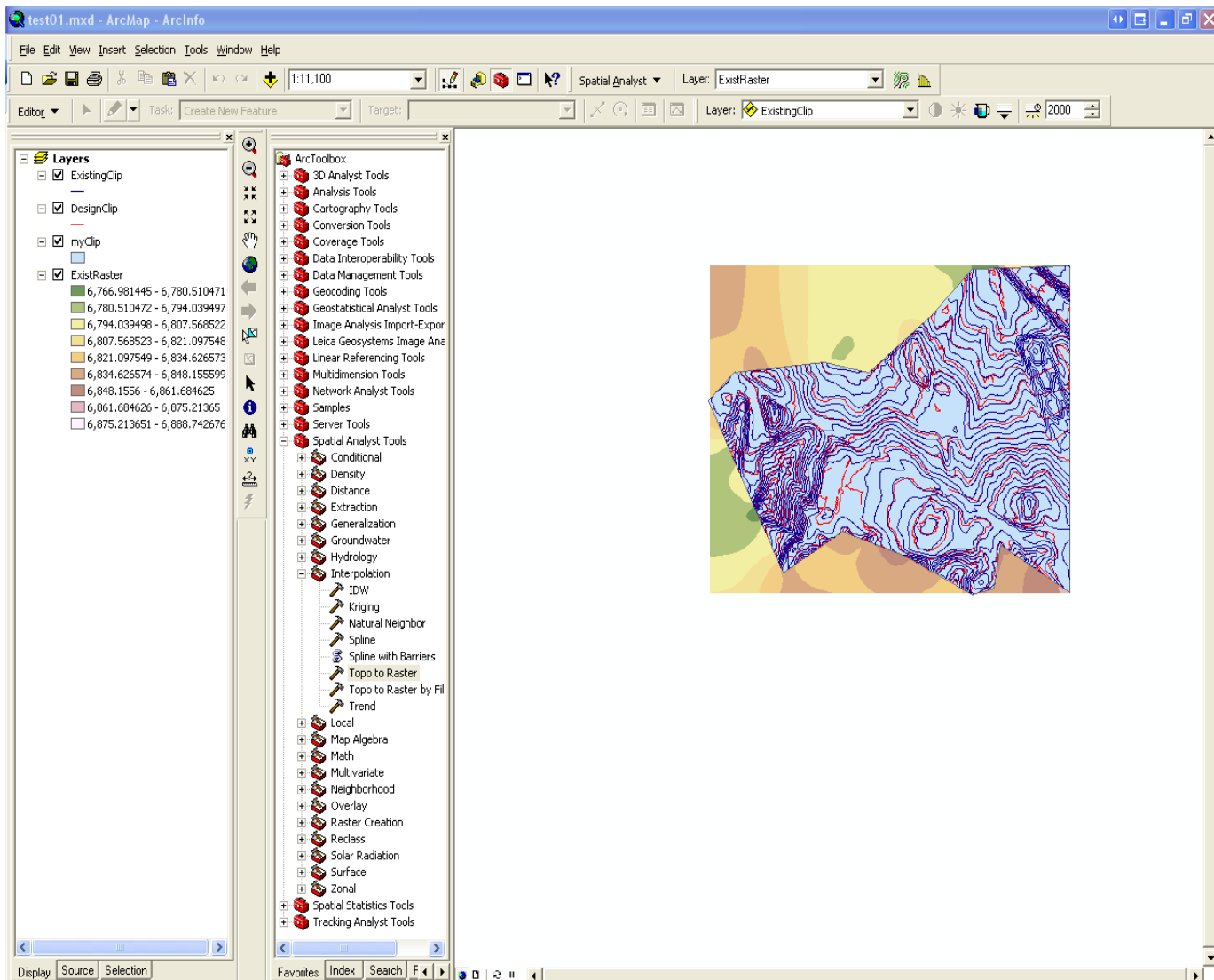
- Start ArcToolbox
- Navigate to Spatial Analyst Tools | Interpolation | double-click Topo to Raster
- For Input feature data click on the down arrow and choose ExistingClip
- For Output surface raster browse to the Folder created on C: in Step1 and name the file ExistRaster
(Don't put a space in the name and note that if you name it something different you are only allowed 13 characters)
- Click Save
- For Output cell size enter 2.5
- Click OK
- When the process box finishes click Close *(this process could take a long time!)*



5b. At this point your ArcMap screen should look similar to this

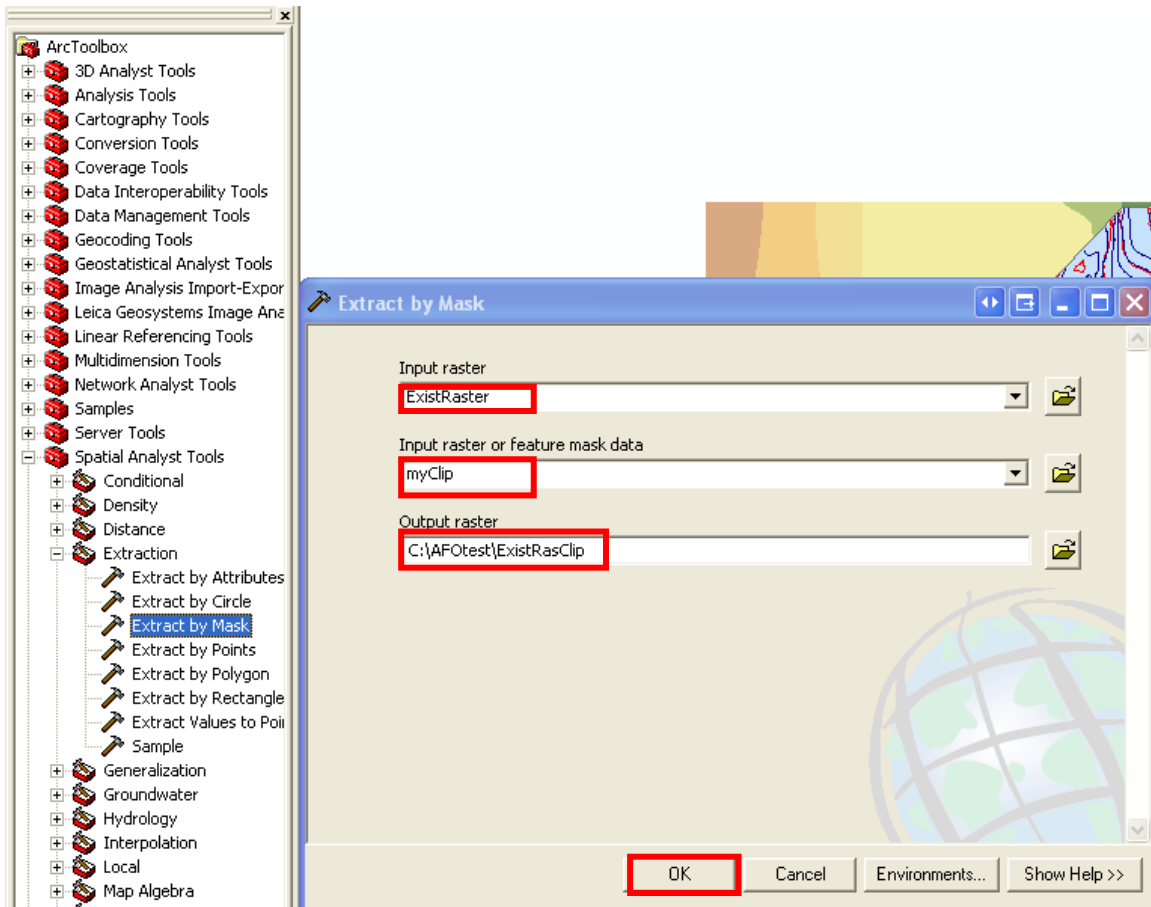
- *Of course your raster may be a different color than shown here*

This function has created a rectangular grid around the clipped area and the extraneous data on the outside of the clipped area is bad data and must be removed.



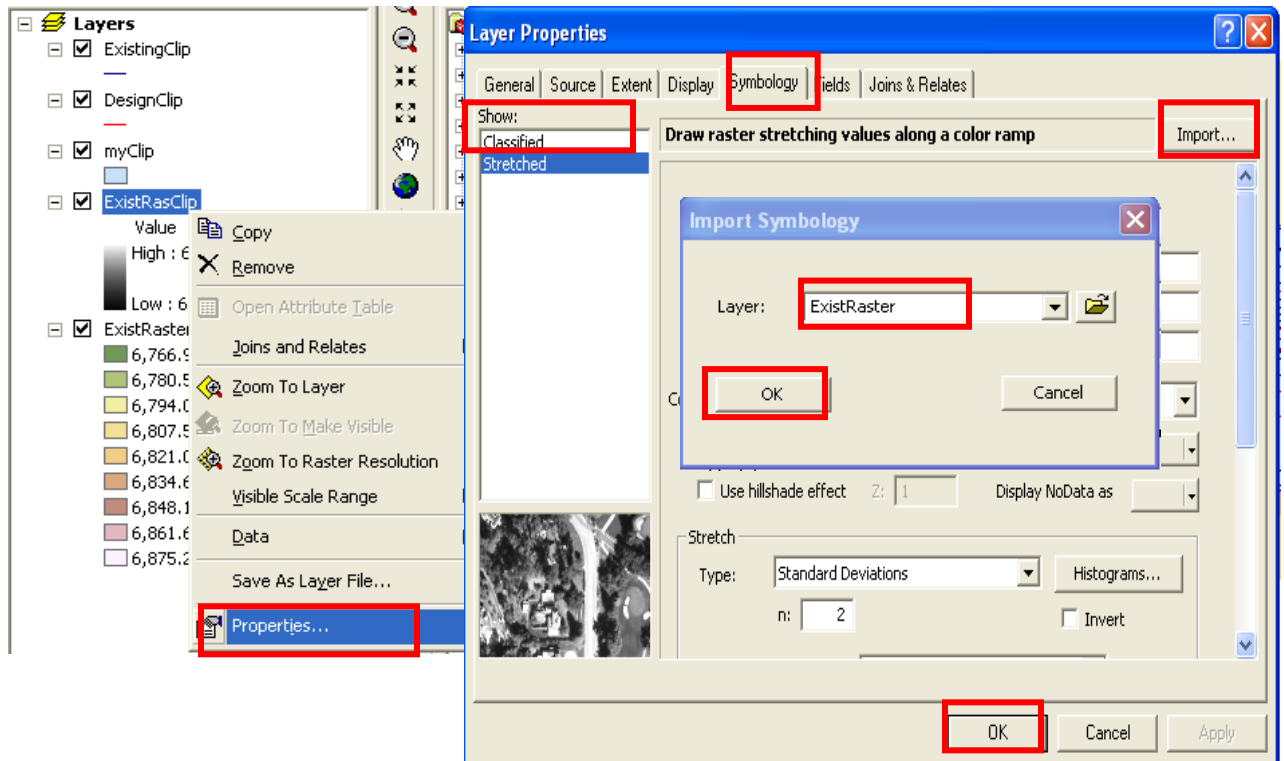
6. Extract the bad data from the raster using the clip area as a mask

- Start ArcToolbox if it is not already started
- Navigate to Spatial Analyst Tools | Extraction | double-click Extract by Mask
- For Input raster click on the down arrow and choose ExistRaster
- For Input raster or feature mask data click on the down arrow and choose myClip
- For Output raster browse to the Folder created on C: in Step1 and name the file ExistRasClip
(Don't put a space in the name and note that if you name it something different you are only allowed 13 characters)
- Click Save, then Click OK
- When the process box finishes click Close



6a. Adjust the symbology of the ExistRasClip raster

- In ArcMap table of contents right-click on ExistRasClip then click Properties
- Click on the Symbology tab
- Under Show click Classified | then click the Import button
- For Layer click on the down arrow and choose ExistRaster
- Click OK
- Click OK

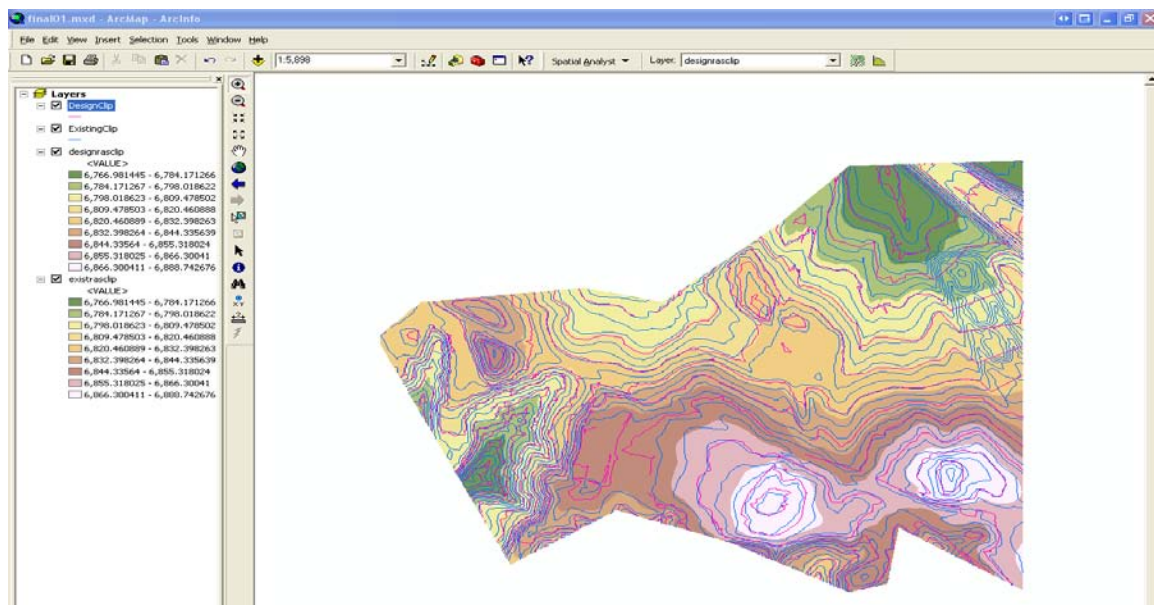


7. Repeat all of Steps 5 and 6 for the DesignClip contour

- ***Be certain to name the resulting files appropriately!***
- For example: In Step 5a input DesignClip and name the output DesignRaster
- For example: In Step 6 input DesignRaster and name the output DesignRasClip
- For example: In Step 6a right-click on DesignRasClip and for Layer choose DesignRaster

7a. Remove unnecessary layers from ArcMap

- In ArcMap Table of Contents click on myClip
- Hold down the Ctrl-key on the keyboard
- Click on DesignRaster, ExistRaster
- Right-click and then click Remove
- Close ArcToolbox
- Your ArcMap screen should look similar to this



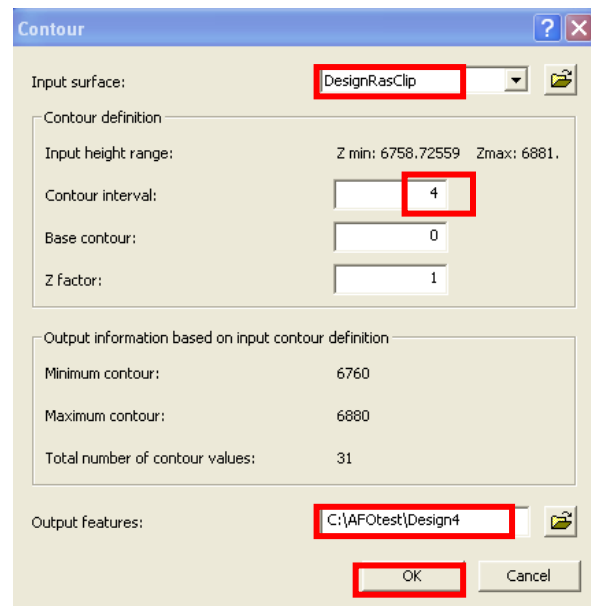
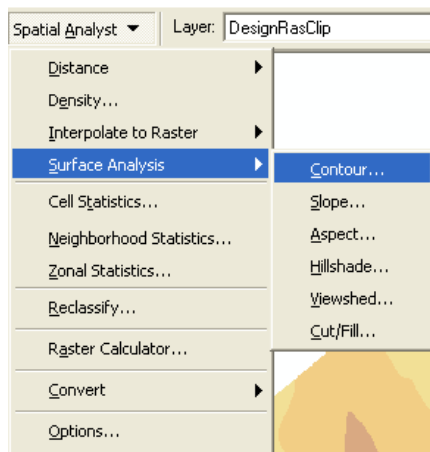
**Now you have two raster surfaces of the extent of interest.
Part 2 of this tutorial will illustrate creating Contour, Slope, and Hillshade.**

Chapter 2 - Step by Step Guide - Perform Analysis on raster surfaces

8. Contours

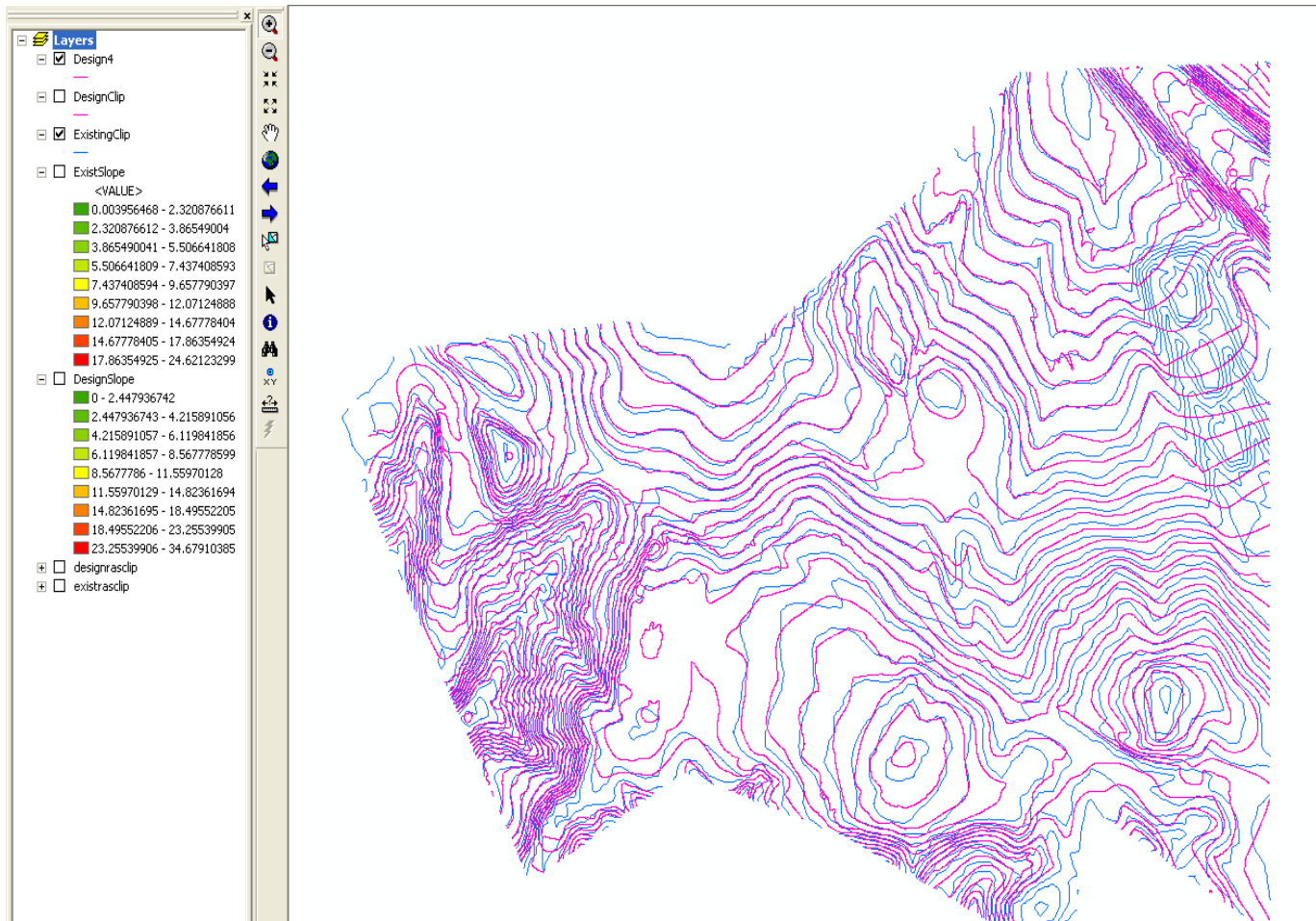
Currently the existing contours reflect a 4-foot interval and the design contours reflect a 10-foot interval. Suppose we wanted to compare more closely the existing and the design contours. We could ask Spatial Analyst to create 4-foot intervals from our design raster.

- Click on the Spatial Analyst toolbar | Surface Analysis | Contour
- For Input surface click on the down arrow and choose DesignRasClip
- For Contour interval type 4
- For Output features browse to the Folder on C: created in Step 1
- Name the output Design4, to stand for 4-ft contour intervals.
- Leave other options at their default
- Click OK



8a. Contours Example

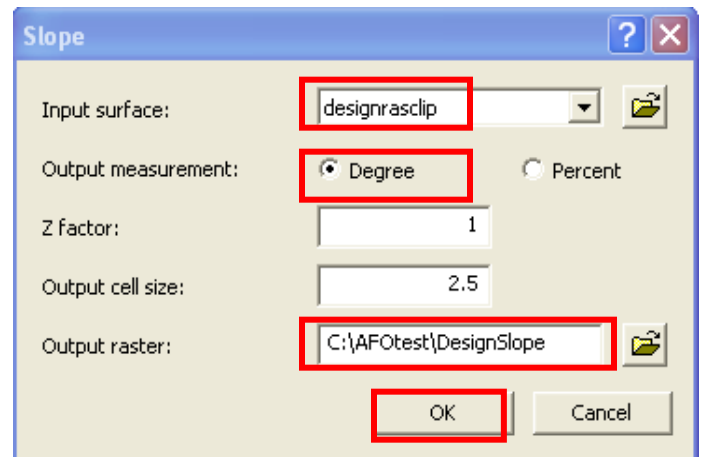
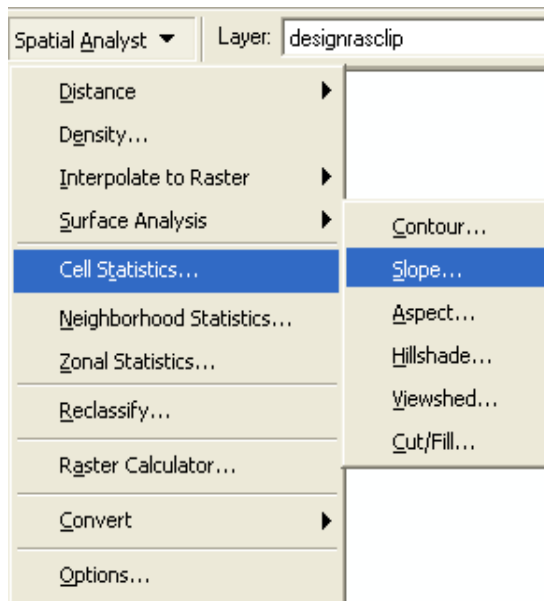
The blue lines represent 4-foot elevation contours of the existing surface. The pink lines represent 4-foot elevation contours of the design surface.



9. Slope

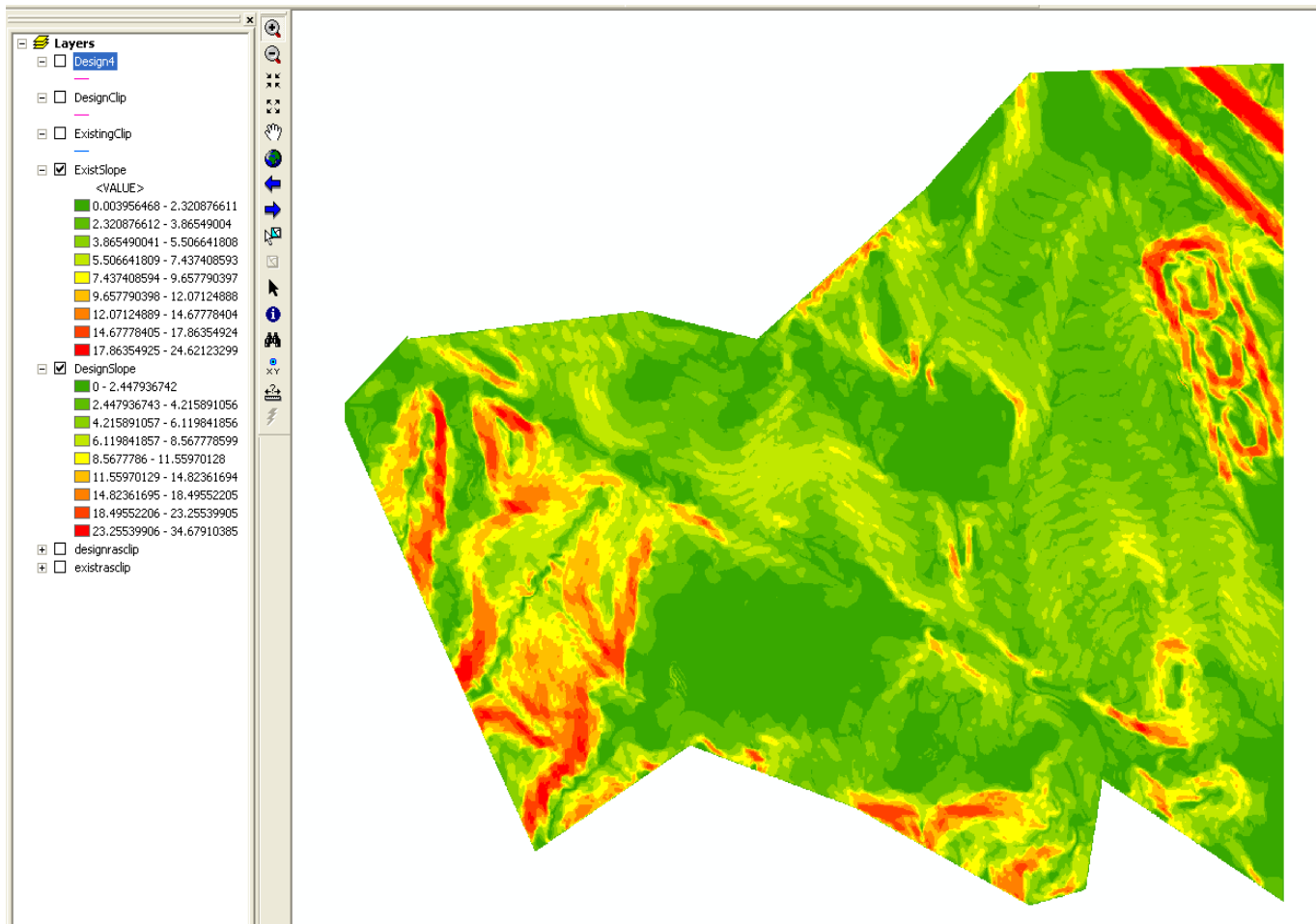
Suppose we were interested in comparing the existing slopes to the design slopes. We could ask Spatial Analyst to create slopes for us to compare.

- Click on the Spatial Analyst toolbar | Surface Analysis | Slope
 - For Input surface click on the down arrow and choose DesignRasClip
 - For Output measurement you could choose either, let's choose degree
 - For Output raster browse to the Folder on C: created in Step 1
 - Name the output DesignSlope
 - Leave other options at their default
 - Click OK
-
- Repeat Step 9 to create a slope for the ExistRasClip



9a. Slope Example

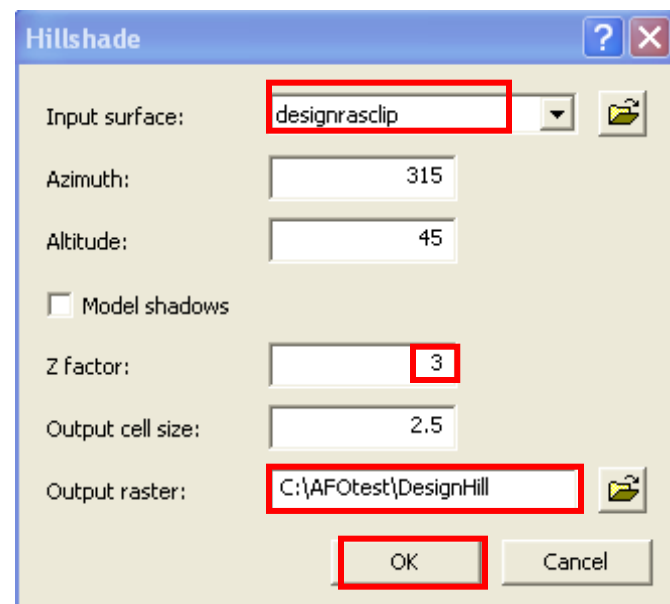
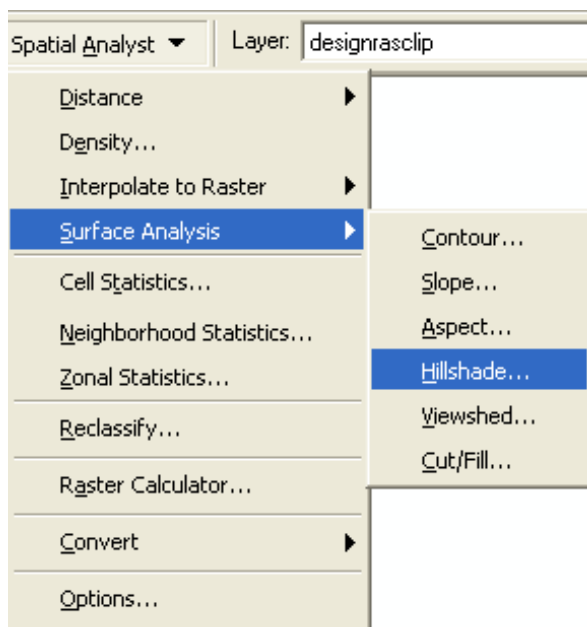
This is a view of the existing slope. The red areas reflect greater slope, the green areas reflect lesser slope.



10. Hillshade

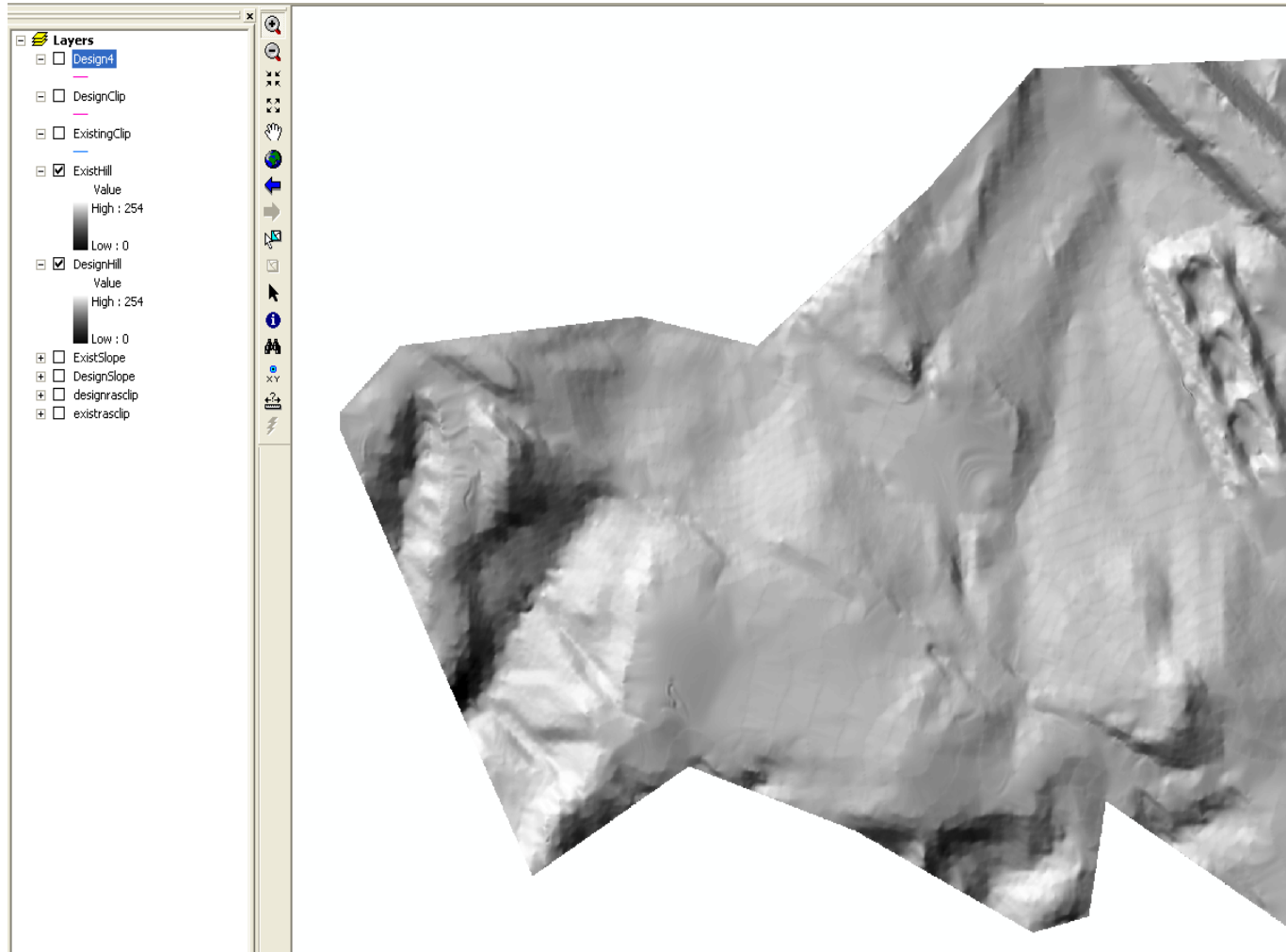
The Spatial Analyst Hillshade tool creates a shaded relief raster from a raster by considering the illumination angle and shadows.

- Click on the Spatial Analyst toolbar | Surface Analysis | Hillshade
 - For Input surface click on the down arrow and choose DesignRasClip
 - For Z factor type 3 (increasing the Z factor increases the exaggeration of the Hillshade)
 - For Output raster browse to the Folder on C: created in Step 1
 - Name the output DesignHill
 - Leave other options at their default
 - Click OK
-
- Repeat Step 10 to create a Hillshade for the ExistRasClip



10a. Hillshade Example

This is a Hillshade of the existing raster clip.



Conclusion. Save your ArcMap session with any name you choose, if you choose.

*Don't forget to turn off the Spatial Analyst extension when you are finished using it.
Tools | Extensions | uncheck Spatial Analyst | Close*

This concludes the tutorial covering what we talked about in Albuquerque. I would support experimenting with the other functions within Spatial Analyst. Just remember to always make backup copies of your original data. Then you can experiment all you desire without worry.



Keep in mind that the test data used in this tutorial was a very small sub-set of a much larger contour file. In practice the time it takes ArcMap to carry out the processes described within may be much longer.

**Don't forget to turn off the Spatial Analyst extension when you are finished using it!
Tools | Extensions | uncheck Spatial Analyst | Close**

I hope this tutorial is helpful ---
Janine Ferarese ☺

