

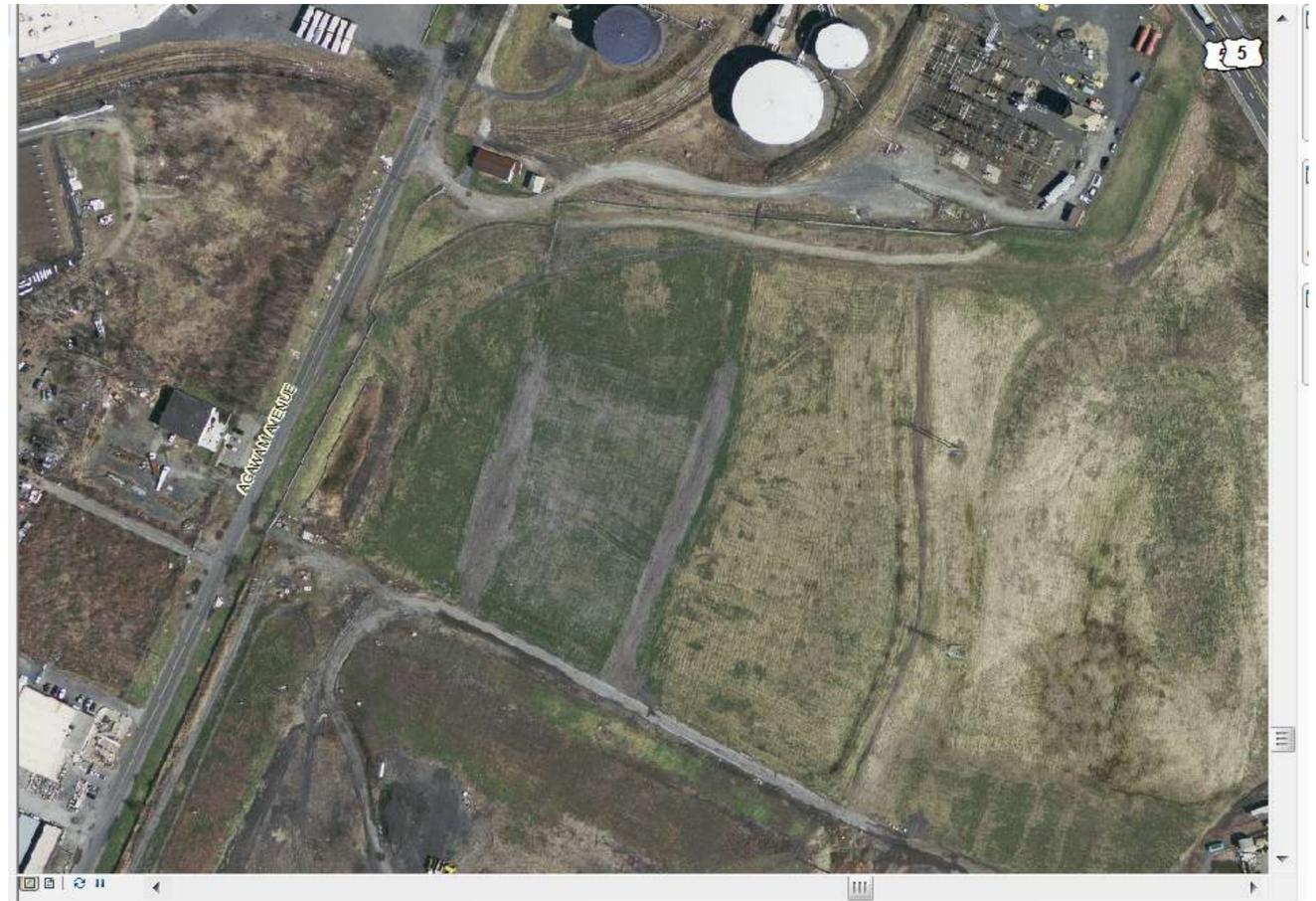
Determination of the Volume of Material Deposited in a Landfill

Bill Guazzo
william.guazzo@state.ma.us
Massachusetts DEP GIS
Springfield, Ma.

Site Location

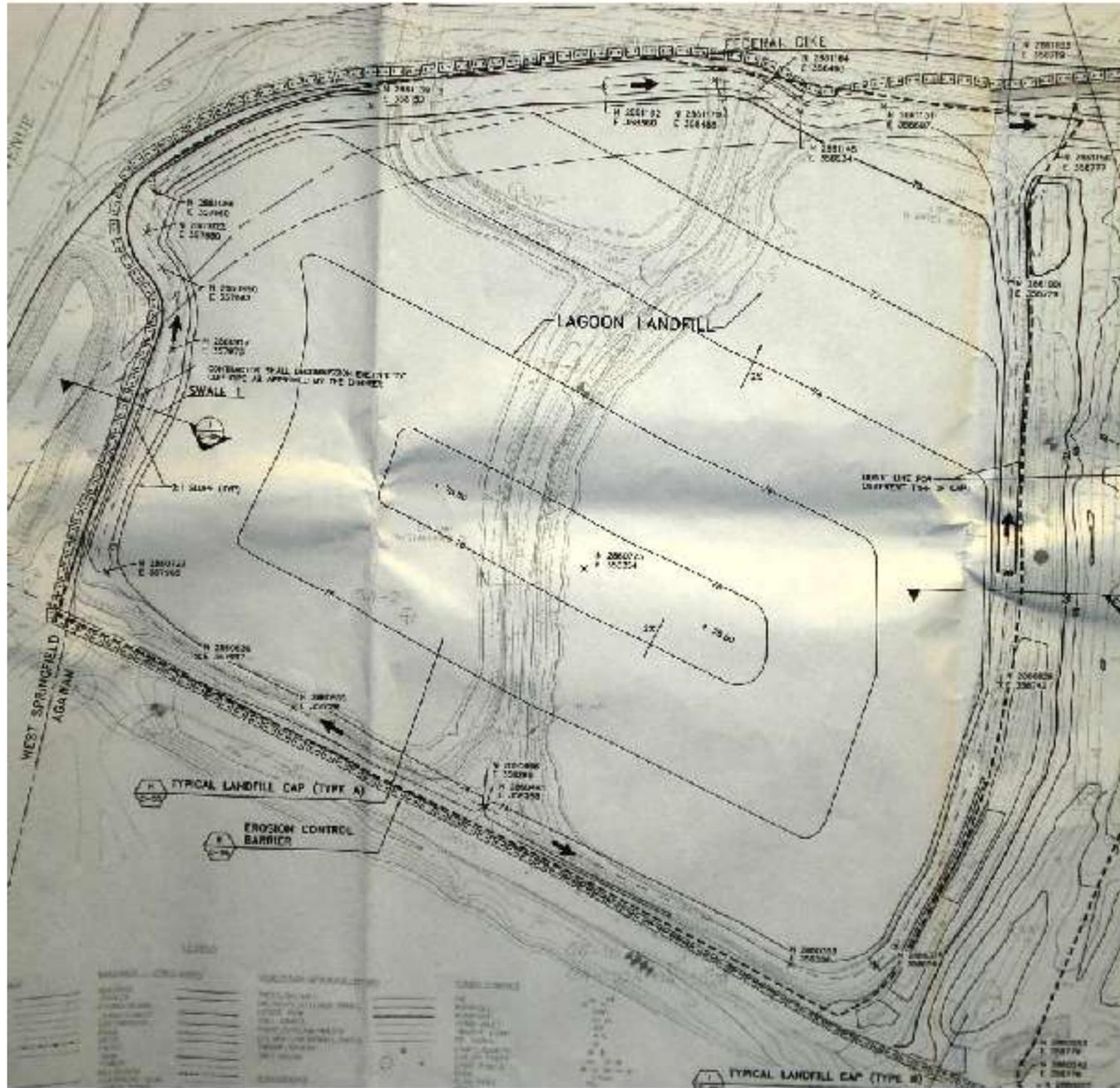


2005

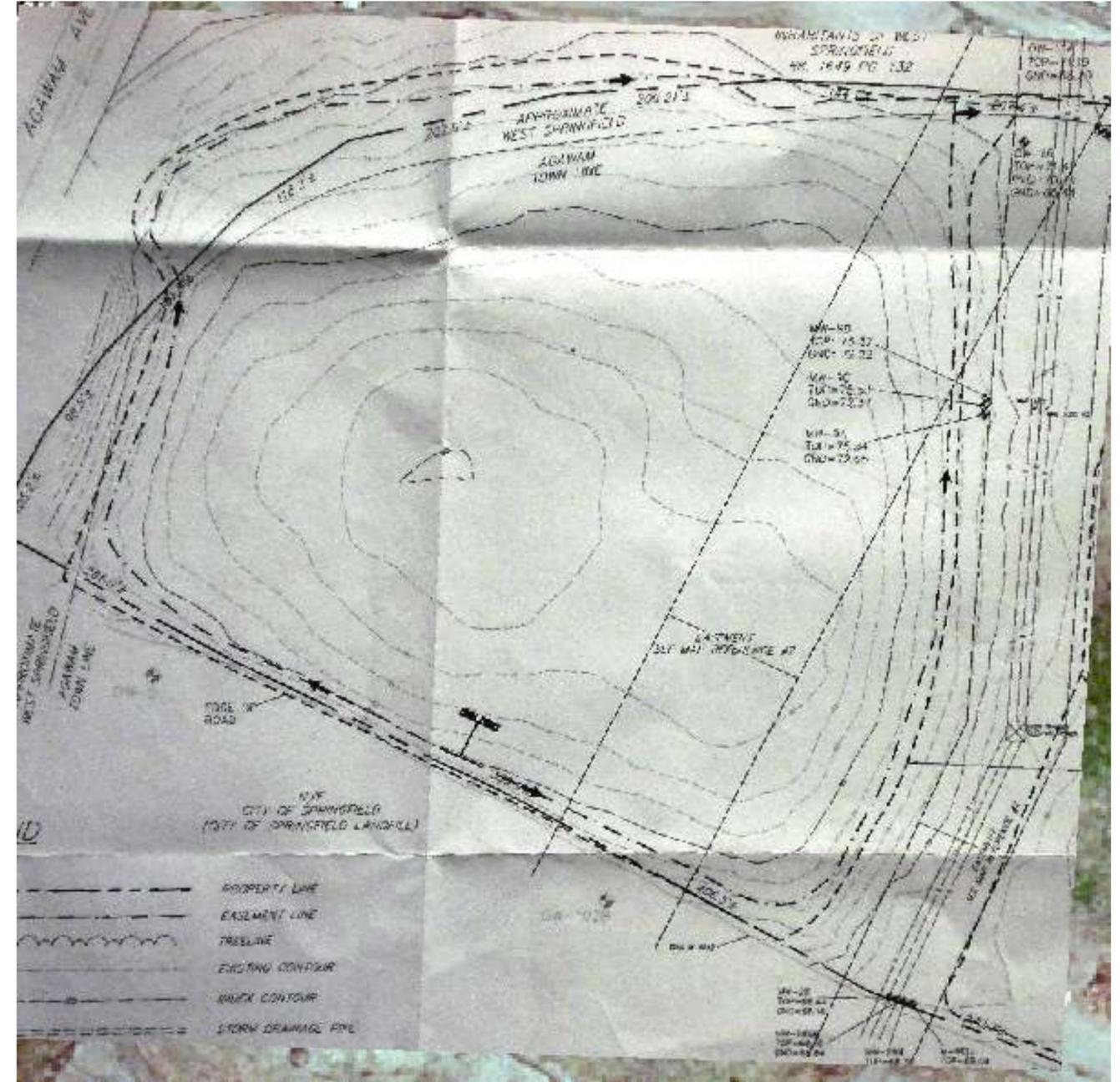


2009

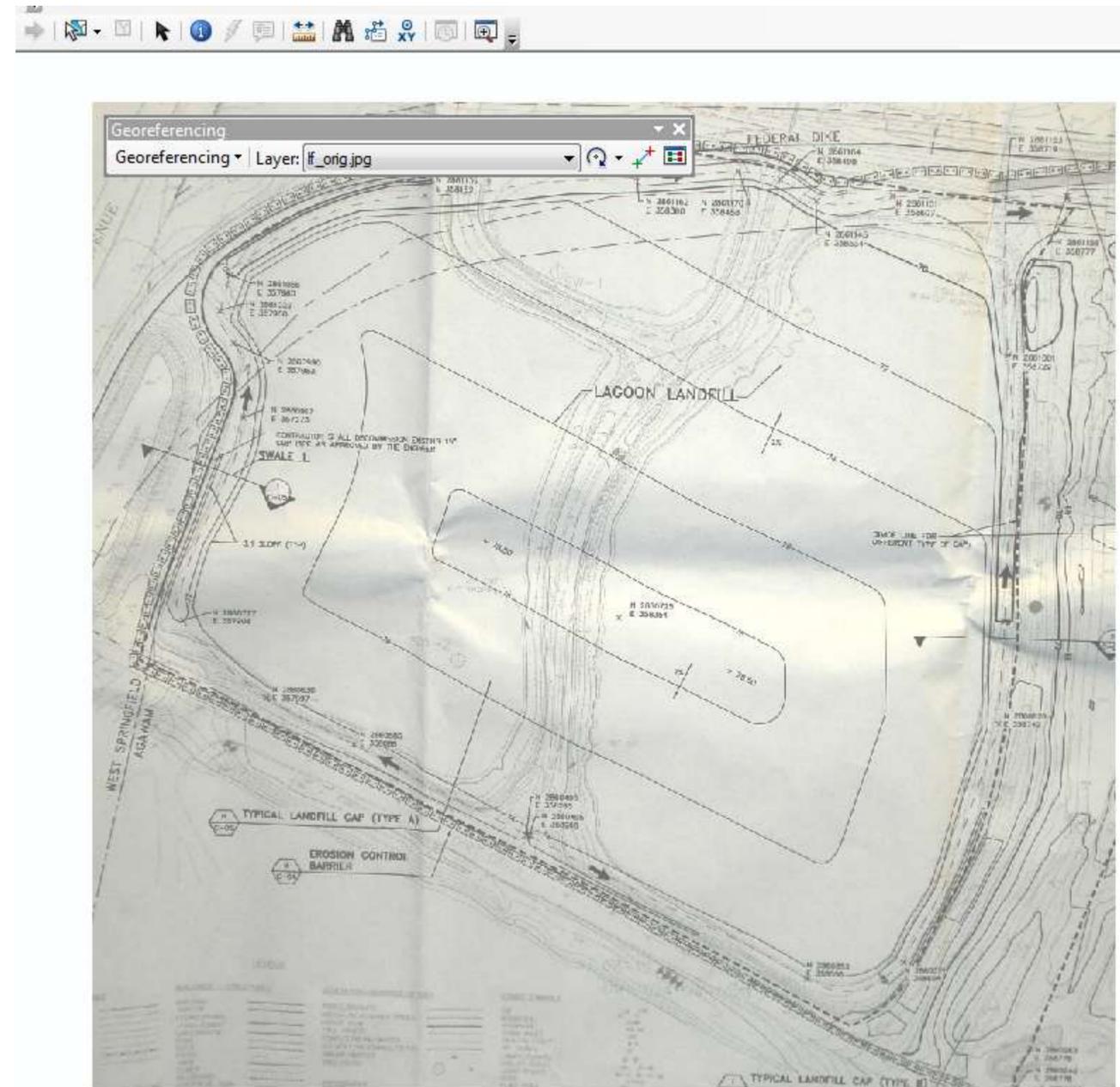
Paper Drawings



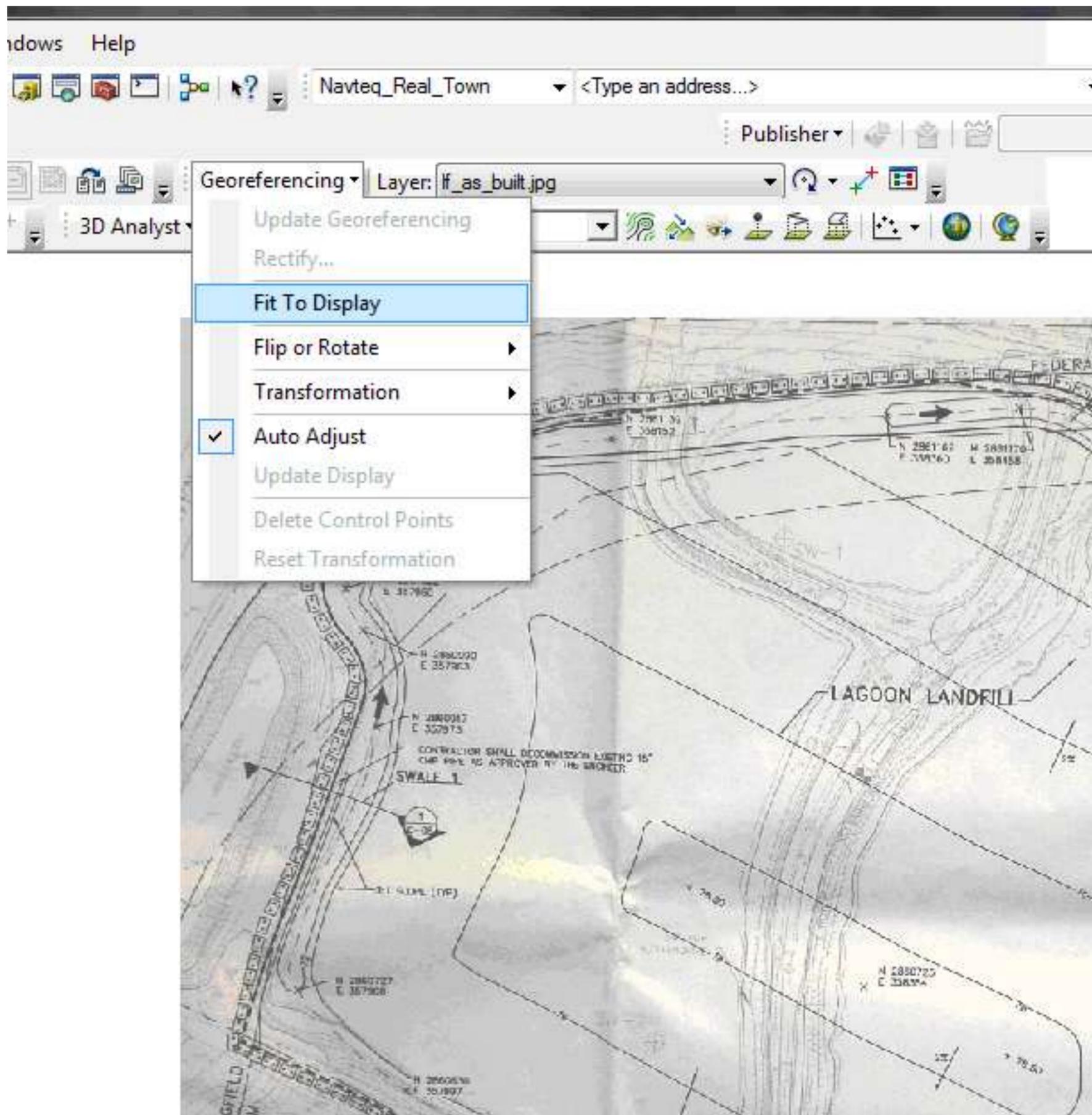
Original Design



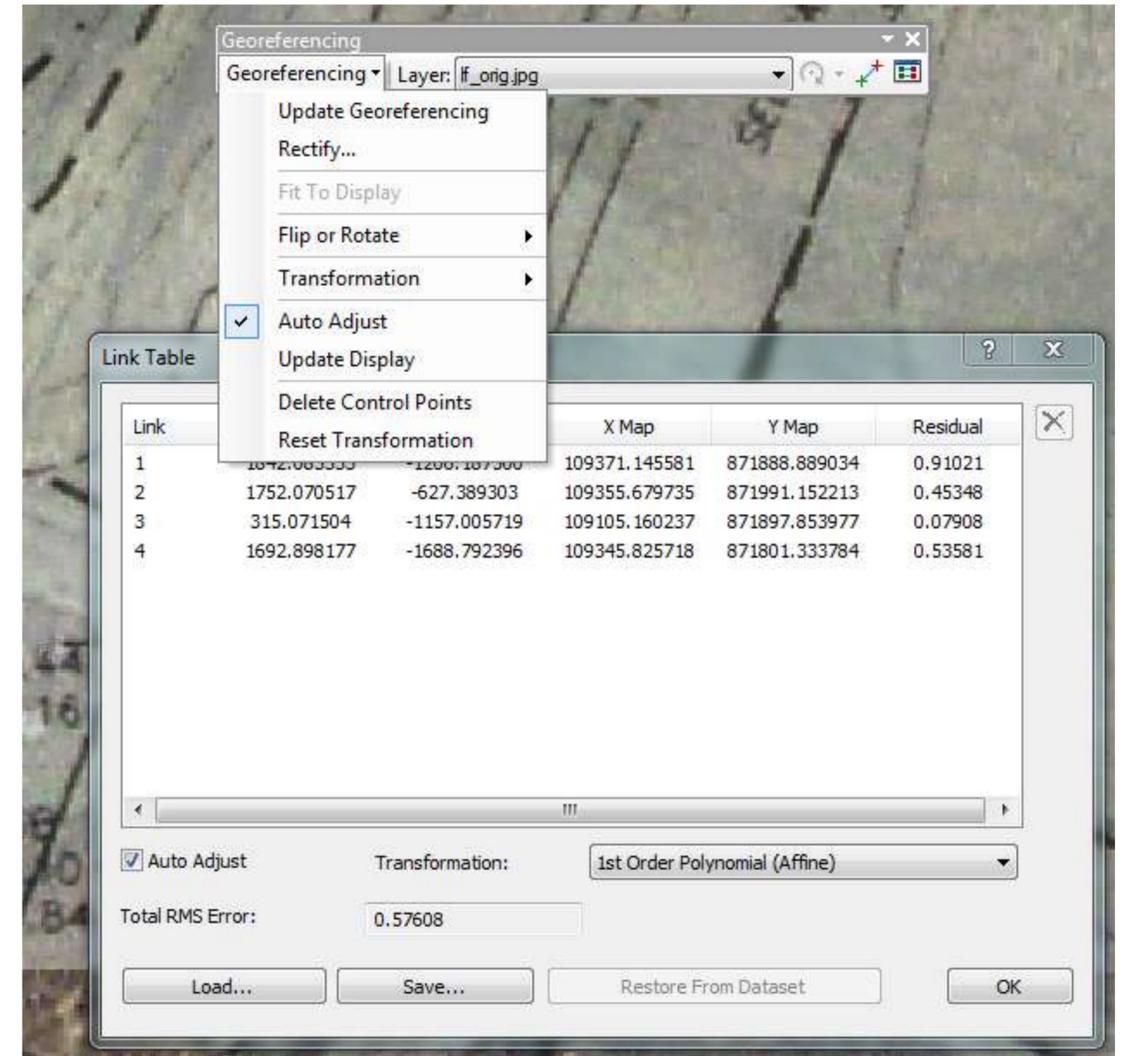
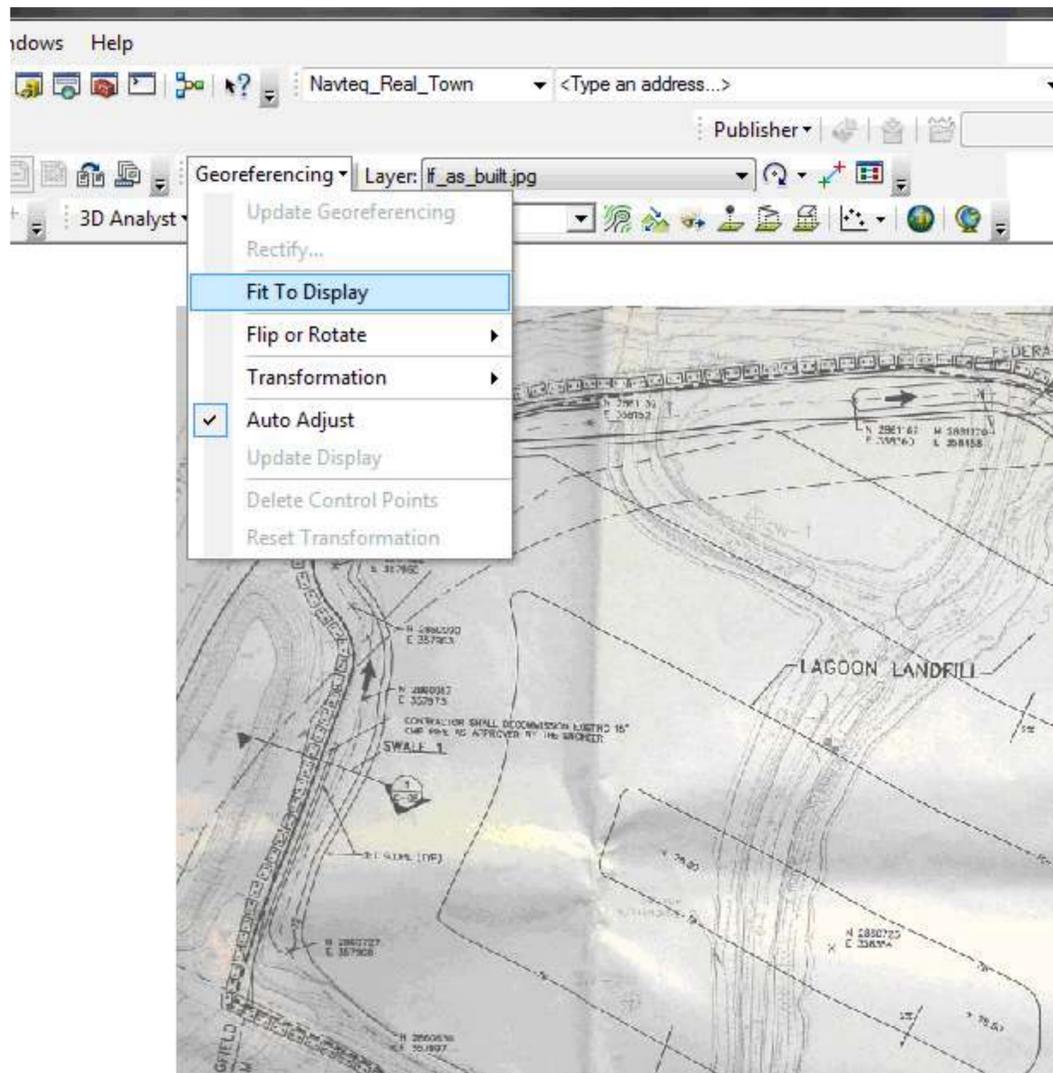
As Built



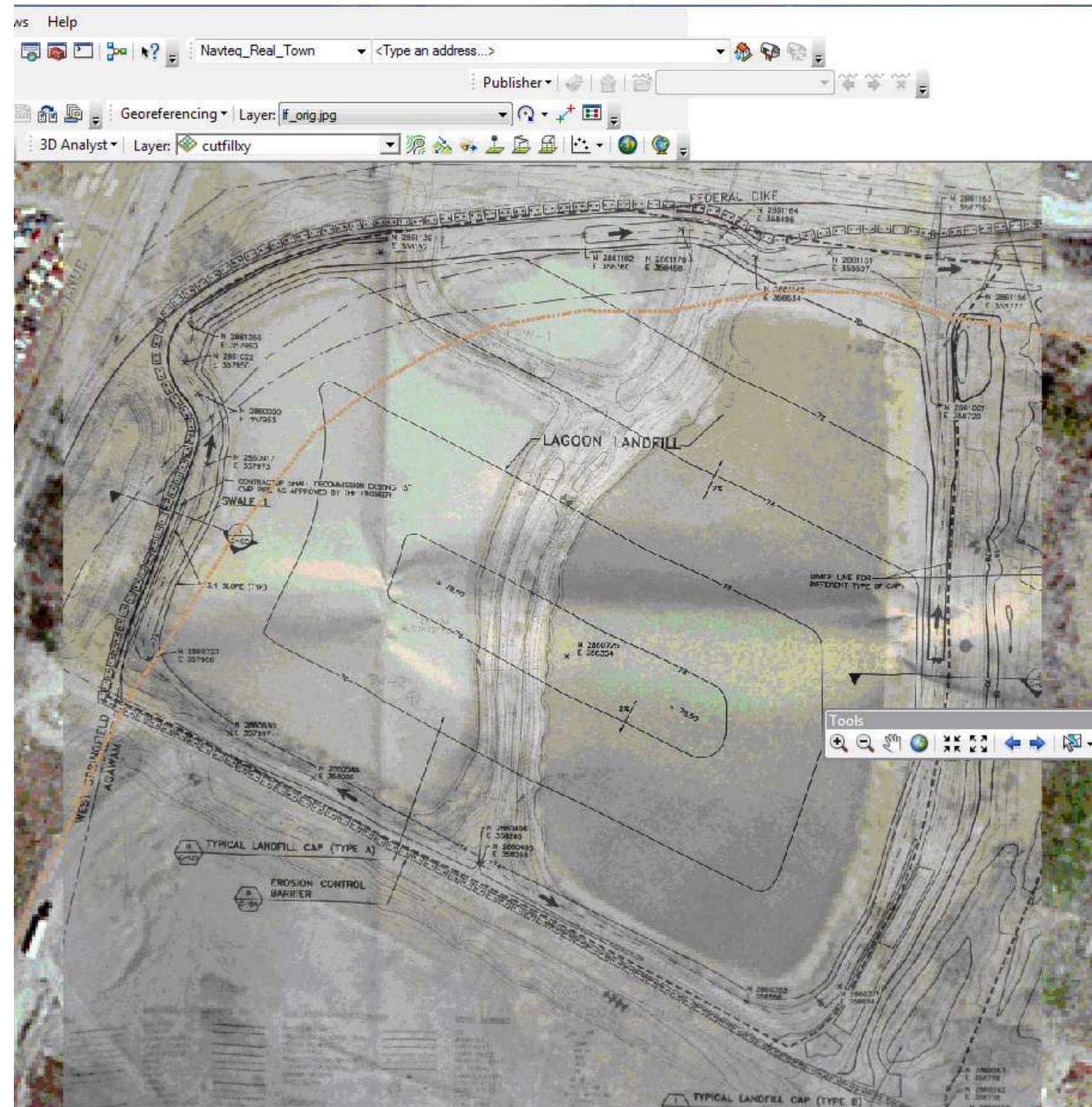
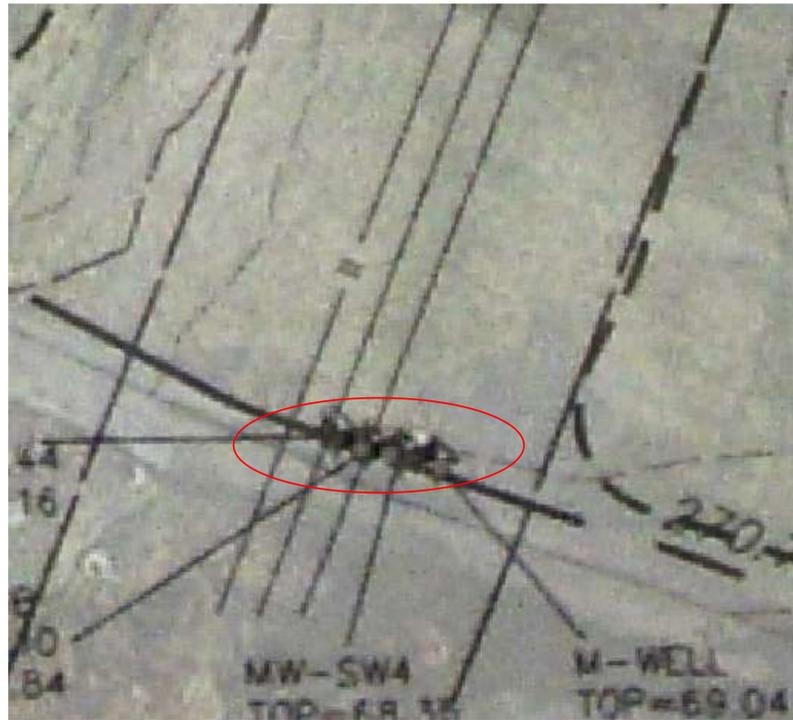
Initially any image will be in the drawing space. They will need to be converted to the aerial photo space.



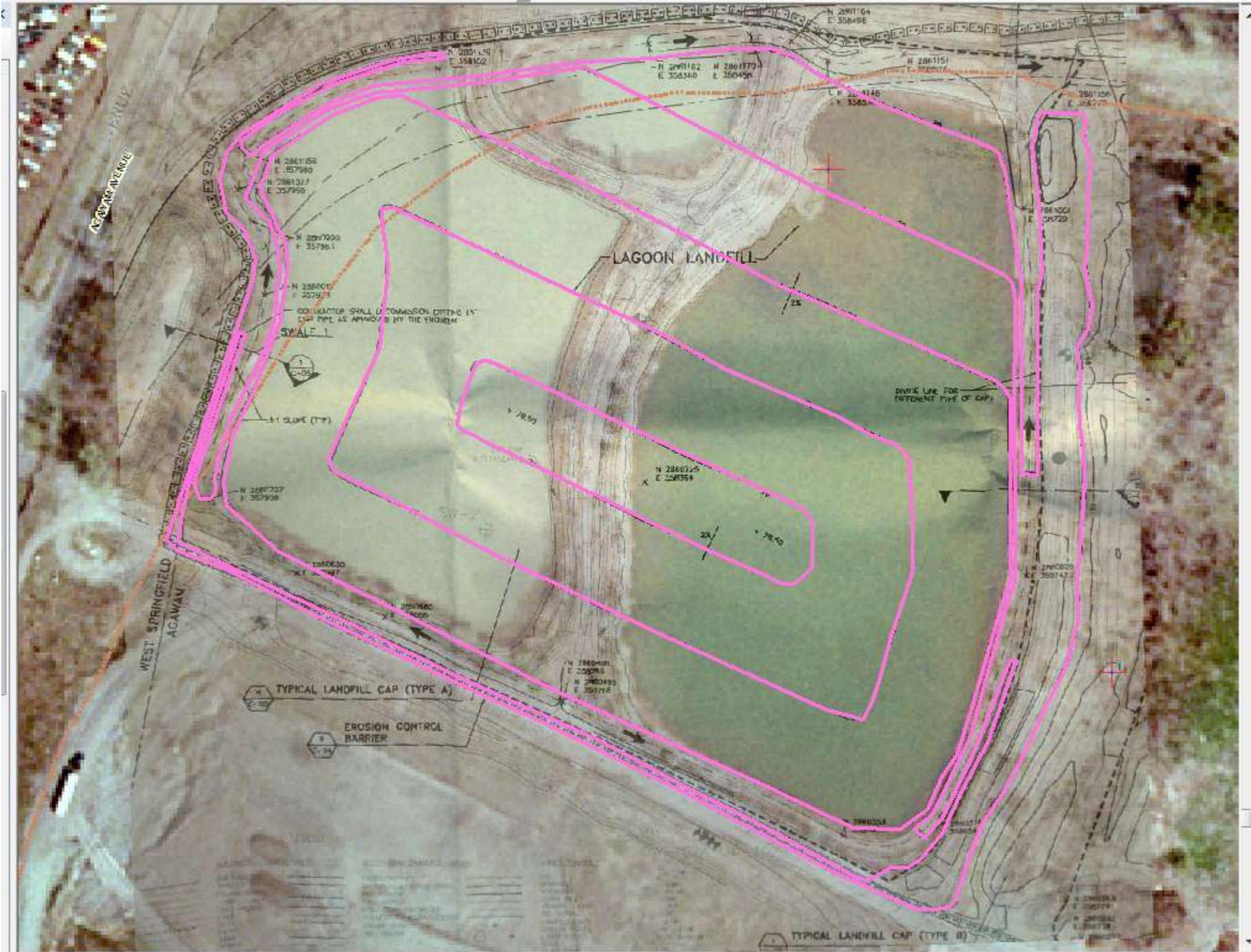
The Drawings can be Transformed using the Georeferencing Toolbar



Using Georeferencing – ‘Fit to Display’ and ‘Control Points’ the image can be moved into alignment with the aerial photo.



The plot is now georeferenced and ready for further processing.



Create Features

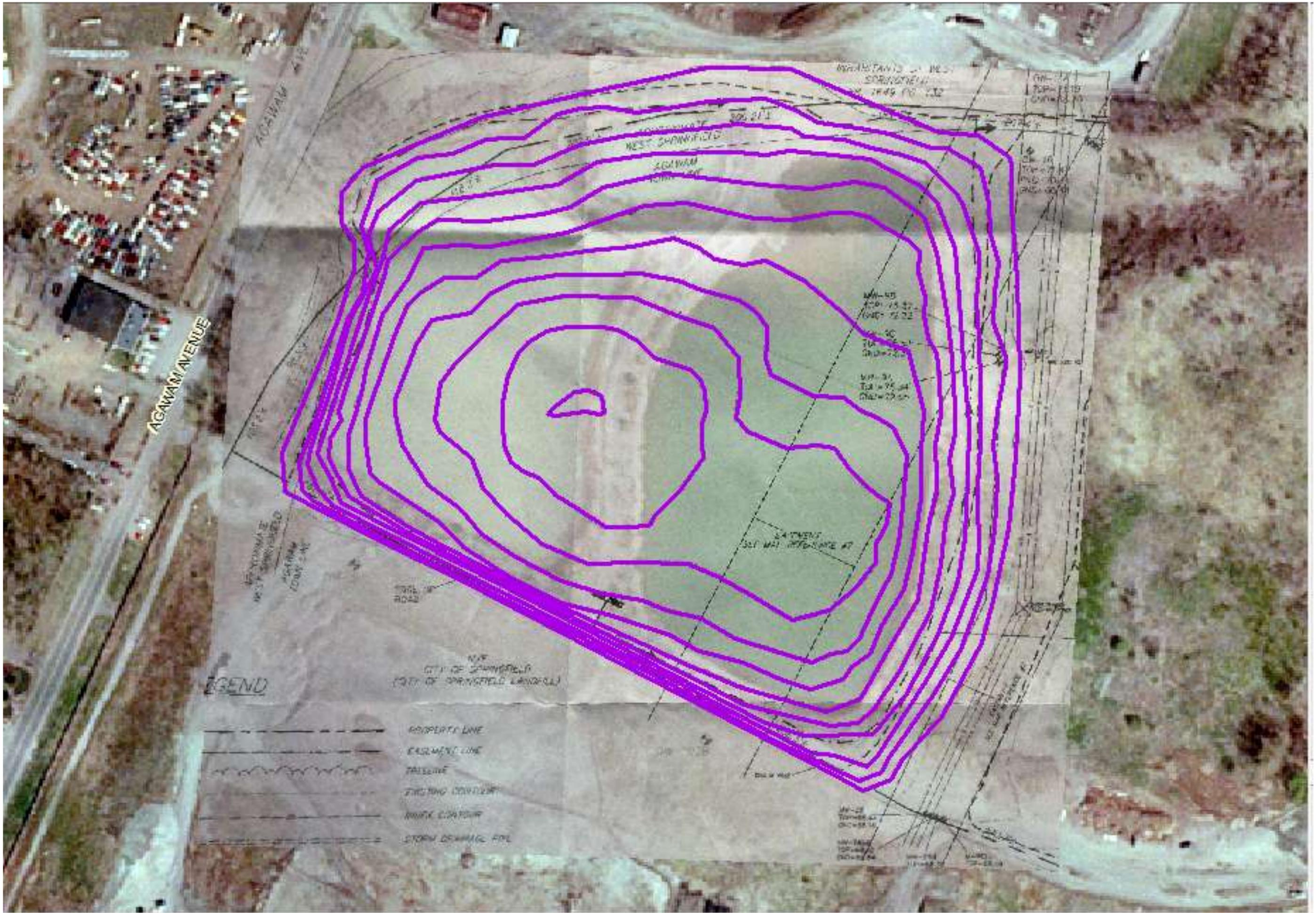
<Search>

lf_orig_contours

lf_orig_contours

Construction Tools

- Polygon
- Rectangle
- Circle
- Ellipse
- Freehand



AGAWAM AVENUE

LEGEND

- PROPERTY LINE
- EASEMENT LINE
- ~~~~~ TRAILLINE
- EXISTING CONTOUR
- UTILITY LOCATION
- STORM DRAINAGE PIPE

N/E
CITY OF SPRINGFIELD
(CITY OF SPRINGFIELD LANDFILL)

WPA-105
TOP-15.22
DATE-12.22

305.211

WEST SHOWNFIELD

AGAWAM

EASEMENT
30' W/1' REFERENCE AT

WPA-105
TOP-15.22
DATE-12.22

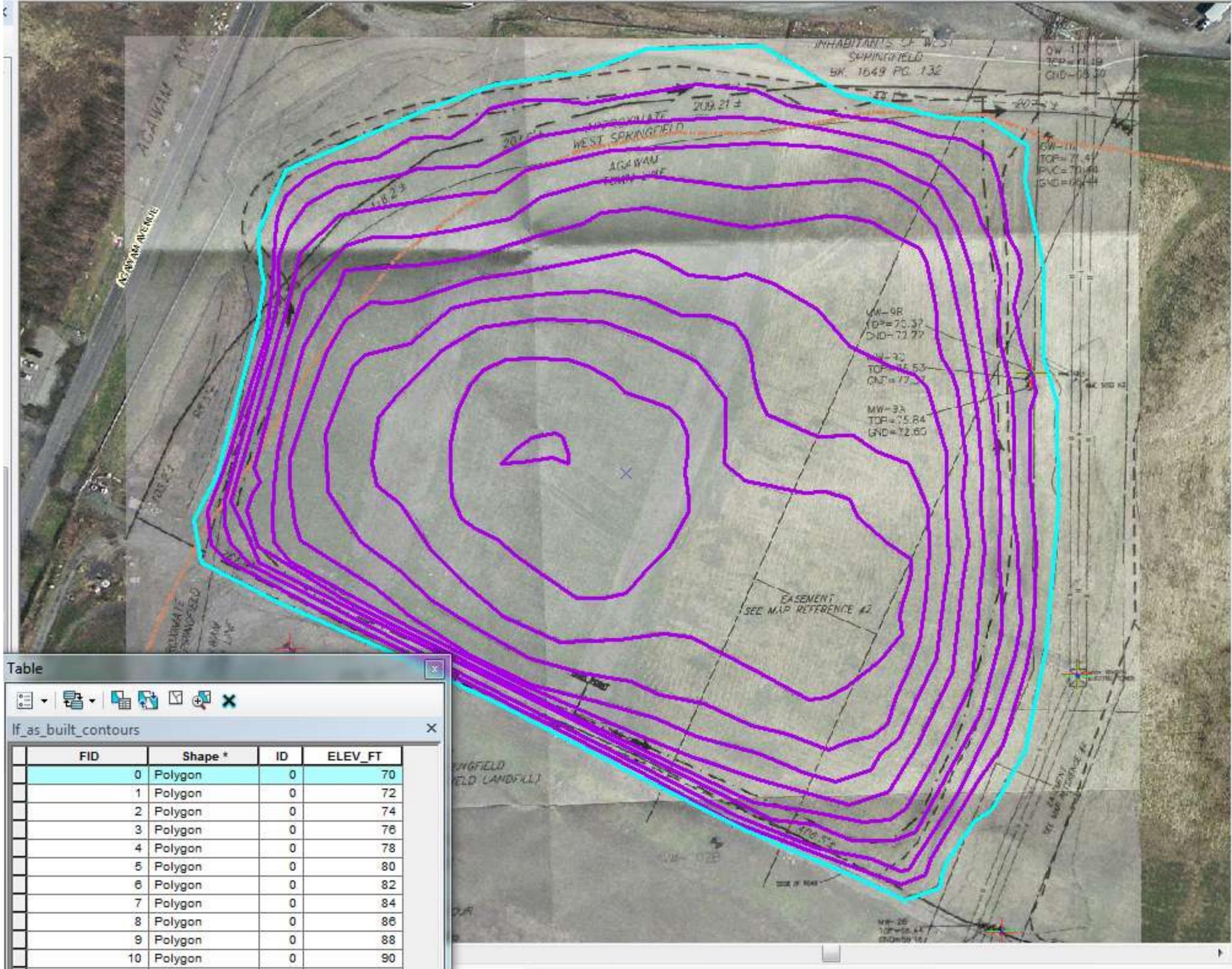
WPA-105
TOP-15.22
DATE-12.22



SEE MAP EASTMENT REFERENCE

Georeferencing Layer: lf_as_built.jpg

3D Analyst Layer: cutfillyx



Create Features

<Search>

- If_as_built_contours
- If_as_built_contours

Table

If_as_built_contours

FID	Shape *	ID	ELEV_FT
0	Polygon	0	70
1	Polygon	0	72
2	Polygon	0	74
3	Polygon	0	76
4	Polygon	0	78
5	Polygon	0	80
6	Polygon	0	82
7	Polygon	0	84
8	Polygon	0	86
9	Polygon	0	88
10	Polygon	0	90

Construction Tools

- Polygon
- Rectangle
- Circle
- Ellipse
- Freehand

Table

If_as_built_contours

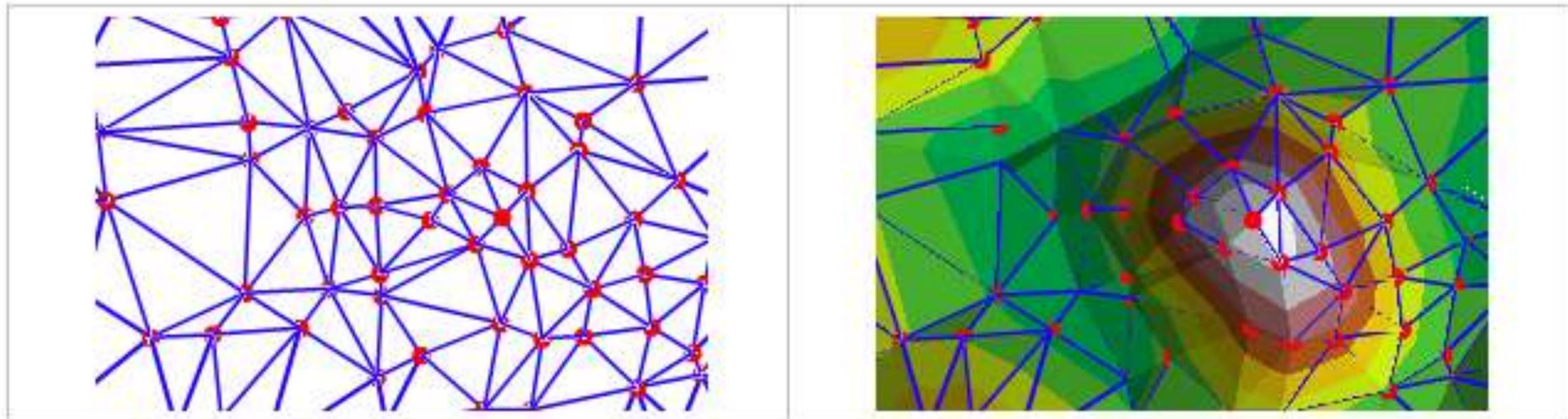
	FID	Shape	ID	ELEV_FT	elev_m
▶	0	Polygon	0	70	21.34
	1	Polygon	0	72	21.95
	2	Polygon	0	74	22.58
	3	Polygon	0	76	23.16
	4	Polygon	0	78	23.77
	5	Polygon	0	80	24.38
	6	Polygon	0	82	24.99
	7	Polygon	0	84	25.6
	8	Polygon	0	86	26.21
	9	Polygon	0	88	26.82
	10	Polygon	0	90	27.43

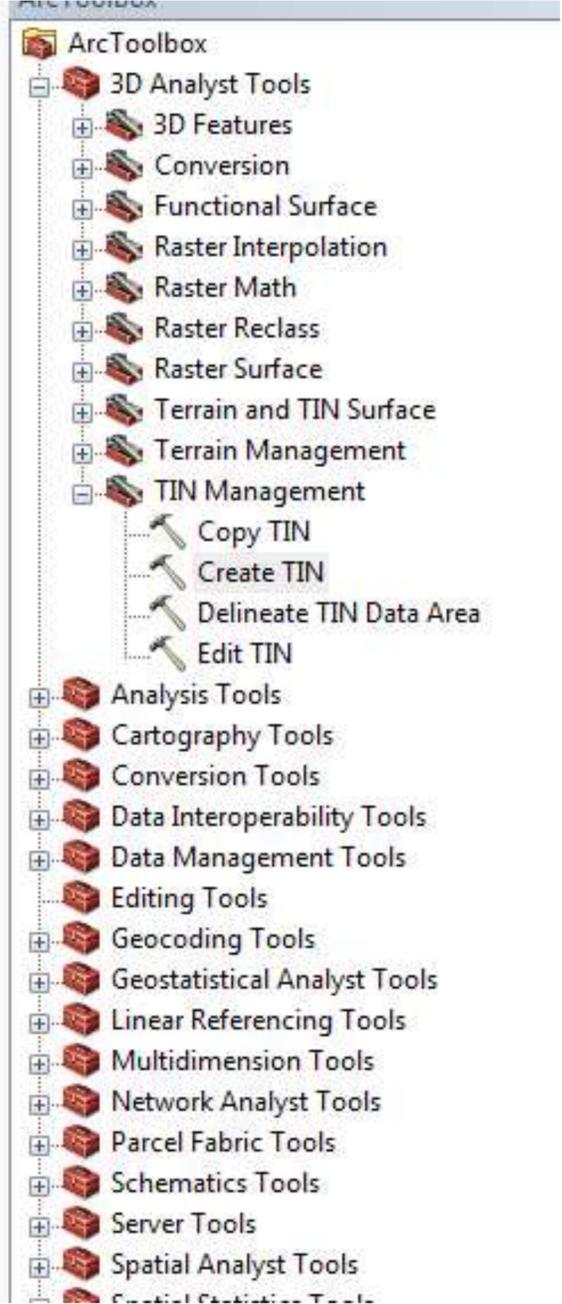
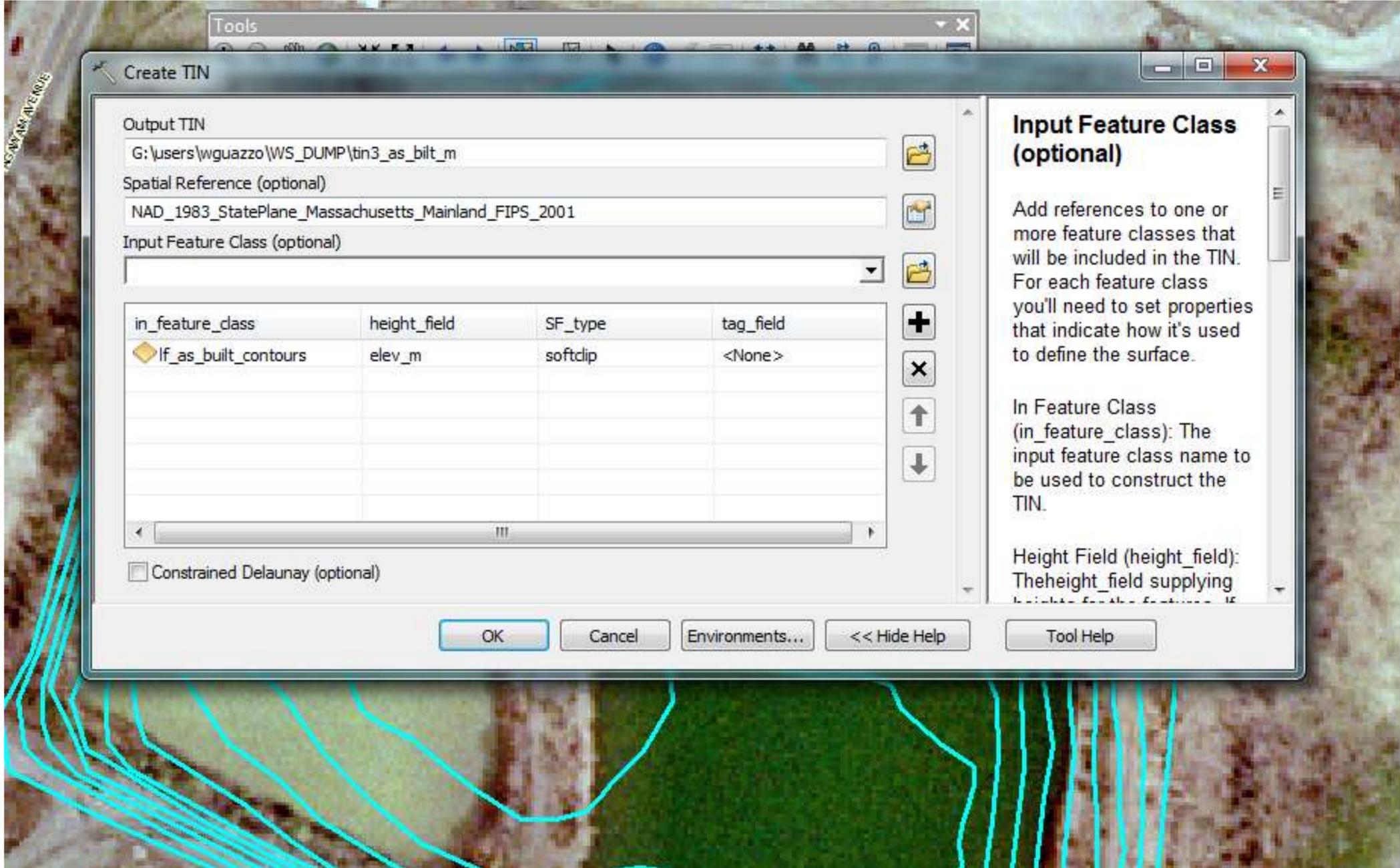
Add a column using the same units as the base – meters.

Next – Create a TIN

Triangular irregular networks (TIN) have been used by the GIS community for many years and are a digital means to represent surface morphology.

The edges of TINs form contiguous, nonoverlapping triangular facets and can be used to capture the position of linear features that play an important role in a surface, such as ridgelines or stream courses. The graphics below show the nodes and edges of a TIN (left) and the nodes, edges, and faces of a TIN (right).





Output TIN

G:\users\wguazzo\WS_DUMP\tin3_as_bilt_m

Spatial Reference (optional)

NAD_1983_StatePlane_Massachusetts_Mainland_FIPS_2001

Input Feature Class (optional)

in_feature_class	height_field	SF_type	tag_field
If_as_built_contours	elev_m	softclip	<None>

Constrained Delaunay (optional)

Input Feature Class (optional)

Add references to one or more feature classes that will be included in the TIN. For each feature class you'll need to set properties that indicate how it's used to define the surface.

In Feature Class (in_feature_class): The input feature class name to be used to construct the TIN.

Height Field (height_field): The height_field supplying heights for the features.

- OK
- Cancel
- Environments...
- << Hide Help
- Tool Help

ArcToolbox

- 3D Analyst Tools
 - 3D Features
 - Conversion
 - Functional Surface
 - Raster Interpolation
 - Raster Math
 - Raster Reclass
 - Raster Surface
 - Terrain and TIN Surface
 - Terrain Management
 - TIN Management
 - Copy TIN
 - Create TIN
 - Delineate TIN Data Area
 - Edit TIN
- Analysis Tools
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- Data Interoperability Tools
- Data Management Tools
- Editing Tools
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- Geostatistical Analyst Tools
- Linear Referencing Tools
- Multidimension Tools
- Network Analyst Tools
- Parcel Fabric Tools
- Schematics Tools
- Server Tools
- Spatial Analyst Tools
- Spatial Statistics Tools

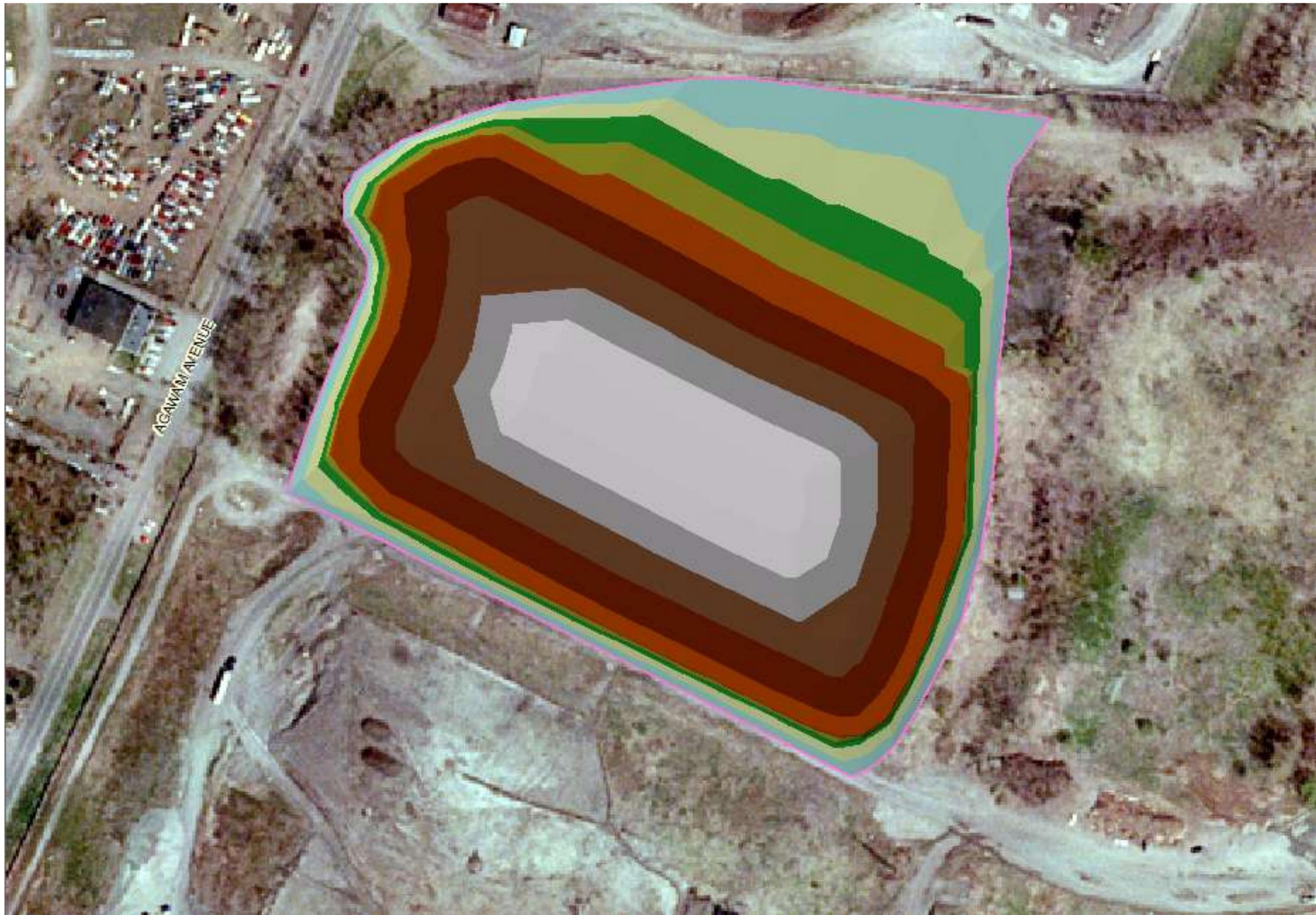


Table of Contents

Globe layers

Floating layers

Draped layers

tin_as_bilt

Edge type

Soft Edge

Elevation

26.753 - 27.43

26.077 - 26.753

25.4 - 26.077

24.723 - 25.4

24.047 - 24.723

23.37 - 24.047

22.693 - 23.37

22.017 - 22.693

21.34 - 22.017

tin_orig

<all other values>

Edge type

Soft Edge

Elevation

23.5 - 23.77

23.23 - 23.5

22.96 - 23.23

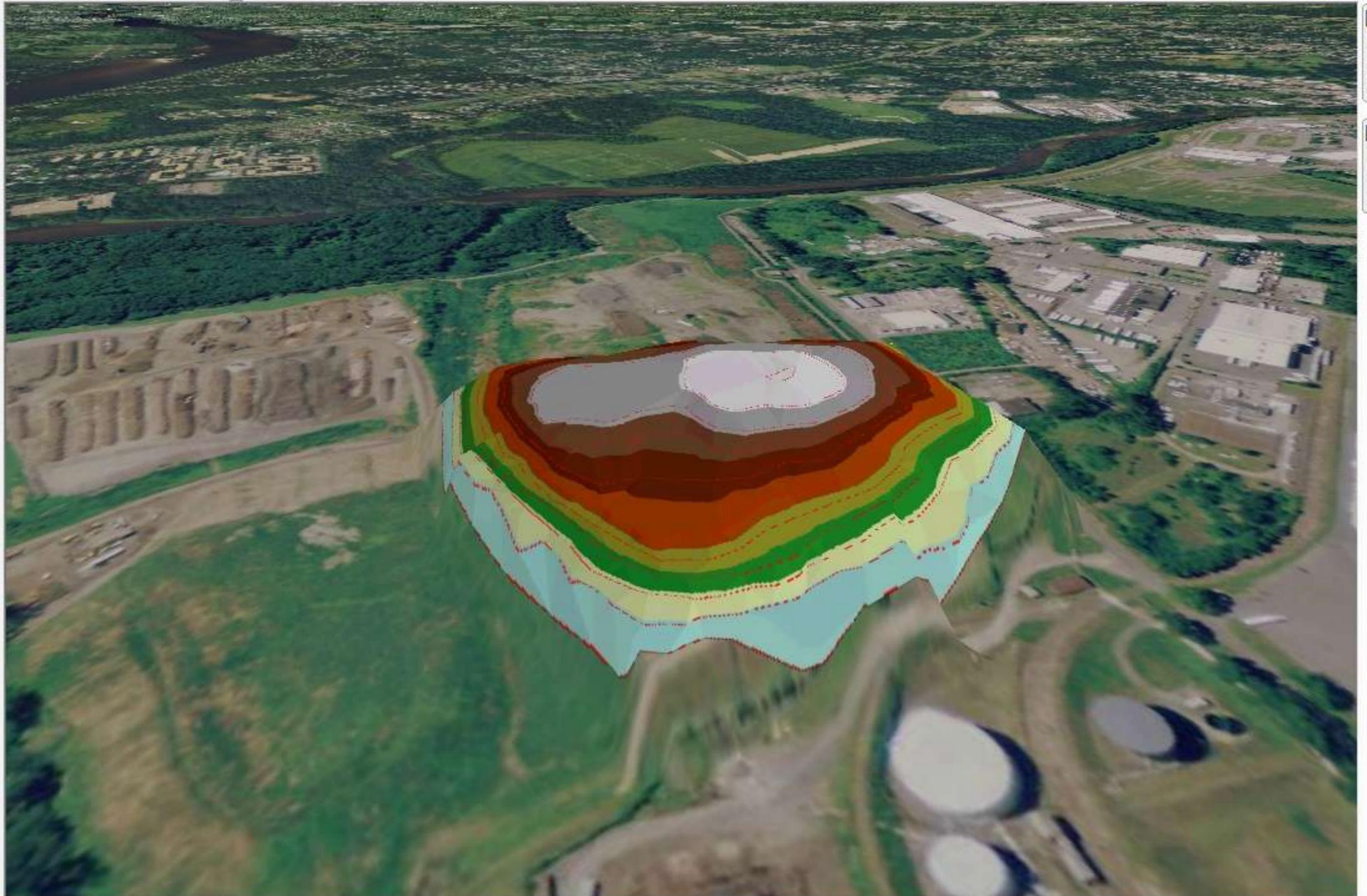
22.69 - 22.96

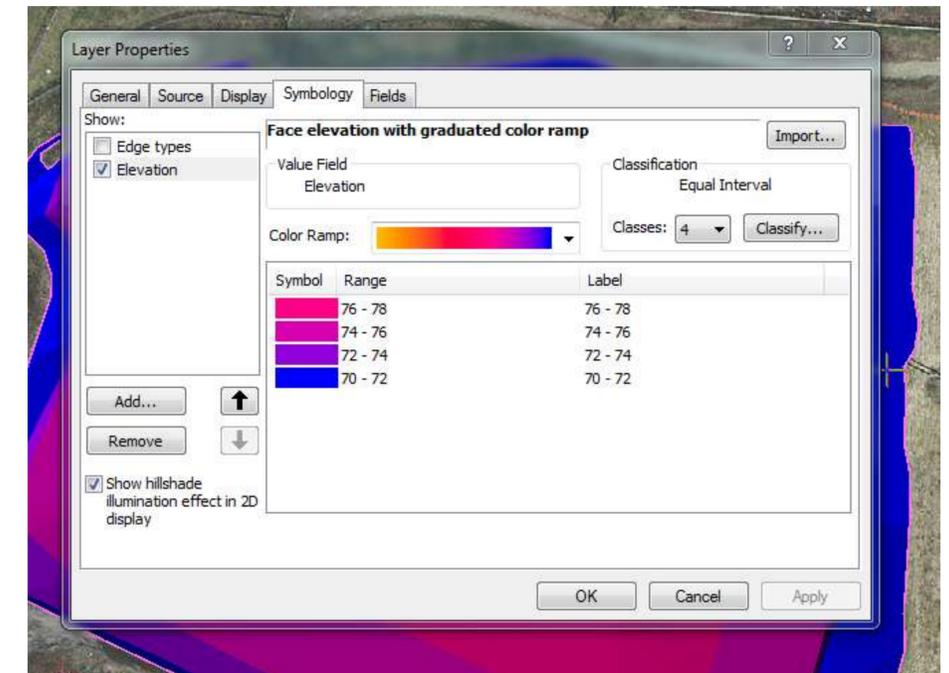
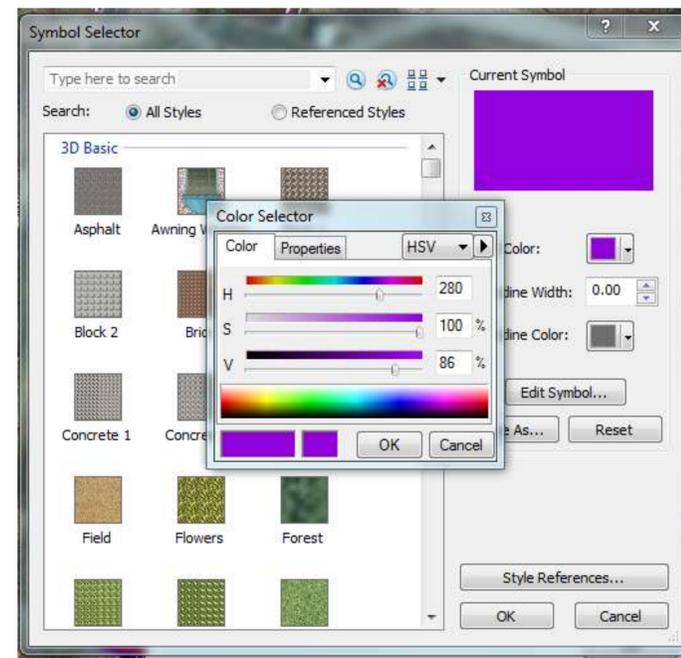
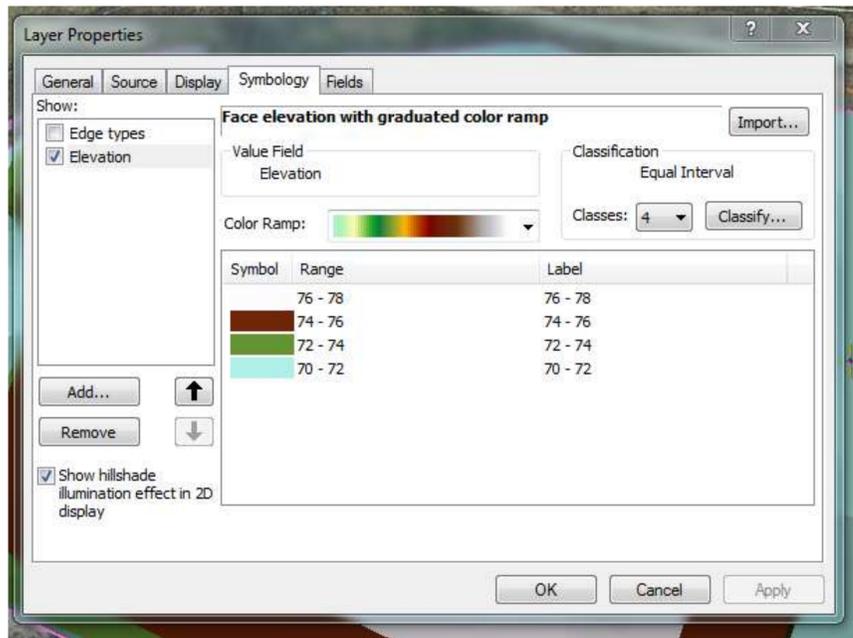
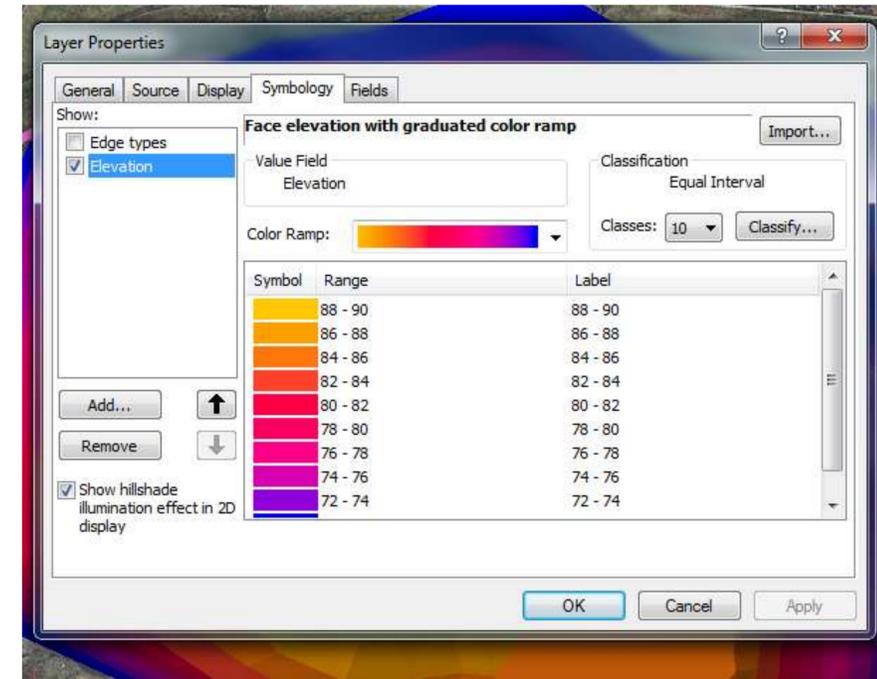
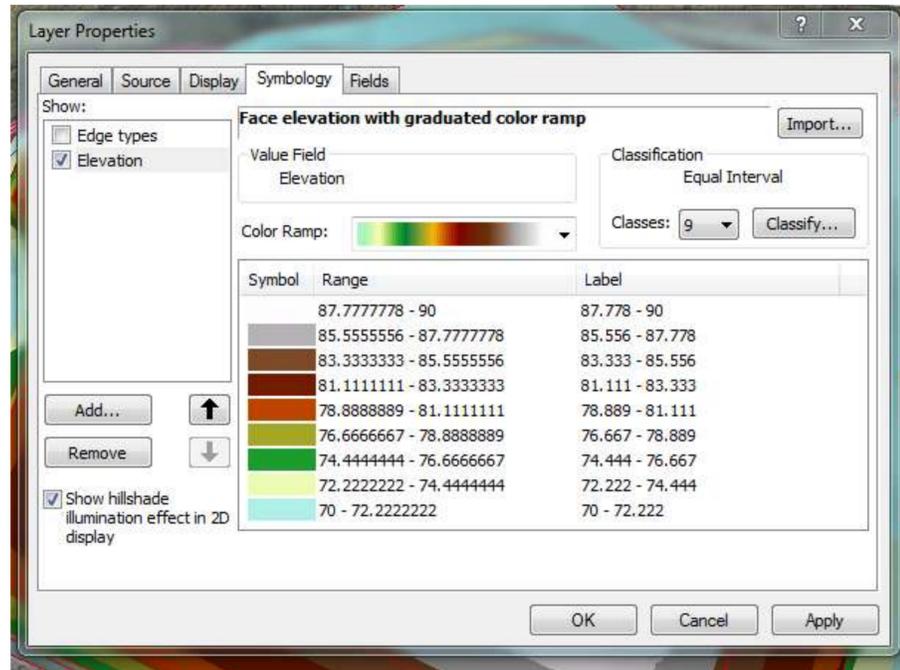
22.42 - 22.69

22.15 - 22.42

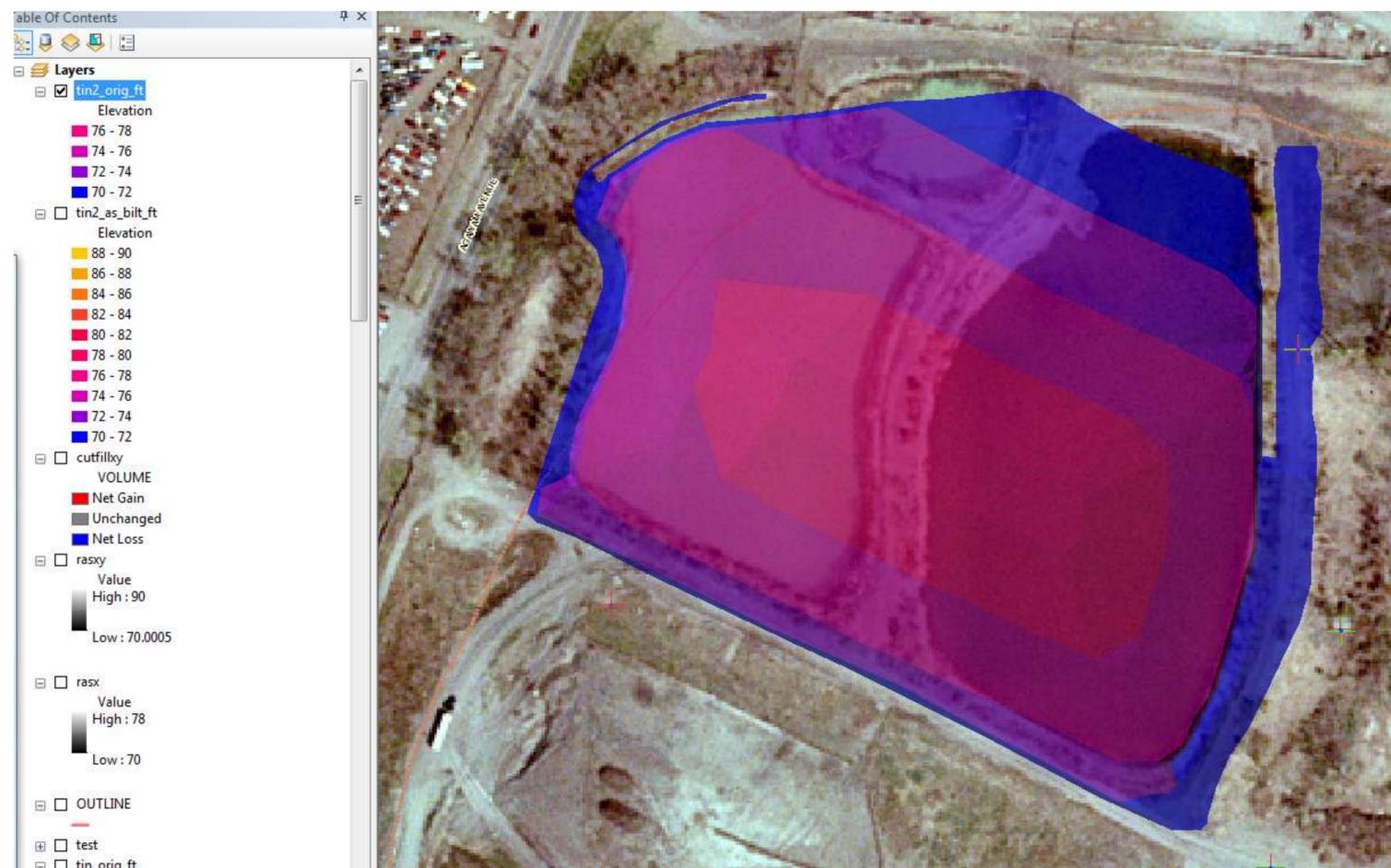
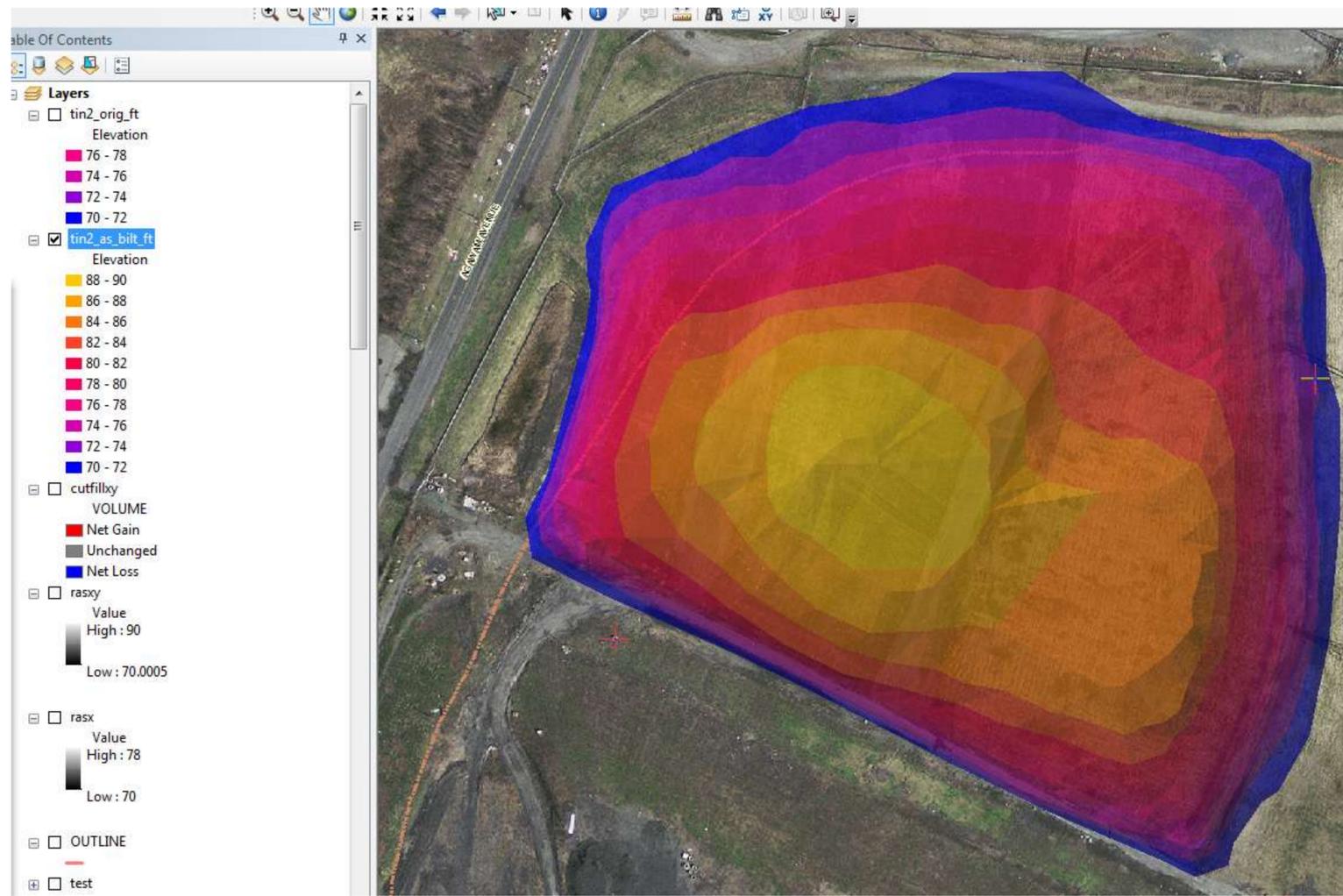
21.88 - 22.15

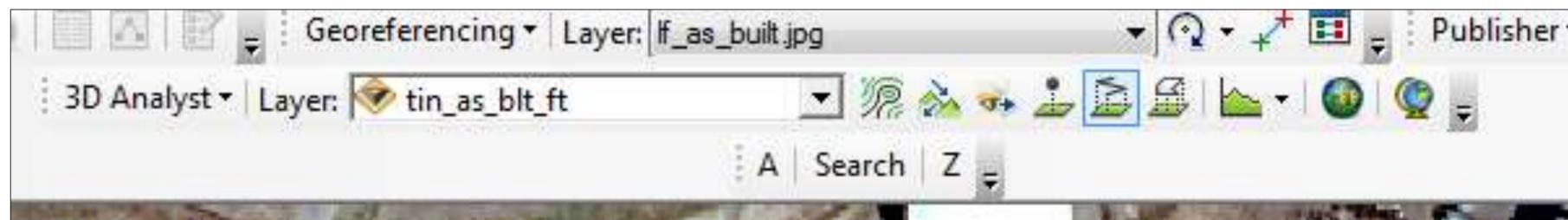
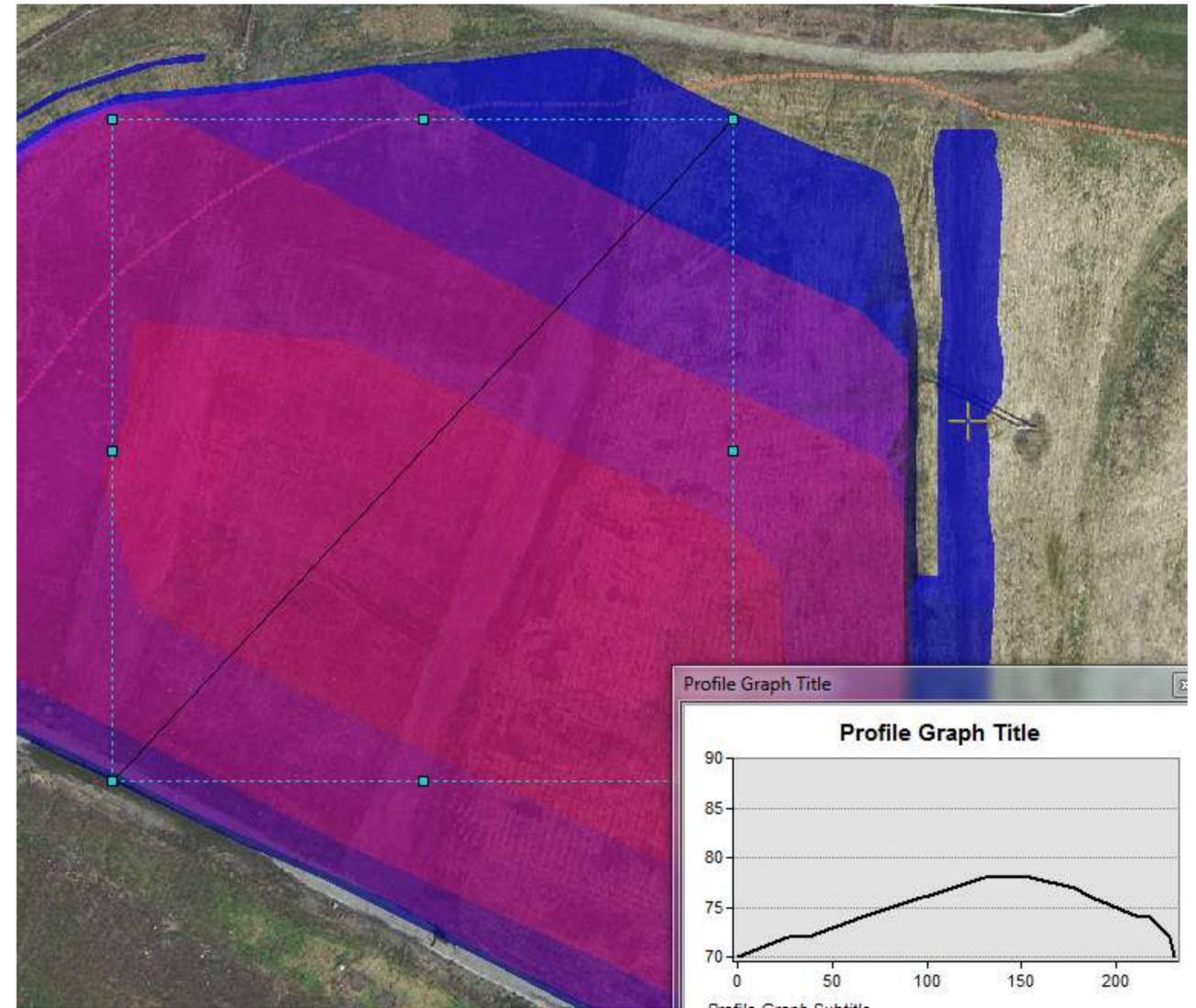
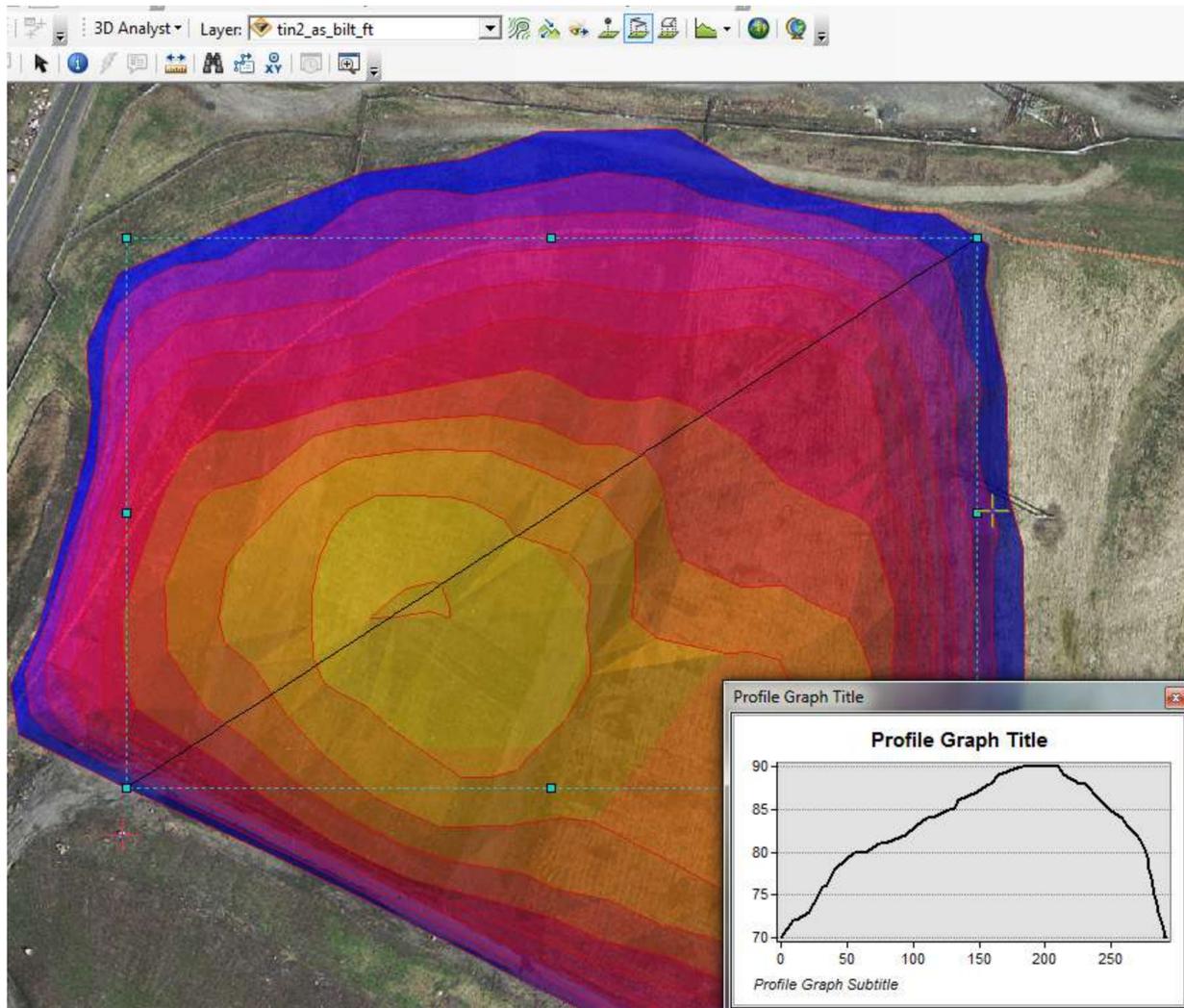
21.61 - 21.88



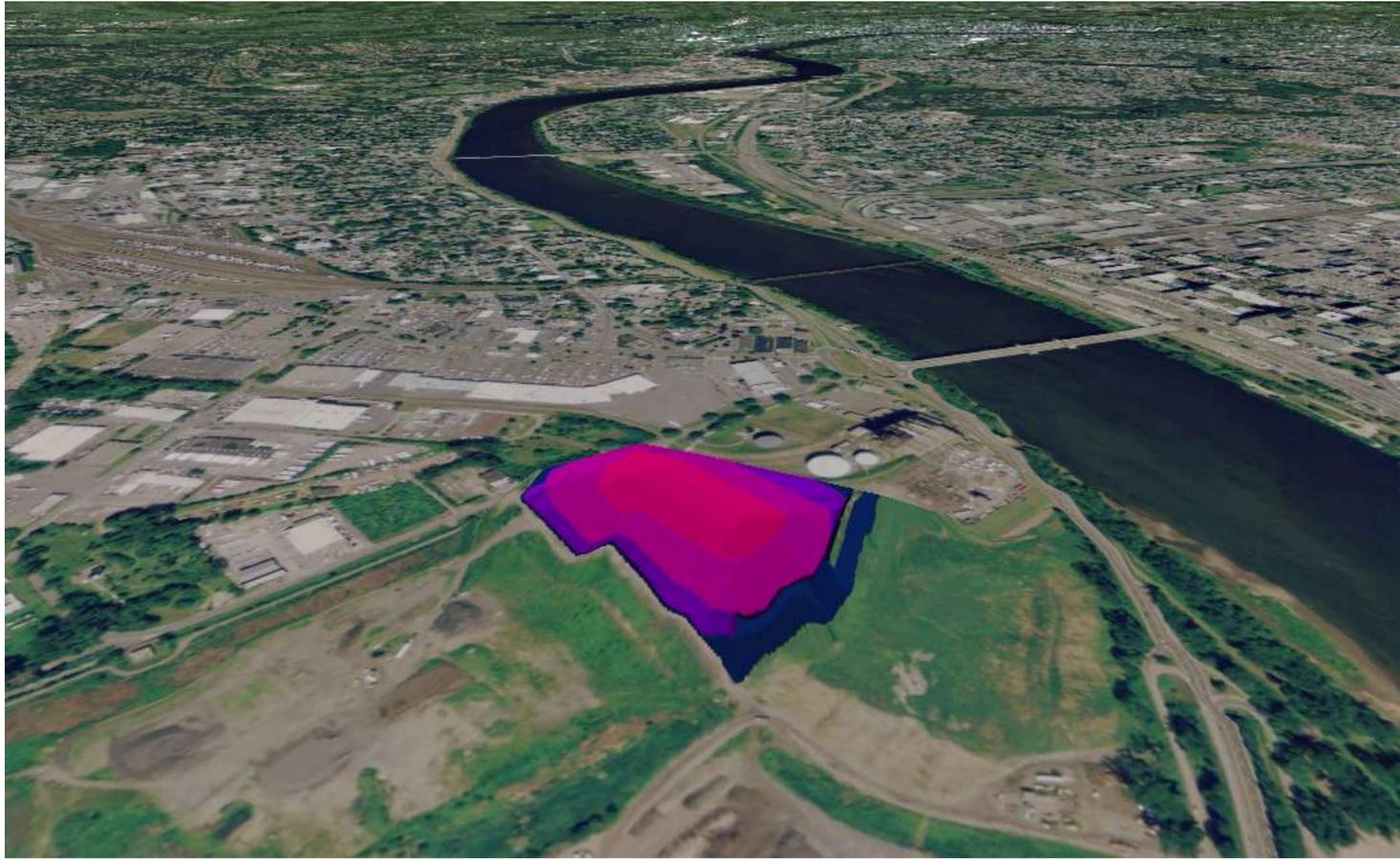
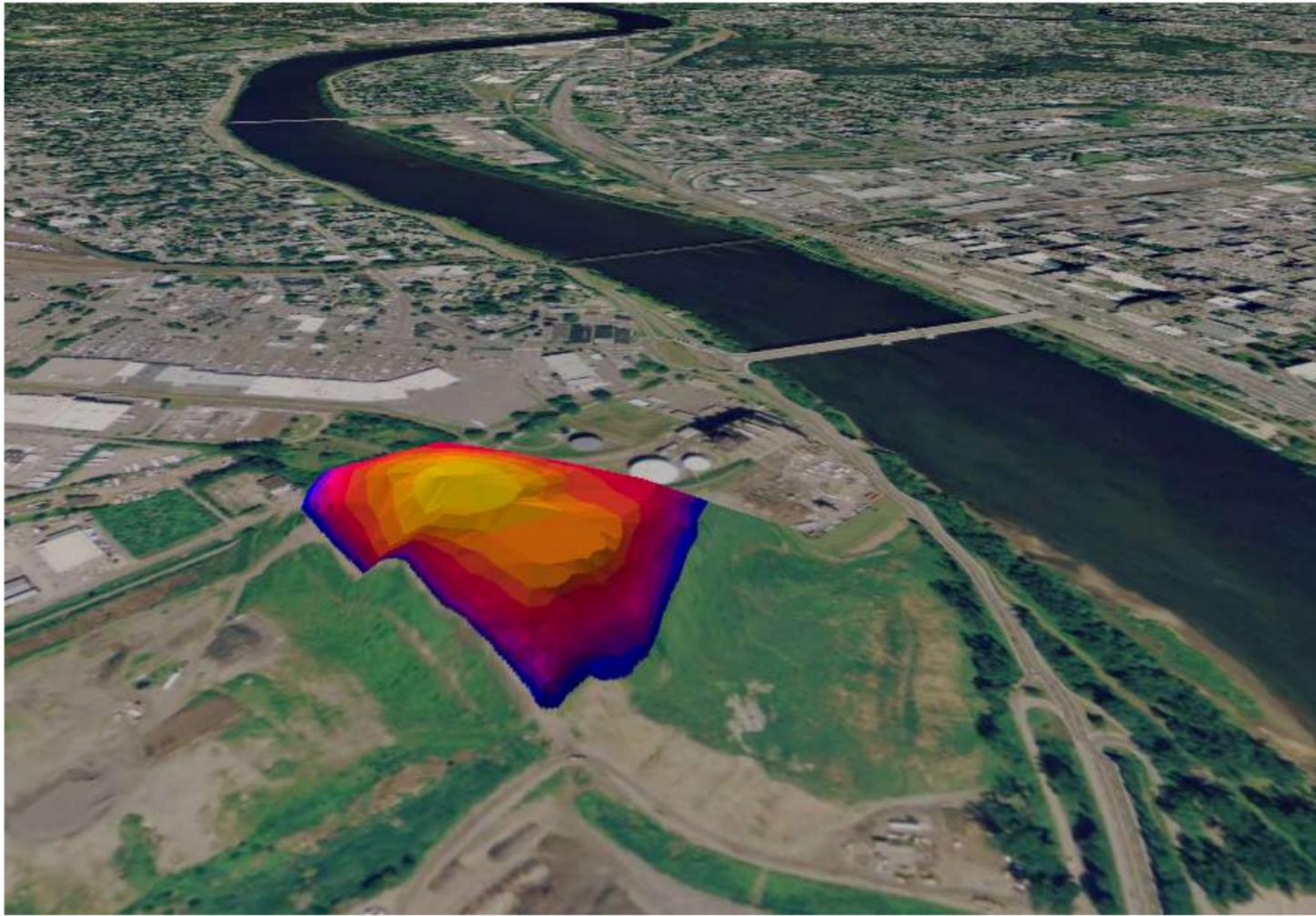


The color ramps need to match.





**With the 3D Analyst tool bar -
use 'Interpolate line' tool and
then 'profile graph' tool**



Type a question, then click Ask.

volume

Powered by AnswerWorks®



History

100 topics found

- | Click to view | Rank |
|--|------|
| Visibility Volume (3D Analyst) | |
| Find the volume contained in a surface | |
| Polygon Volume (3D Analyst) | |
| Surface Volume (3D Analyst) | |
| Feature Shadow Volume (3D Analyst) | |
| TIN Polygon Volume (3D Analyst) | |
| How Polygon Volume (3D Analyst) works | |
| How Surface Volume (3D Analyst) works | |
- [More...](#)

Summary

This tool calculates the area and volume of a raster, triangulated area network (TIN), or terrain dataset surface above or below a given reference plane.

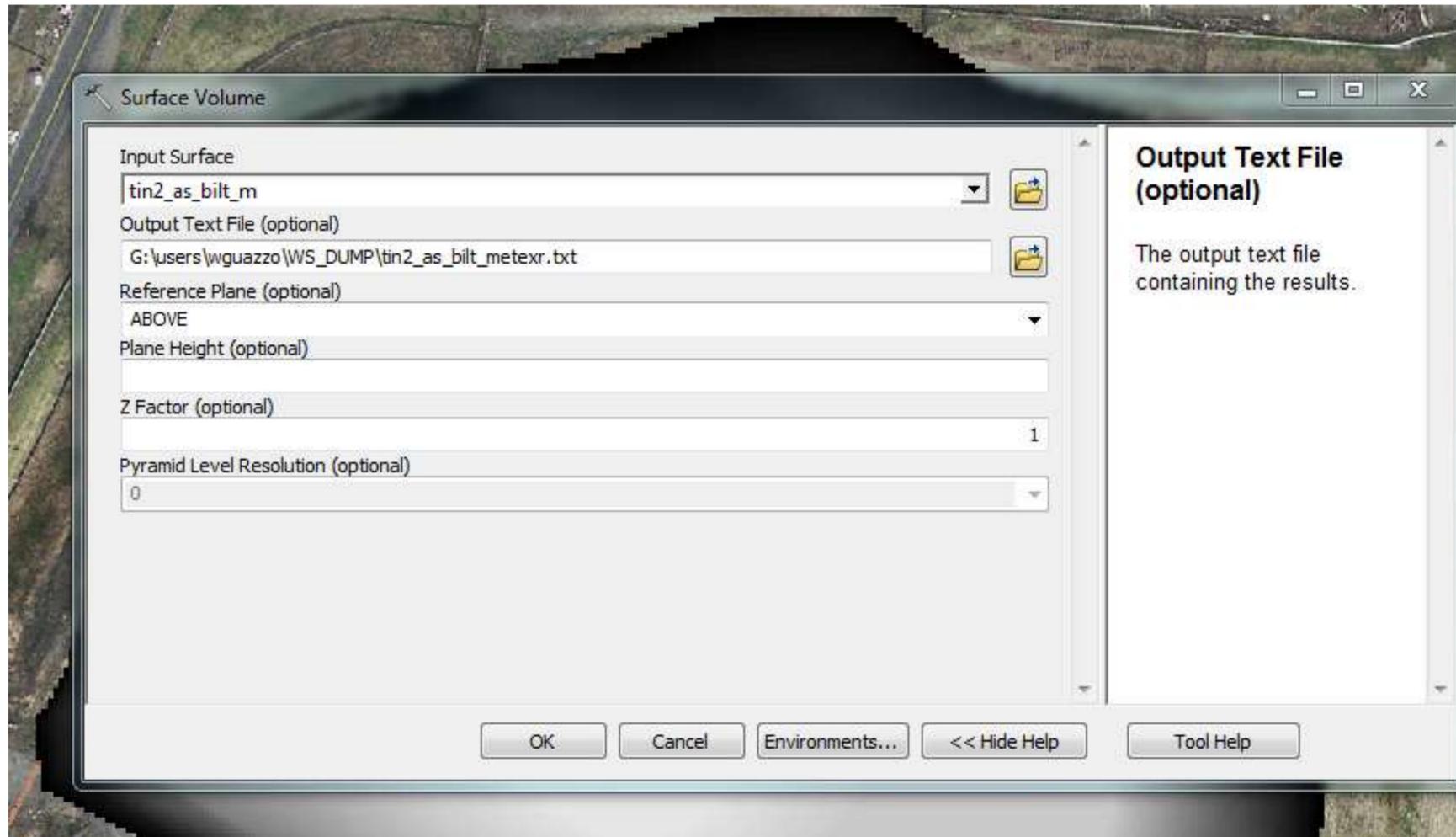
[Learn more about how Surface Volume \(3D Analyst\) works](#)

Illustration



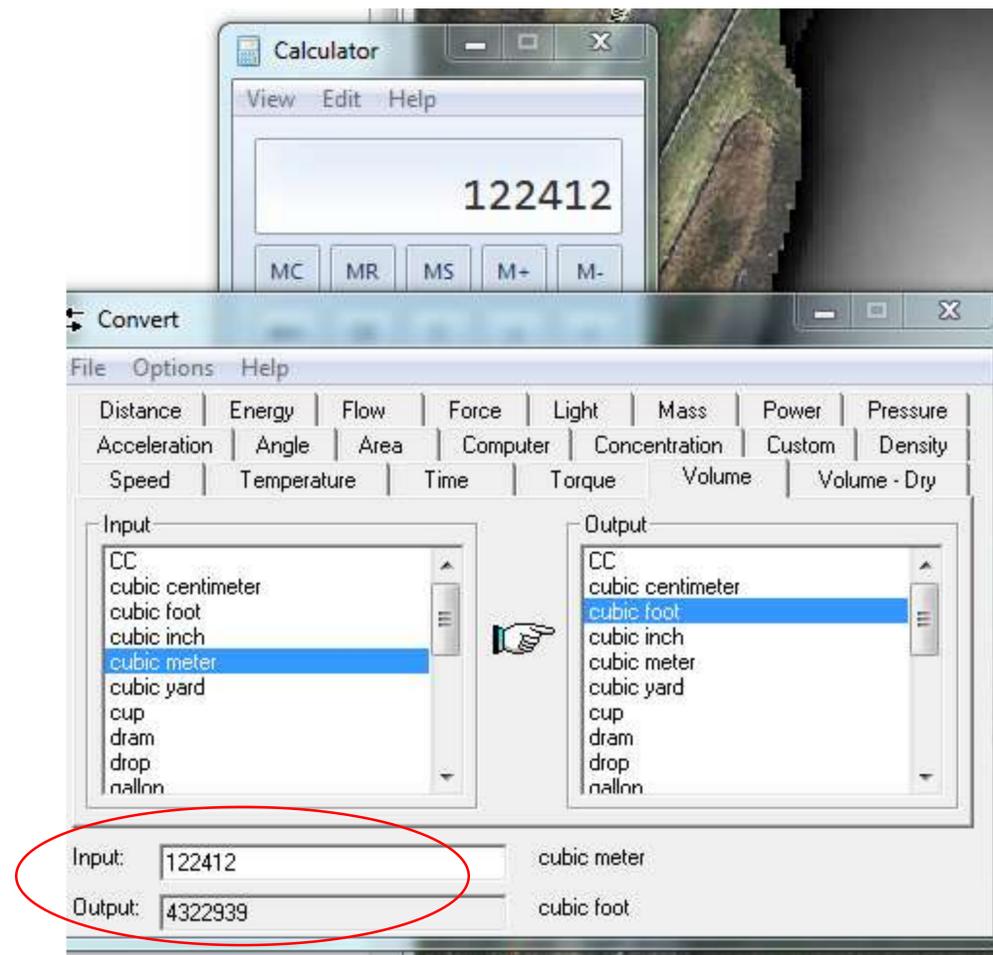
Output Format

Dataset	Plane Height	Reference	Z Factor	Area 2D	Area 3D	Volume
D:\temp\GP\dtm_tin	100.00	ABOVE	1.00	15984467.82	16354331.40	1886012931.07



```
tin2_orig_meter - Notepad
File Edit Format View Help
Dataset, Plane_Height, Reference, Z_Factor, Area_2D, Area_3D, Volume
..rs\wguazzo\WS_DUMP\tin2_orig_m, 21.34, ABOVE, 1.000000, 53598.897521027, 53698.588803203, 74896.687944141
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```
tin2_as_bilt_meter - Notepad
File Edit Format View Help
Dataset, Plane_Height, Reference, Z_Factor, Area_2D, Area_3D, volume
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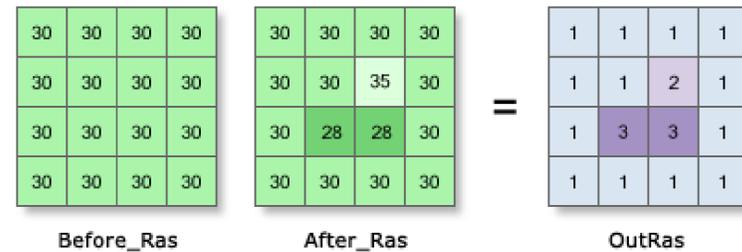
**4,322,939 cu. Ft
difference**

Summary

Calculates the volume change between two surfaces. This is typically used for cut and fill operations.

[Learn more about how Cut Fill works](#)

Illustration



How Cut Fill works

A cut-and-fill operation is a procedure in which the elevation of a landform surface is modified by the removal or addition of surface material.

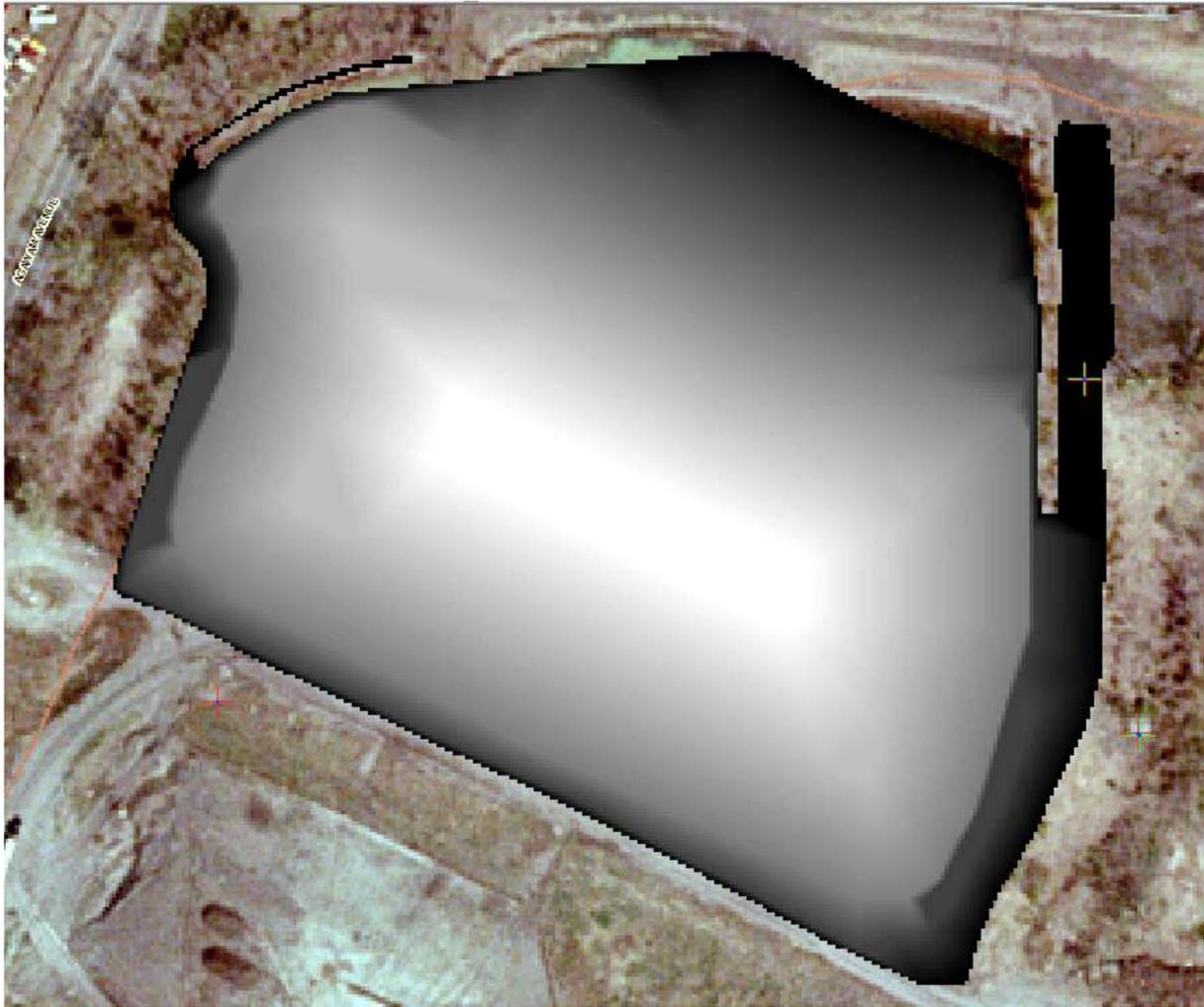
The [Cut Fill](#) tool summarizes the areas and volumes of change from a cut-and-fill operation. By taking surfaces of a given location at two different time periods, it identifies regions of surface material removal, surface material addition, and areas where the surface has not changed.

Applications

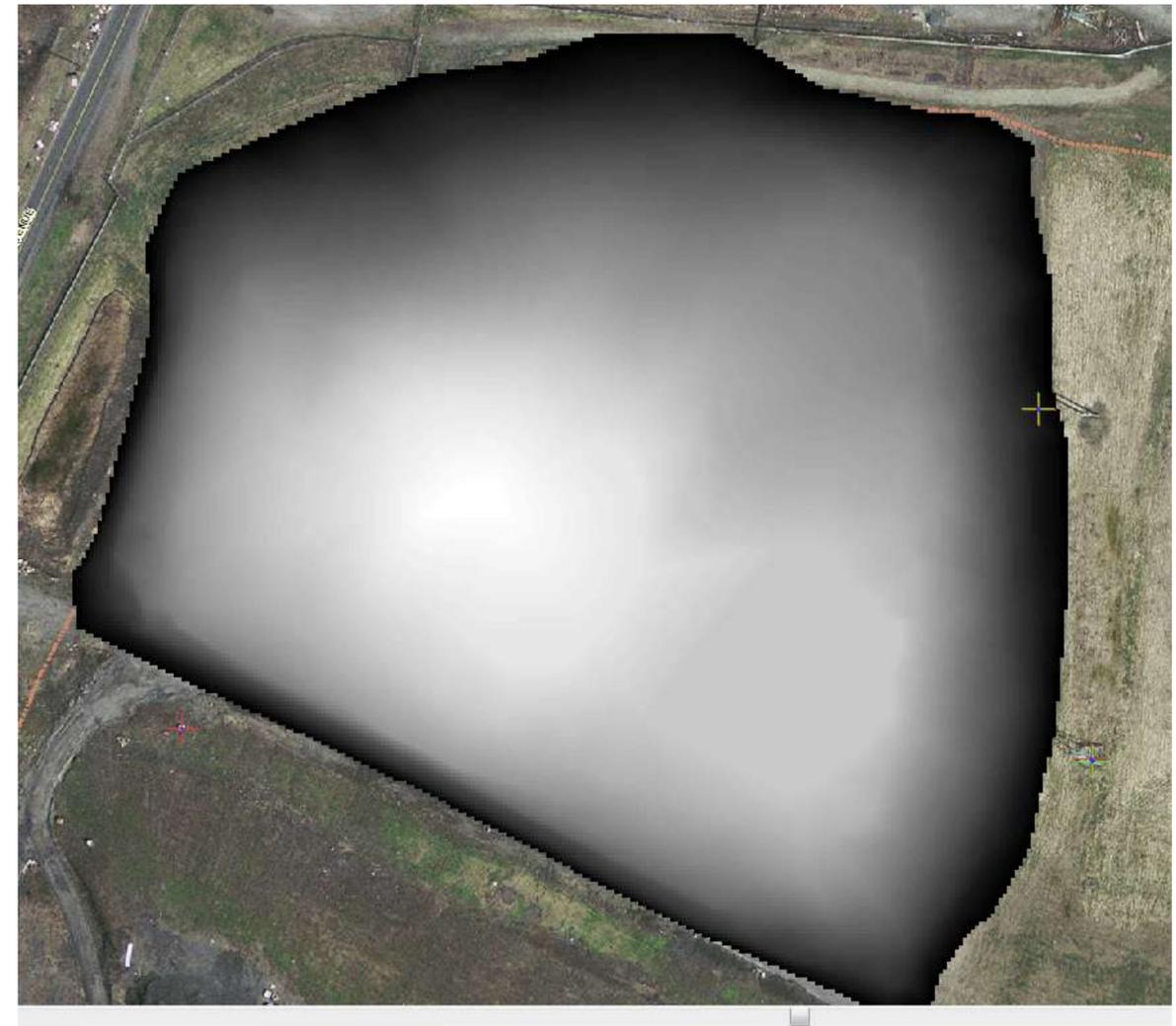
With the Cut Fill tool, you can do the following:

- Identify regions of sediment erosion and deposition in a river valley.
- Calculate the volumes and areas of surface material to be removed and areas to be filled to level a site for building construction.
- Identify areas that become frequently inundated with surface material during a mudslide in a study to locate safe areas of stable land for building homes.

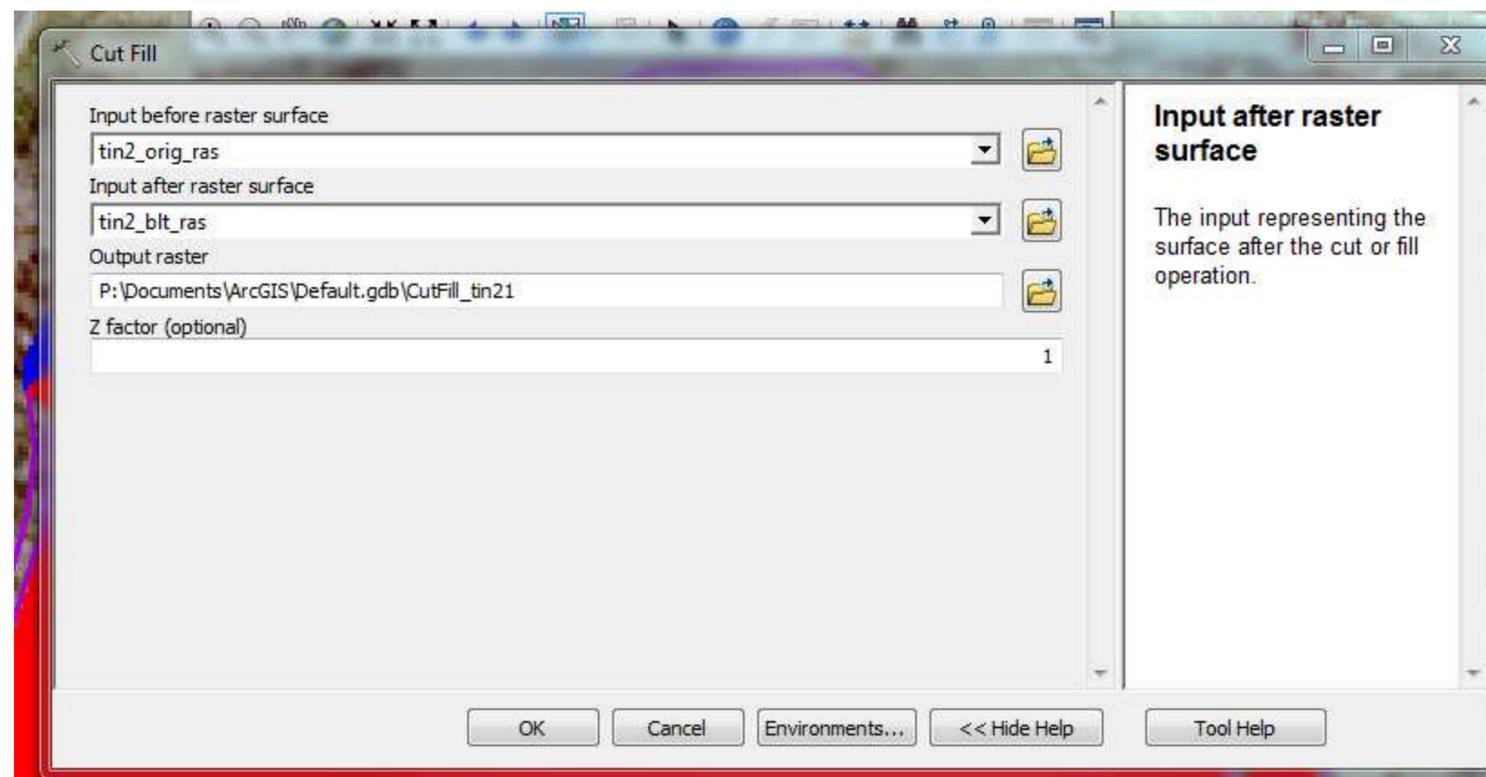
But it wants a raster.



Before Raster



After Raster

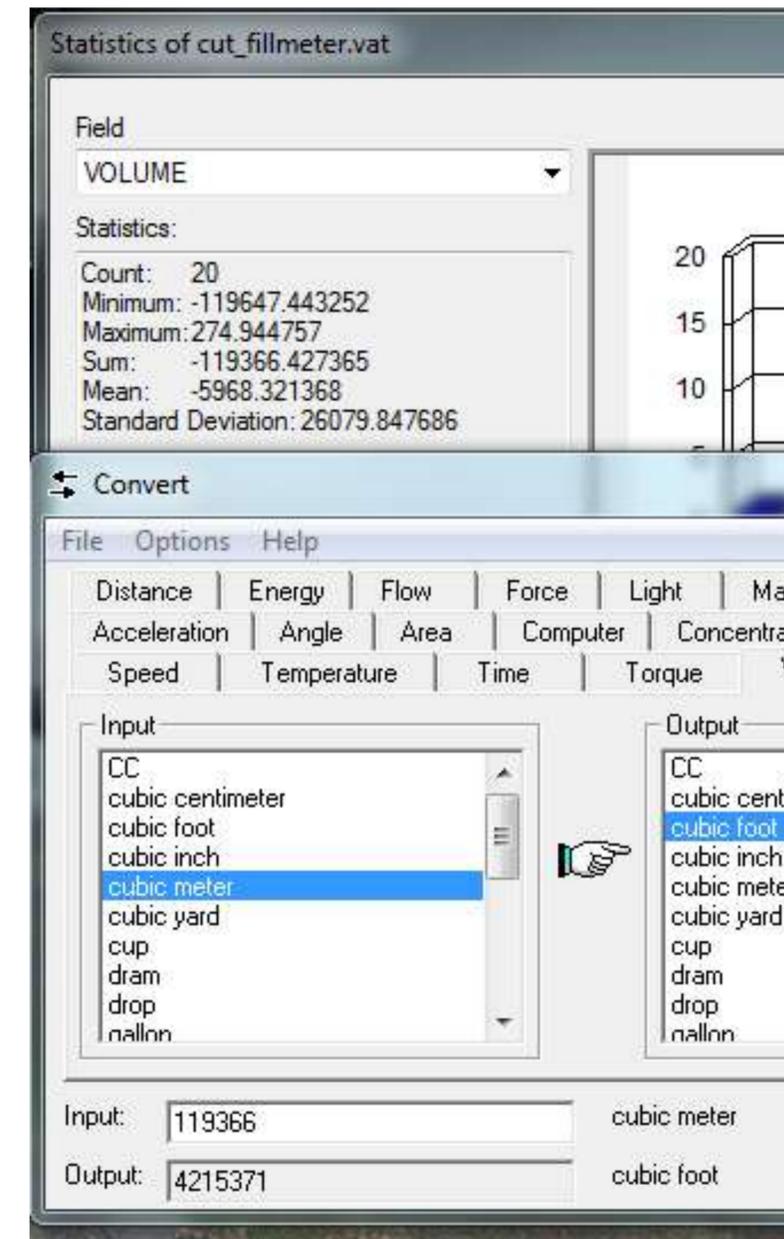
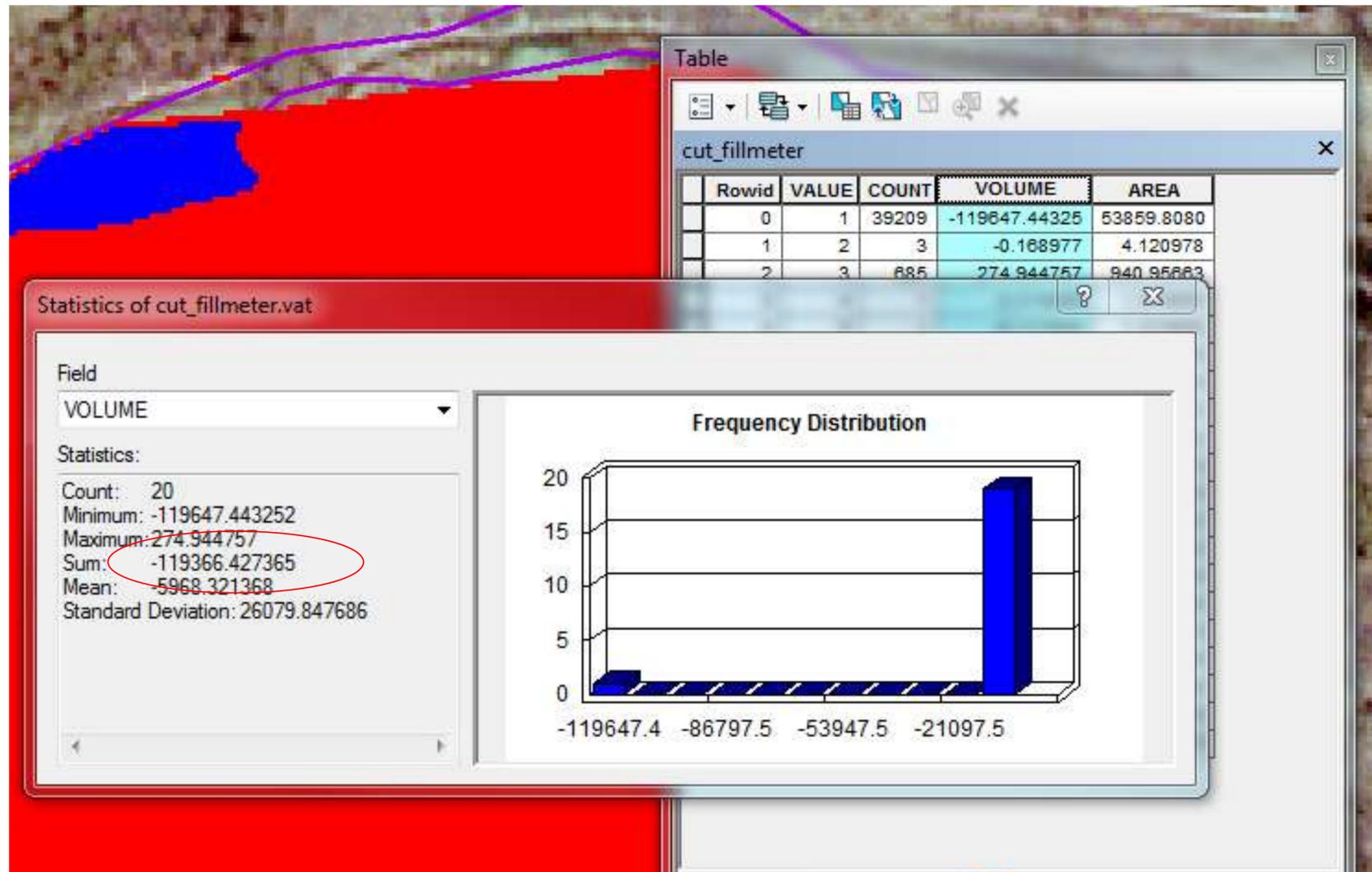


Layers

- tin2_orig_ft
- tin2_as_blt_ft
- cut_fill2**
 - VOLUME
 - Net Gain
 - Unchanged
 - Net Loss
- tin2_blt_ras
 - Value
 - High : 295.2
 - Low : 229.605
- tin2_orig_ras
 - Value
 - High : 255.84
 - Low : 229.6
- cutfillxy
- rasxy
- rasx
- OUTLINE
- test
- tin_orig_ft
- tin_as_blt_ft
- Contours asbilt
- Contours Proposed
- If_as_built_contours
- If_orig_contours
- orig_bltxx
- as_bltxx
- Solid Waste Facilities - All



Cut & Fill Result



4,215,371 cu. Ft. difference using the cut & fill method

4,322,939 cu. Ft difference using the subtraction method