Refining an HEC-RAS Model

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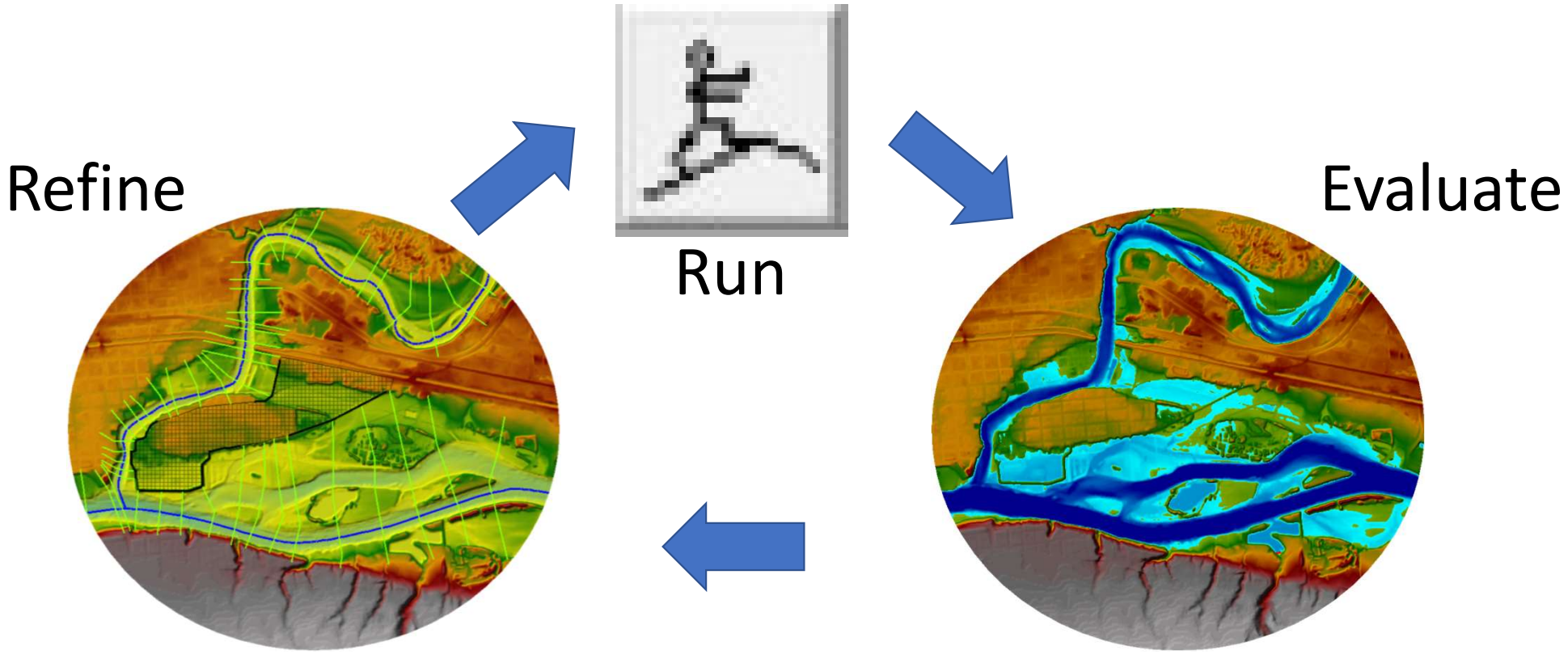
USACE, Institute for Water Resources, Hydrologic Engineering Center

US Army Corps of Engineers

HEC-RAS Modeling Life Cycle

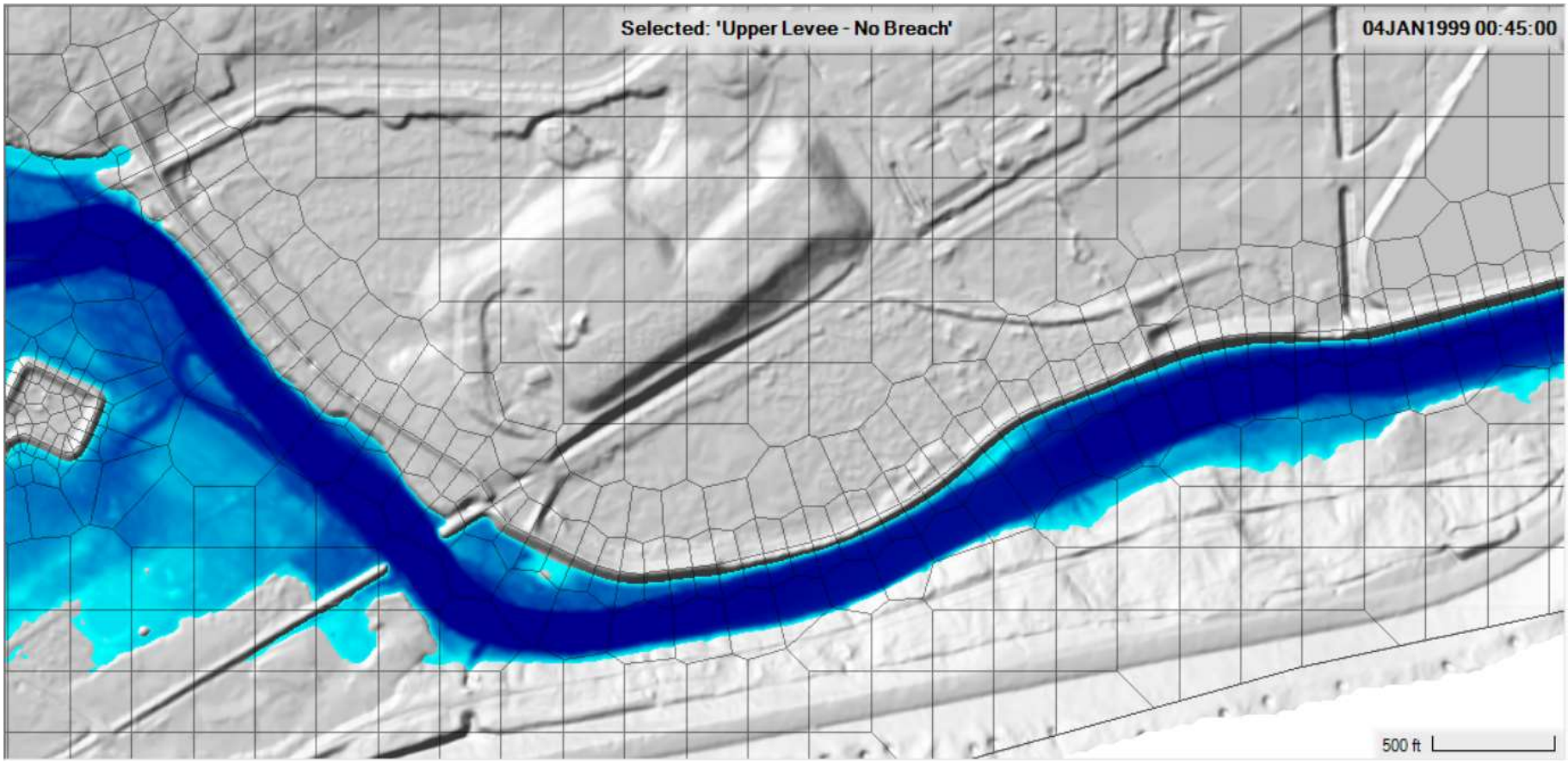


Overview

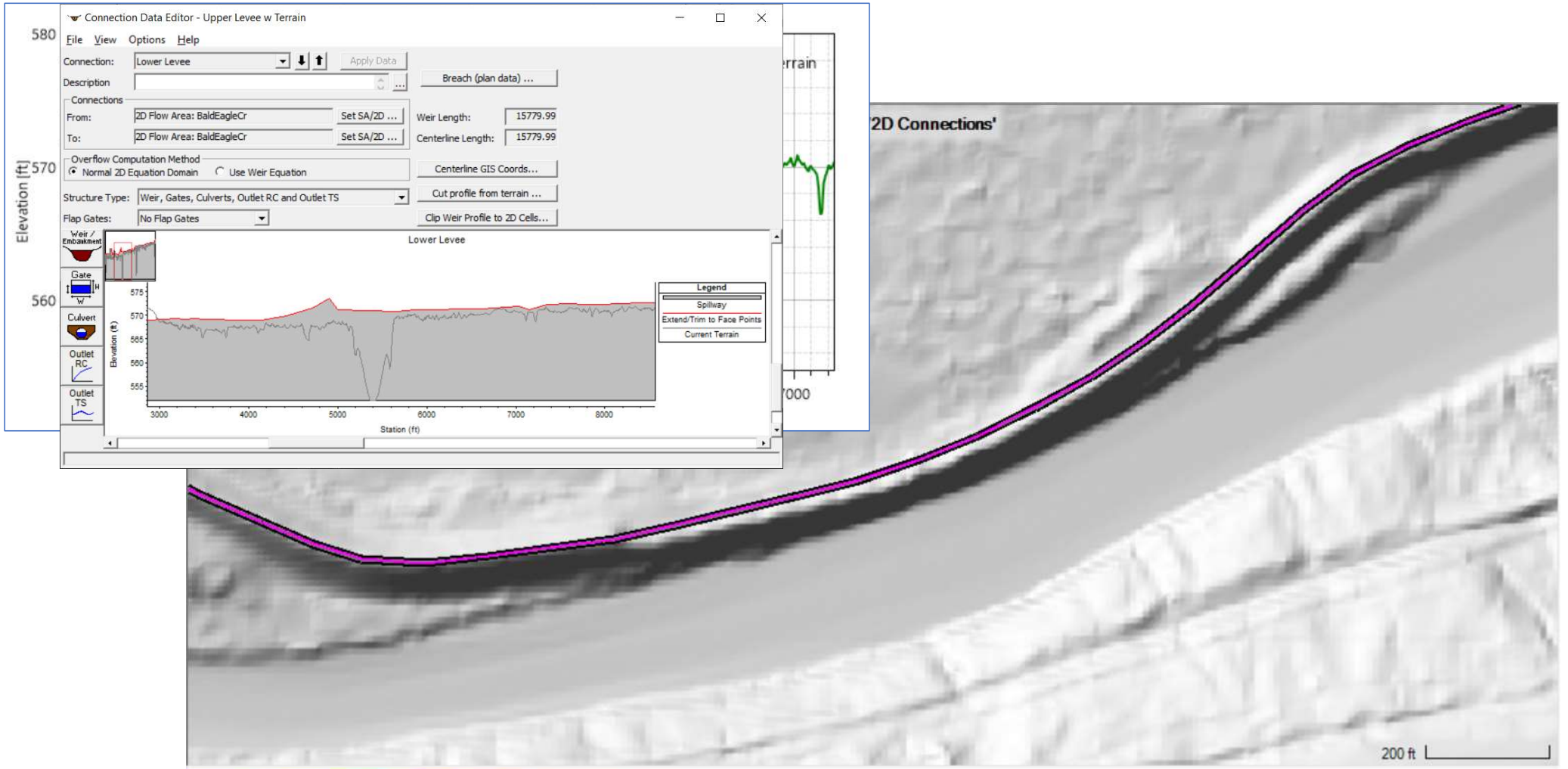
- Breaklines and 2D Connections
- Terrain Modifications
- National Levee Database (NLD)
- Manning's n and Land Cover (NLCD)
  - Channel Refinement
  - Classification Polygons

Breaklines and 2D Connections

Breaklines and 2D Connections



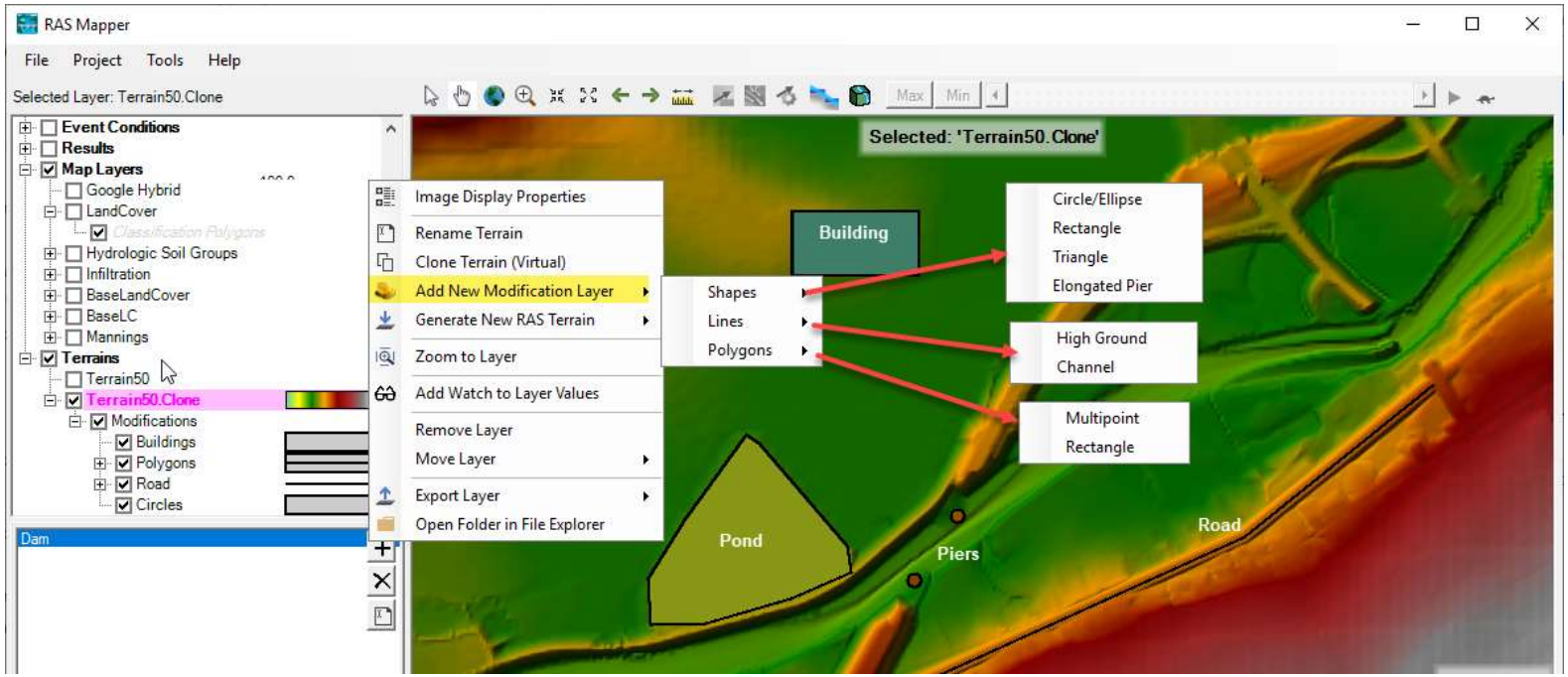
Breaklines and 2D Connections



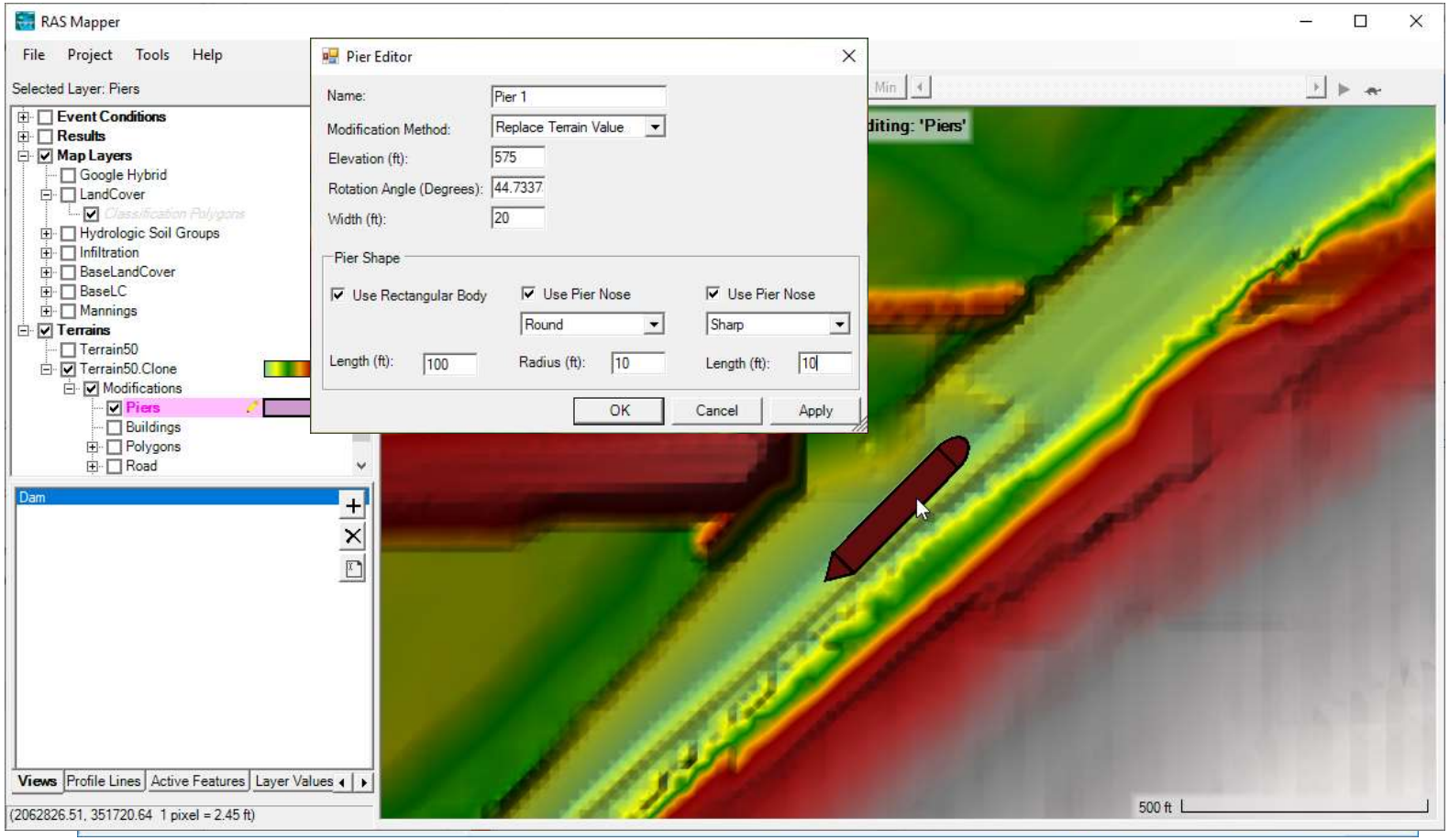
Terrain Modifications

Terrain Modifications

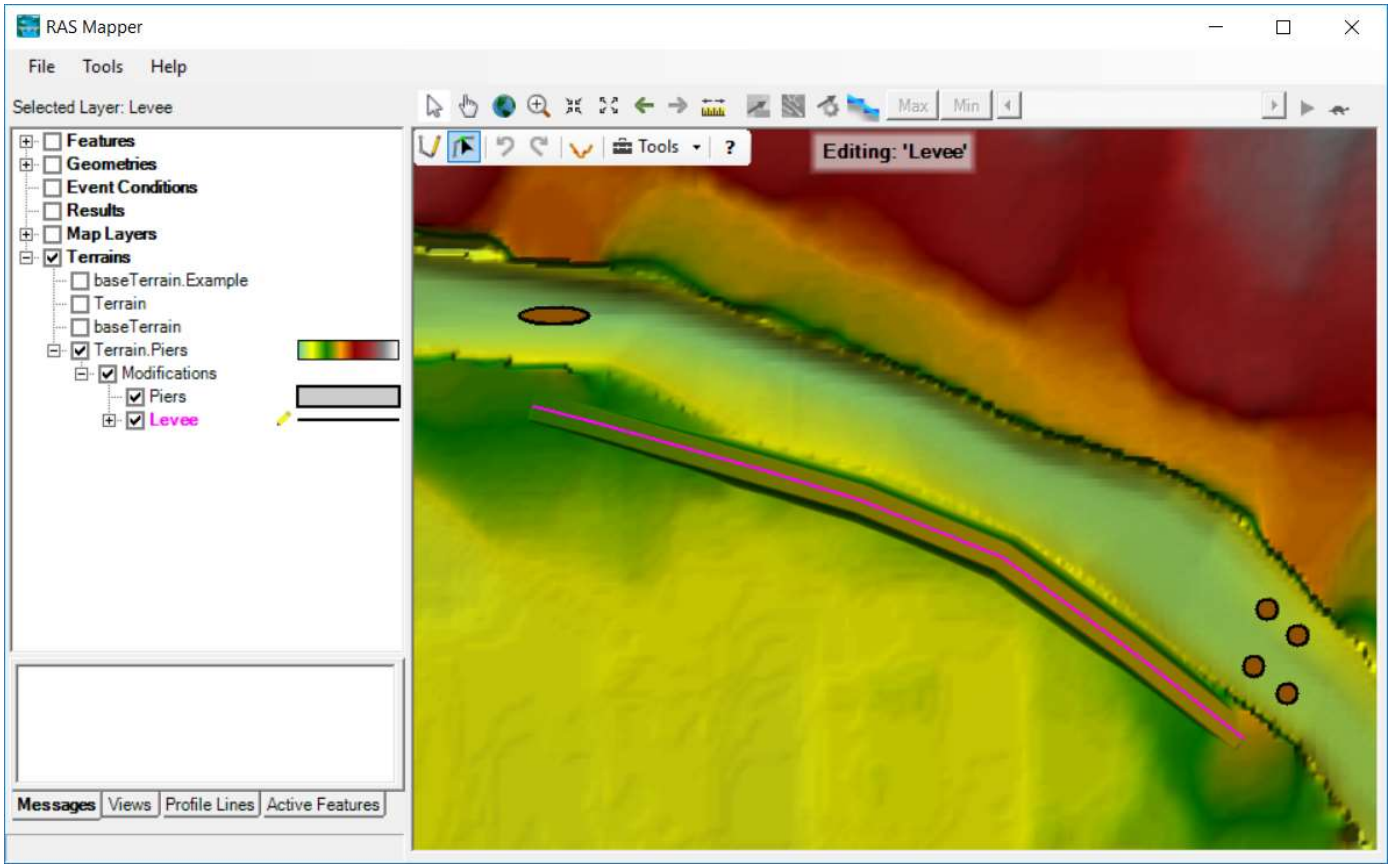
- Vector Overrides to Terrain Layer
  - Simple Shapes (Piers), Lines (Channel, Roads, Levees), Polygons (Areas, Buildings)



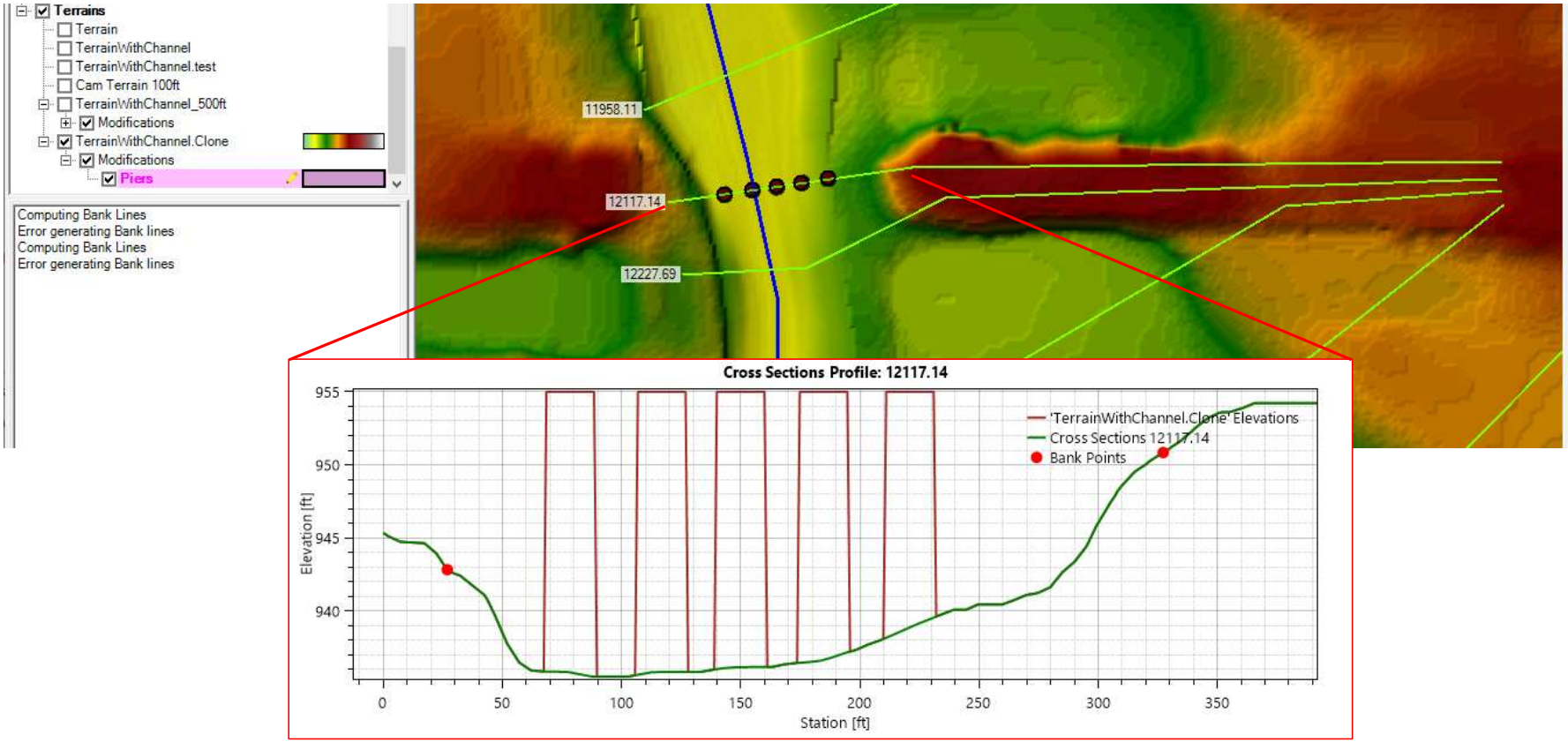
Shapes - Piers



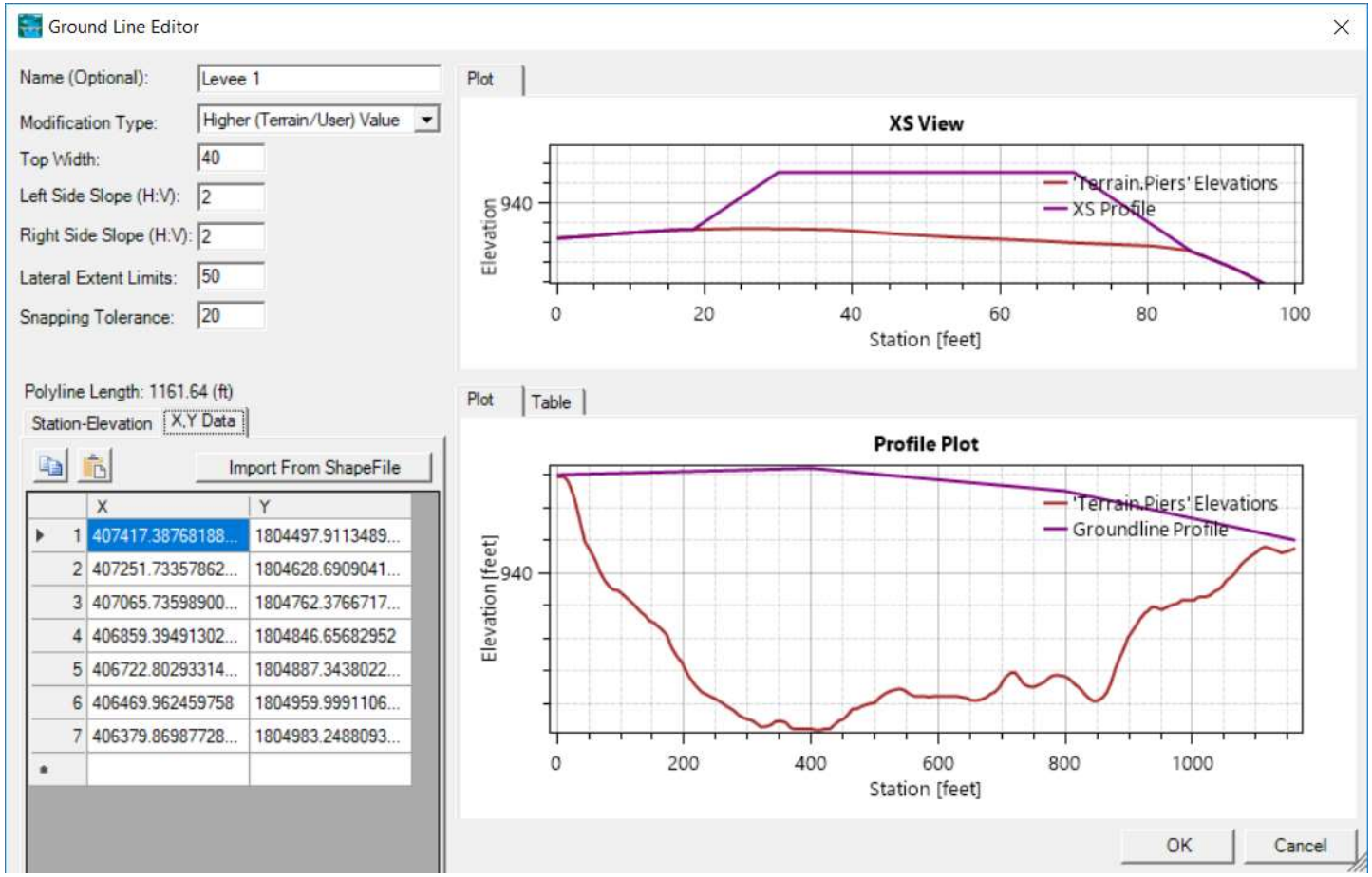
Lines - High Ground



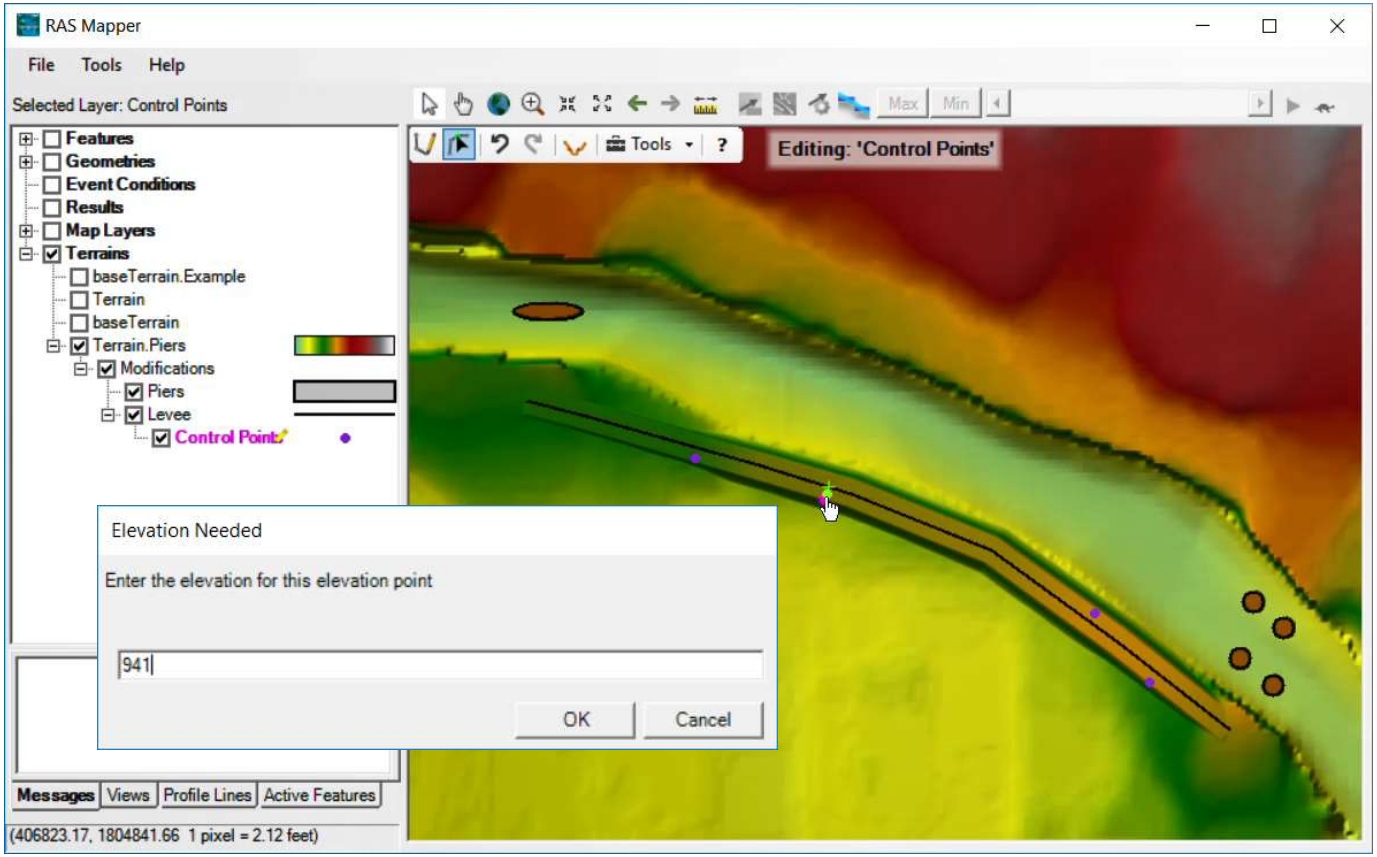
Terrain Modifications



Lines – High Ground

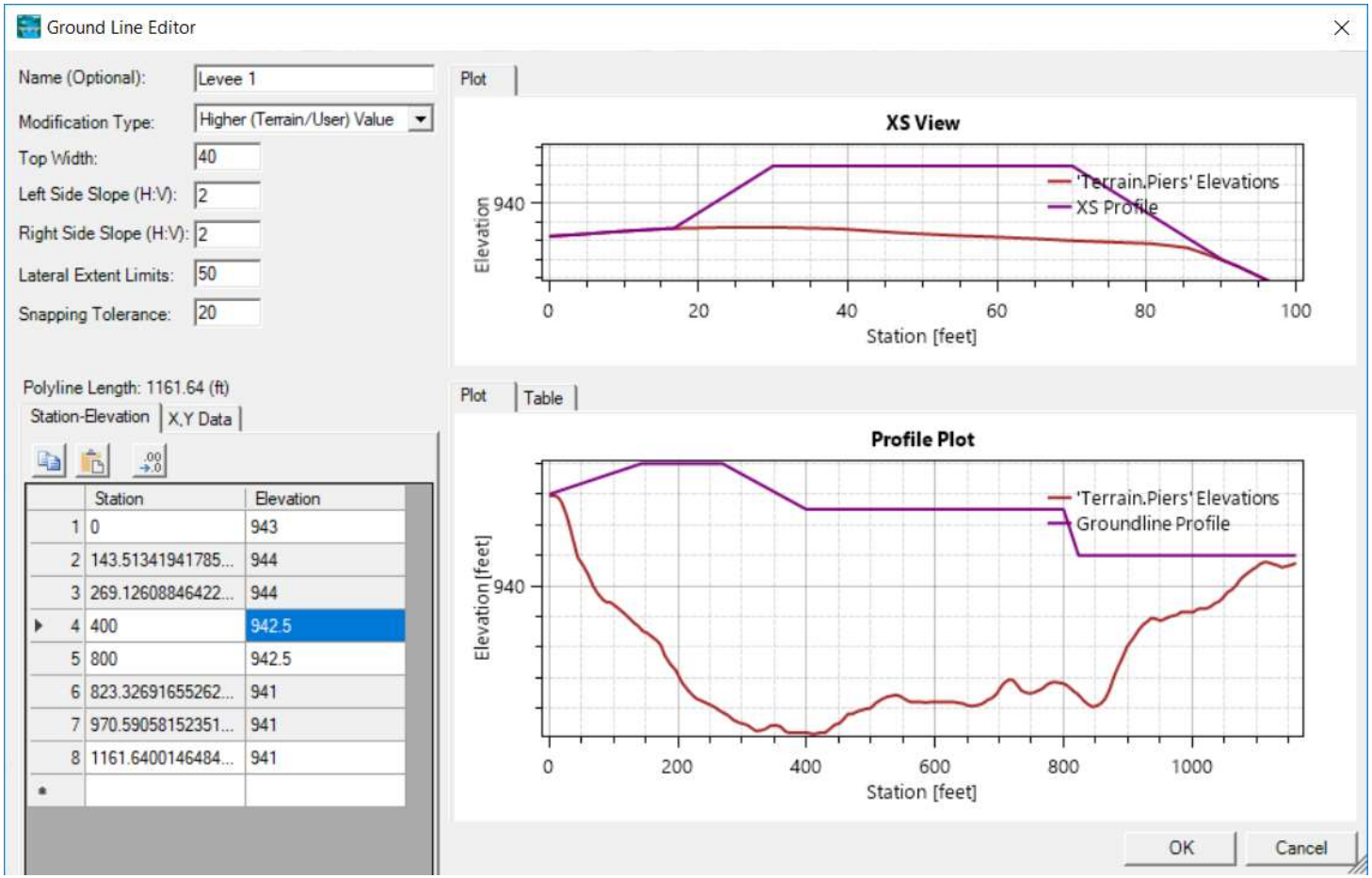


Lines – Elevation Control Points

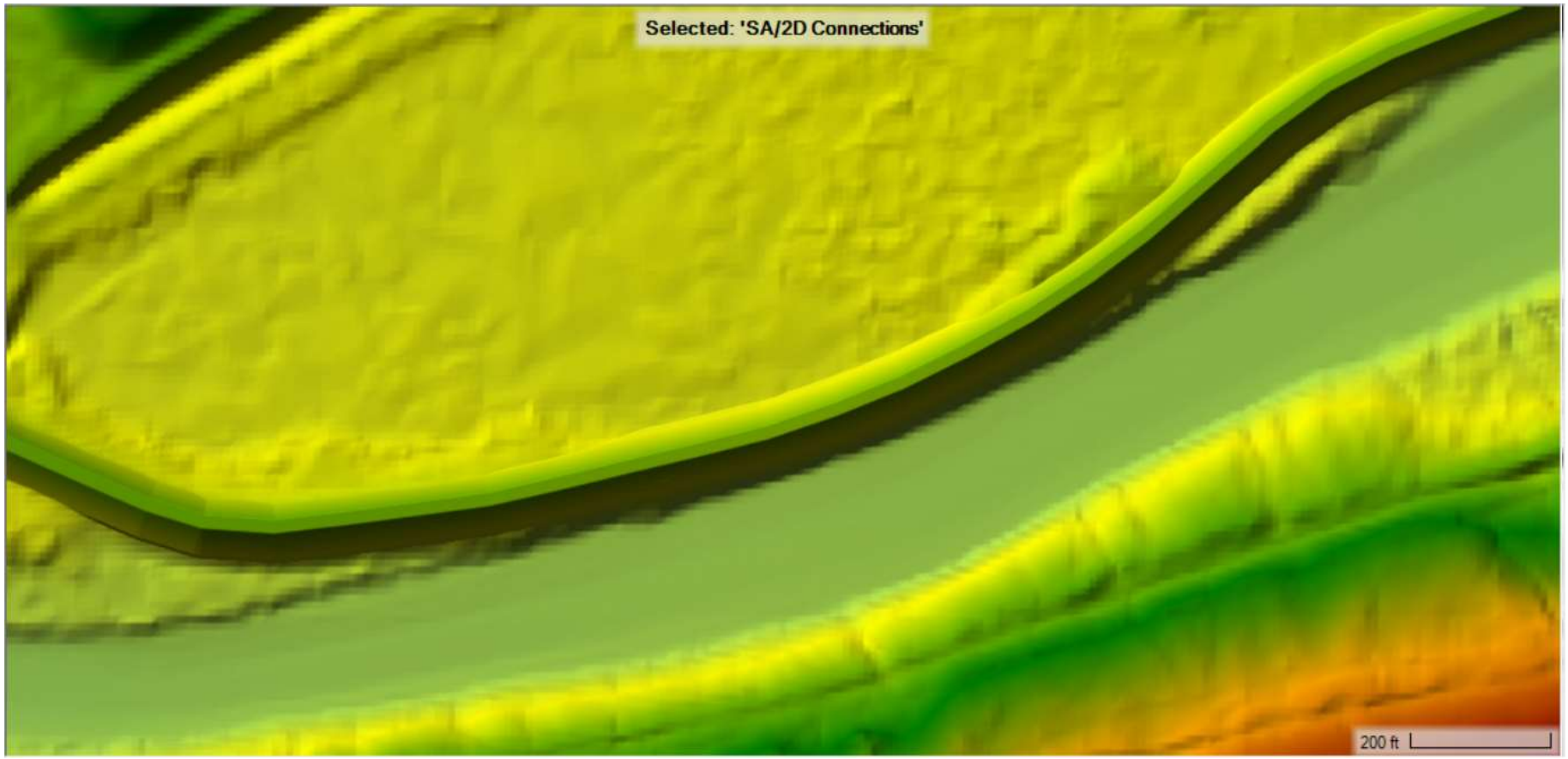


Lines – Elevation Control Point

- Elevation control points shown in grey

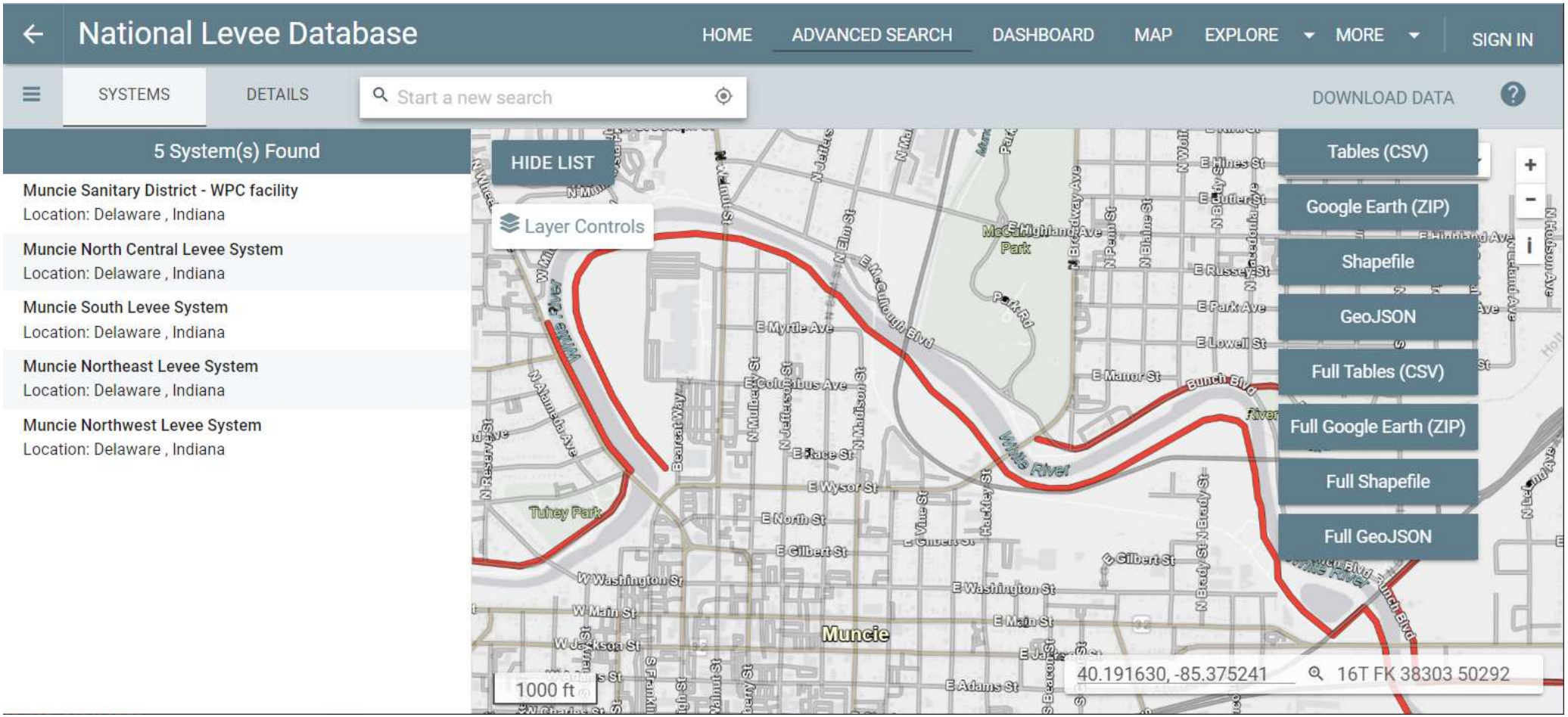


Lines, Levee Lines

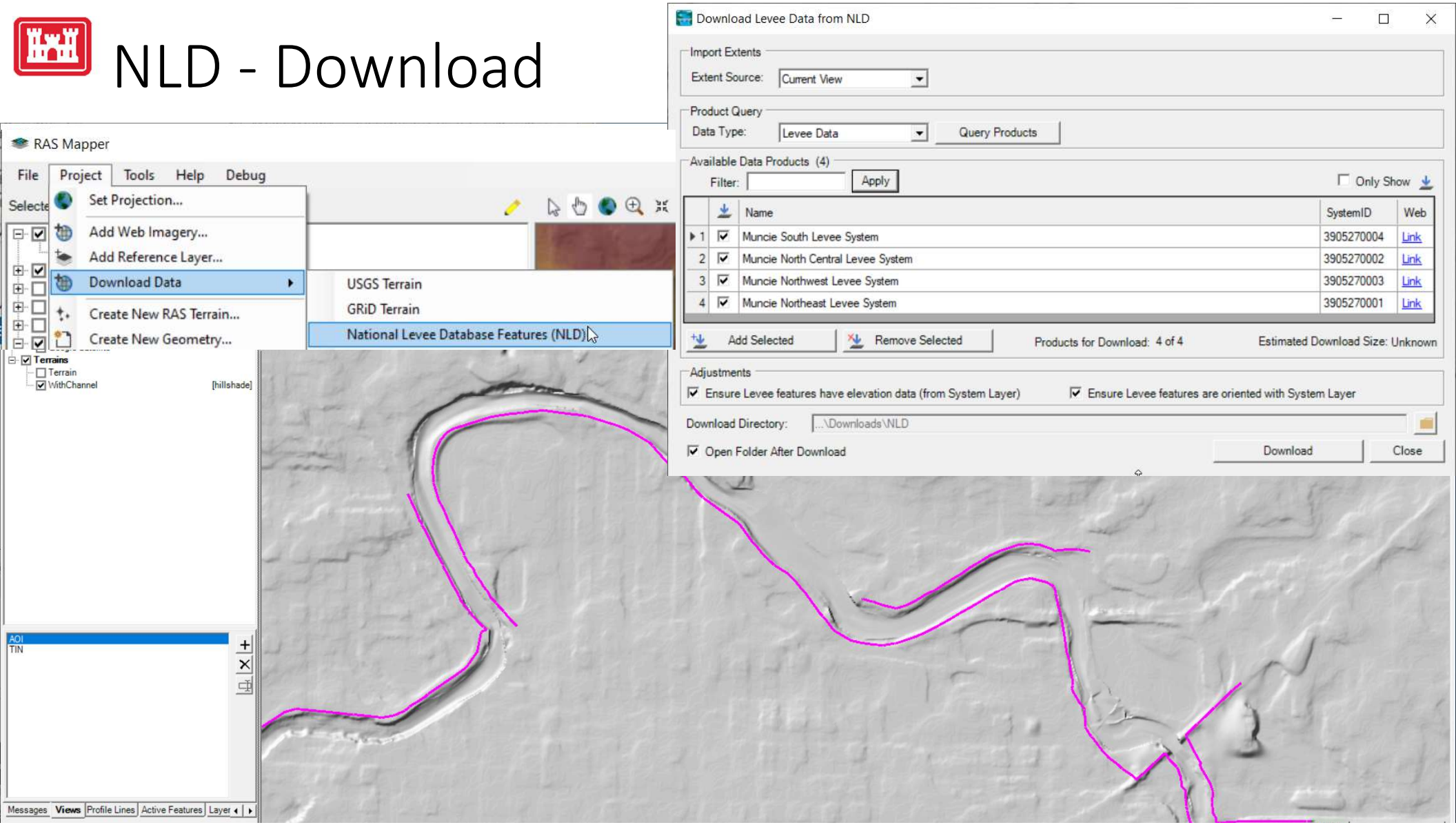


National Levee Database (NLD) Download Tool

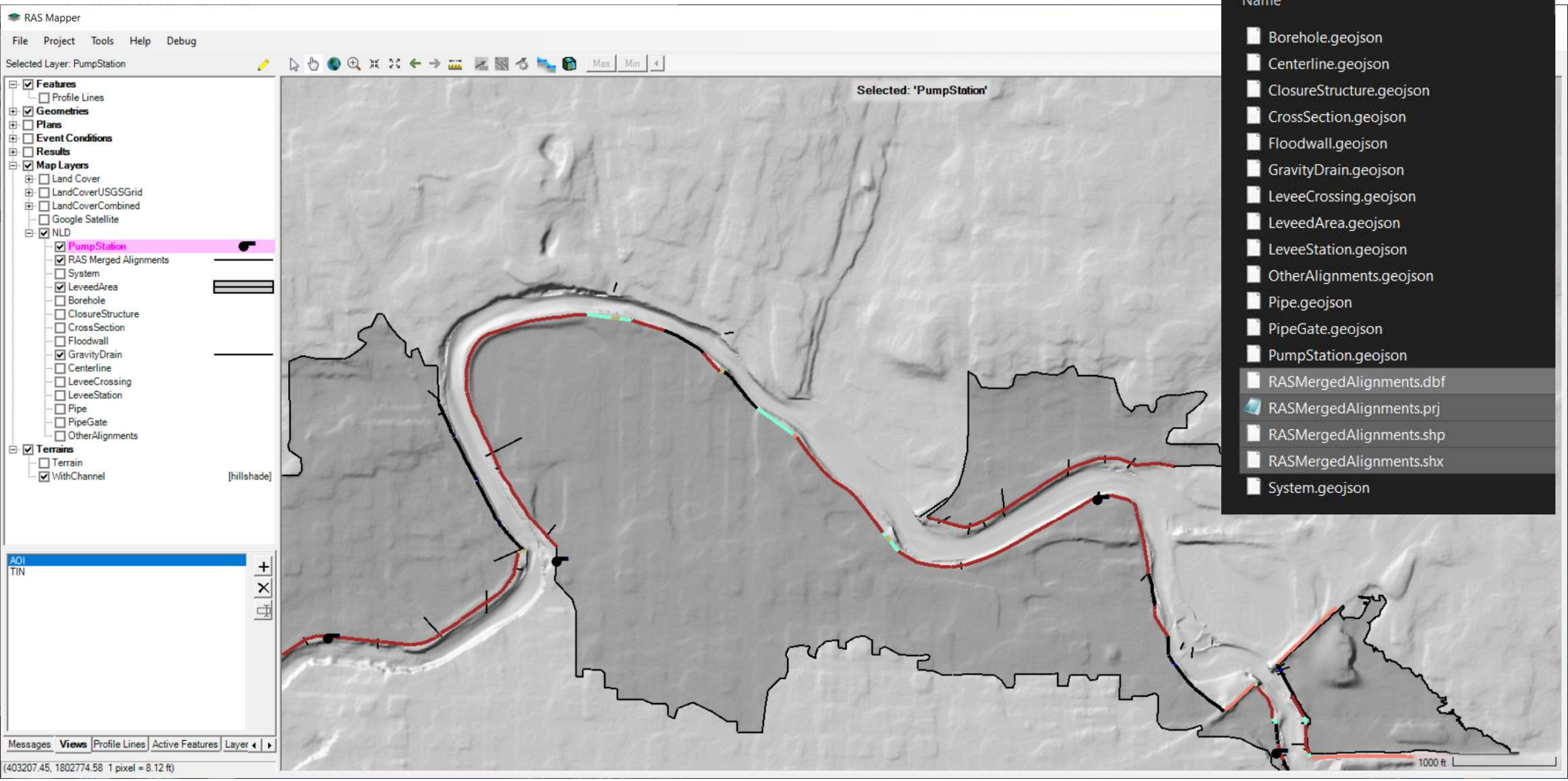
NLD - Example


National Levee Database
HOME
ADVANCED SEARCH
DASHBOARD
MAP
EXPLORE
MORE
SIGN IN
SYSTEMS
DETAILS
Start a new search
DOWNLOAD DATA
5 System(s) Found
Muncie Sanitary District - WPC facility
Location: Delaware , Indiana
Muncie North Central Levee System
Location: Delaware , Indiana
Muncie South Levee System
Location: Delaware , Indiana
Muncie Northeast Levee System
Location: Delaware , Indiana
Muncie Northwest Levee System
Location: Delaware , Indiana
HIDE LIST
Layer Controls
Tables (CSV)
Google Earth (ZIP)
Shapefile
GeoJSON
Full Tables (CSV)
Full Google Earth (ZIP)
Full Shapefile
Full GeoJSON
Muncie
White River
Tuhey Park
1000 ft
40.191630, -85.375241
16T FK 38303 50292

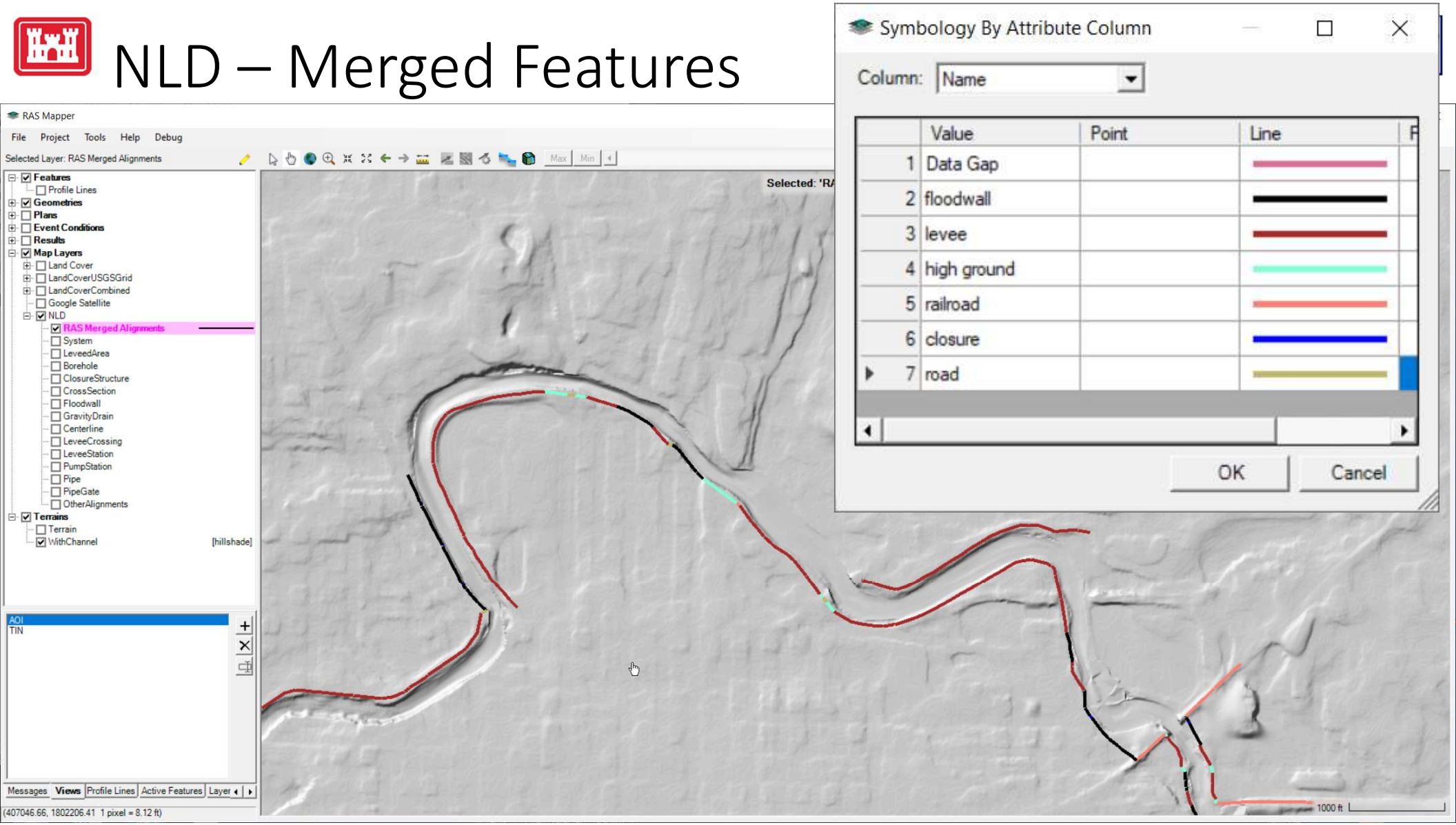
NLD - Download



NLD – All Data Features



NLD – Merged Features

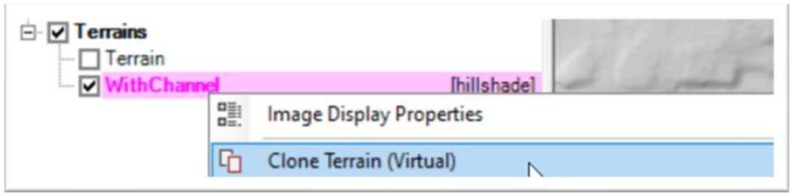


Levee System Layer

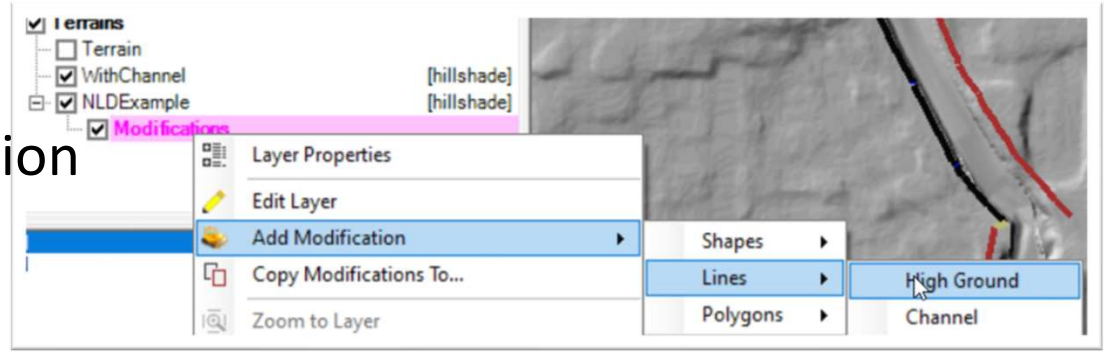
FID	SystemName	SystemID	Name	Width	LeftSlope	RightSlope
0	Muncie South Levee System	3905270004	Data Gap			
1	Muncie South Levee System	3905270004	floodwall	1.8		
2	Muncie South Levee System	3905270004	floodwall	1.8		
3	Muncie South Levee System	3905270004	levee	9	3	3
4	Muncie South Levee System	3905270004	floodwall	1.5		
5	Muncie South Levee System	3905270004	high ground			
6	Muncie South Levee System	3905270004	levee	8	3	3
7	Muncie South Levee System	3905270004	high ground			
8	Muncie South Levee System	3905270004	railroad			
9	Muncie South Levee System	3905270004	floodwall			
10	Muncie South Levee System	3905270004	floodwall	1.6		
11	Muncie South Levee System	3905270004	closure			
12	Muncie South Levee System	3905270004	floodwall	1.6		
13	Muncie South Levee System	3905270004	levee	12	3	3
14	Muncie South Levee System	3905270004	floodwall	1.7		
15	Muncie South Levee System	3905270004	levee	16	3	3
16	Muncie South Levee System	3905270004	high ground			

Using NLD for Terrain Modification

1. Clone Terrain

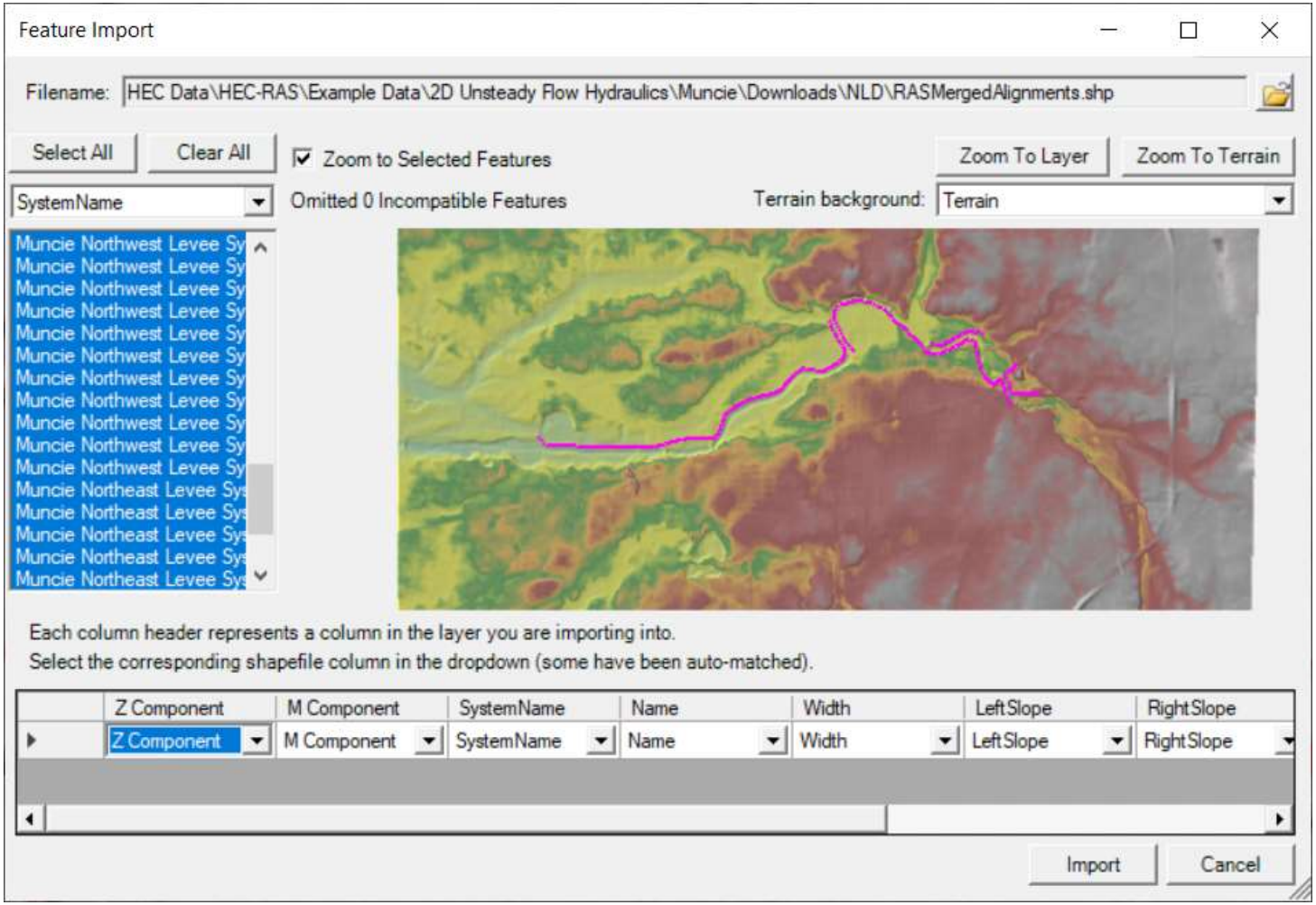


2. Add High Ground Modification



3. Import Features (Merged Layer)
   Right-click on modification group while in Edit mode

Import ‘RASMergedAlignments’ Layer

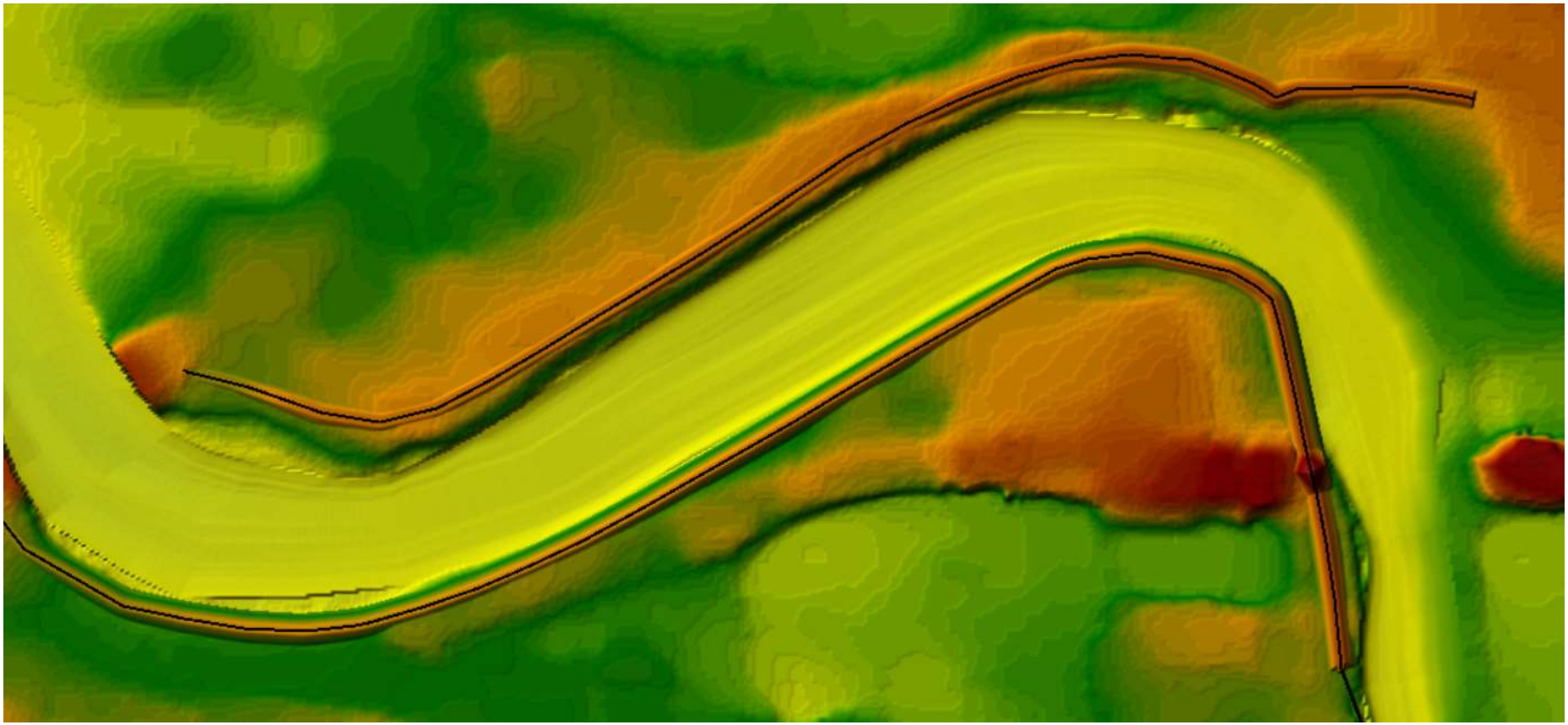


High Ground Modification

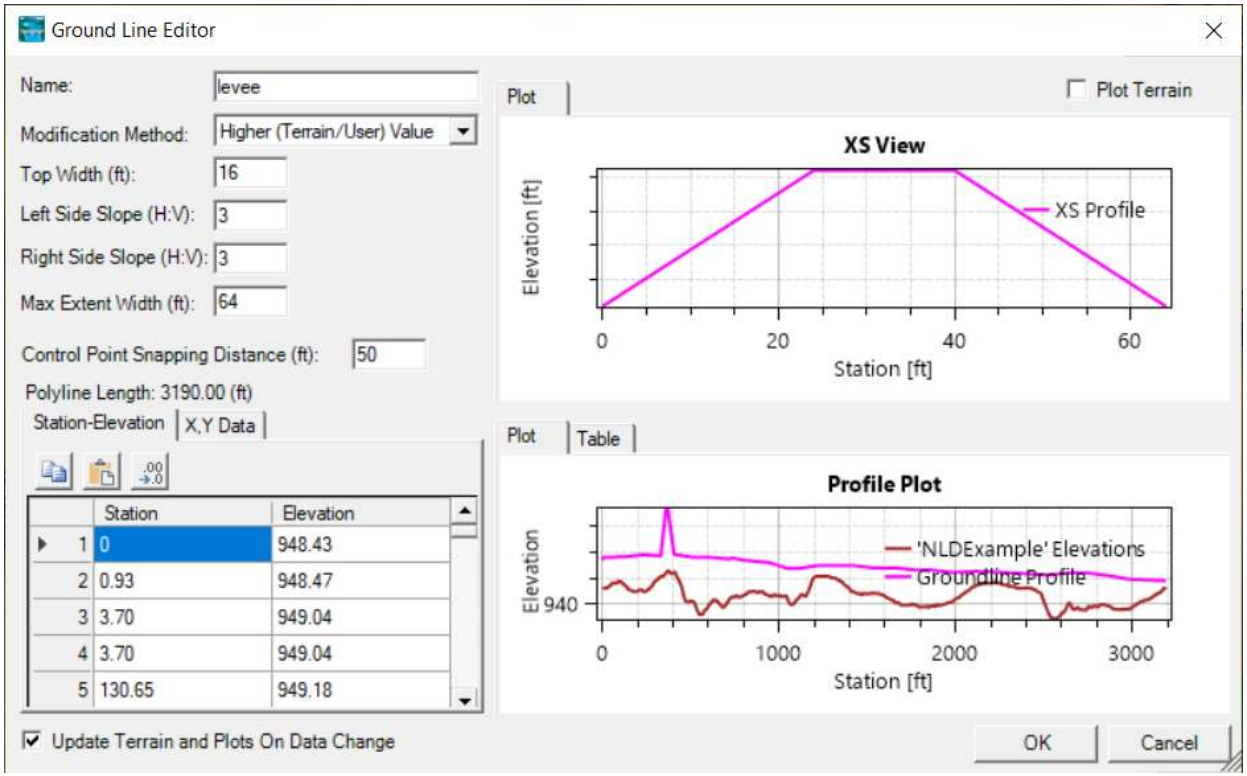
FID	SystemName	Name	Elevation Type	Width	LeftSlope	RightSlope	Max Extent	Transition Percent	Elev Pt Tolerance	Computed System Name	Profile
0	Muncie South Levee System	Data Gap	TakeHigher					1	50	Muncie South Levee System	(2 Points)
1	Muncie South Levee System	floodwall	TakeHigher	1.8	0.1	0.1	7.2	1	50	Muncie South Levee System	(10 Points)
2	Muncie South Levee System	floodwall	TakeHigher	1.8	0.1	0.1	7.2	1	50	Muncie South Levee System	(4 Points)
3	Muncie South Levee System	levee	TakeHigher	9	3	3	36	1	50	Muncie South Levee System	(10 Points)
4	Muncie South Levee System	floodwall	TakeHigher	1.5	0.1	0.1	6	1	50	Muncie South Levee System	(7 Points)
5	Muncie South Levee System	high ground	TakeHigher					1	50	Muncie South Levee System	(2 Points)
6	Muncie South Levee System	levee	TakeHigher	8	3	3	32	1	50	Muncie South Levee System	(17 Points)
7	Muncie South Levee System	high ground	TakeHigher					1	50	Muncie South Levee System	(2 Points)
8	Muncie South Levee System	railroad	TakeHigher					1	50	Muncie South Levee System	(10 Points)
9	Muncie South Levee System	floodwall	TakeHigher	2	0.1	0.1	8	1	50	Muncie South Levee System	(3 Points)
10	Muncie South Levee System	floodwall	TakeHigher	1.6	0.1	0.1	6.4	1	50	Muncie South Levee System	(10 Points)
11	Muncie South Levee System	closure	TakeHigher	2	0.1	0.1	8	1	50	Muncie South Levee System	(2 Points)
12	Muncie South Levee System	floodwall	TakeHigher	1.6	0.1	0.1	6.4	1	50	Muncie South Levee System	(5 Points)
13	Muncie South Levee System	levee	TakeHigher	12	3	3	48	1	50	Muncie South Levee System	(15 Points)
14	Muncie South Levee System	floodwall	TakeHigher	1.7	0.1	0.1	6.8	1	50	Muncie South Levee System	(7 Points)

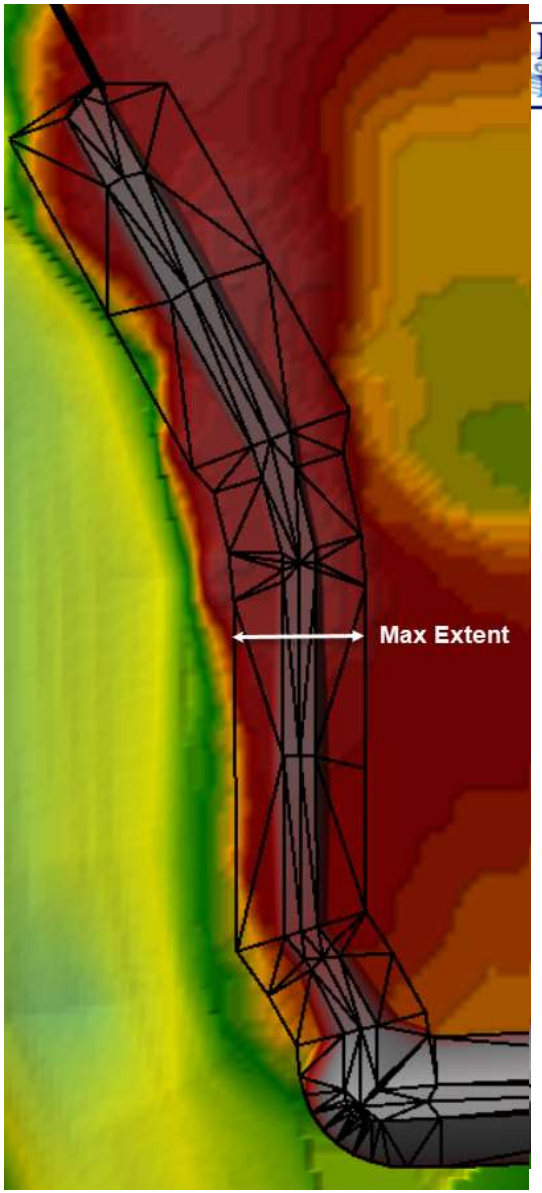
- Flood walls and closure structure defaults – 2ft width, 0.1 side slopes
- “Levee System” is computed – allows for continuous interpolation from segment to segment

Modification Example

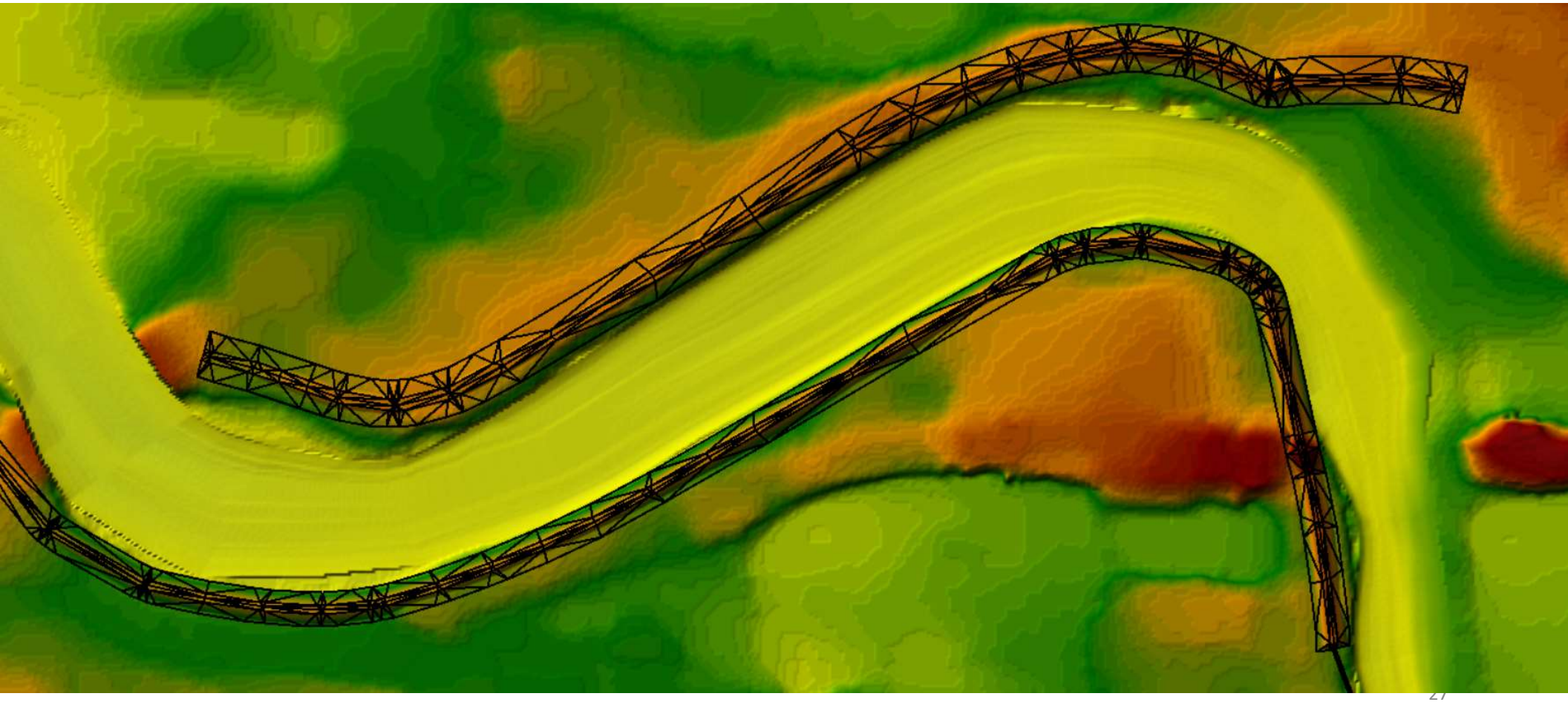


High Ground Line Editor



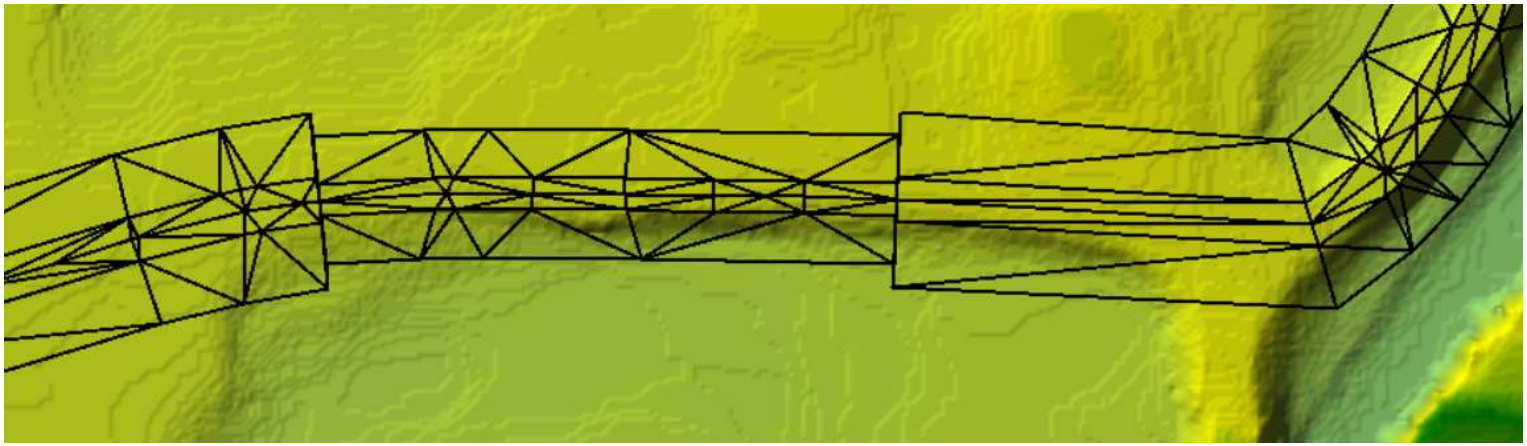


Interpolation along Line Modification

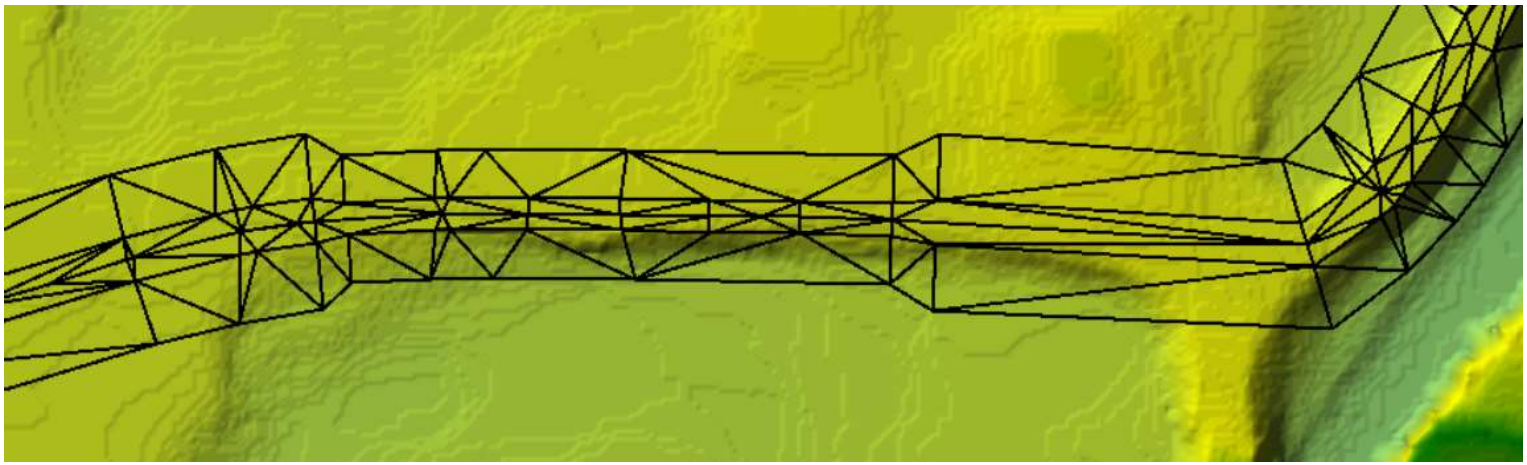


Interpolation – Feature Transition

- None

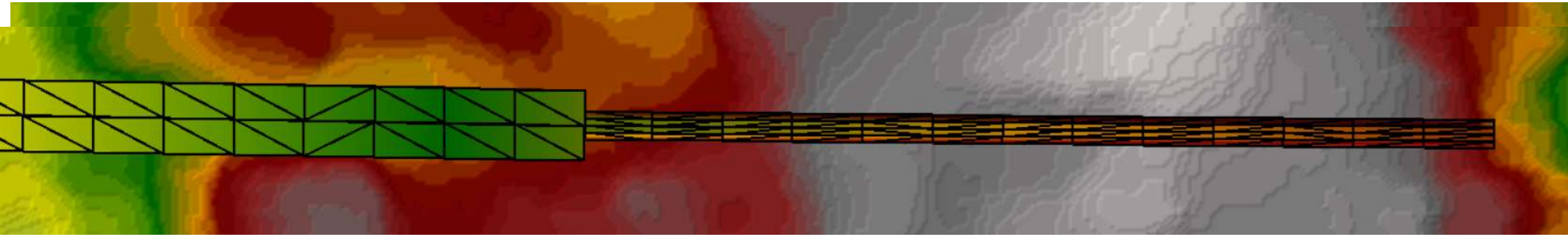


- Some

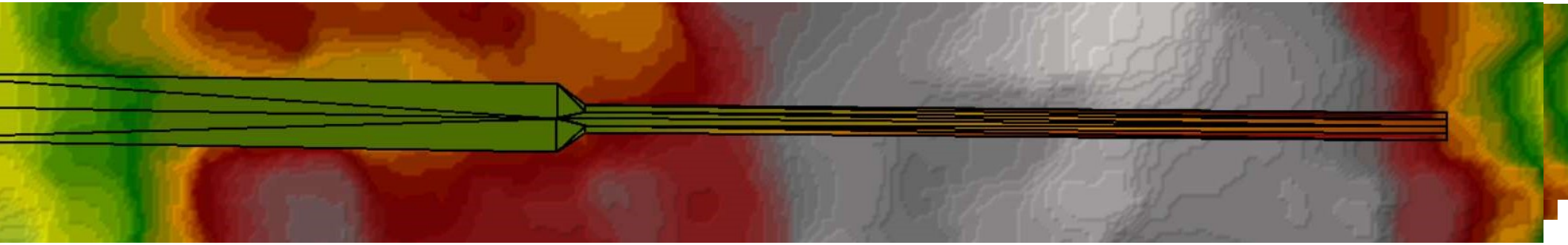


Interpolation – System Name

FID	SystemName	Name	Elevation Type	Width	LeftSlope	RightSlope	Max Extent	Transition Percent	Elev Pt Tolerance	Computed System Name
0		Channel 2	TakeLower	20	4	4	40	2	50	
1		Channel 3	TakeLower	100	4	4	100	0	50	



FID	SystemName	Name	Elevation Type	Width	LeftSlope	RightSlope	Max Extent	Transition Percent	Elev Pt Tolerance	Computed System Name
0	fakeit	Channel 2	TakeLower	20	4	4	40	2	50	fakeit
1	fakeit	Channel 3	TakeLower	100	4	4	100	1	50	fakeit



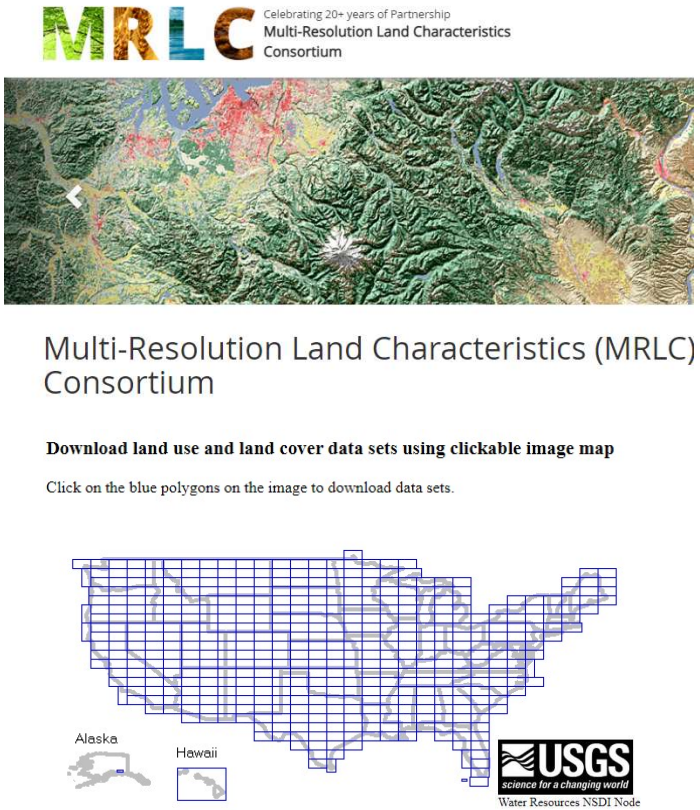
Terrain Modification – Focus Areas

- Triangulation
  - Fast
  - Reliable
  - Provide limited user controls
- Rendering
  - Fast
- Consideration for expansive use of new capability
  - Handle good people doing “bad” things ☺

Land Cover and Manning's *n* values

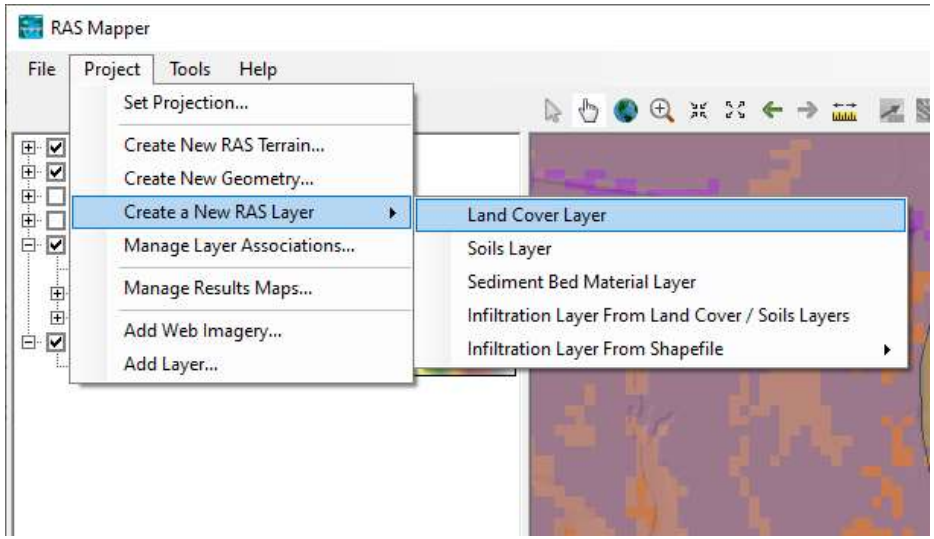
Land Cover Data Sources

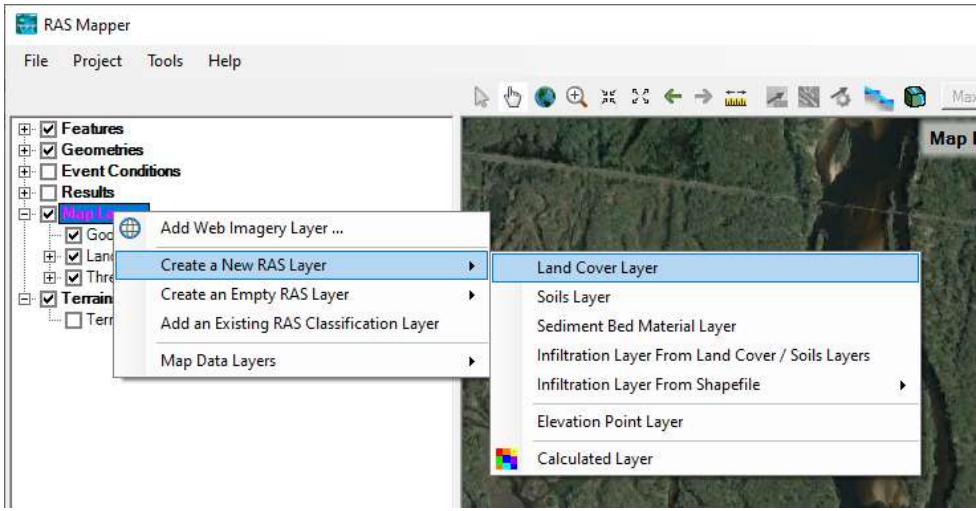
- Support use of Land Cover data for estimating Manning's n values
  - Raster and Shapefile polygon datasets
- NLCD 2019
  - http://www.mrlc.gov
    (30-m raster)
- USGS LULC
  - http://water.usgs.gov/GIS/dsdl/ds240/index.html
    (vector or raster)



Importing Land Cover Data

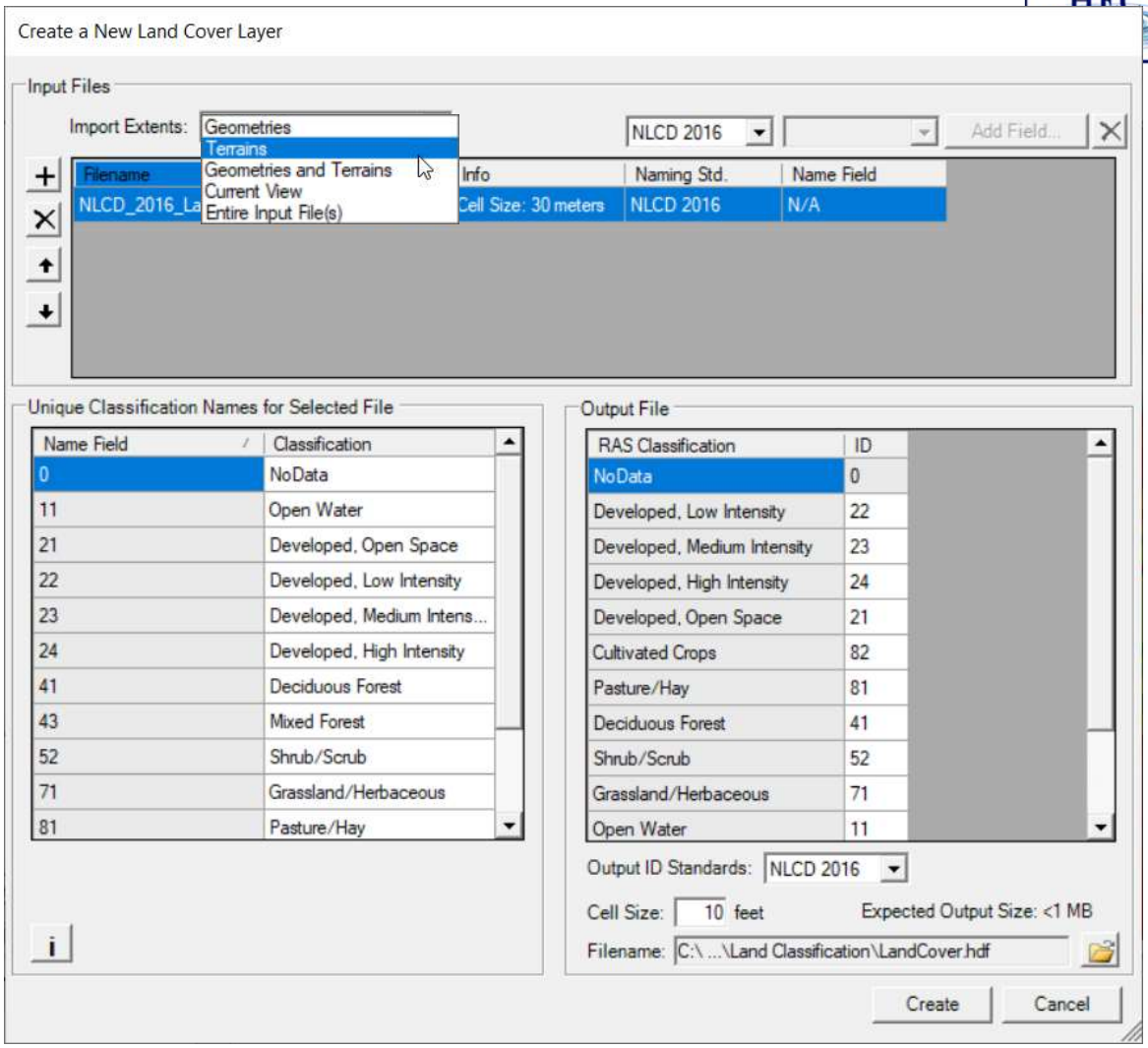
- Define the project domain
  - Terrain model
  - River model construct
- Create a New Land Cover Layer



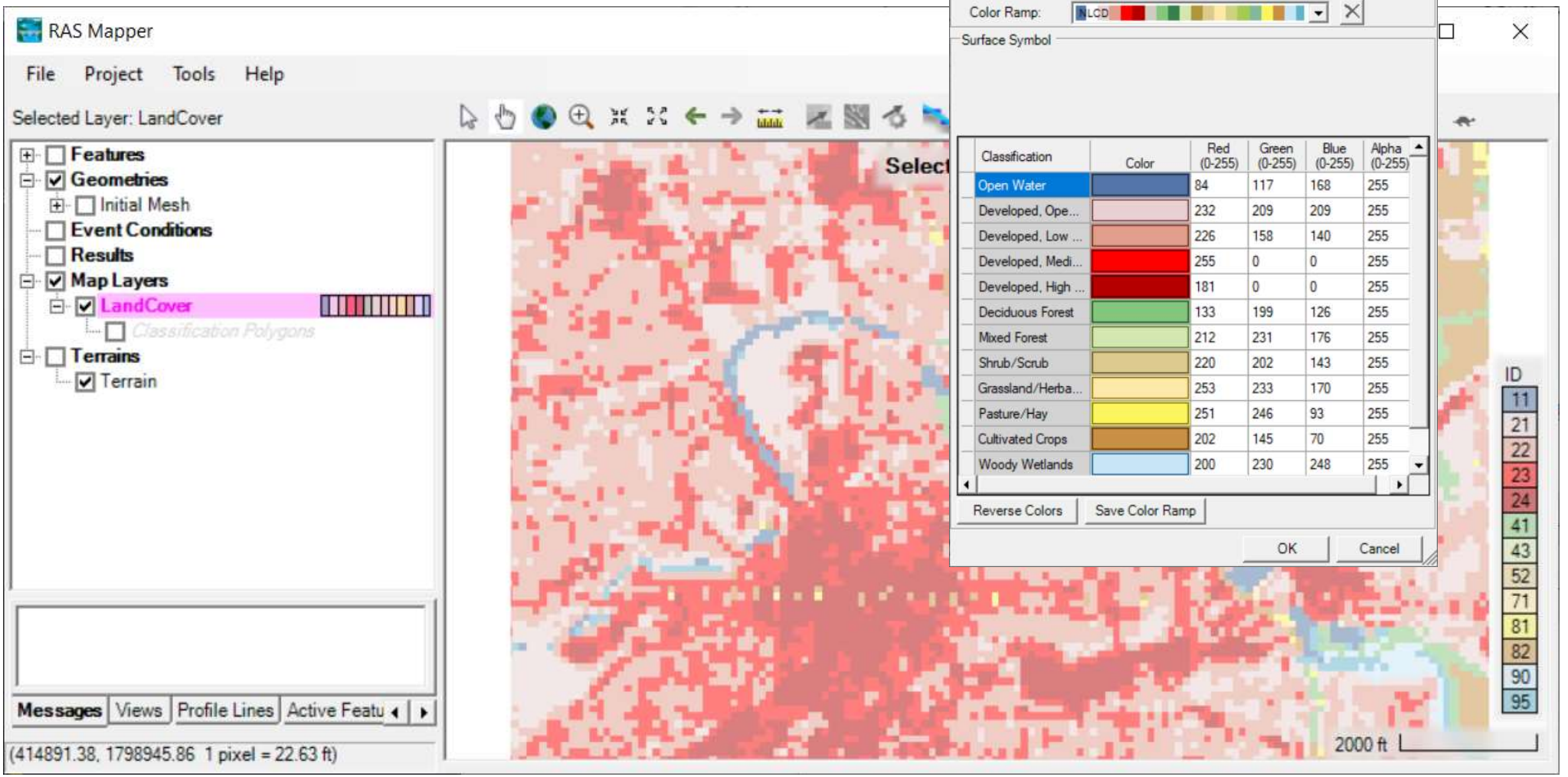


New Land Cover Layer

- Set Extents
- Add Files
- Reclassify
- Set Cell Size
- Provide Filename
- Create

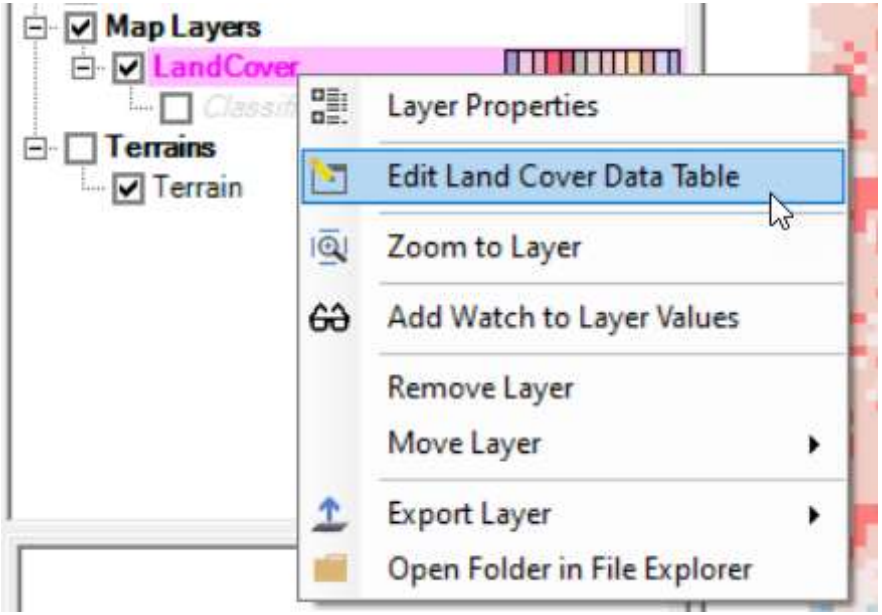


Land Cover Layer



Manning's n Values

- Provide base Manning's n values



This is the first time you will see "Manning n"

Classification Parameters

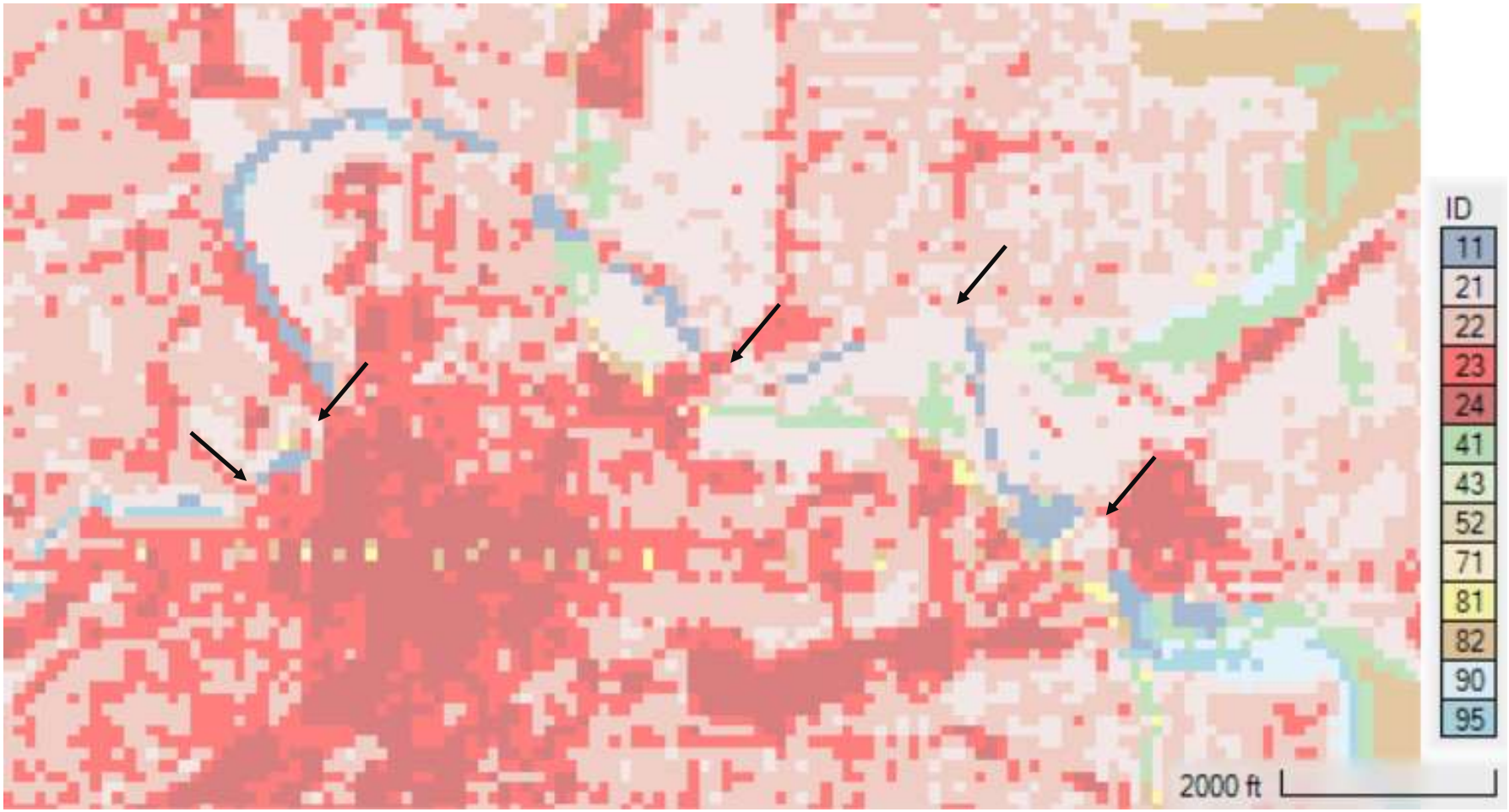
Selected Area Edits

Parameter: ManningsN

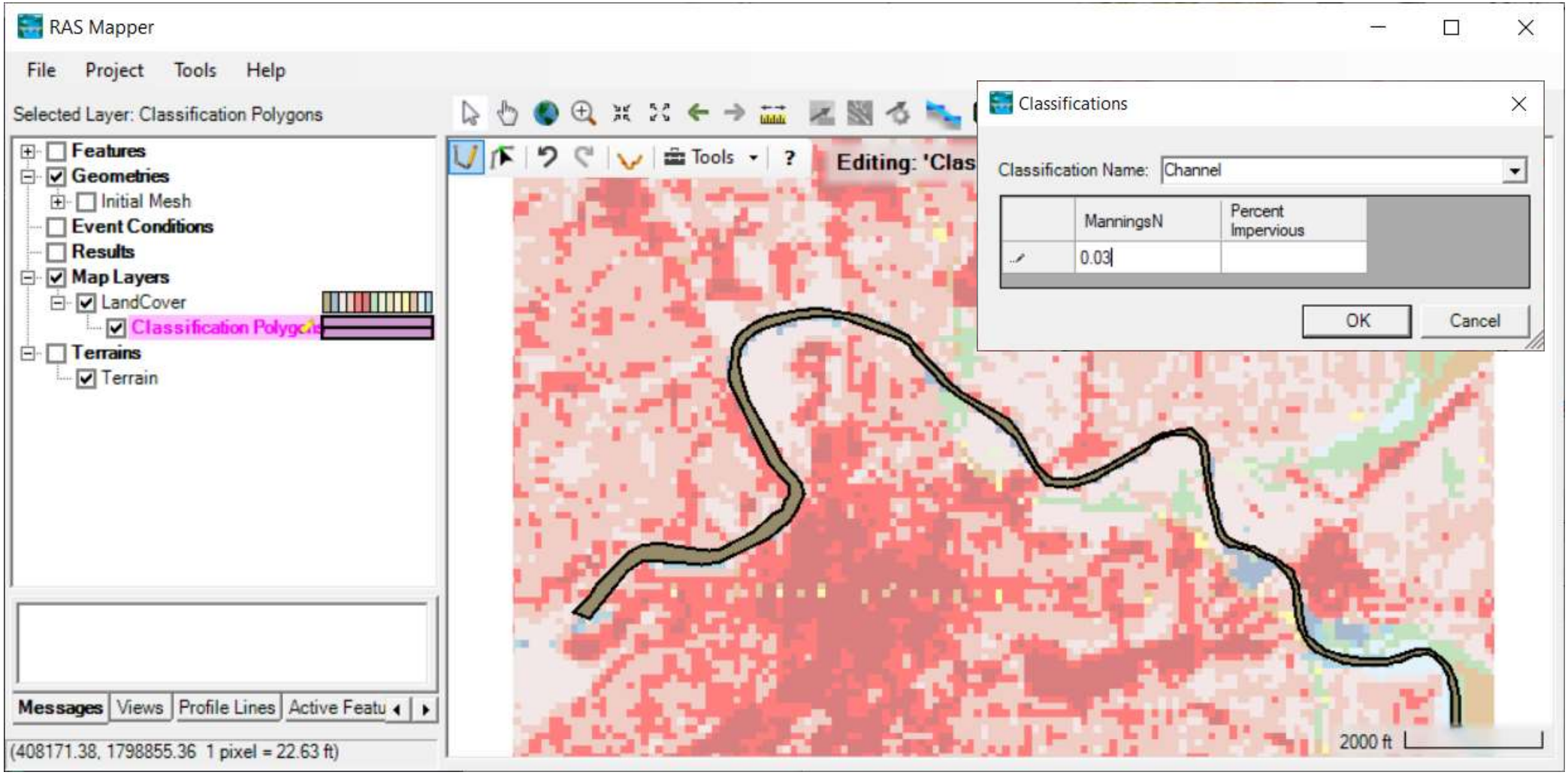
ID	Name	ManningsN
0	NoData	0.066
11	Open Water	0.035
21	Developed, Open Space	0.04
22	Developed, Low Intensity	0.06
23	Developed, Medium Intensity	0.08
24	Developed, High Intensity	0.1
41	Deciduous Forest	0.16
43	Mixed Forest	0.14
52	Shrub/Scrub	0.04
71	Grassland/Herbaceous	0.055
81	Pasture/Hay	0.04
82	Cultivated Crops	0.05
90	Woody Wetlands	0.09
95	Emergent Herbaceous Wetlan...	0.65

OK Cancel

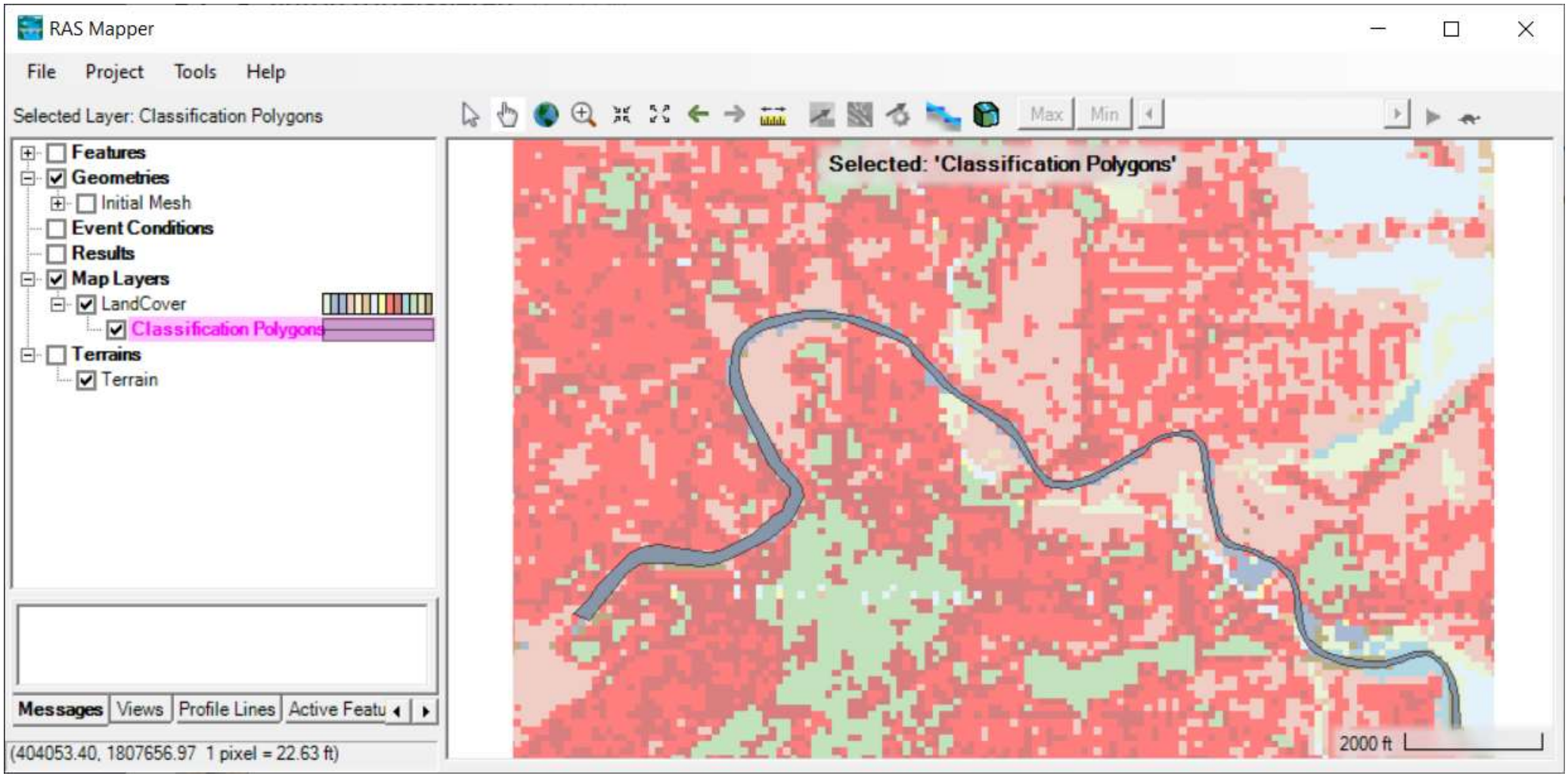
Land Cover Layer –Data Issues



Land Cover Classification



Land Cover Layer with Vector Polygons



Questions?