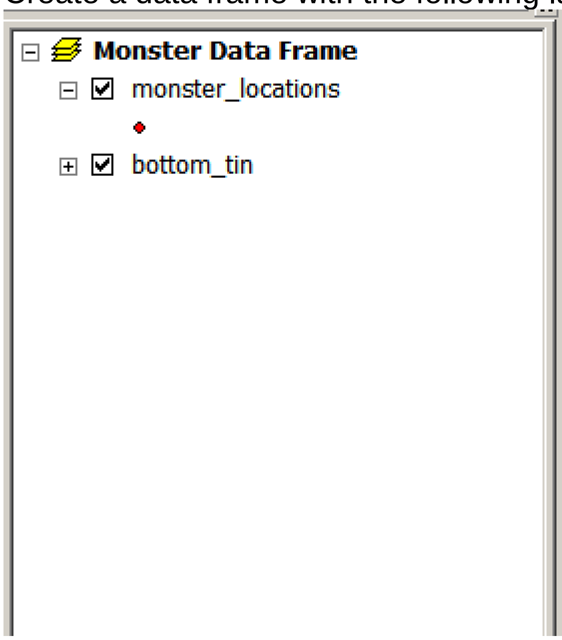
NRM435 Spring 2018 3D Lab

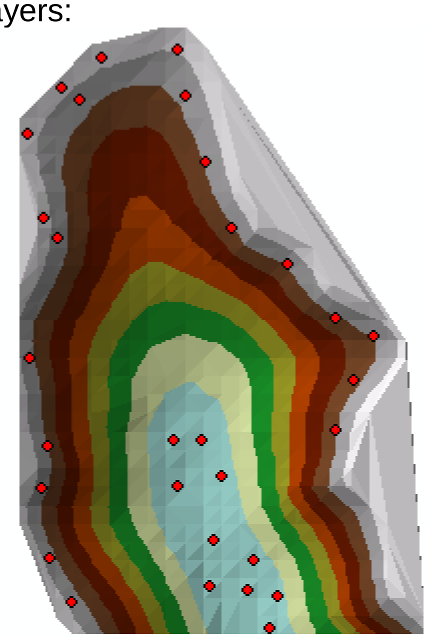
Download and unzip the file ***3D__lab.zip*** from:

http://dverbyla.net/nrm435/data/

3D ShapeFiles

Create a data frame with the following layers:





The point layer has the depth from surface to the monster as determined using sonar

monster_locations

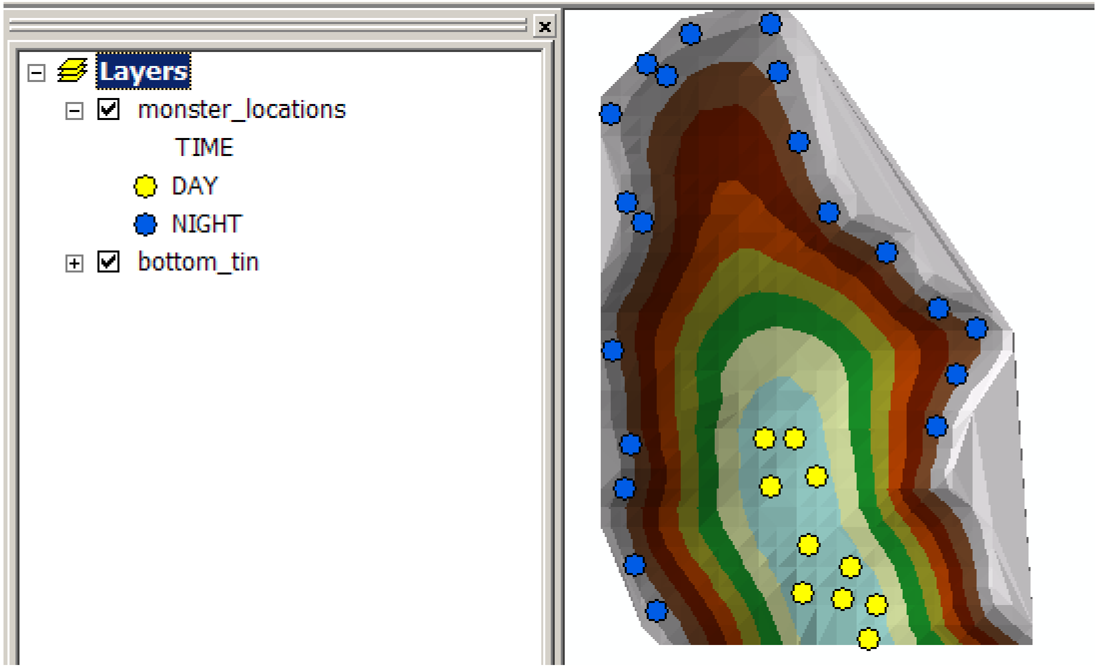
Shape *	TIME	DEPTH
Point	DAY	-197.746
Point	DAY	-195.704
Point	DAY	-192.017

Is the distribution of the monster different during the day versus the night? Use ArcGIS to determine the following information:

Determine the mean depth from the surface for the monster during day versus night time periods. Use the ***Summary Statistics*** tool with Time as the case field

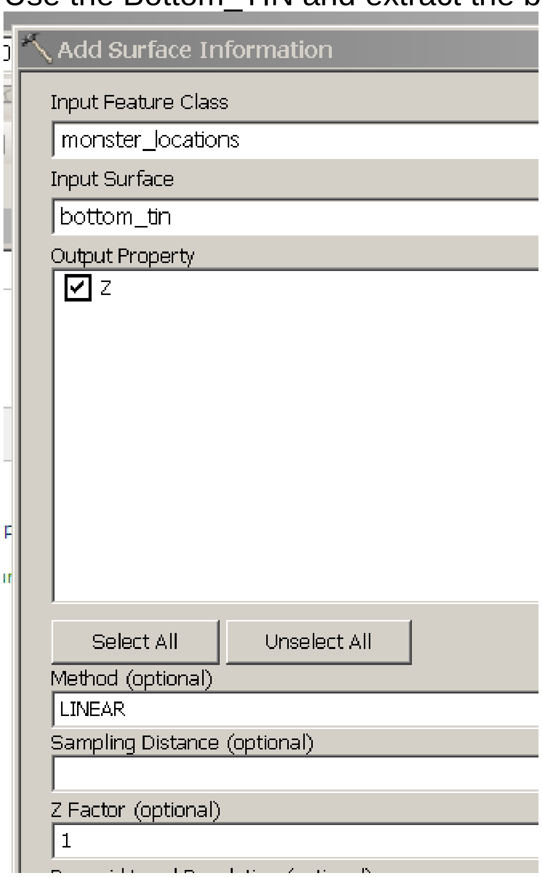
MeanDepth_By_Time

TIME	FREQUENCY	MEAN_DEPTH
DAY	10	-192.8
NIGH	20	-22.6



Next determine the mean height ***above the bay bottom*** during the day versus night time periods for the monster. To do this, you will transfer the bottom elevation values to each point. Check on the 3D Analyst extension to be able to use 3D Analyst tools.

Use the Bottom_TIN and extract the bottom elevation below each monster location.



monster_locations

	Shape *	TIME	DEPTH	Z
▸	Point	DAY	-197.746	-197.745529
	Point	DAY	-195.704	-195.704041
	Point	DAY	-192.017	-192.017487

Where Z is the bottom depth below each point X,Y location.

Compute the height above the bottom for each monster location.

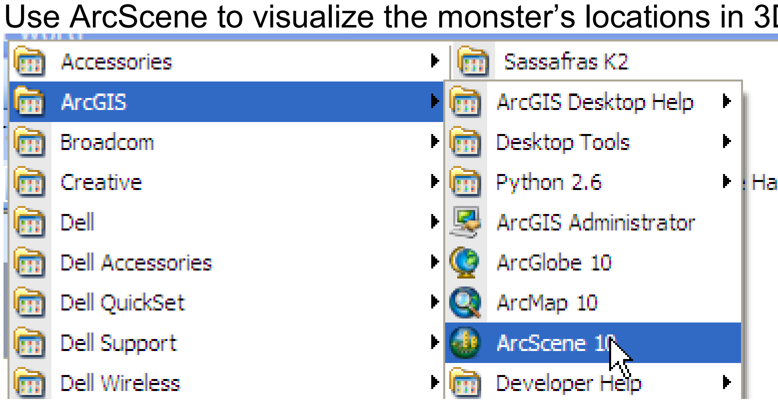
Shape	TIME	DEPTH	Z	ABOVE
Point	DAY	-197.746	-197.7455	0.000
Point	DAY	-195.704	-195.7040	0.000
Point	DAY	-192.017	-192.0174	0.000
Point	DAY	-196.809	-196.8090	0.000
Point	DAY	-194.609	-194.6091	0.000
Point	DAY	-195.475	-195.4754	0.000
Point	DAY	-186.652	-186.6521	0.000
Point	DAY	-189.4	-189.4003	0.000
Point	DAY	-189.273	-189.2725	0.000
Point	DAY	-190	-190	0.000
Point	NIGHT	-29.001	-39.00079	10.000
Point	NIGHT	-33.834	-41.83383	8.000
Point	NIGHT	-35.814	-45.81353	10.000

Then determine the mean distance above the bottom for monster locations during the day versus the night.

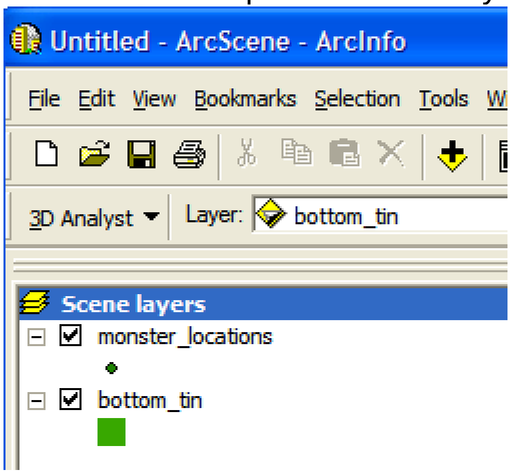
TIME	FREQUENCY	MEAN_ABOVE
DAY	10	0.00
NIGHT	20	12.20

So the monster was on the bottom during the day and at least 8 meters above the bottom during the night.

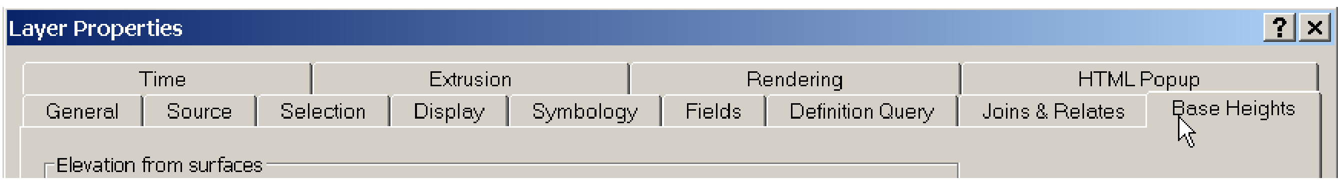
Use ArcScene to visualize the monster's locations in 3D. Start ArcScene

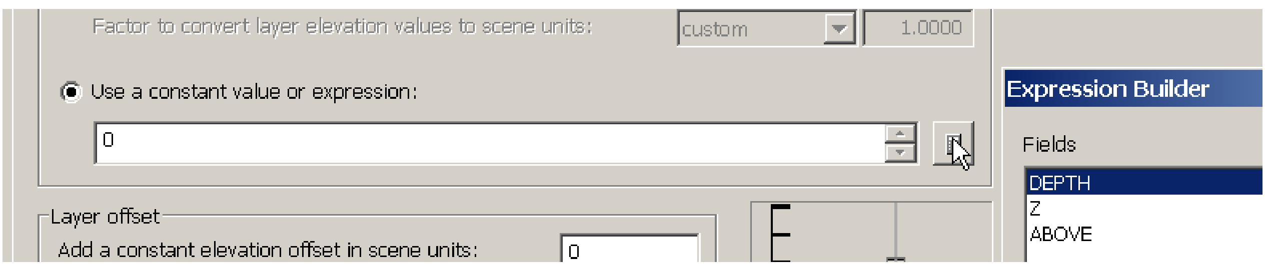


Add the TIN and point theme into your ArcScene data frame.

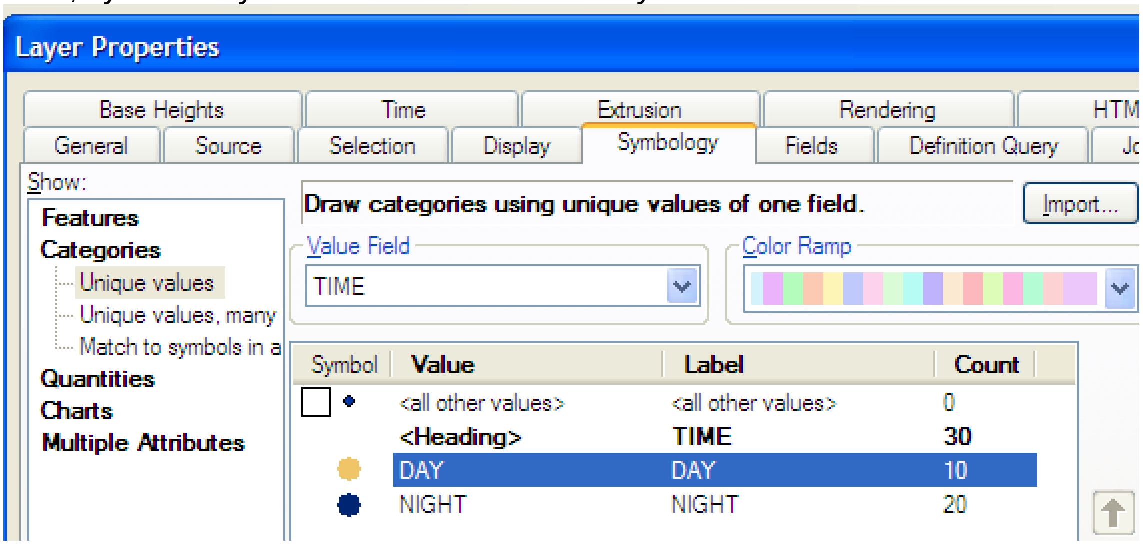


Specify the field representing the elevation at each monster location.

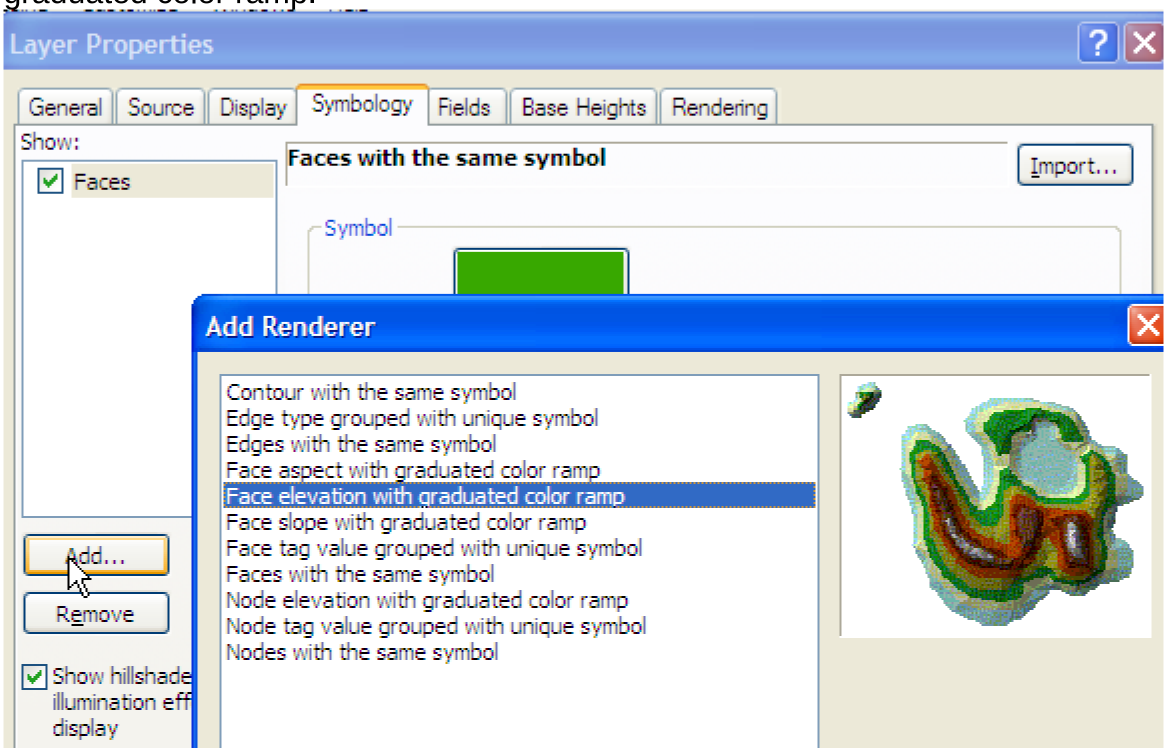


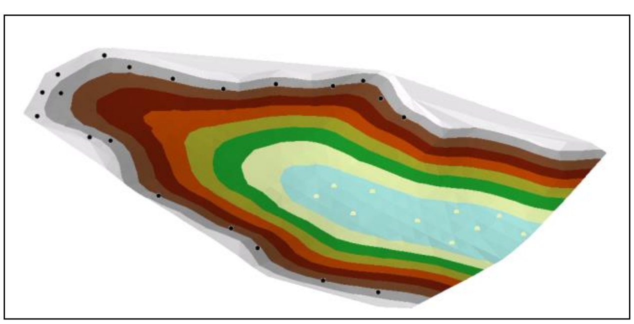


Next, symbolize your 3D monster locations by time.

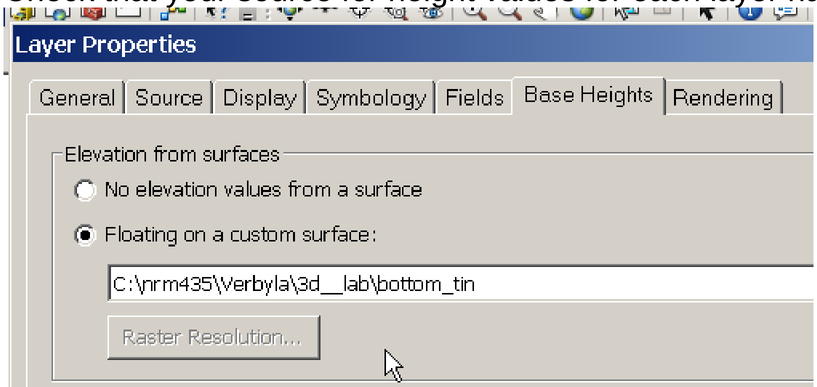


Next symbolize your TIN so the triangle faces are symbolized by elevation using a graduated color ramp.

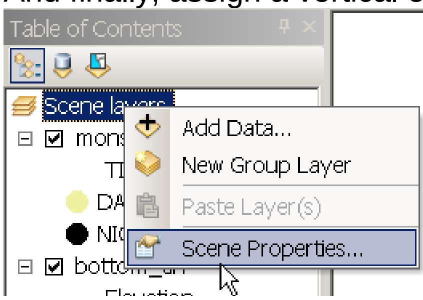


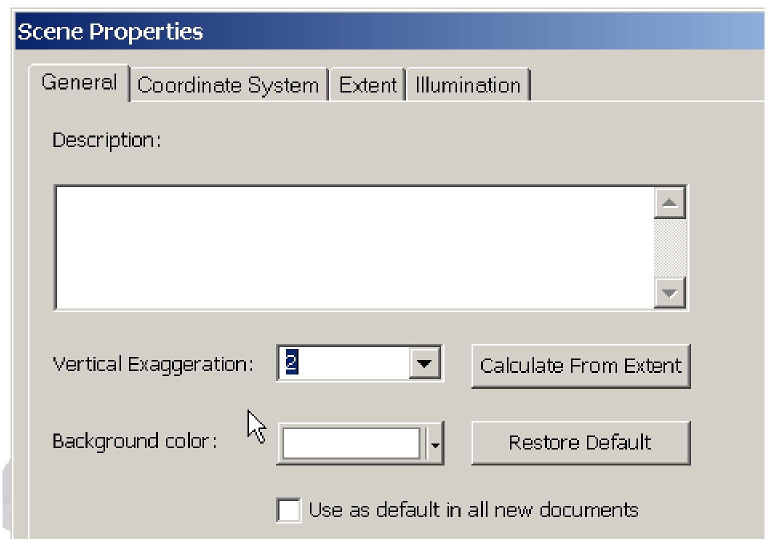


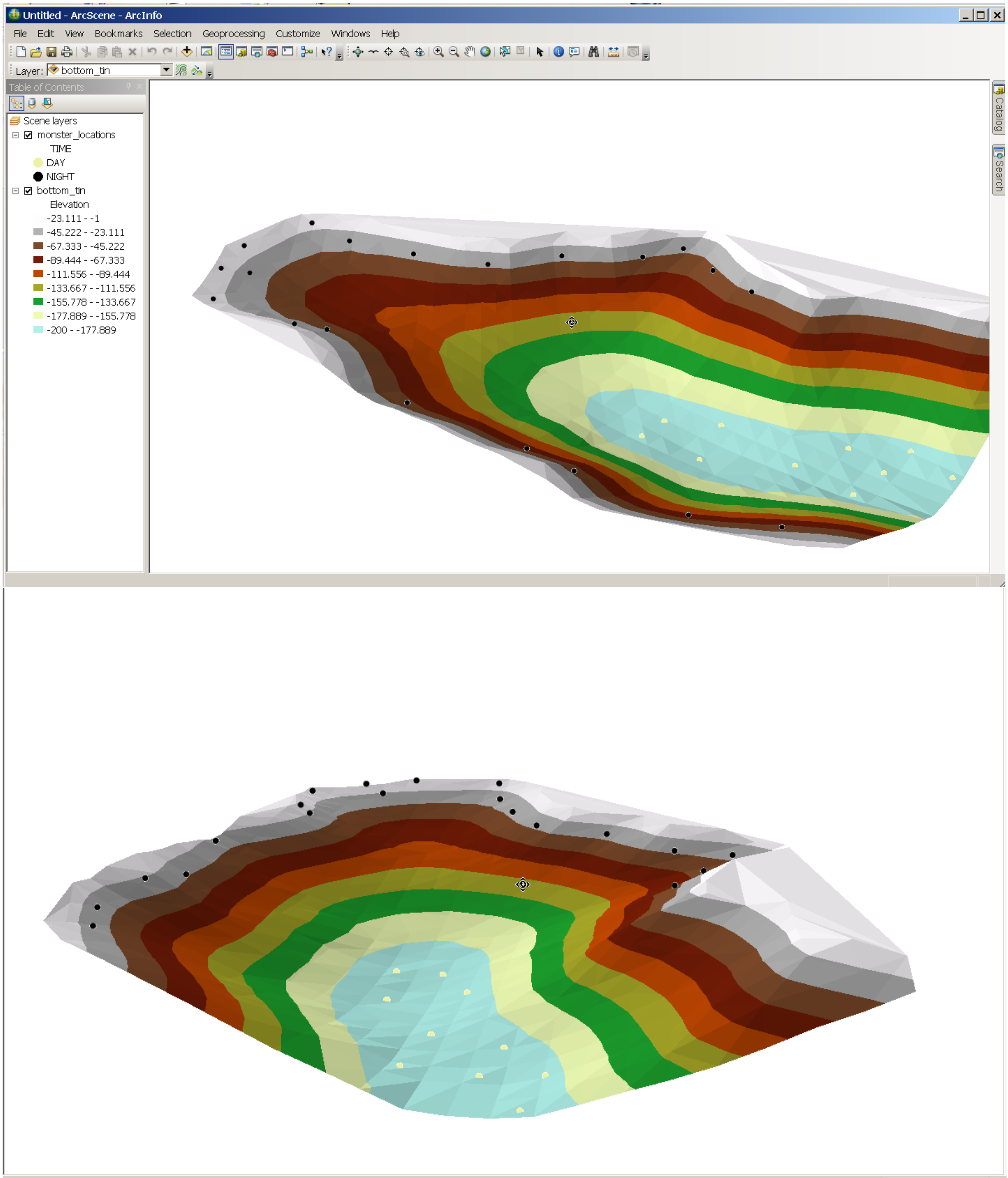
Check that your source for height values for each layer have been set.



And finally, assign a vertical exaggeration value for your data frame.





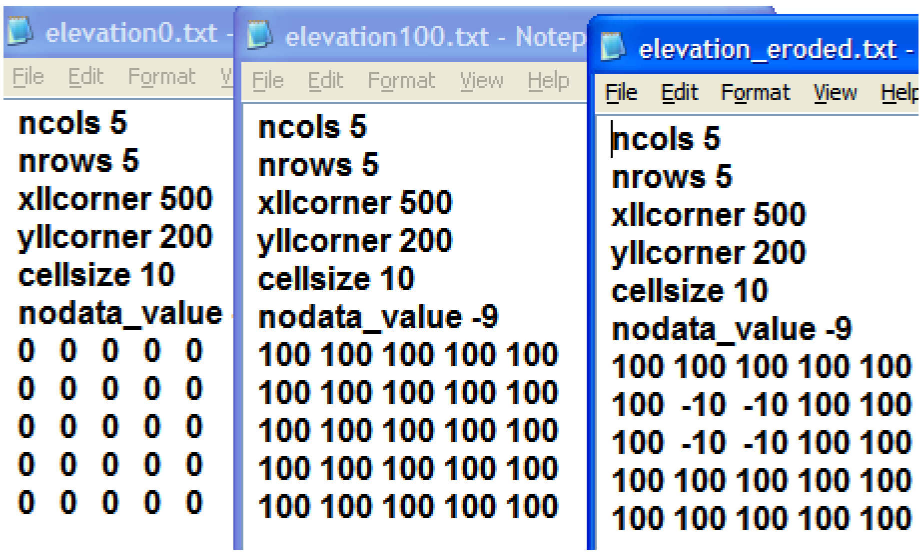


Once again, the monster is deep and at the bottom during the day, and near the surface, in the shallows at night.

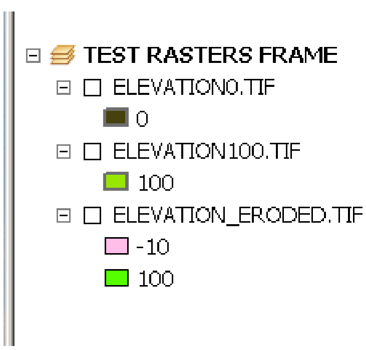
Exit out of ArcScene and back to Arcmap…

Cut/Fill Estimates

You can estimate the volume of cut/fill with rasters or TiNs. Start by creating three test rasters that you know the elevation of each cell…you downloaded the following text files with the lab data:



Use the **ASCII to Raster** tool to create 3 integer tif rasters from these 3 text files.



Elev0.tif

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

Elev100.tif

100	100	100	100	100
100	100	100	100	100
100	100	100	100	100
100	100	100	100	100
100	100	100	100	100

Elev_eroded.tif

100	100	100	100	100
100	**-10**	**-10**	100	100
100	**-10**	**-10**	100	100
100	100	100	100	100
100	100	100	100	100

If you have an increase of elevation of 100, what is the total volume filled for the elevation extent? Each cell is 10 X10 = 100m^2

so each cell would gain in volume 100m^2 * 100m elevation gain = 10,000 m^3
5 rows X 5 cols * 10,000 m^3 = ***volume gain of 250,000*** cubic meters

Use the spatial analyst toolbox, surface toolset, ***Cut/Fill*** tool

Use your Elev0.tif as your before raster, and your Elev100.tif as your after raster.

elev_0_to100.tif

Value	Count	VOLUME	AREA
1	25	-250000	2500

Notice that net gain is coded as a negative volume, loss would be a positive volume

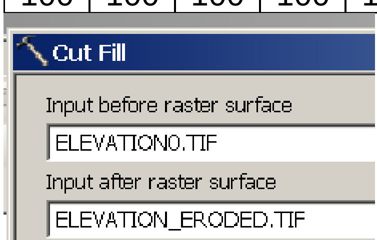
VOLUME
-250000

Next conduct a cut/fill where some cells gain elevation and others loose elevation…
Time1

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

Time2

100	100	100	100	100
100	-10	-10	100	100
100	-10	-10	100	100
100	100	100	100	100
100	100	100	100	100



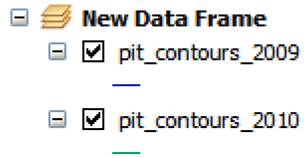
Count	VOLUME
21	-210,000
4	4,000

So 21 pixels gained a height of 100 each, while 4 pixels decreased by -10 each

3D Analyst

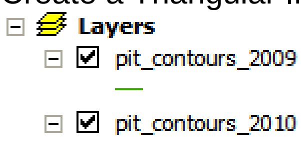
You can also do a cut/fill analysis using triangulated irregular networks as representations of an elevation surface. You have a contour themes of a gravel pit from the year 2000 and 2009. ***All X,Y, Z units are in feet*** in this example.

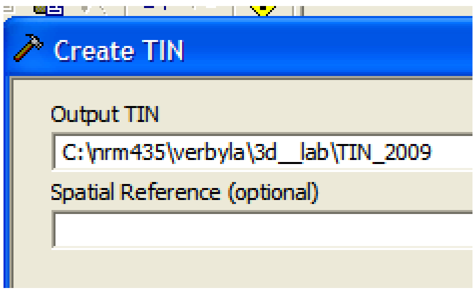
Start a new data frame with the following themes:



1) Estimate the volume of gravel extracted between 2009 and 2010 in cubic meters.

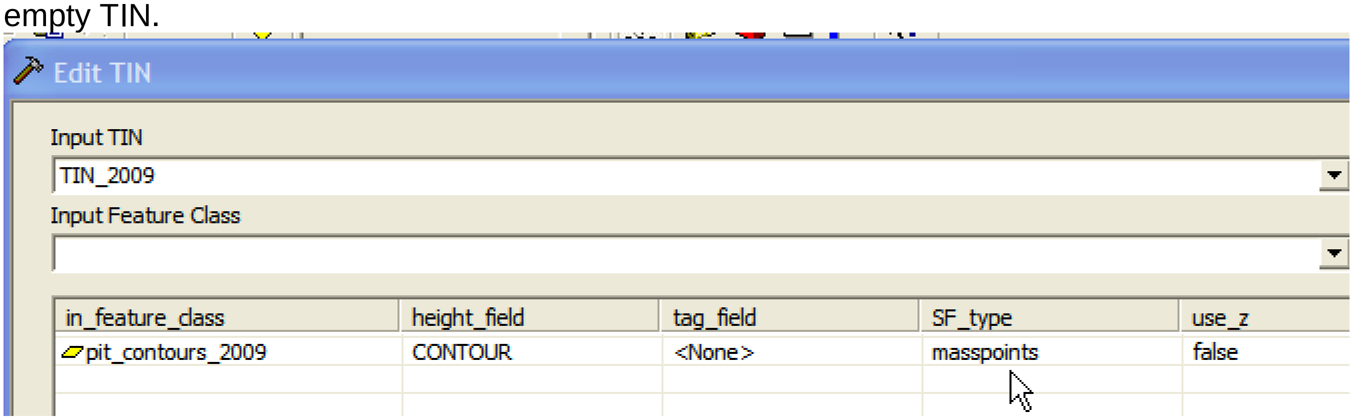
Create a Triangular Irregular Network Theme from each contour theme





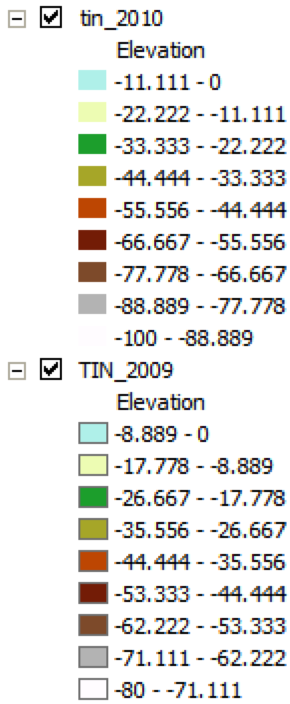
create an empty Triangulated Irregular Network dataset for 2009 and for 2010

Next use all the points and contour elevation value from each contour line to modify the empty TIN.

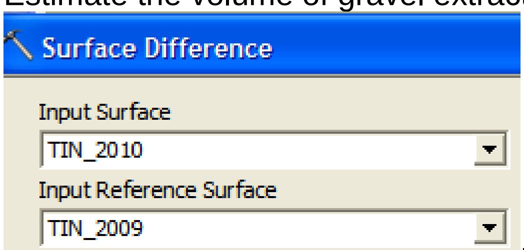


Repeat the process for the 2010 contours and associated TIN.

Symbolize your TINs with a color ramp based on the elevations of faces.



Estimate the volume of gravel extracted between the 2 time periods:



TIN_2010_2009_DIFFER

Shape *	Volume	SArea	Code
Polygon	36,797,118.3	2,771,340.0	-1
Polygon	0.0	160.4	0
Polygon	0.0	6,198.9	0

A Code of 0 represents no change, -1 represents loss, +1 represents gain.

So about 37 million ft^3 were extracted.

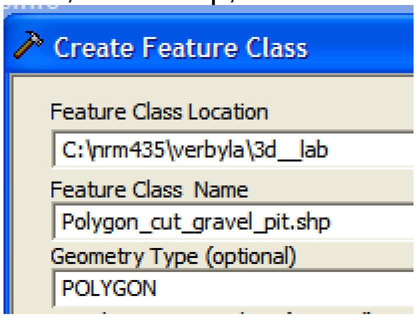
Convert volume from cubic feet to meters. There are 3.281 feet in one meter, therefore 1 cubic meter is 3.281^3 feet

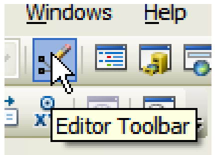
Cubic_M
1,041,825.8

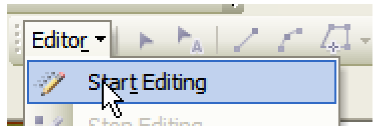
about 1 million cubic meters extracted.

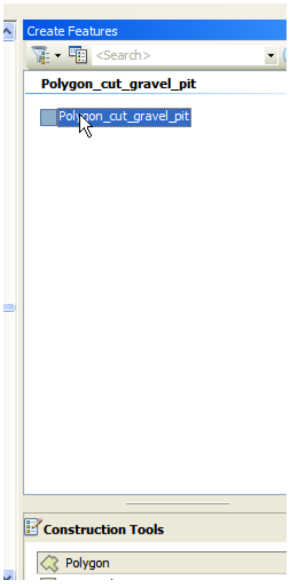
2) **Create a 3D layout showing a longitudinal view from the two dates**.

First, in Arcmap, create a new polygon theme that cuts your gravel pit down the long axis.

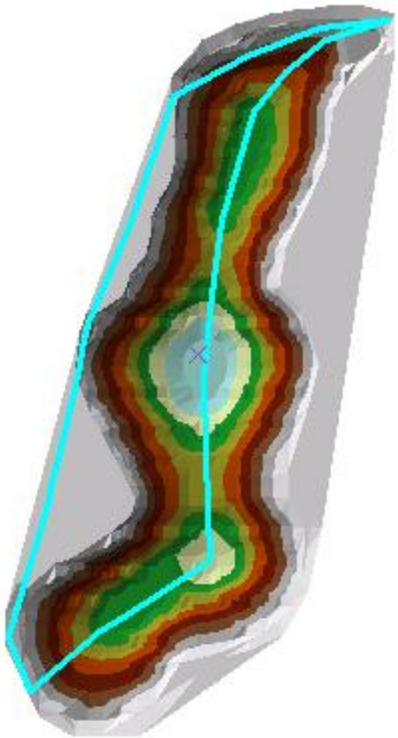




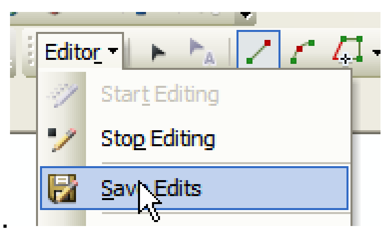




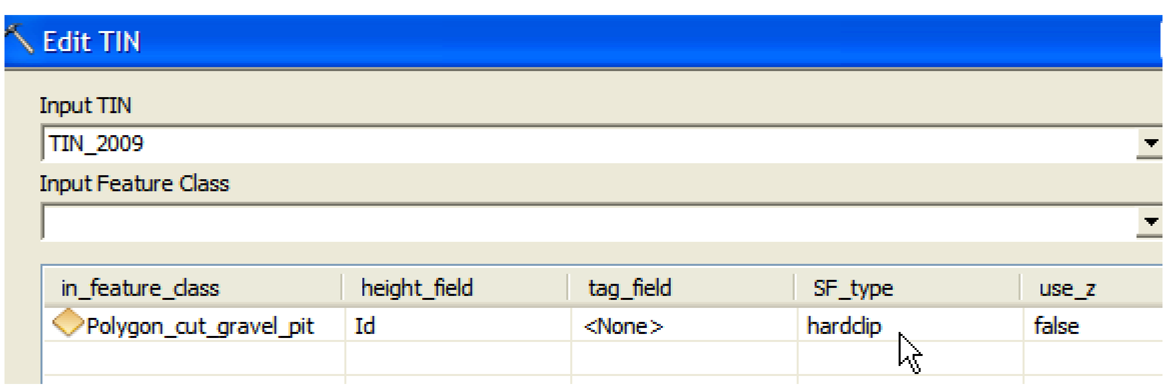
and create a polygon like the following figure.

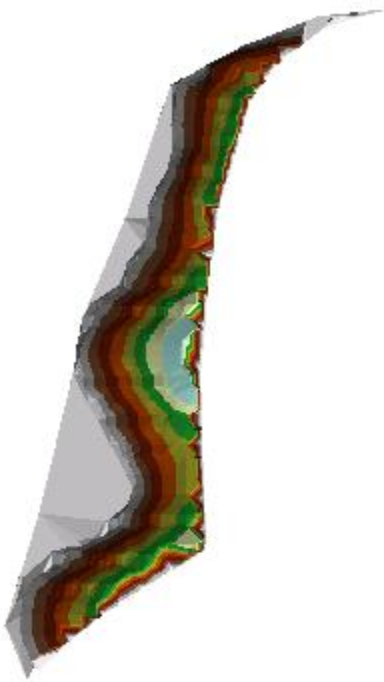


Save your edits and stop editing…



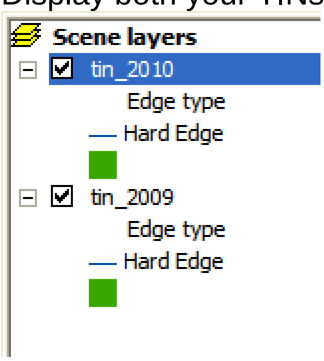
Use your polygon theme as a hard clip polygon to clip out each TIN.



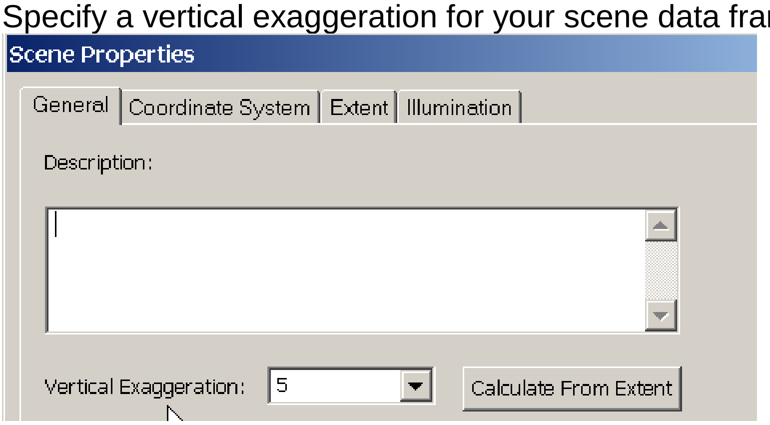


Save your arcmap document and exit out of Arcmap. Start Arcscene…

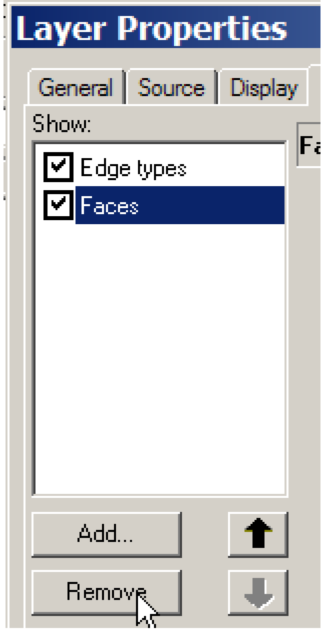
Display both your TINs in Arcscene.

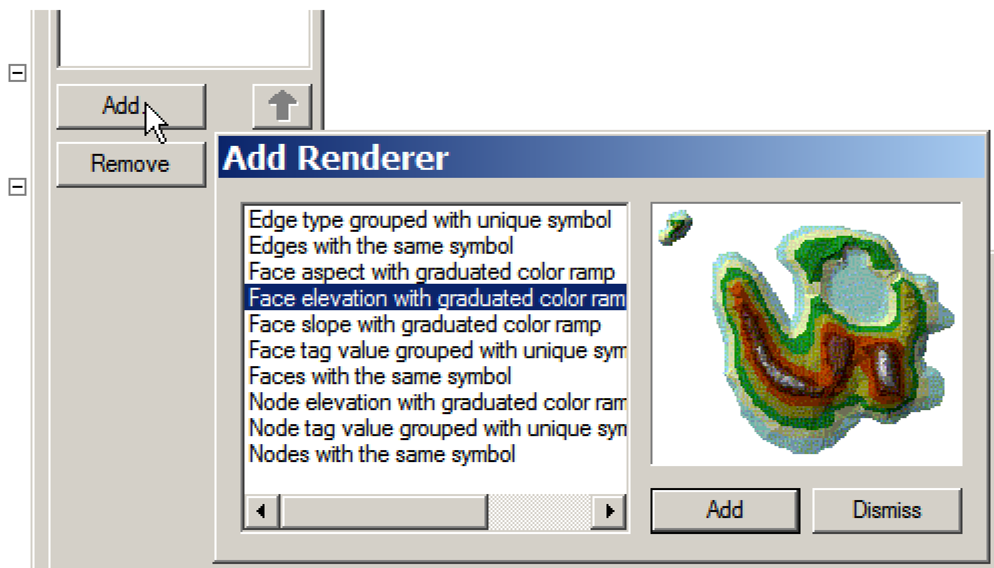


Specify a vertical exaggeration for your scene data frame:

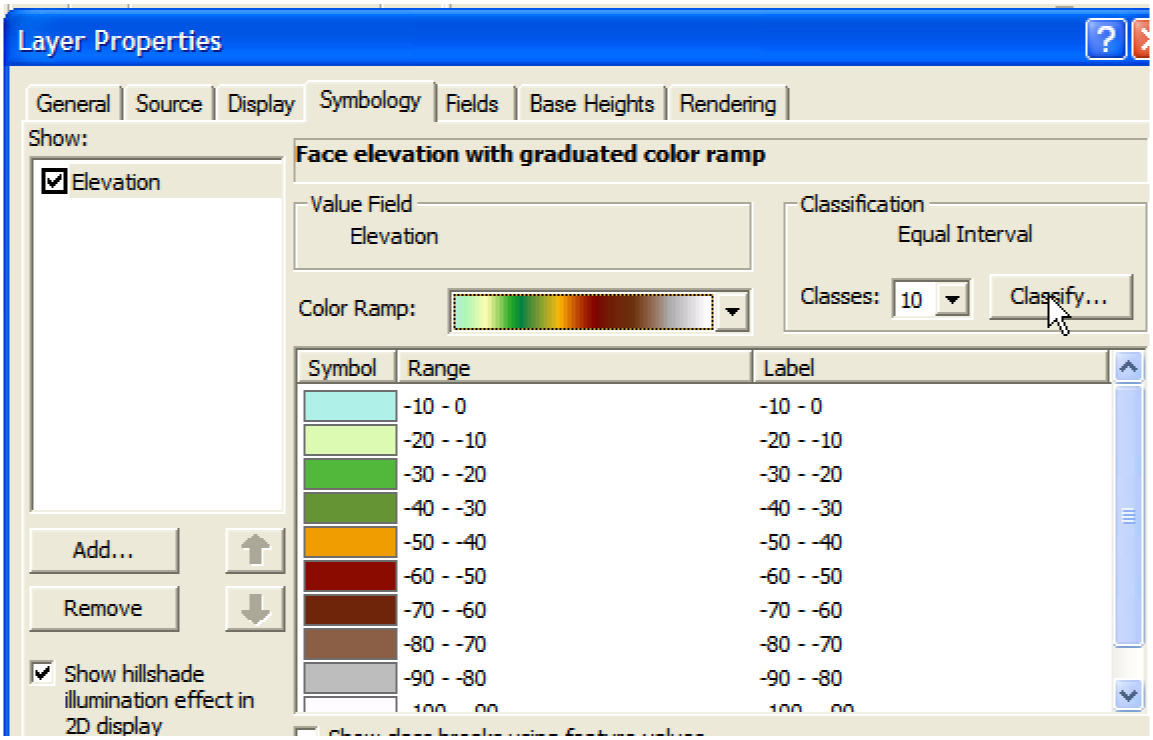


Change the symbology for your 2010 TIN…

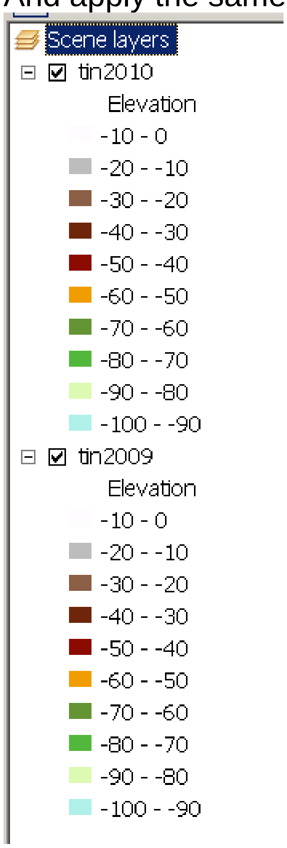




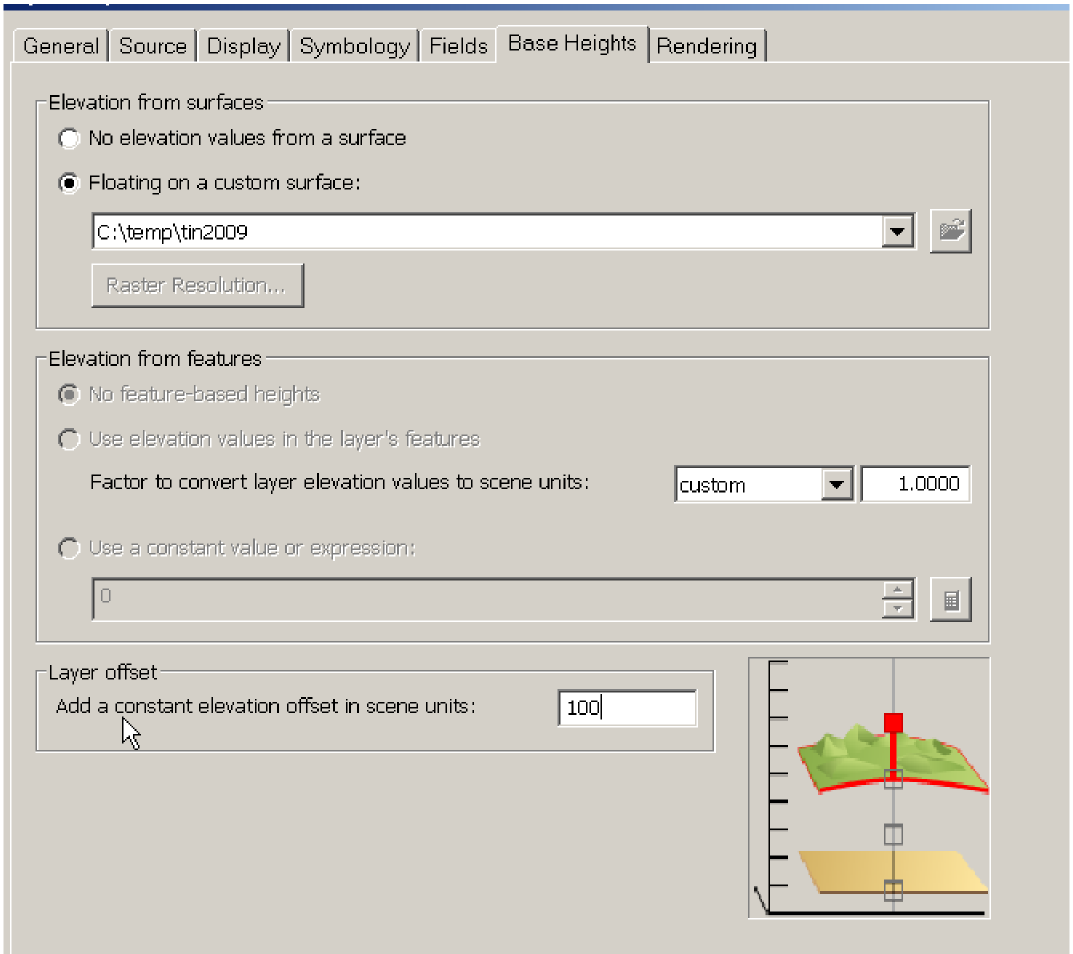
Edit the TIN legends so that ***each 10-meter elevation class has a unique color.***

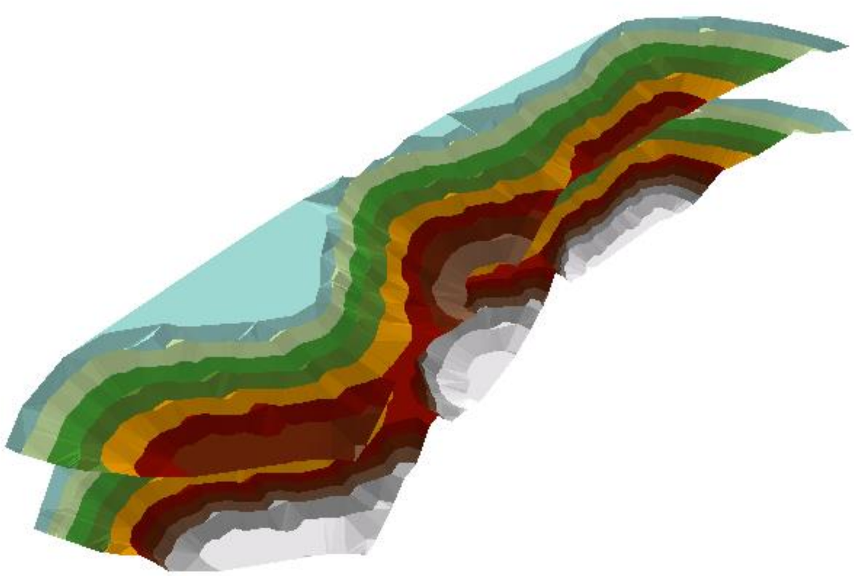


And apply the same classification/colors to your 2009 TIN



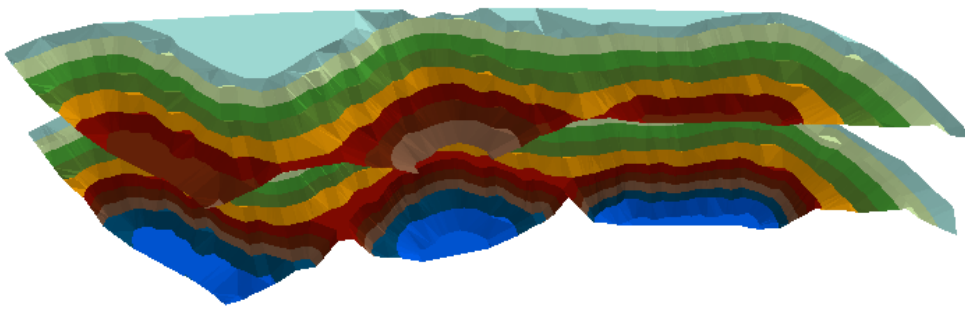
Raise your 2009 surface so that it floats 100 feet above your 2010 surface.

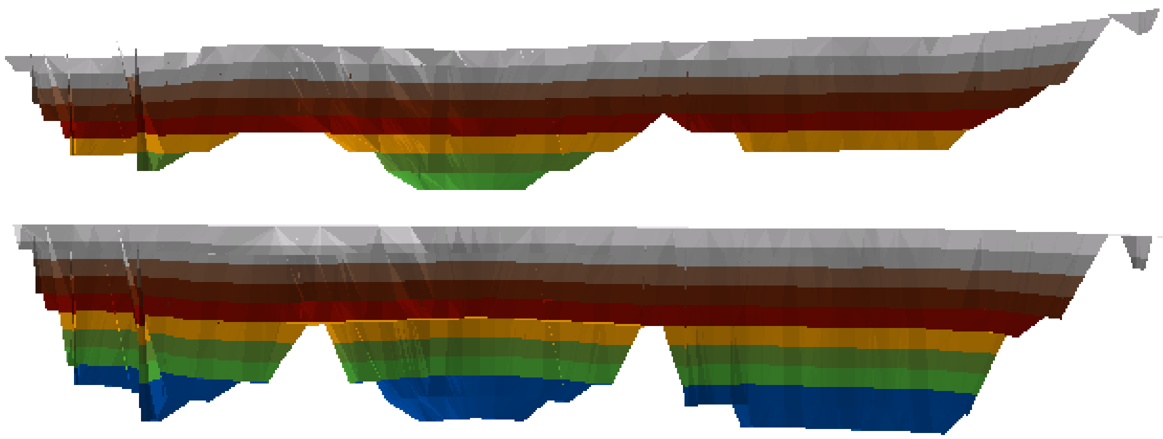




Notice that the deepest part of the 2009 gravel pit was -80 feet.

So change the 2010 TIN symbology such that all triangles deeper than -80 feet are a dark color.





The facets in blue represent areas where gravel was extracted.