

# HEC-RAS Mapper Results Visualization

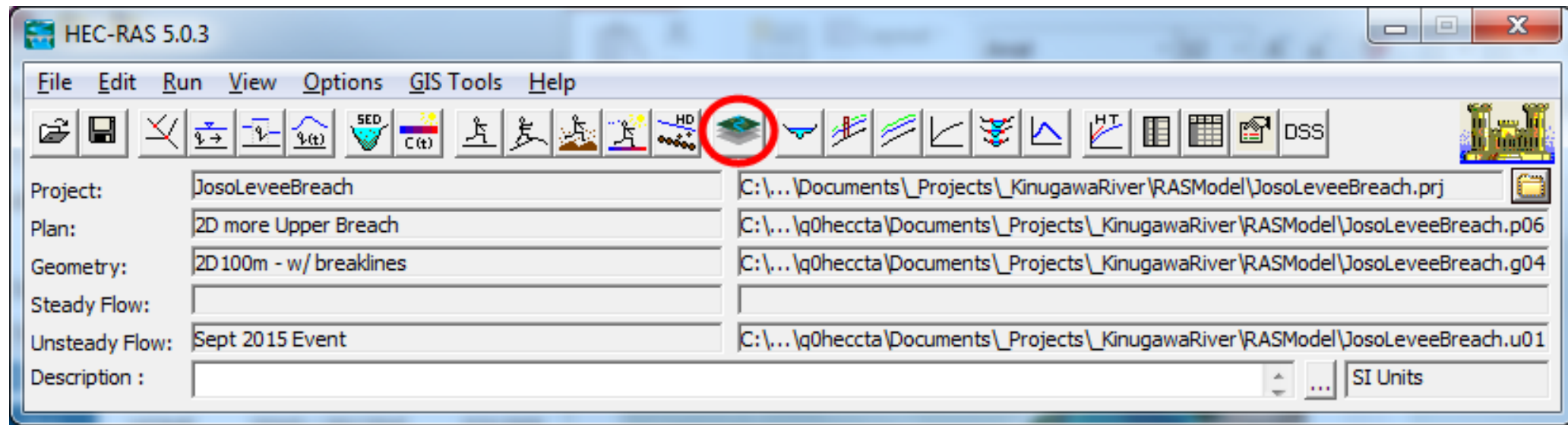
Cameron Ackerman, P.E., D.WRE

USACE, Institute for Water Resources, Hydrologic Engineering Center



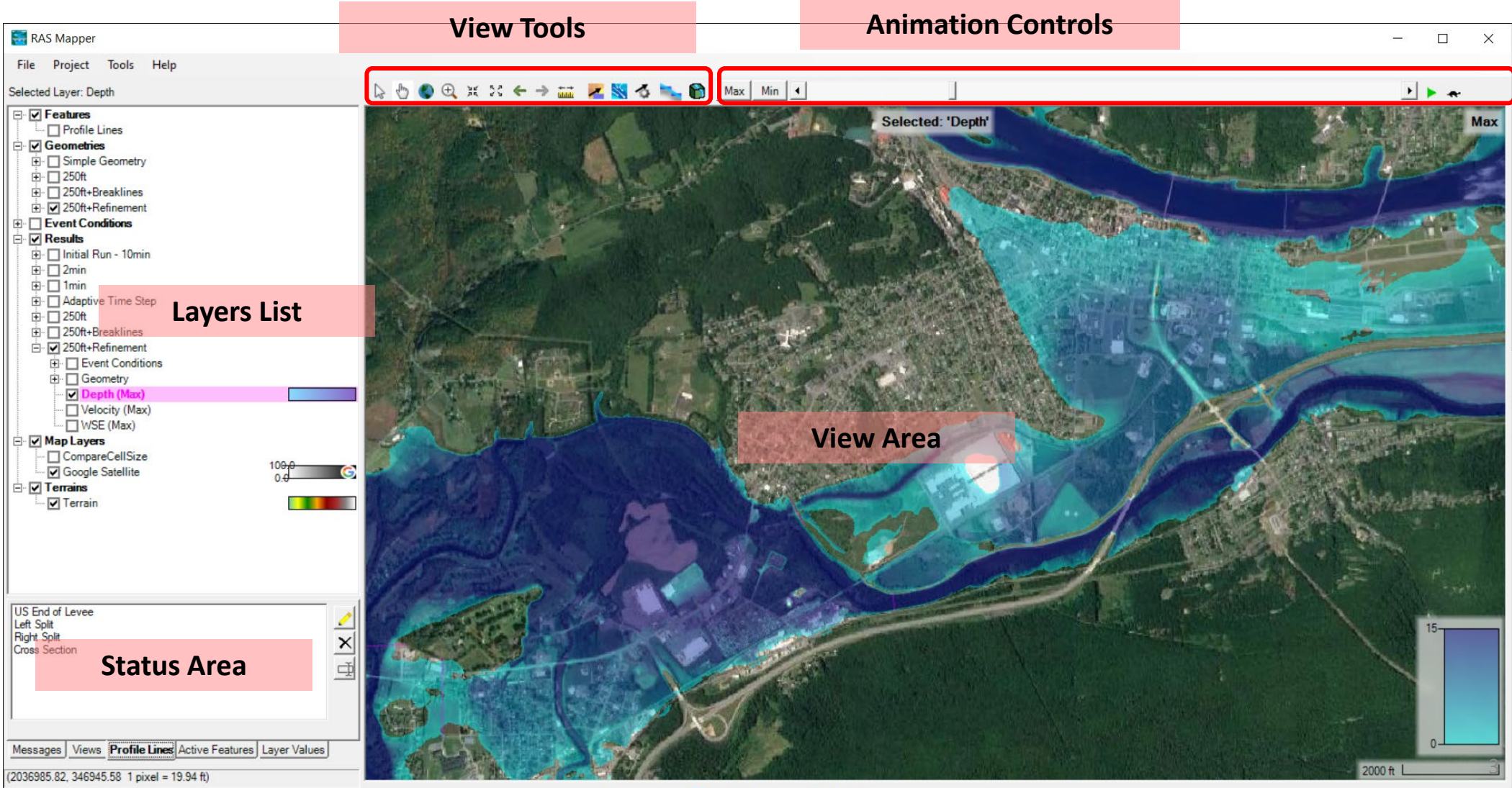
# Overview

- How do we visualize RAS results?
- How do we debug our model?
- How do we compare different plans?





# HEC-RAS Mapper





- Profile Lines
- Geometries
- Results
- Map Layers
- Terrains



Symbology is shown to the right of any checked layers.



The selected layer is highlighted in magenta.





# Status Area

- Messages – What just happened
- View – Quickly zoom to predefined areas
- Profile Lines – Access results at specific locations
- Active Features – Quick access to features in layer
- Layer Values – Watch values for multiple results

Geometry 'Imported GIS Data +Bridges' association was set to the one terrain available (Terrain)  
XS Interpolation Surfaces generated in 167 ms

Airport  
Confluence  
WWTP  
Santa Fe Ave Bridge

US End of Levee  
Left Split  
Right Split  
Cross Section

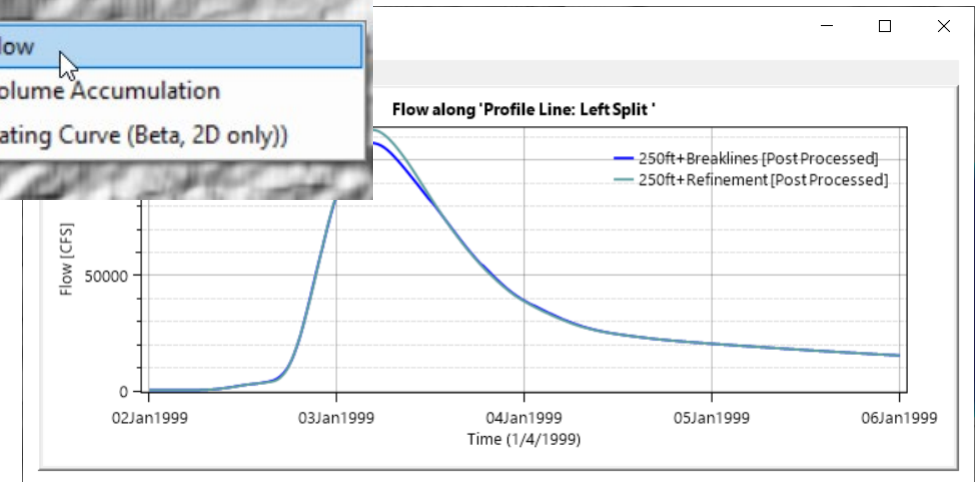
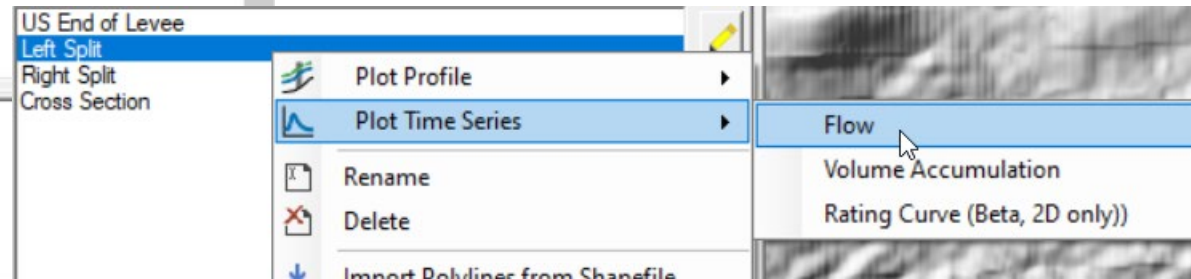
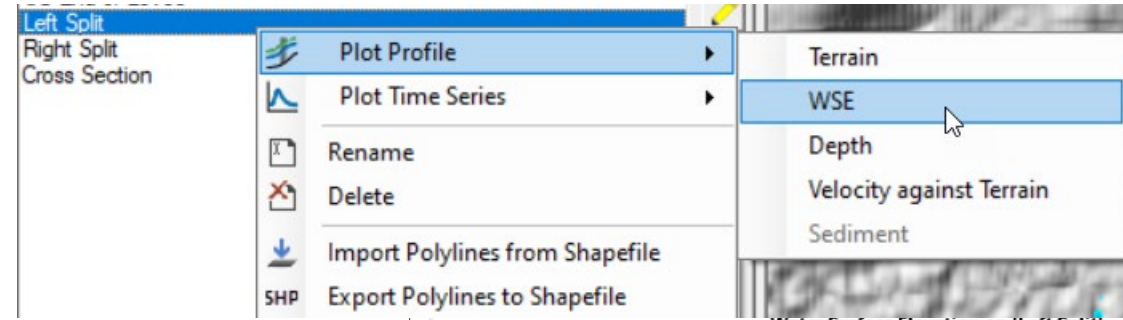
15696.24  
15485.51  
15370.43  
15205.20

Use	Name	ID	Value
<input checked="" type="checkbox"/>	Velocity (250ft+Refinement)	vR	1.51
<input checked="" type="checkbox"/>	Velocity (250ft+Breaklines)	vBL	1.40
<input checked="" type="checkbox"/>	WSE (250ft+Refinement)	wR	573.71
<input checked="" type="checkbox"/>	WSE (250ft+Breaklines)	wBL	575.43

Messages Views Profile Lines Active Features **Layer Values**

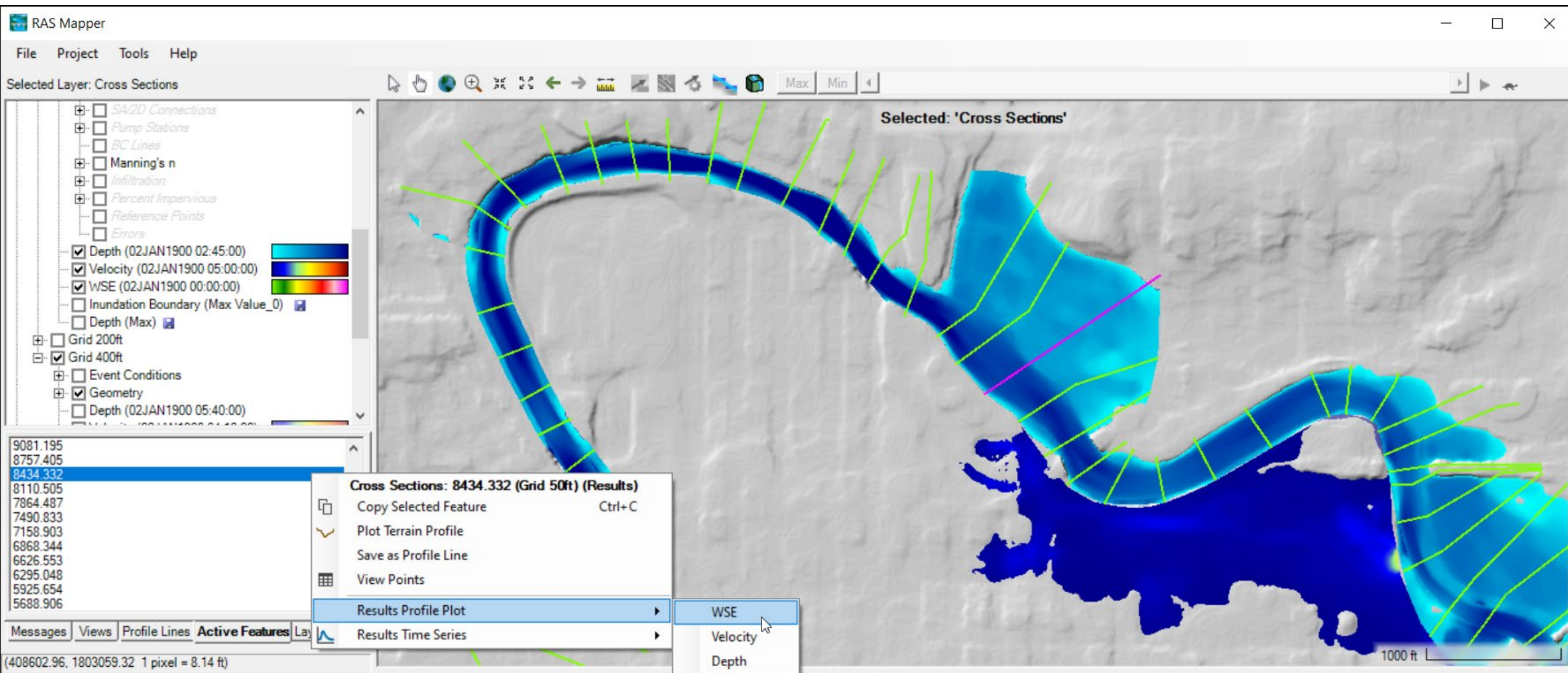


- User-defined/editable features





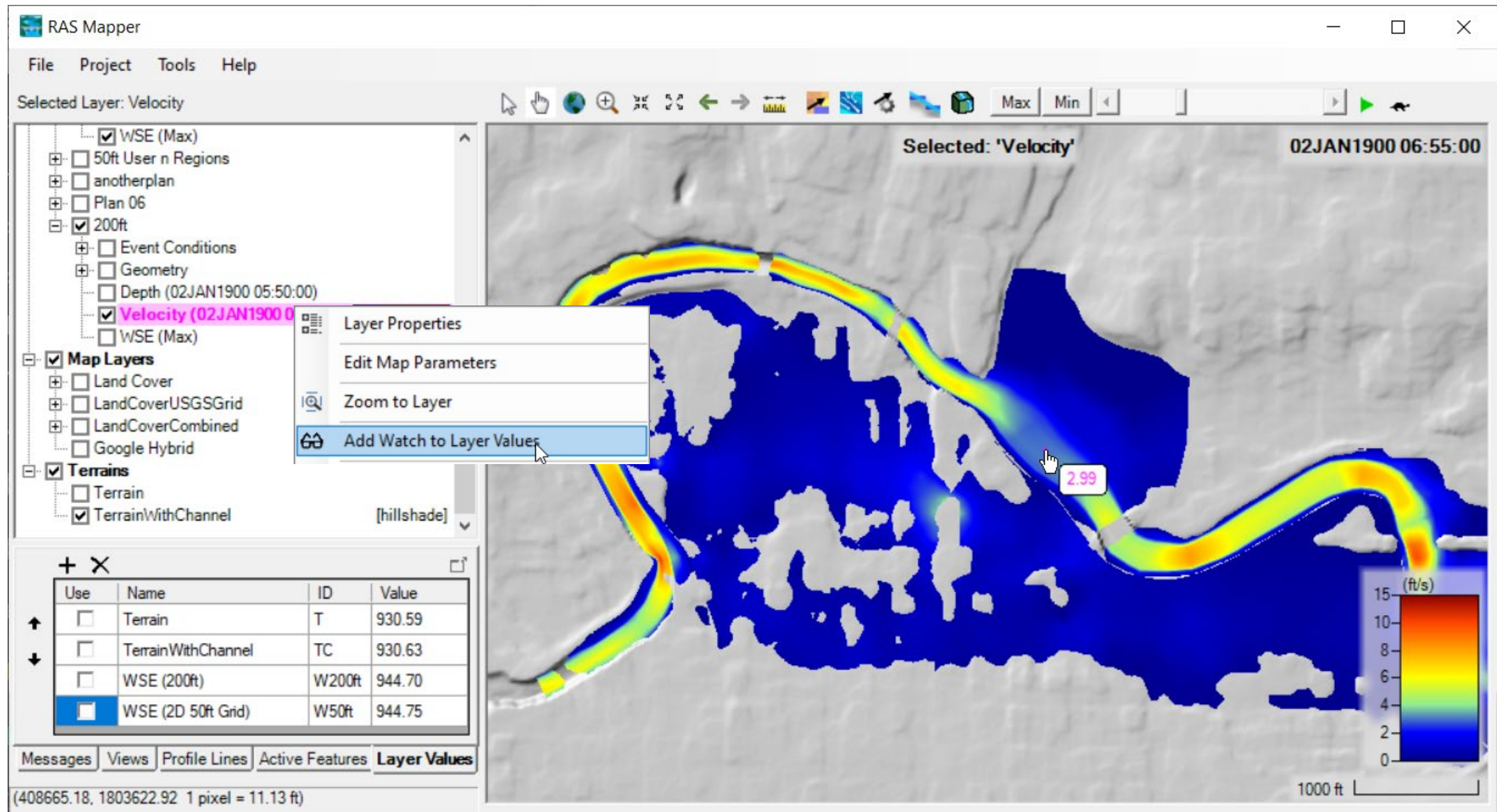
# Active Features







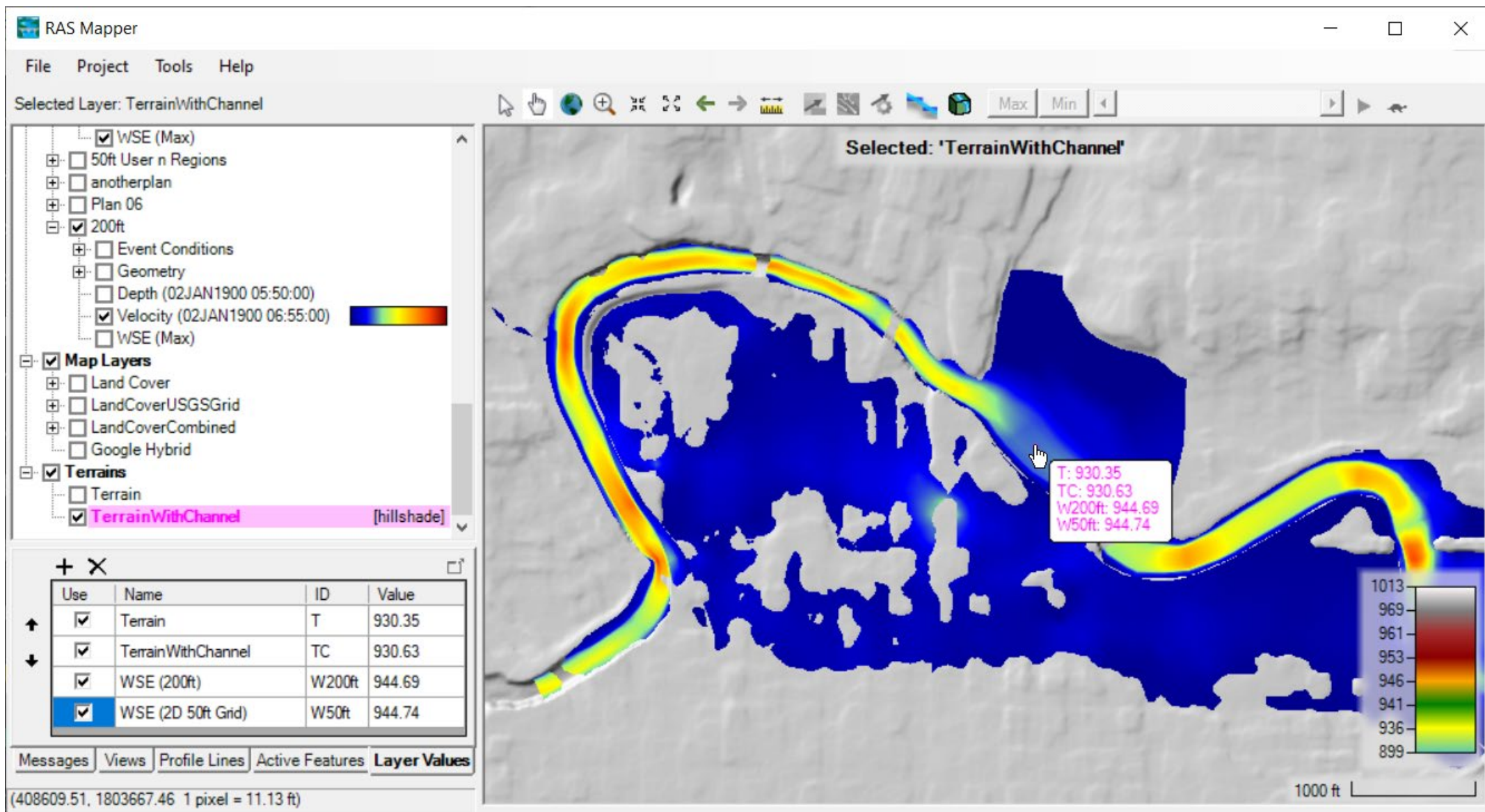
# Watch Layers List





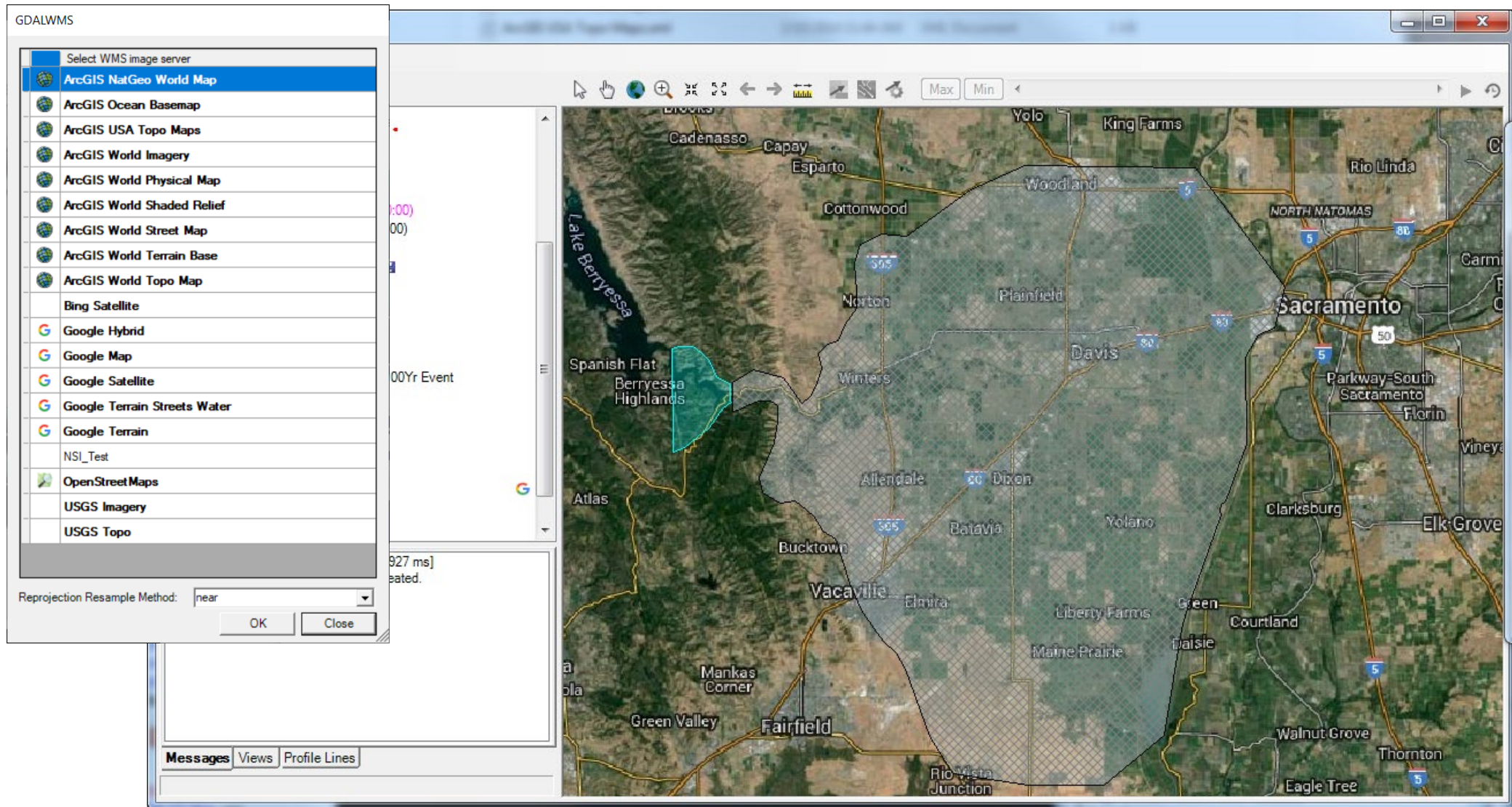


# Watch Layers List





# Web Imagery

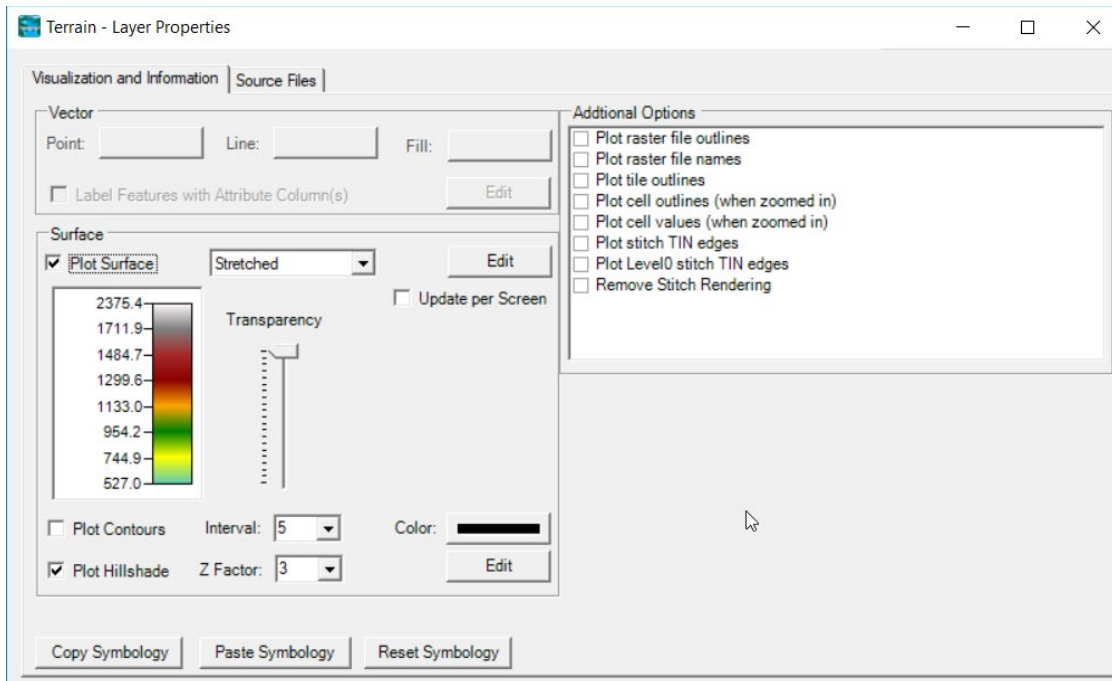




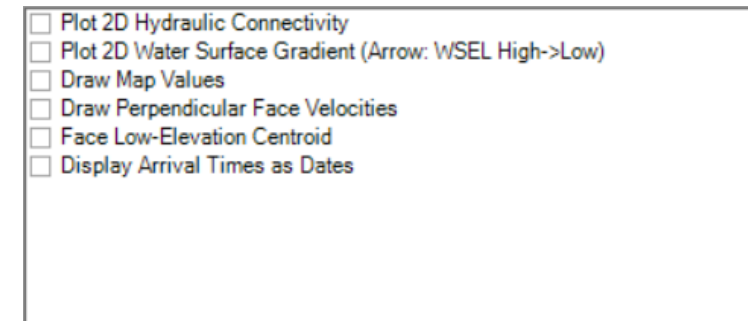


# Plot Options – Layer Specific!

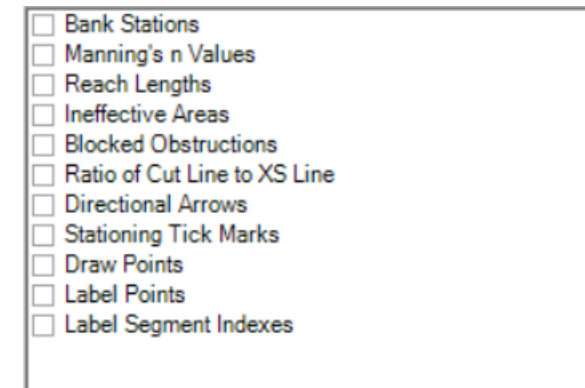
- Terrain



- Depth, WSE



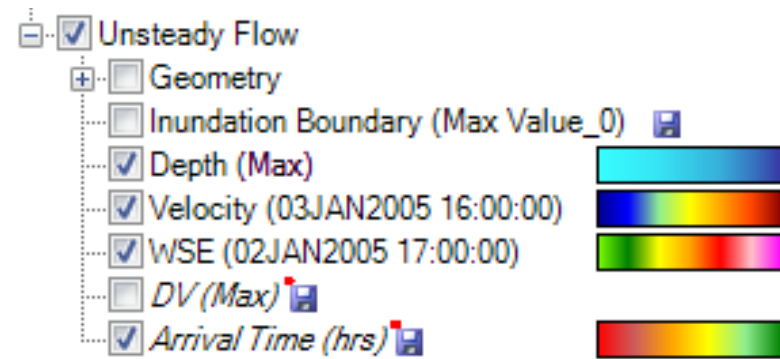
- River, Cross Sections





# Results Mapping

- Dynamic Mapping – on-the-fly mapping
  - Animation of results without waiting



- Stored Maps – results written to file

*\* = There was a problem reading data*





# Results Mapping

Map Type | Profile/Parameter | Mode

Results Map Parameters

Map Type

Hydraulics

Water Surface Elevation

Velocity

Flow (1D Only)

Inundation Boundary

Depth

Courant (Velocity/Length)

Courant (Residence Time, 2D Only)

Froude

Shear Stress

Depth \* Velocity

Depth \* Velocity^2

Energy (Depth)

Energy (Elevation)

Arrival Time

Arrival Time (Max)

Recession

Duration

Parameters

Start Time at: 02JAN1900 00:00:00

☒ Start of simulation

☐ Offset from start of simulation

d  h  m

☐ Fixed date/time (08JUL1995 17:00:00)

Unsteady Profile

☒ Hours

☐ Days

Parameters

Threshold Depth:

Map Output Mode

Generated for Current View (in memory)

☒ Raster (with Associated Terrain)

☐ Point Feature Layer:

Stored (saved to disk)

☐ Raster based on Terrain:

TerrainWithChannel

☐ Point Feature Layer:

☐ Polygon Boundary at Value:

0

	Map Type	Layer Name
▶	Arrival Time	Arrival Time

Add Map

Close

Map Type: A Map layer will be created for The time (from a specified Start Time) for water to reach a specified flood depth.

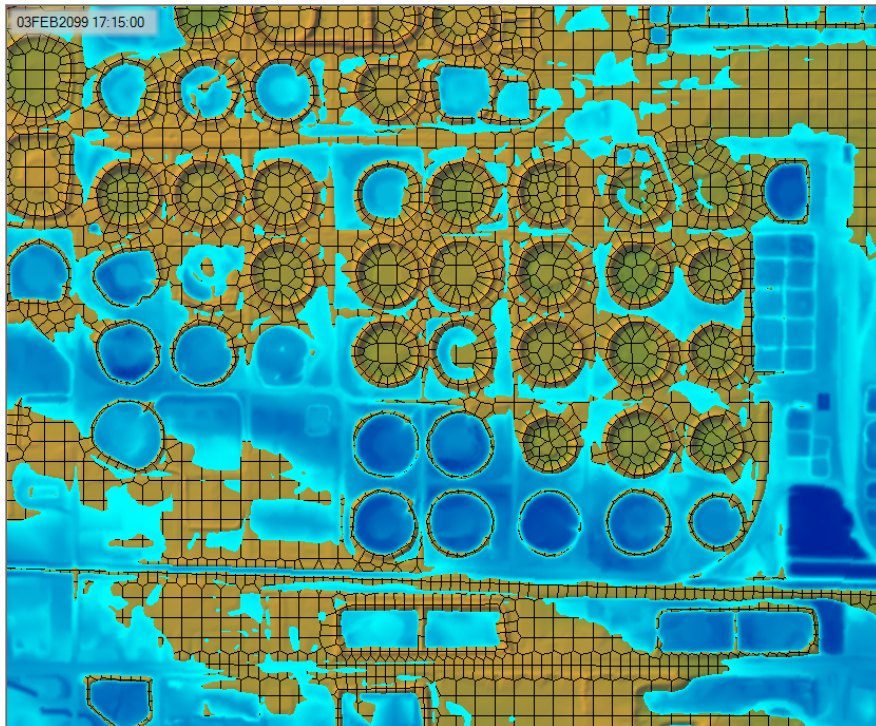
Map Mode: Map results are generated on-the-fly for the current view.

Default maps: Depth, Water Surface Elevation, Velocity

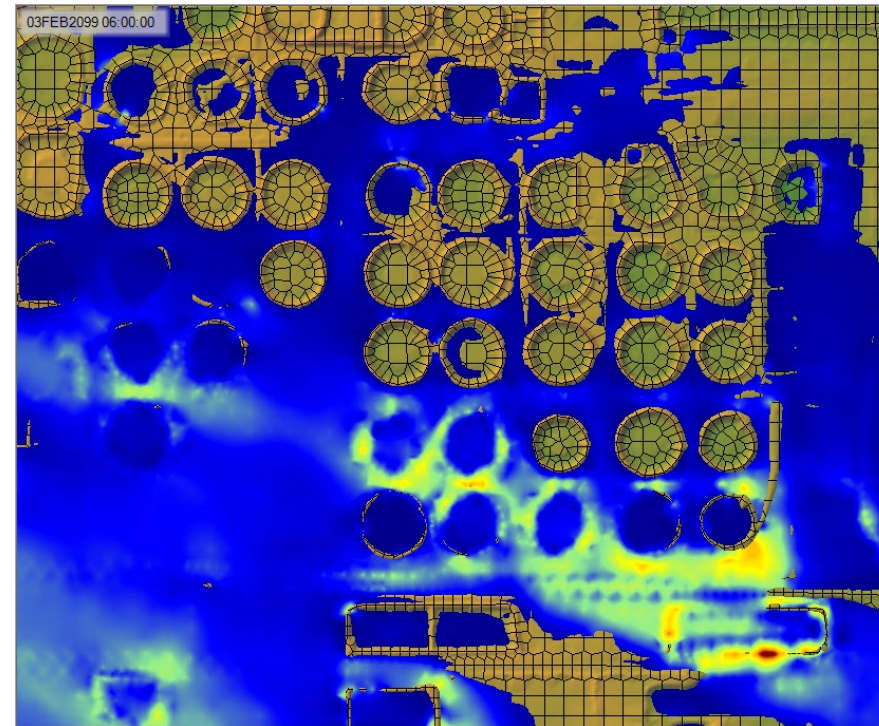


# Example Maps

- Depth



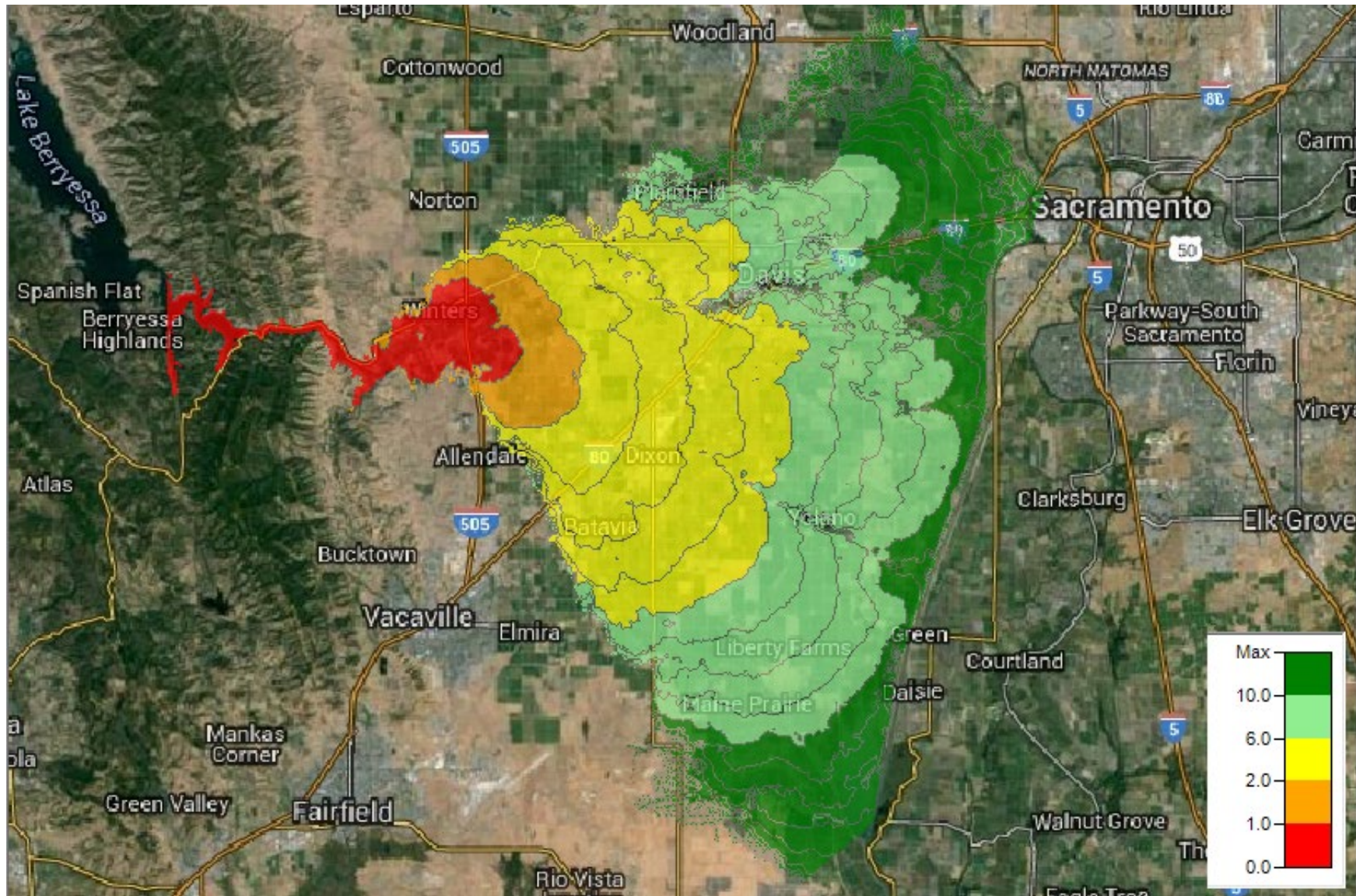
- Velocity







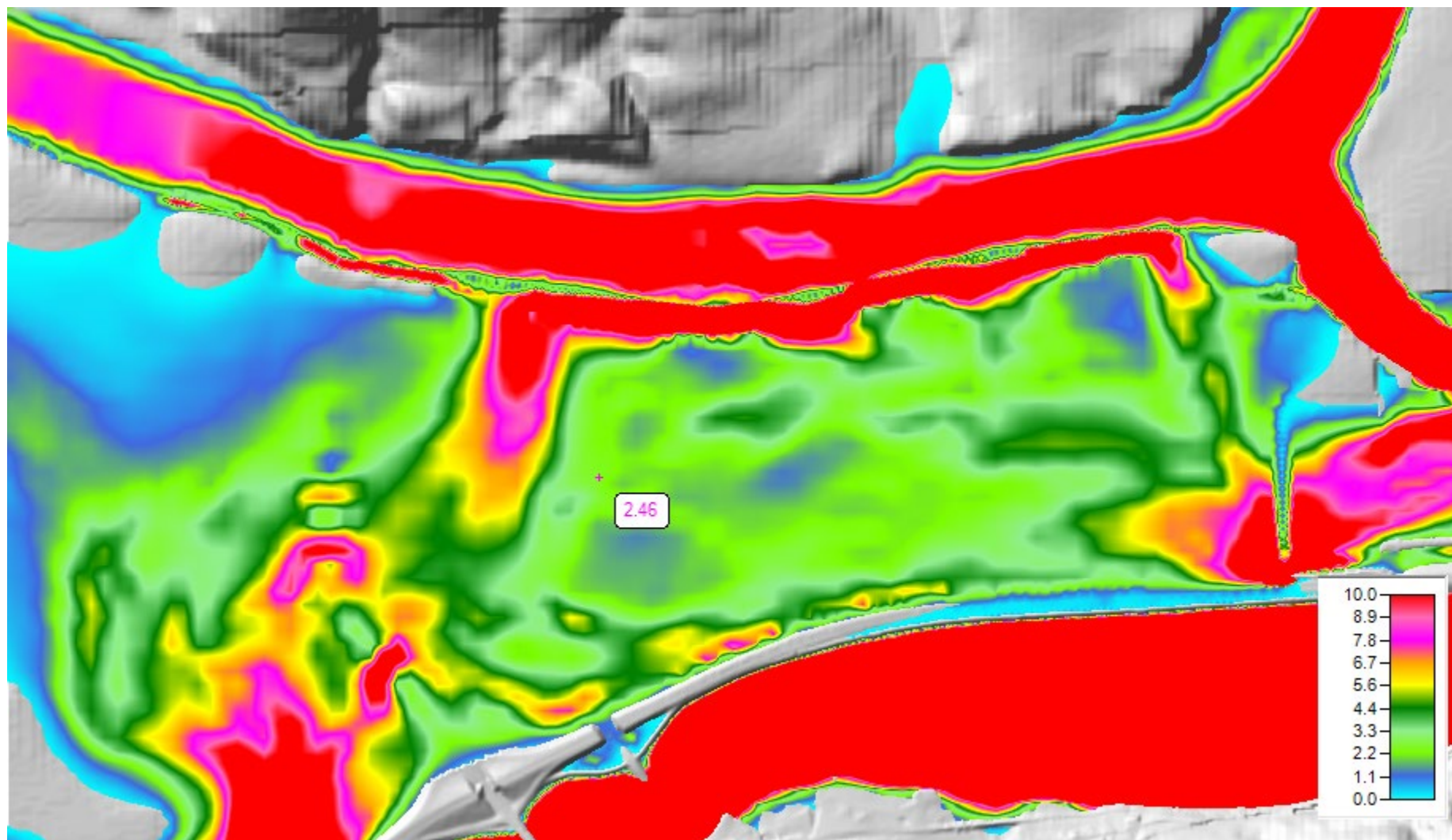
# Arrival Time







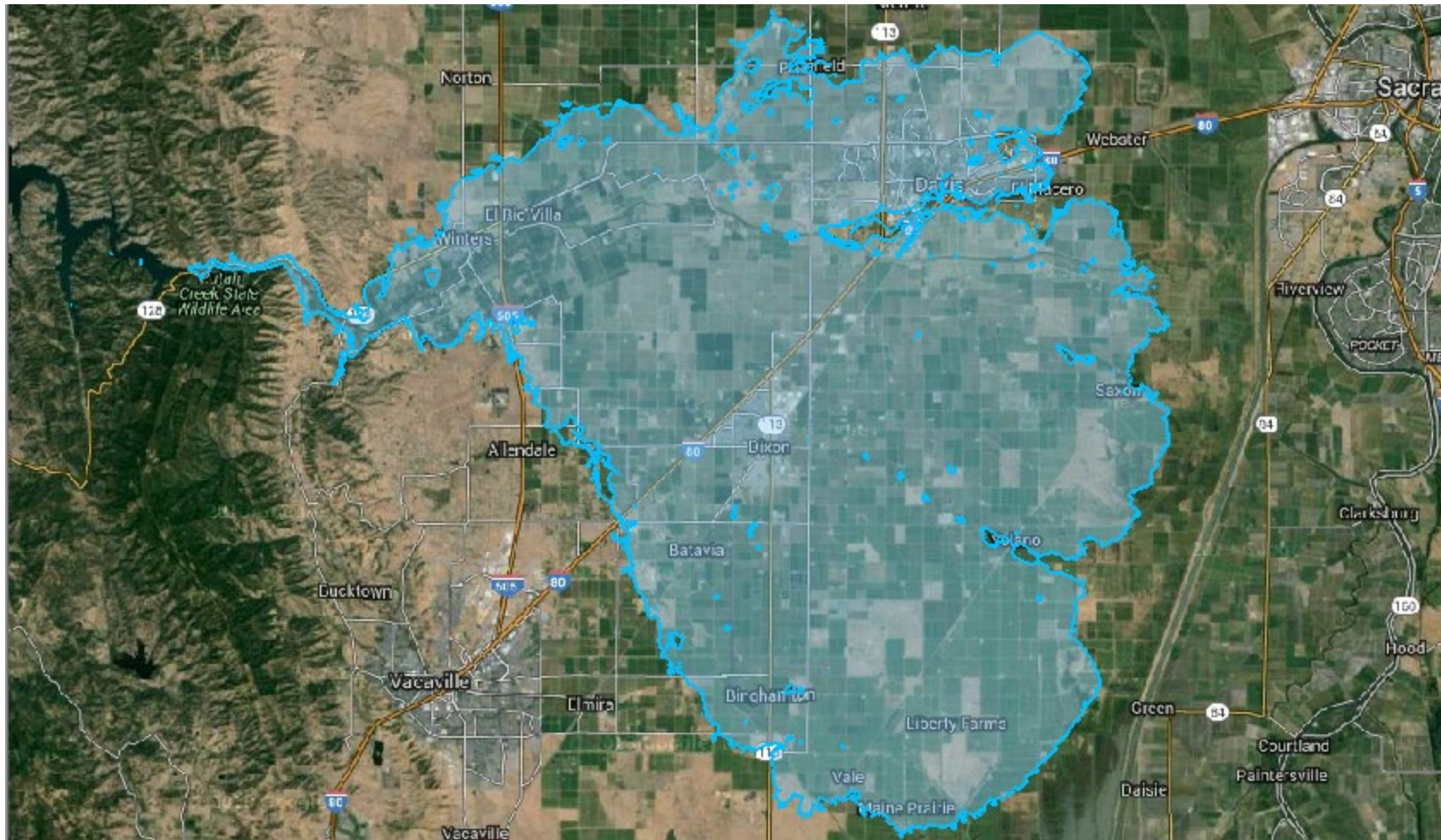
# Hazard Mapping







# Inundation Boundary





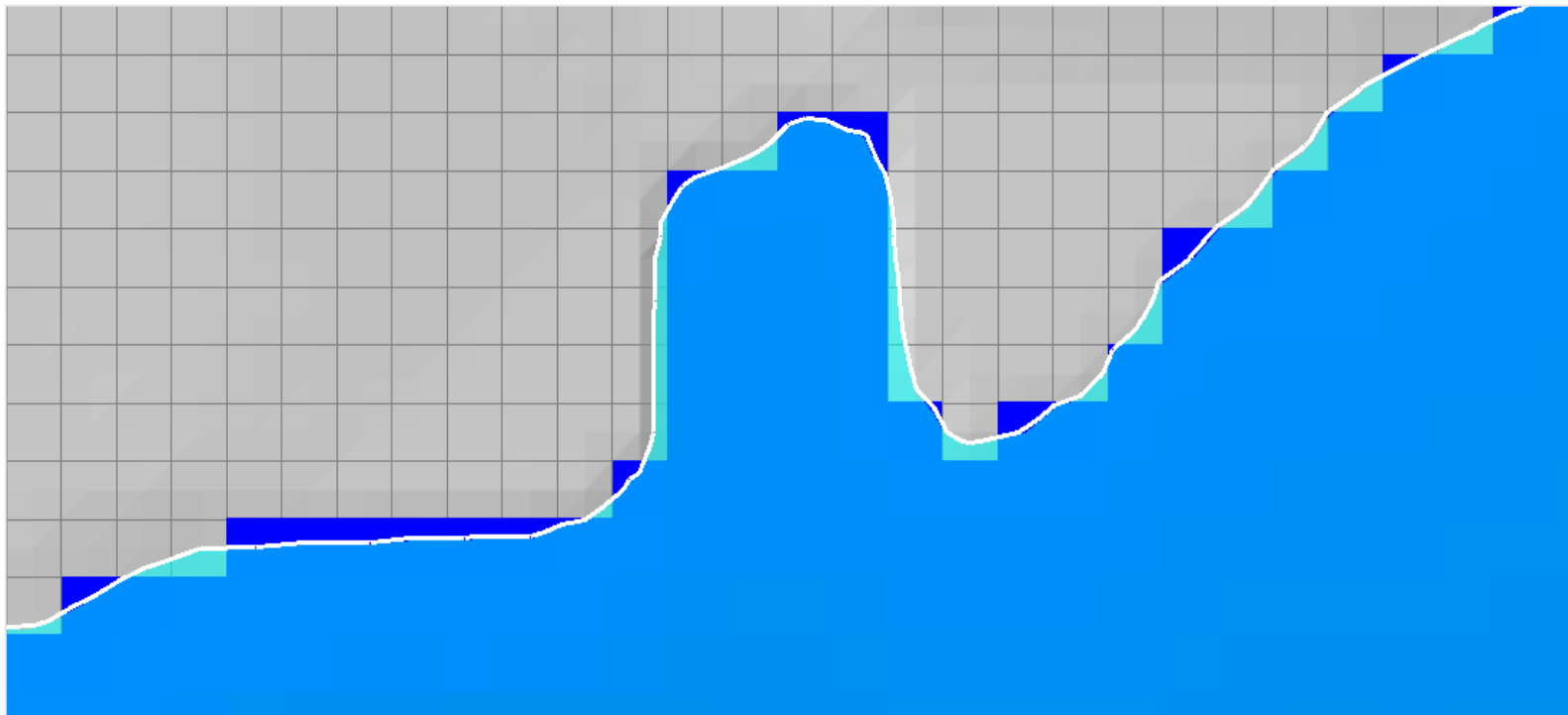
# Map Types – Dynamic vs Stored

- Dynamic: Computed on-the-fly
  - Smooth: Computes to screen-resolution
  - Doesn't use disk space
- Stored: Computed to terrain resolution
  - Stored to disk
  - Faster rendering for slow map types



# Dynamic vs Stored Results

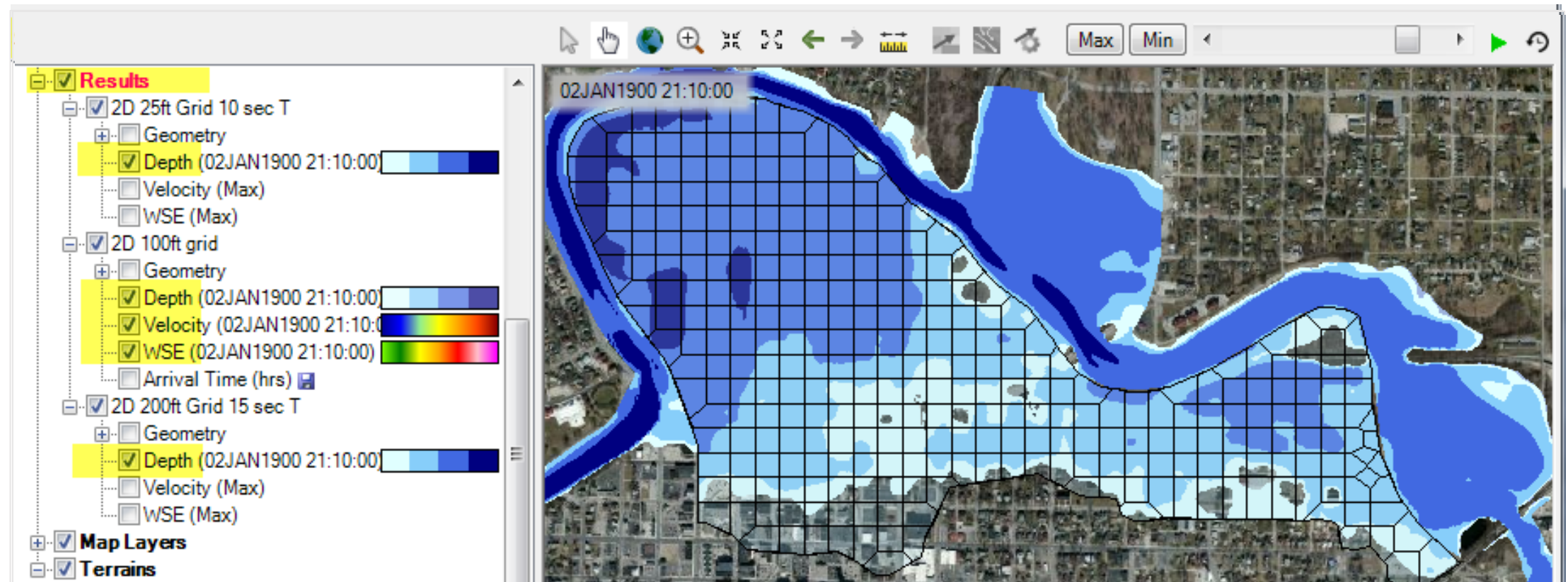
- Dynamic results plot values for the current pyramid level. Boundaries are defined based on interpolation.
- Stored results have a single value per cell.





# Dynamic Mapping

- Animation Toolbar – works on selected layer/group and syncs the timestep







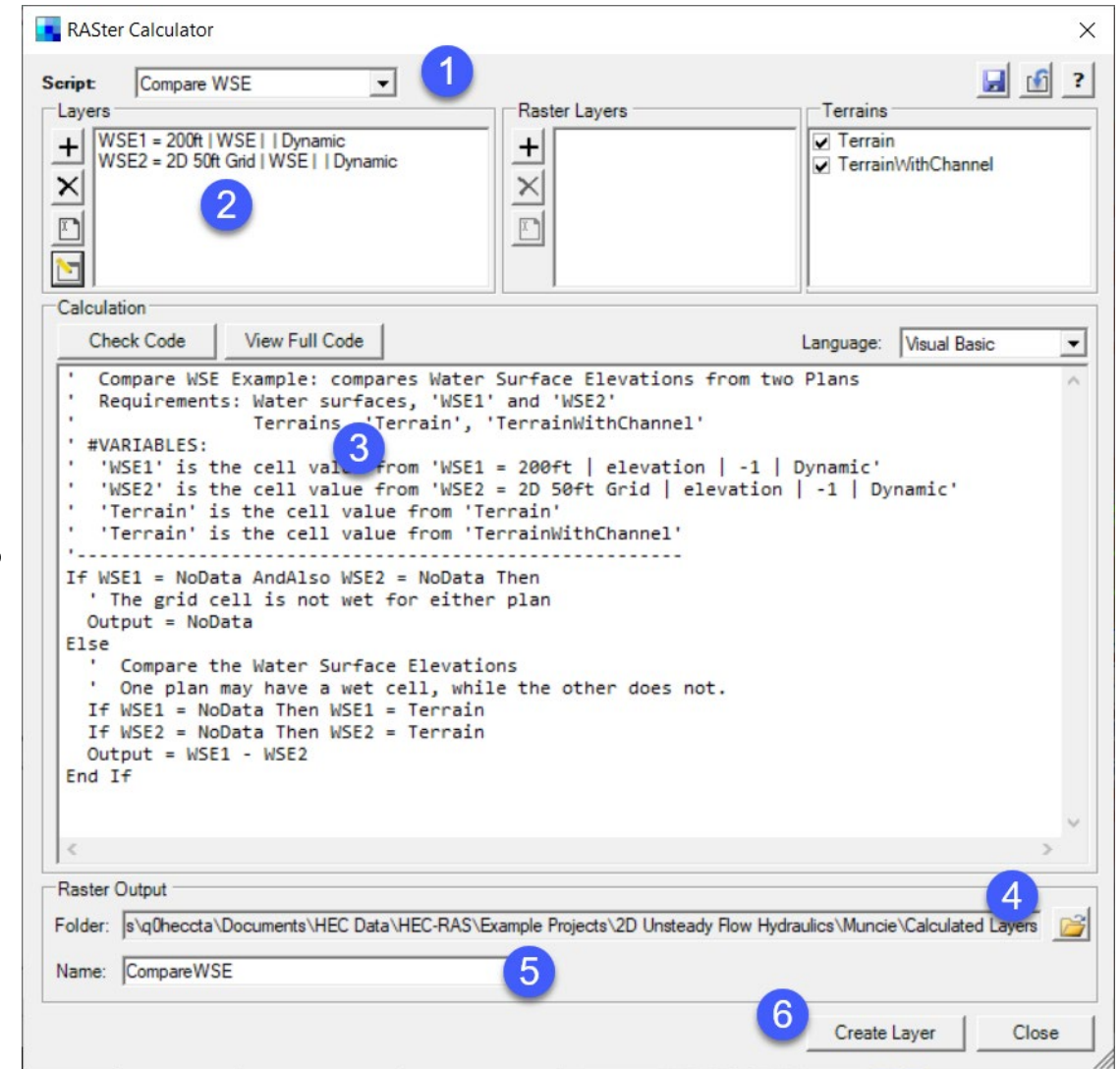
# Dynamic Mapping - Animation





# Calculated Layer

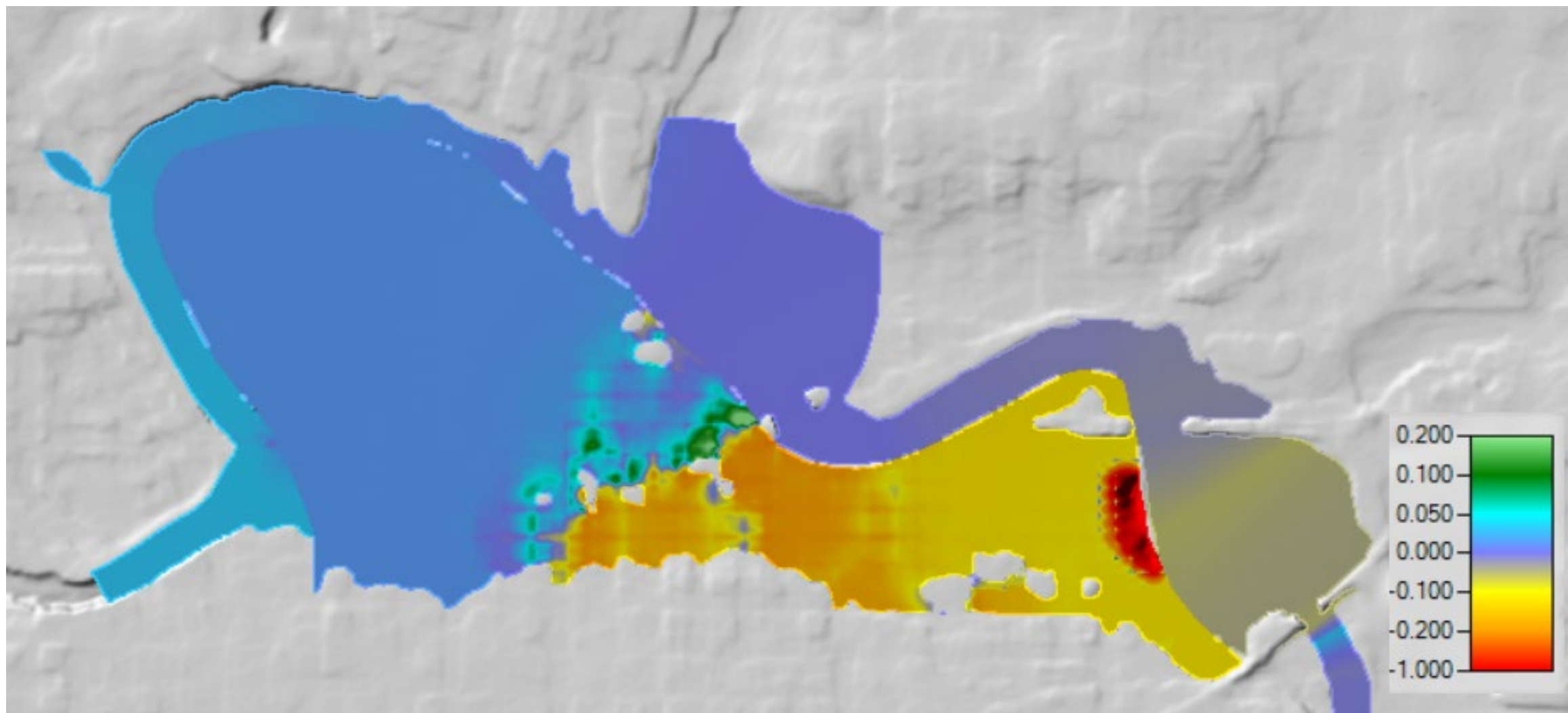
- RASter Calculator
- Custom scripting code to use multiple results
- Works with RAS Results and Terrains
- Works with Rasters on disk





# Water Surface Comparison

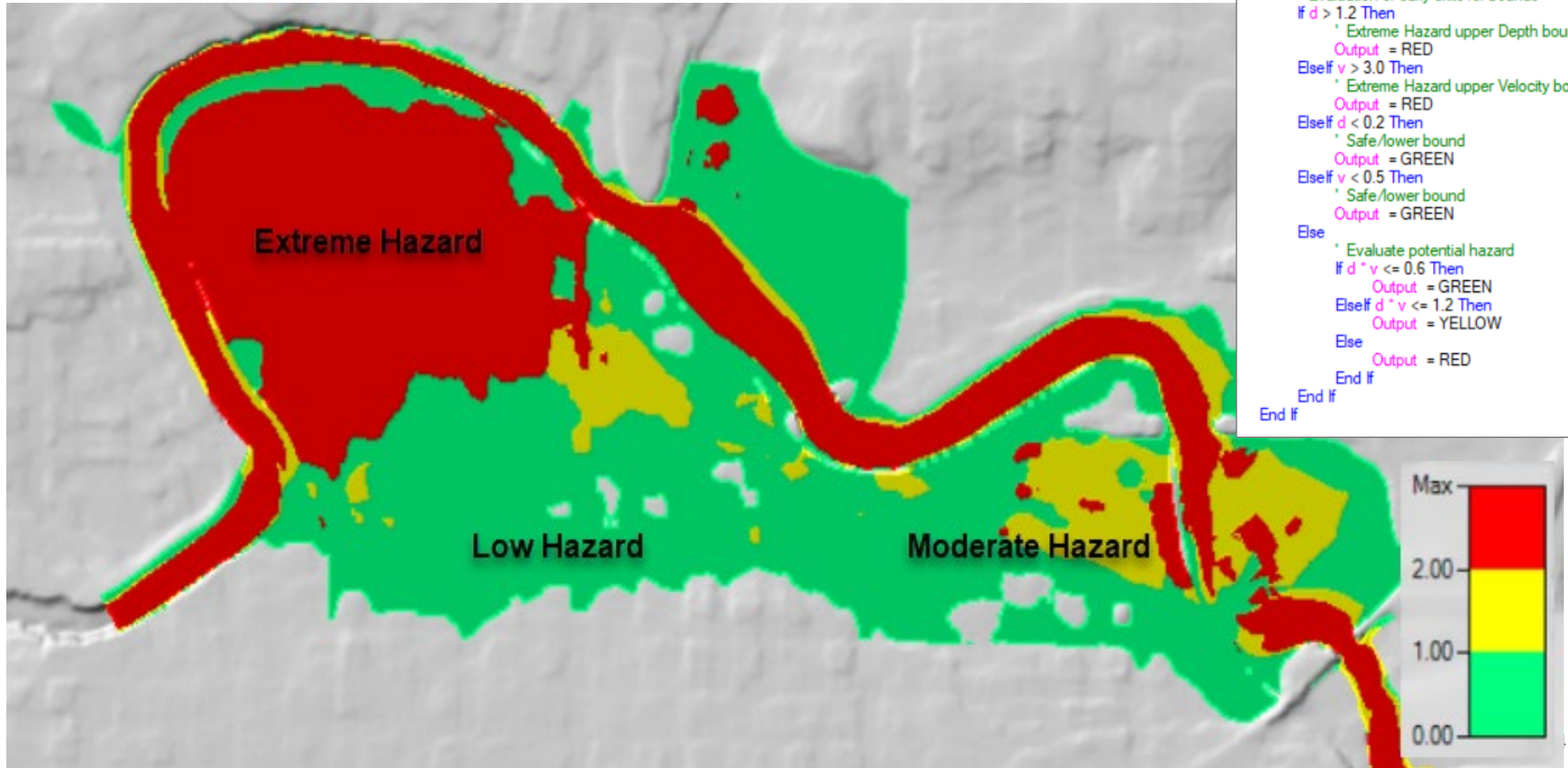
WSE\_Mesh200ft - WSE\_Mesh50ft







# Hazard Evaluation



Const GREEN as Single = 0  
Const YELLOW as Single = 1  
Const RED as Single = 2

```
If d = NoData OrElse v = NoData Then
    Output = NoData
Else
    ' Conversion to metric assuming input variables are in feet
    d = d * 0.3048
    v = v * 0.3048
    ' Evaluation of early exits for bounds
    If d > 1.2 Then
        ' Extreme Hazard upper Depth bound
        Output = RED
    ElseIf v > 3.0 Then
        ' Extreme Hazard upper Velocity bound
        Output = RED
    ElseIf d < 0.2 Then
        ' Safe/lower bound
        Output = GREEN
    ElseIf v < 0.5 Then
        ' Safe/lower bound
        Output = GREEN
    Else
        ' Evaluate potential hazard
        If d * v <= 0.6 Then
            Output = GREEN
        ElseIf d * v <= 1.2 Then
            Output = YELLOW
        Else
            Output = RED
        End If
    End If
End If
```



# Stored Maps

Manage Results Maps

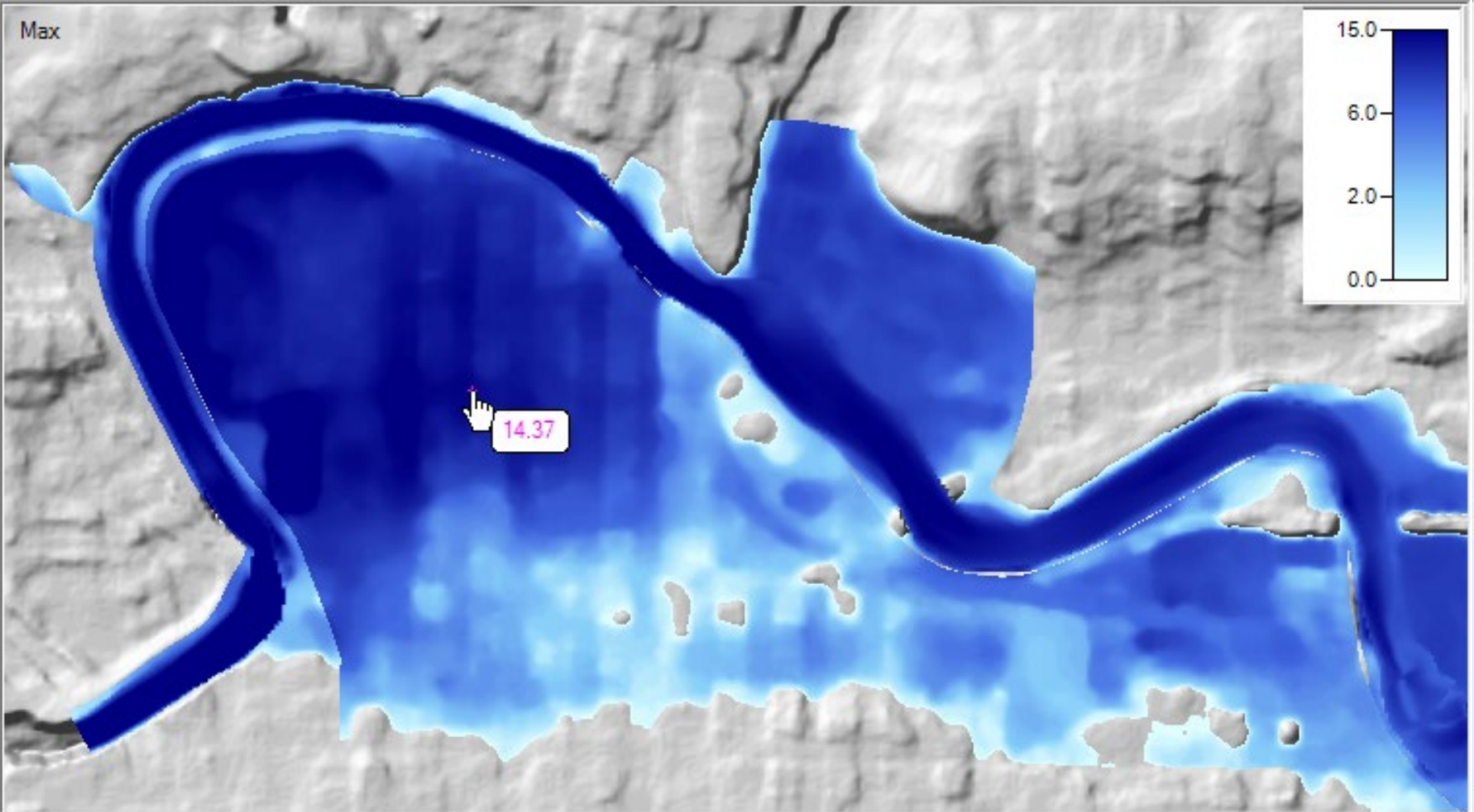
View Result Maps for: All Plan Results

Compute/Update Stored Maps

Results and Maps	Store Status	
<b>2D 25ft Grid 10 sec T</b>		<div>Add New Map</div>
Depth (03JAN1900 00:00:00)	N/A	<div>Edit Map</div>
Velocity (Max)	N/A	<div>Edit Map</div>
WSE (Max)	N/A	<div>Edit Map</div>
<b>2D 100ft grid</b>		<div>Add New Map</div>
Depth (02JAN1900 21:10:00)	N/A	<div>Edit Map</div>
Velocity (02JAN1900 21:10:00)	N/A	<div>Edit Map</div>
WSE (02JAN1900 21:10:00)	N/A	<div>Edit Map</div>
Arrival Time (hrs)	Map files are out of date	<div>Edit Map</div>
<b>2D 200ft Grid 15 sec T</b>		<div>Add New Map</div>
Depth (02JAN1900 21:10:00)	N/A	<div>Edit Map</div>
Velocity (Max)	N/A	<div>Edit Map</div>
WSE (Max)	N/A	<div>Edit Map</div>
Arrival Time (2ft hrs)	Map not created	<div>Edit Map</div>



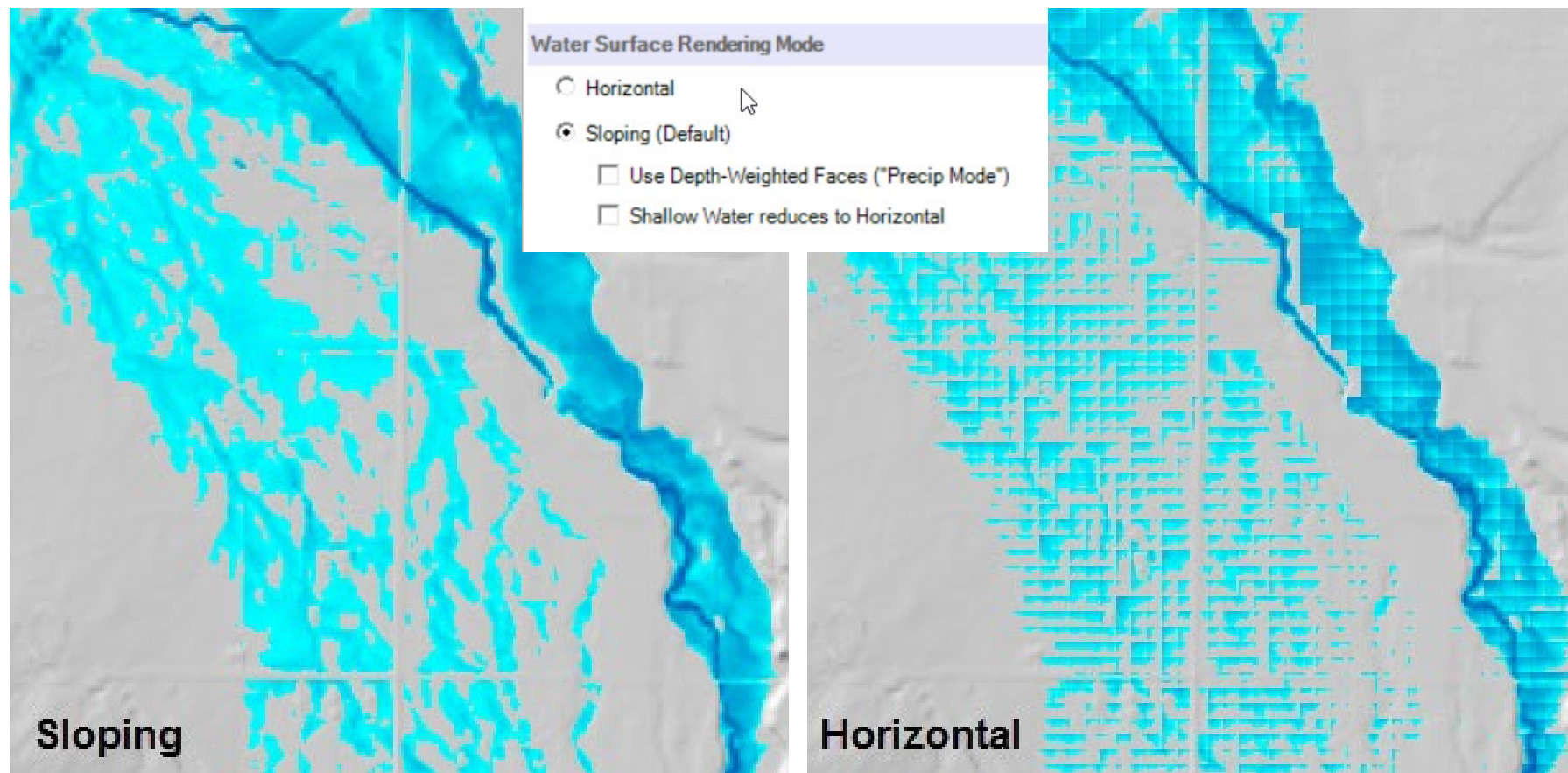
# Results Visualization







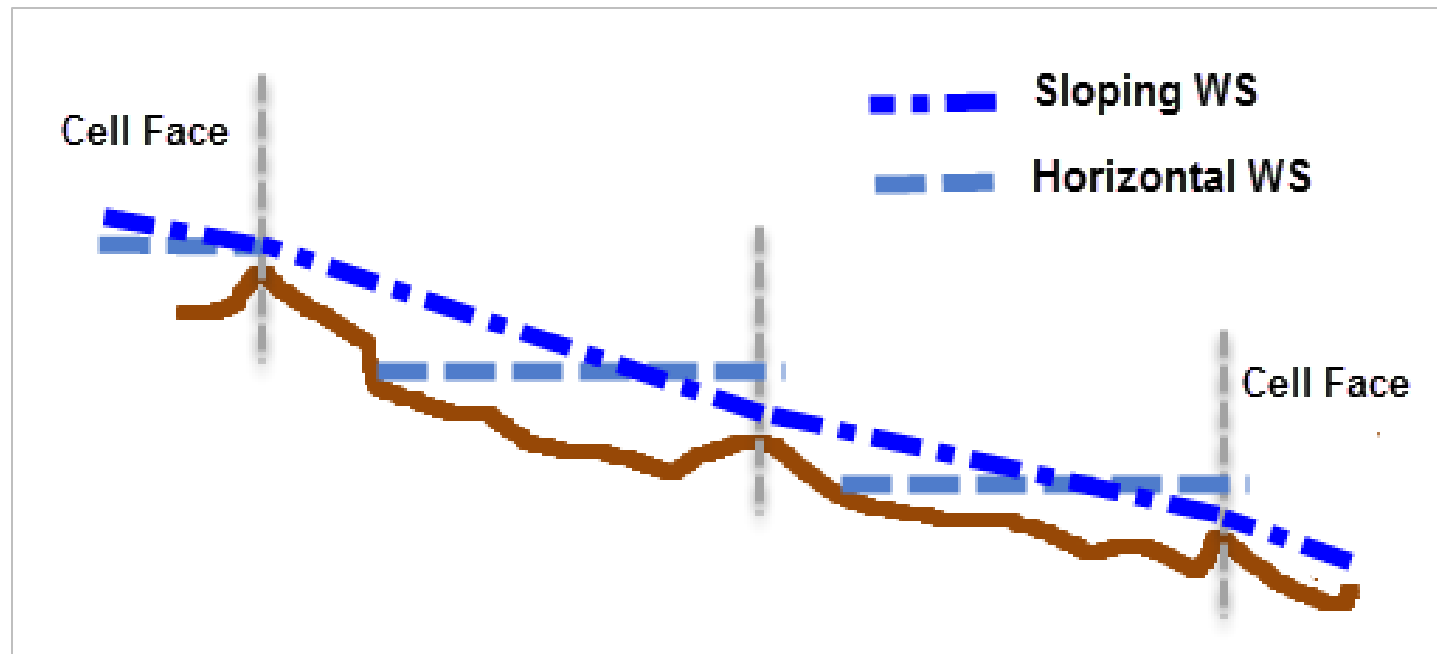
# Render Mode Options





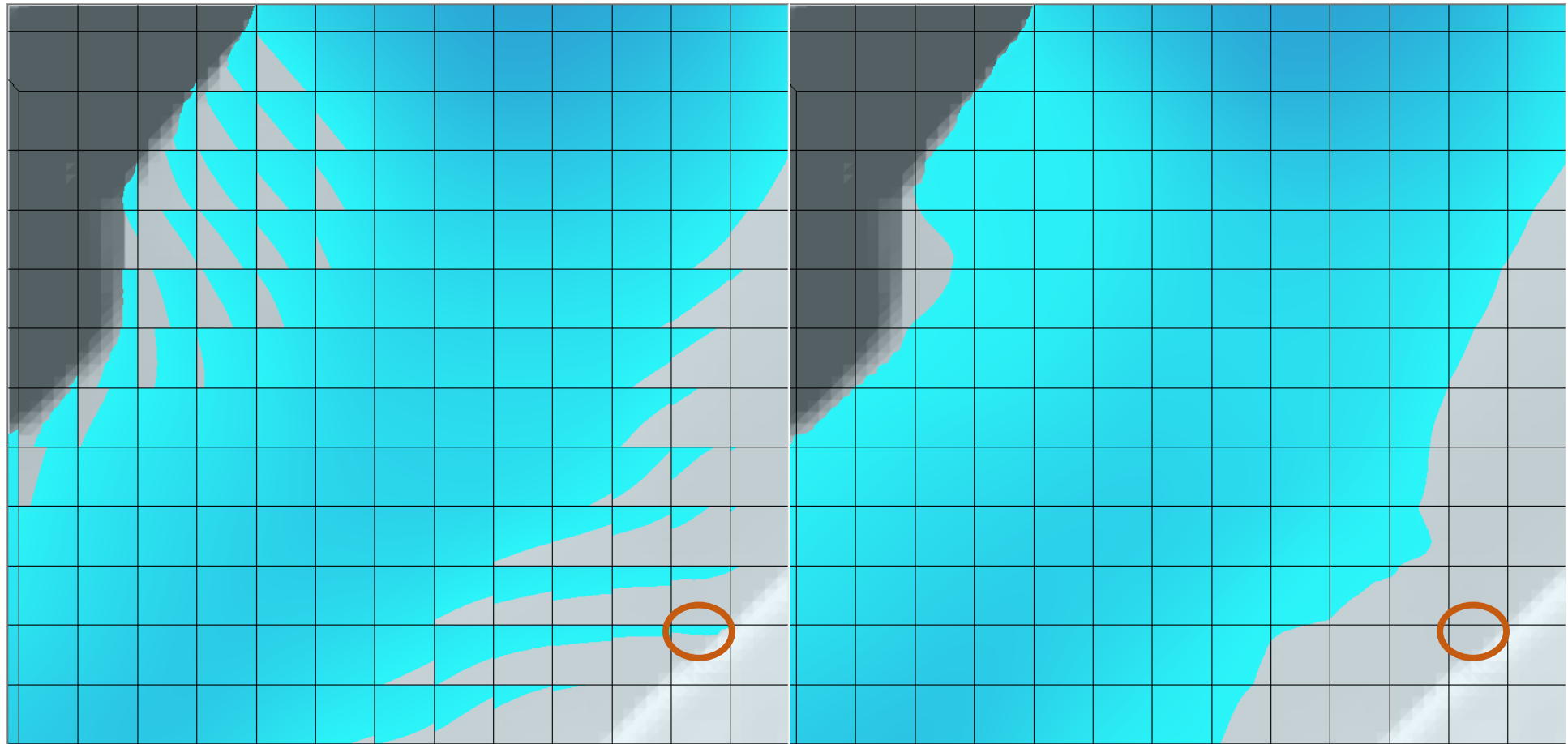
# Results Interpolation

- Render mode options allow for interpolation of water surface elevation values or plotting values at the cell centers.





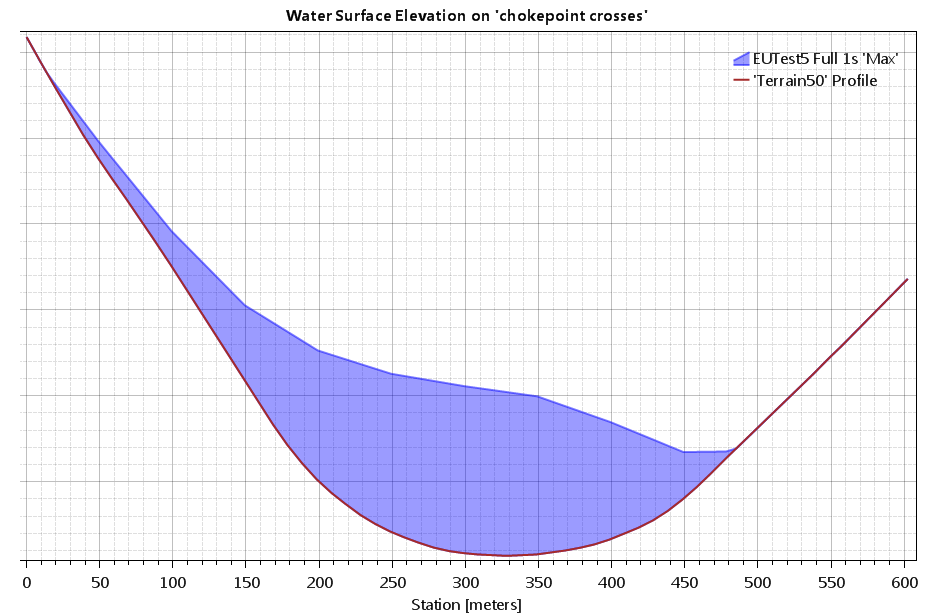
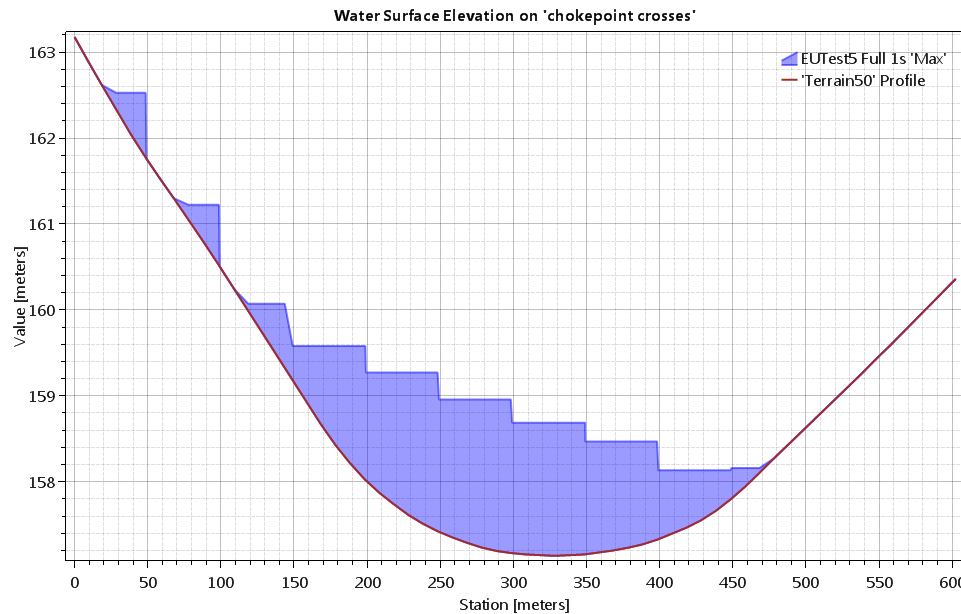
# Horizontal vs Sloping Surface





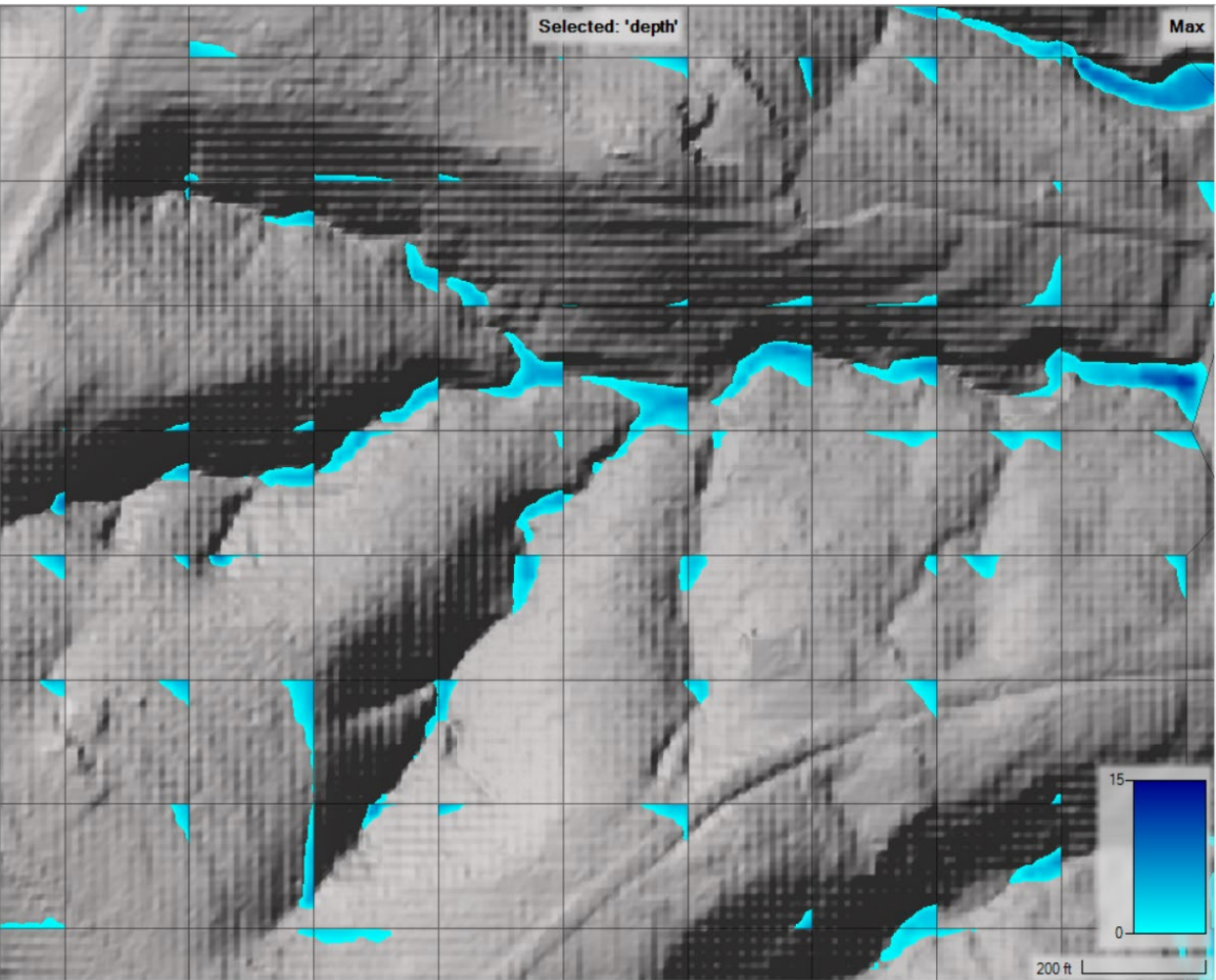


# Horizontal vs Sloping Surface

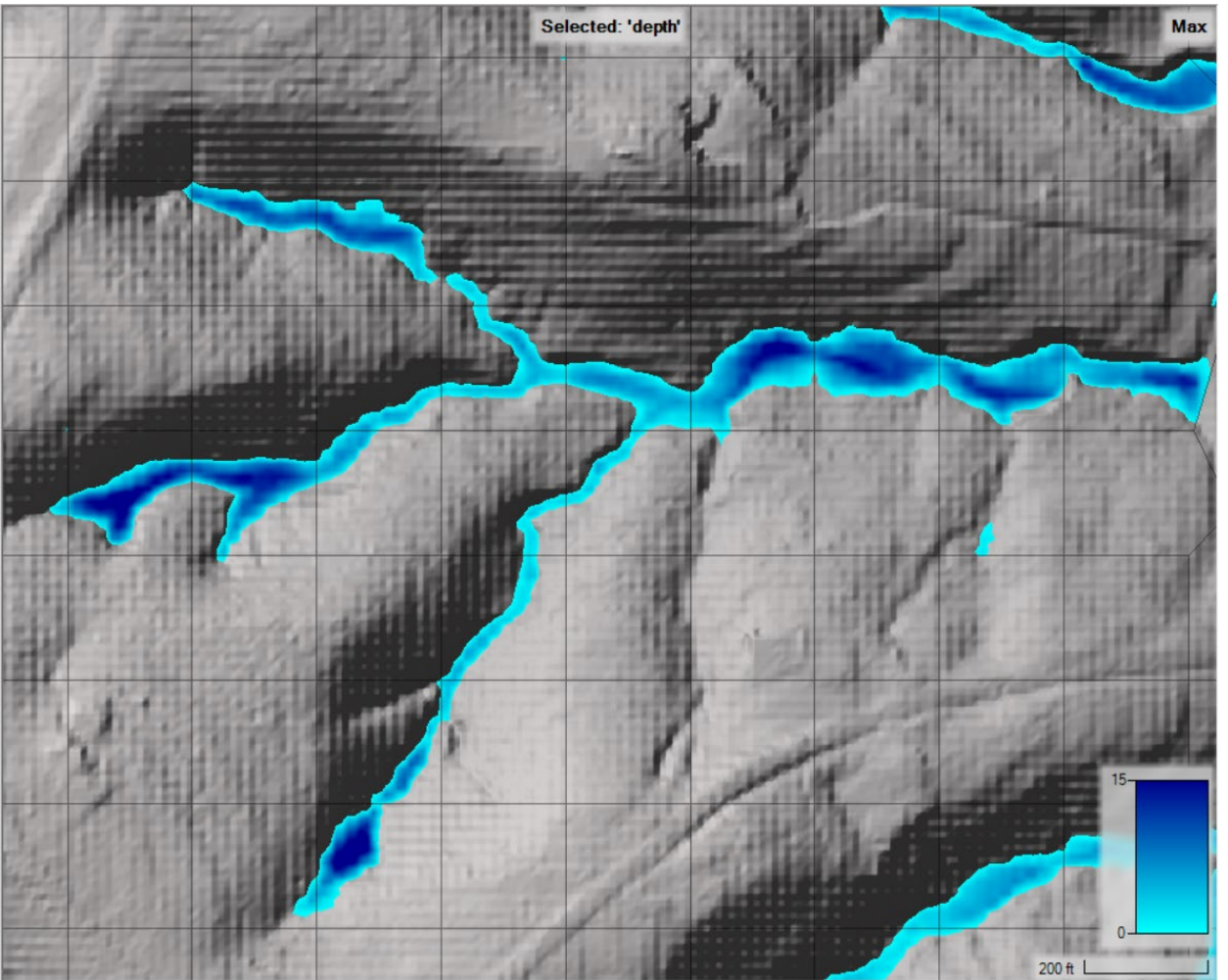




# Sloping Surface Errors



Horizontal

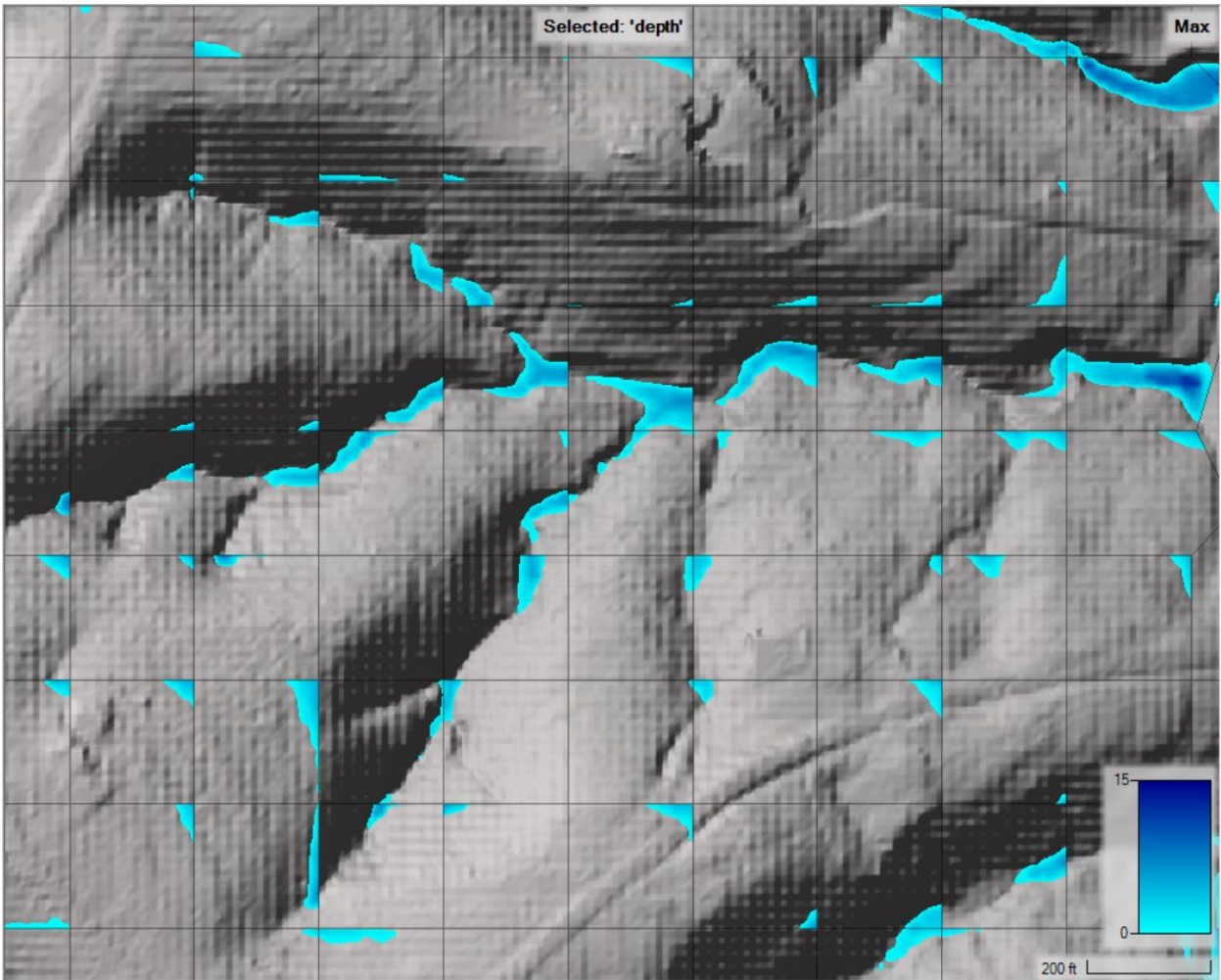


Sloping

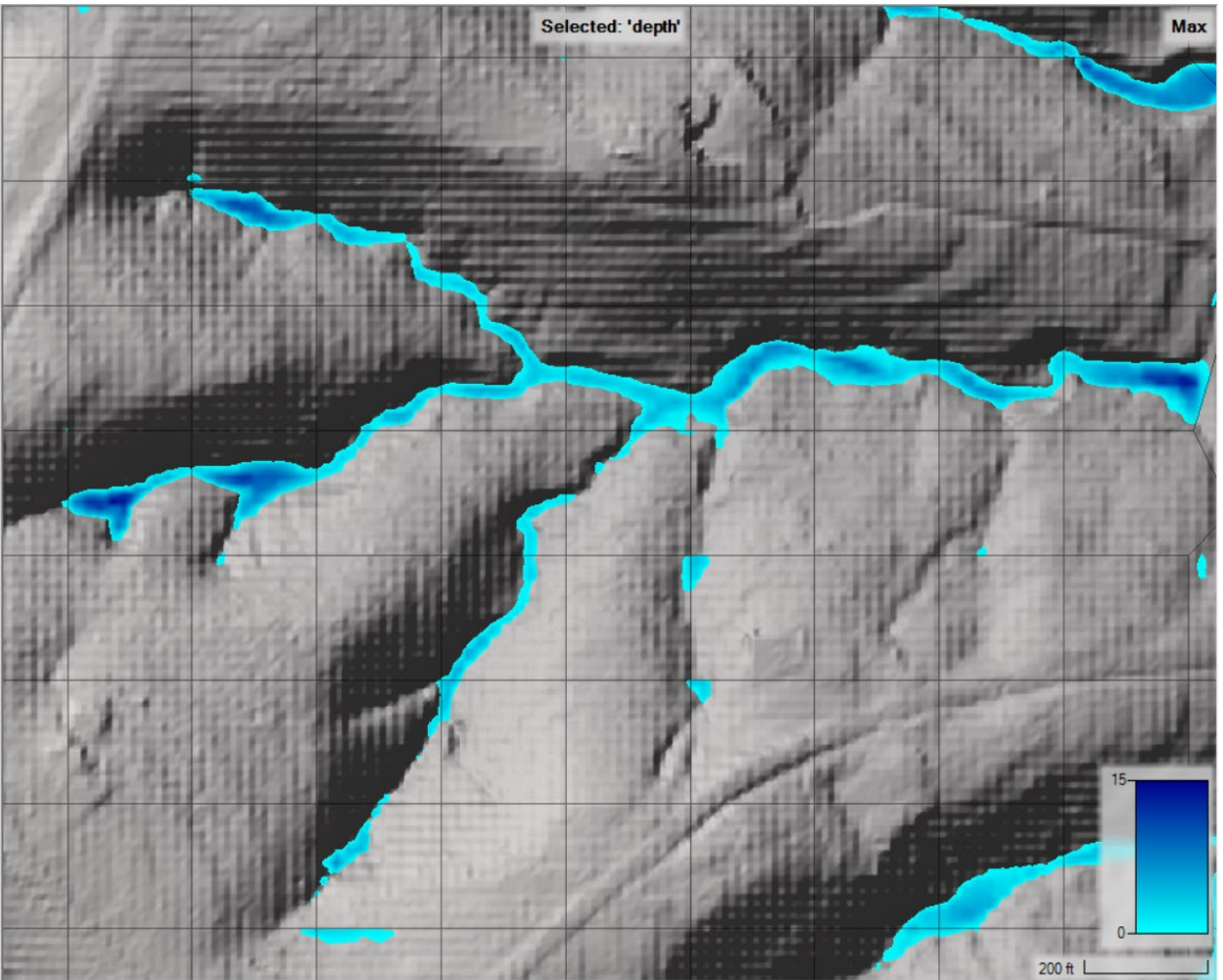




# Sloping Surface Errors



Horizontal



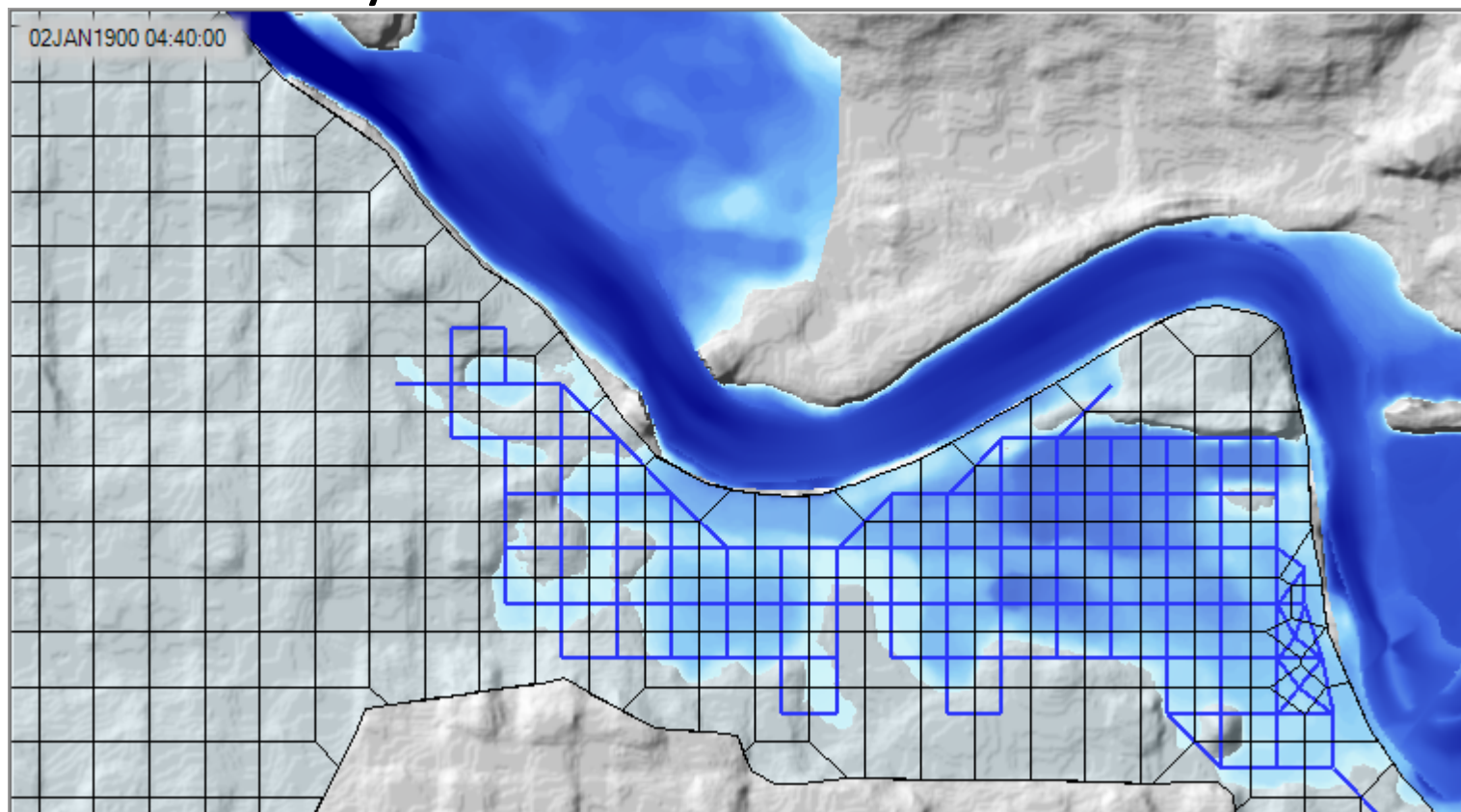
Precip Mode





# Depth Results

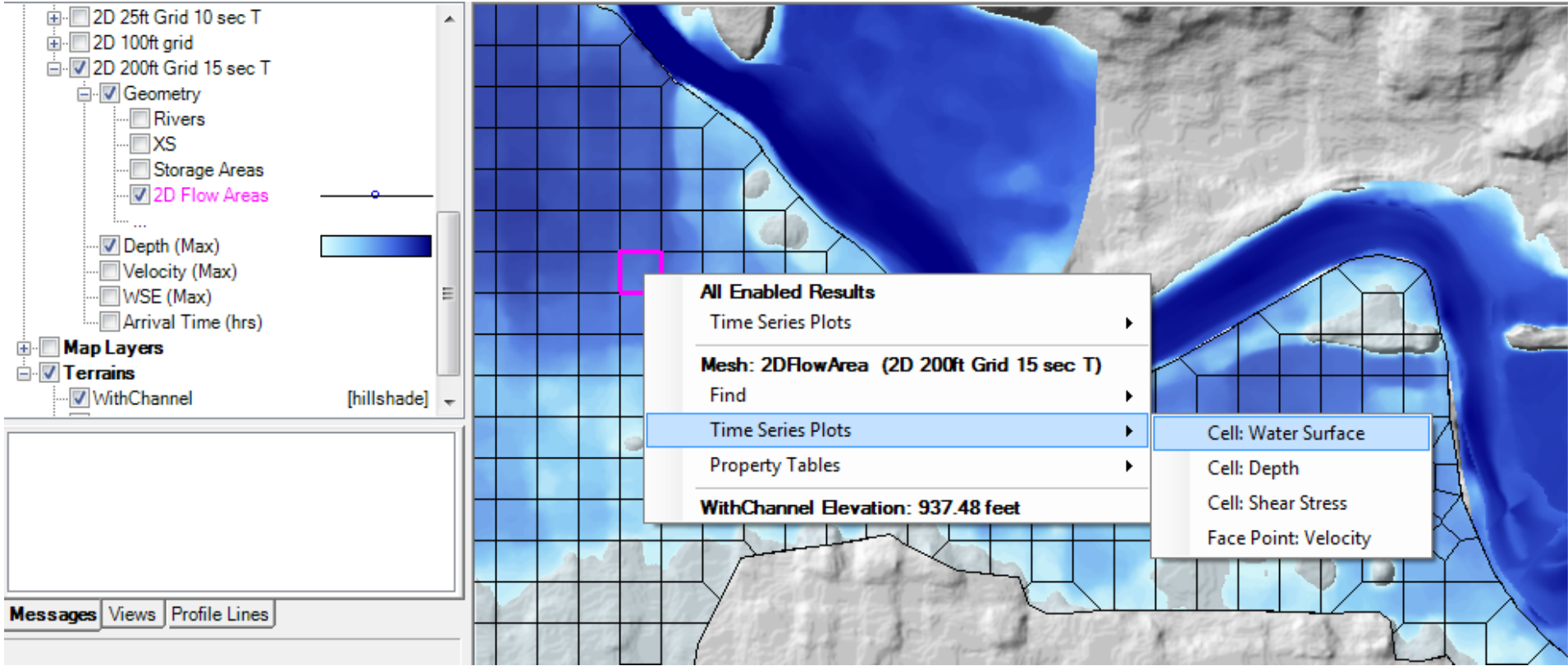
- Hydraulic connectivity from mesh





# Results Query

- 2D Flow Area query





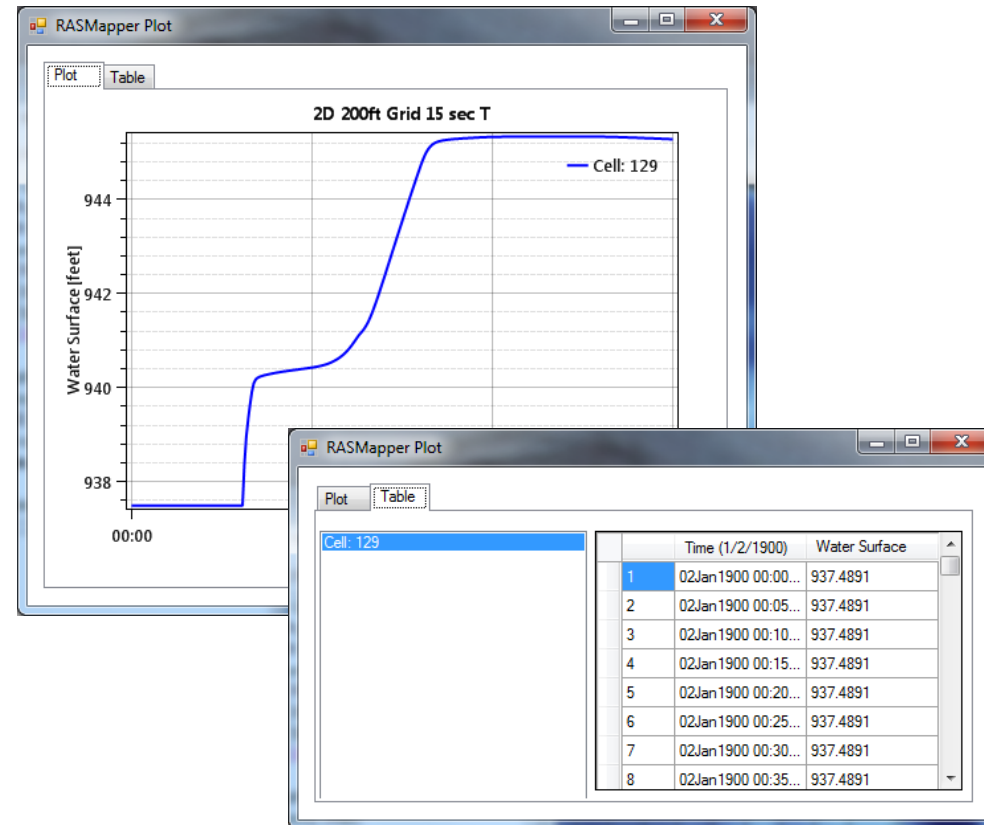
# 2D Flow Area Queries

- Hydraulic Properties

Cell: Volume - Elevation  
Face: Area - Elevation  
Face: Wetted Perimeter - Elevation  
Face: Manning's n - Elevation  
Face: Profile

- Time Series

Cell: Water Surface  
Cell: Depth  
Cell: Shear Stress  
Face Point: Velocity

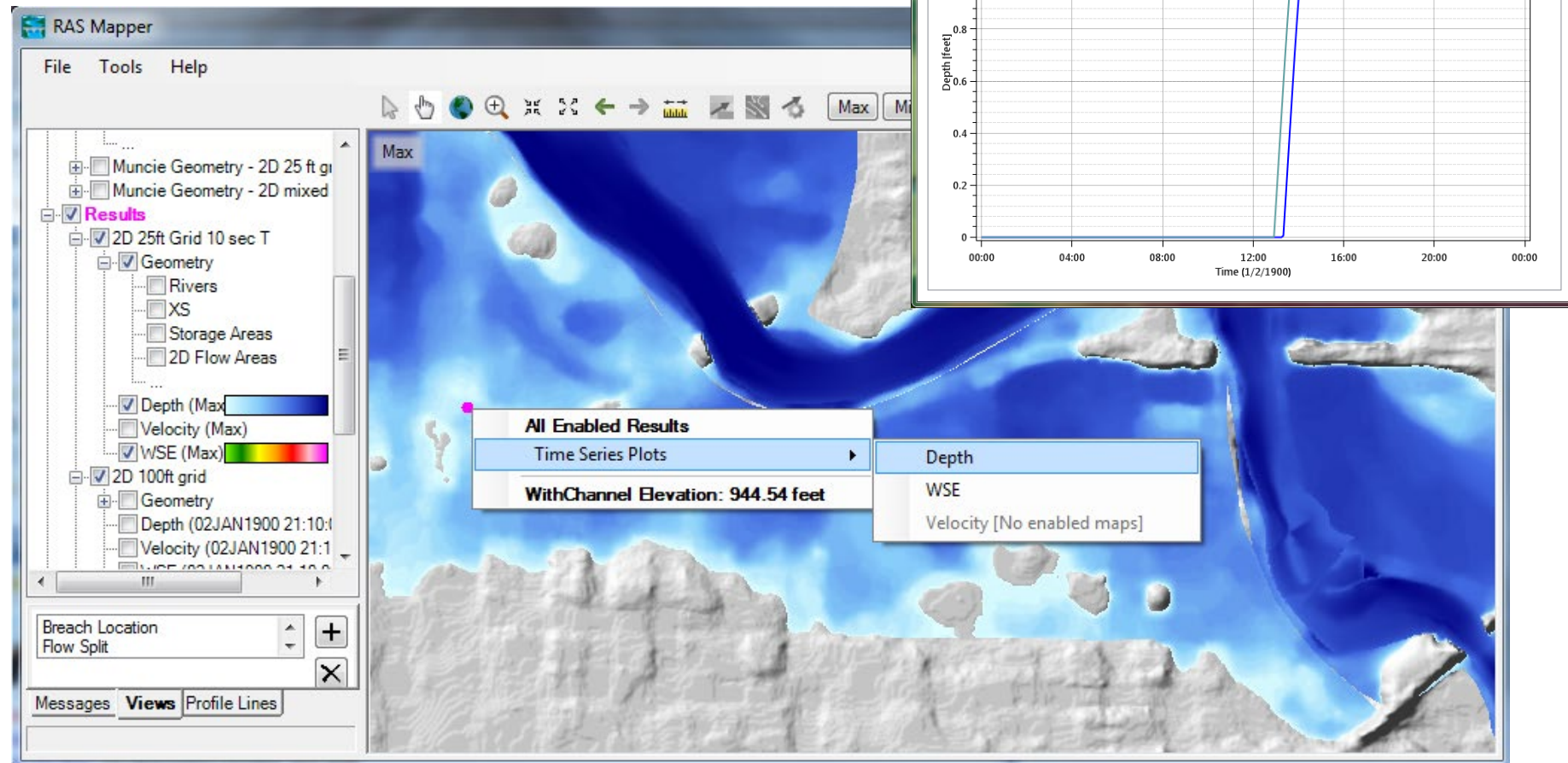






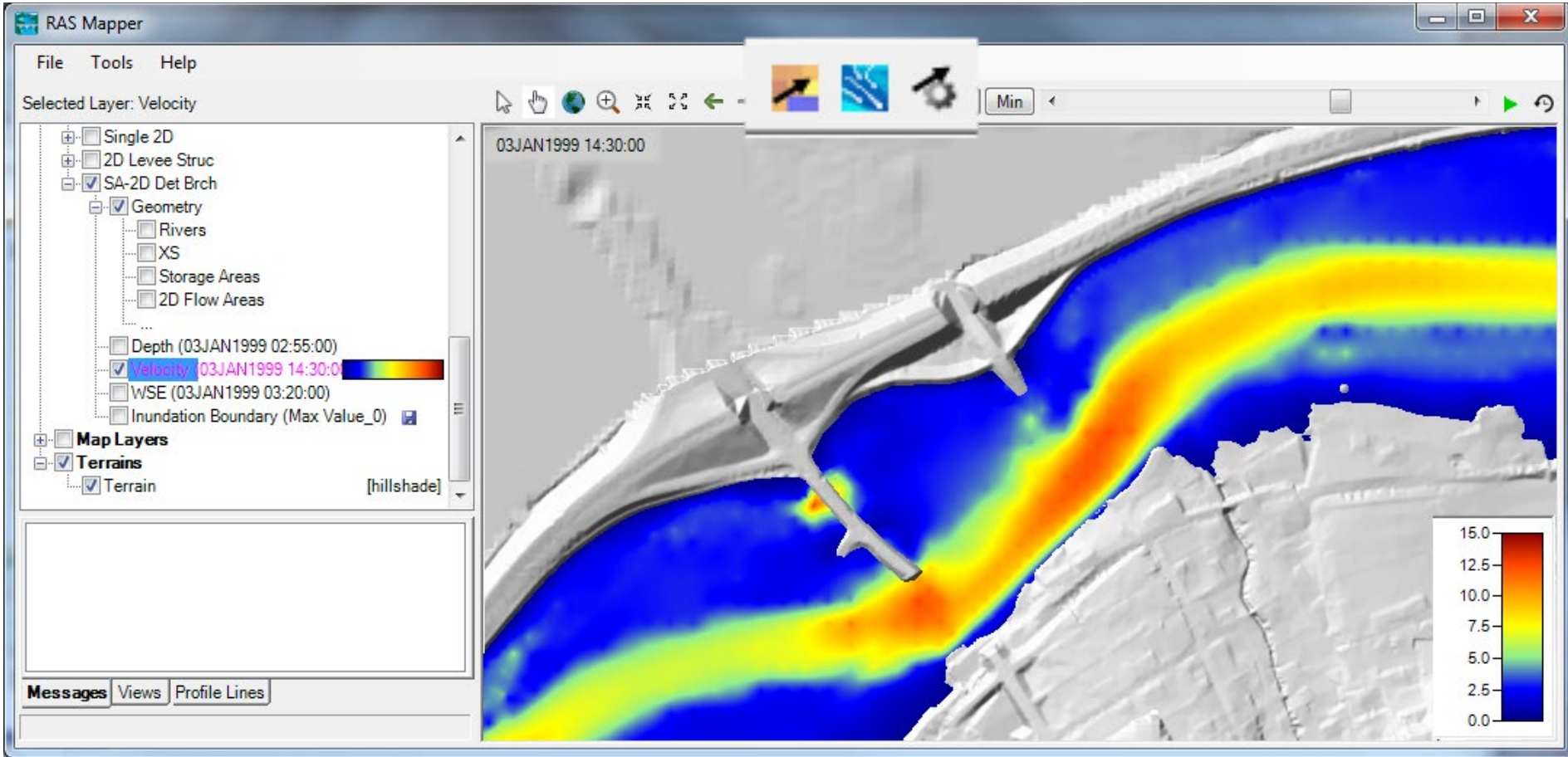
# Results Query

- Time Series



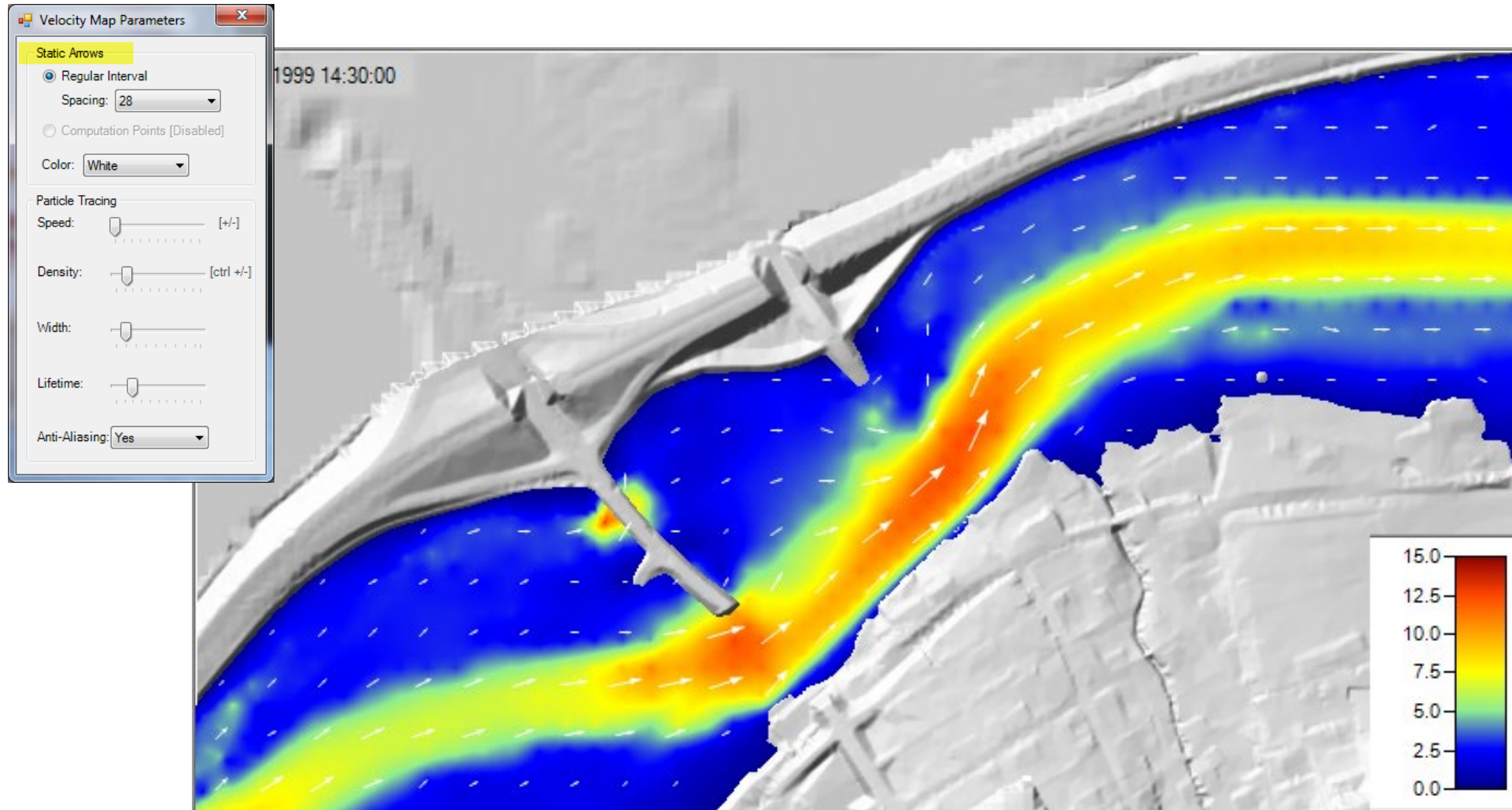


# Velocity Results





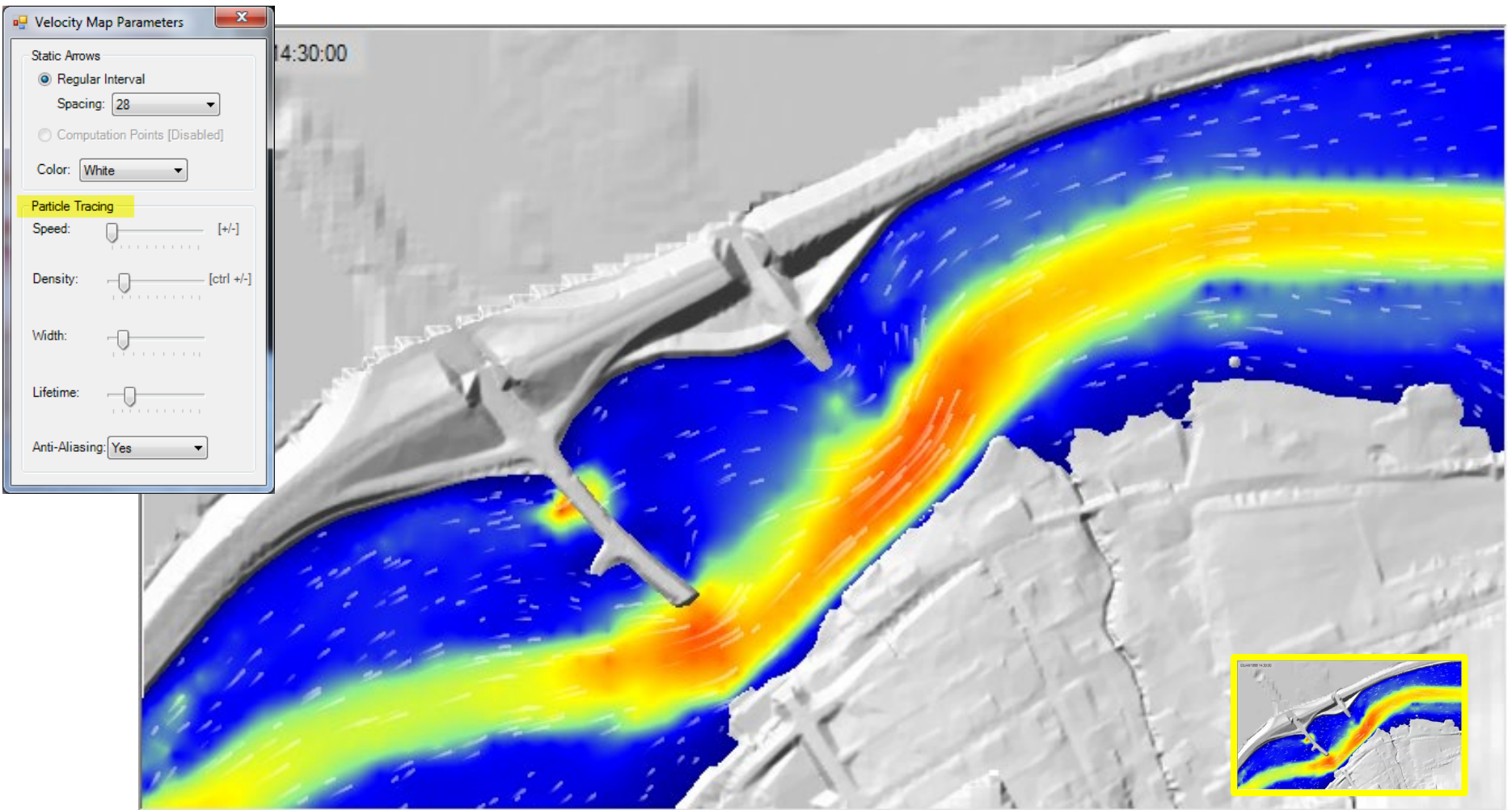
# Velocity Arrows





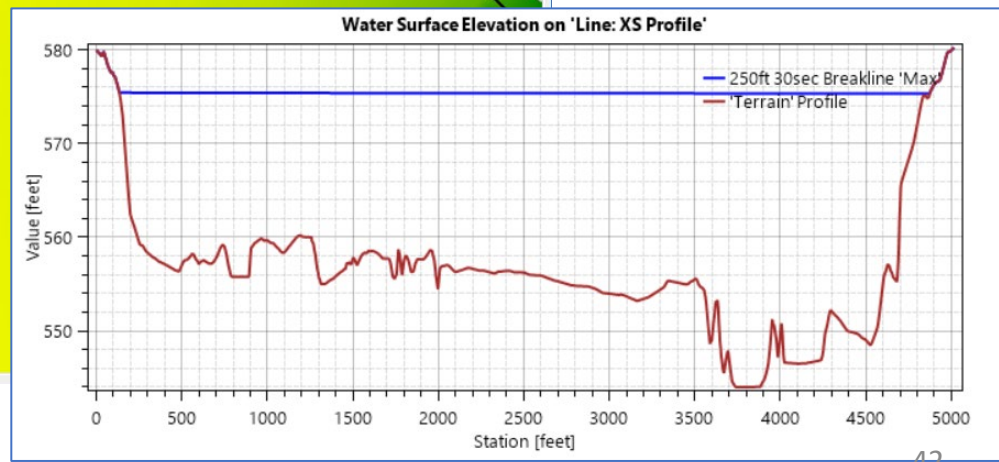
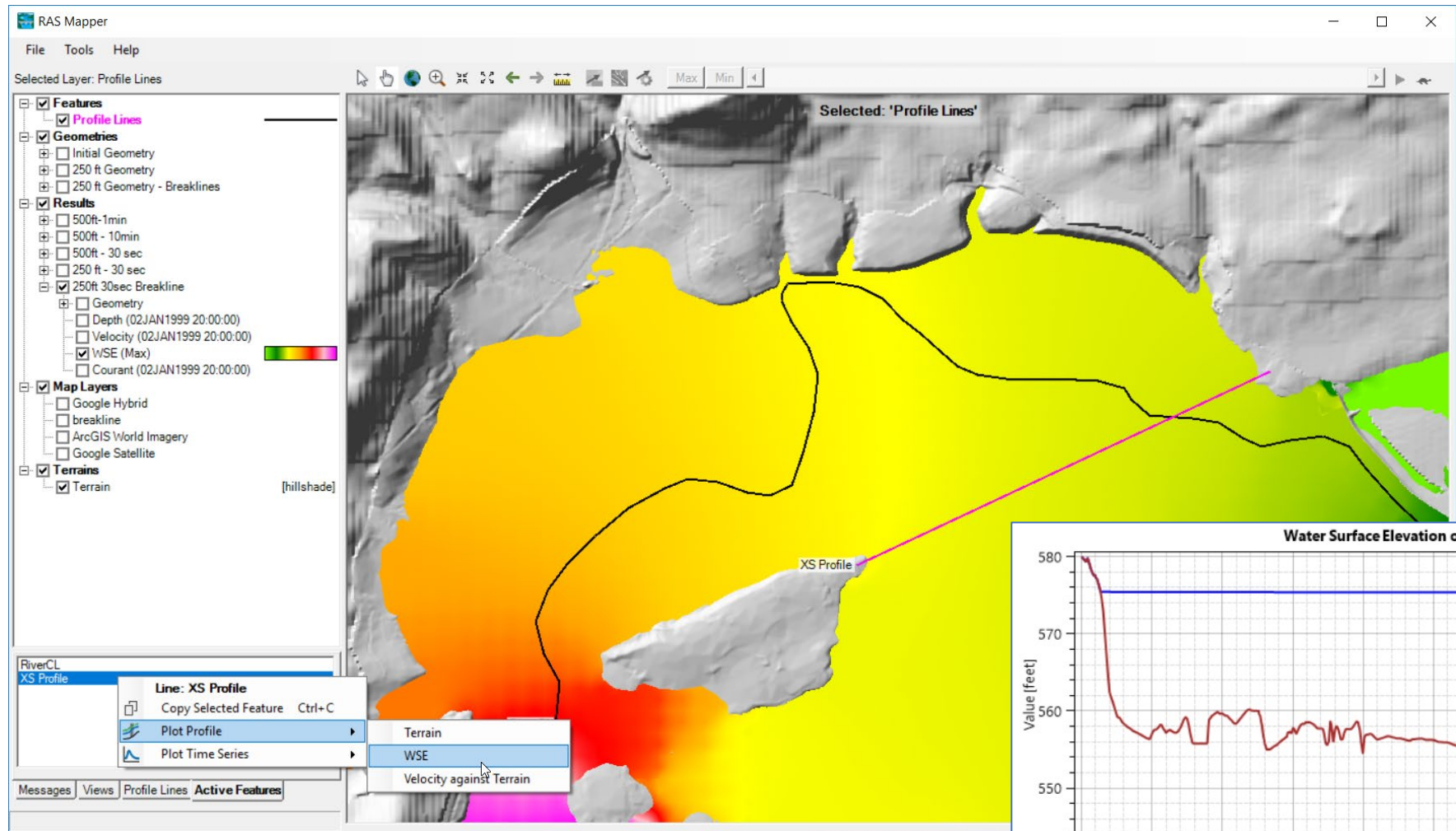


# Velocity Tracing





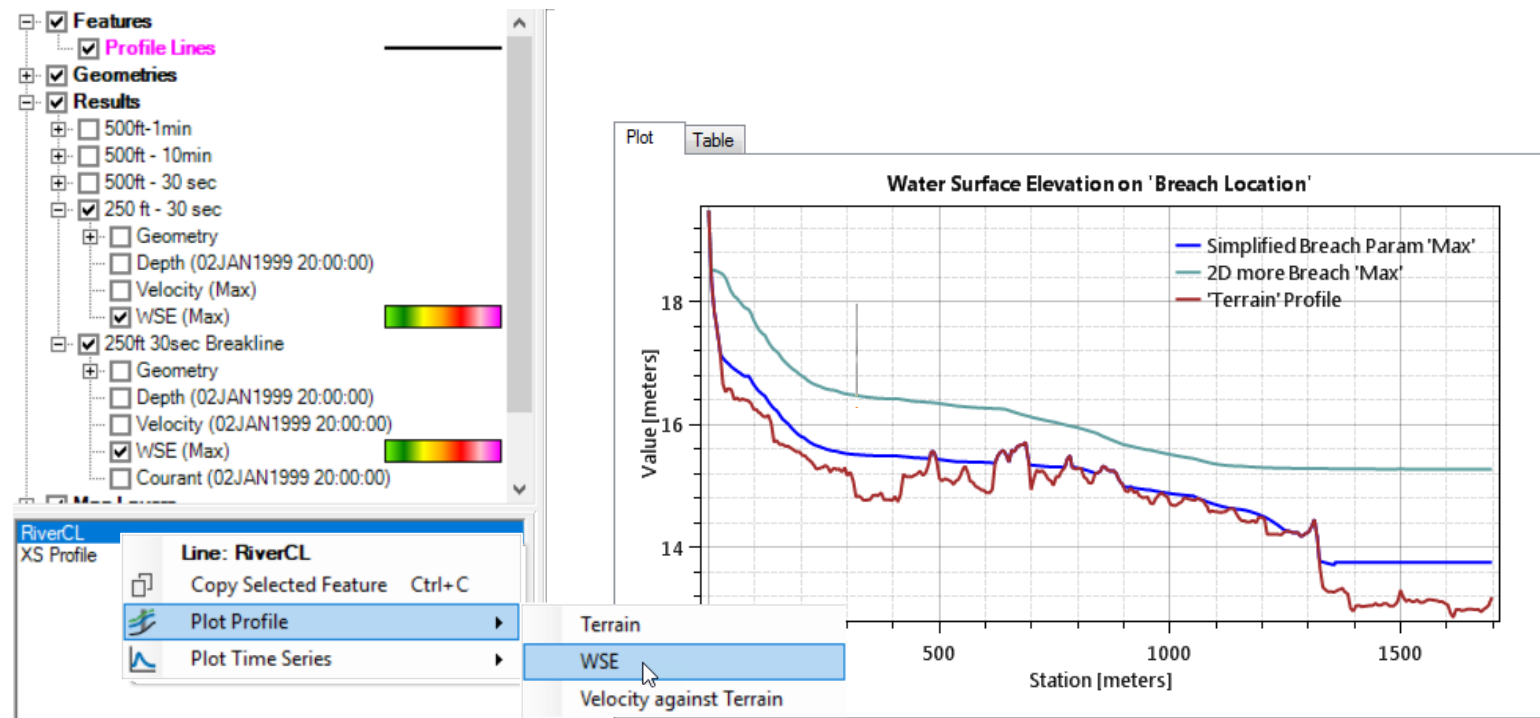
# Profile Lines





# Profile Line - Comparison

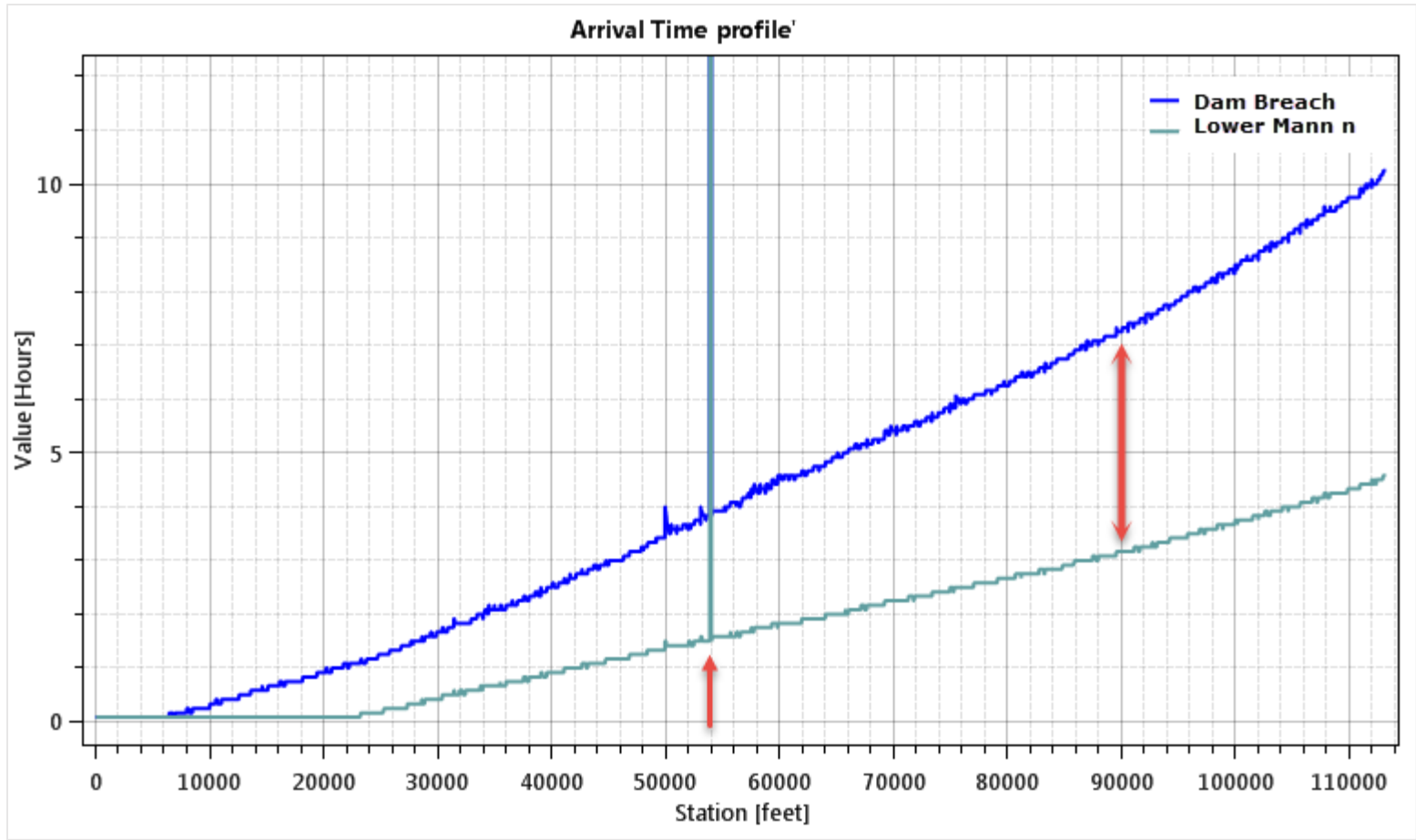
- Turn on multiple result maps
- Choose a Profile (i.e. 'Max')
- Choose **Plot Time Series** or **Plot Profile**





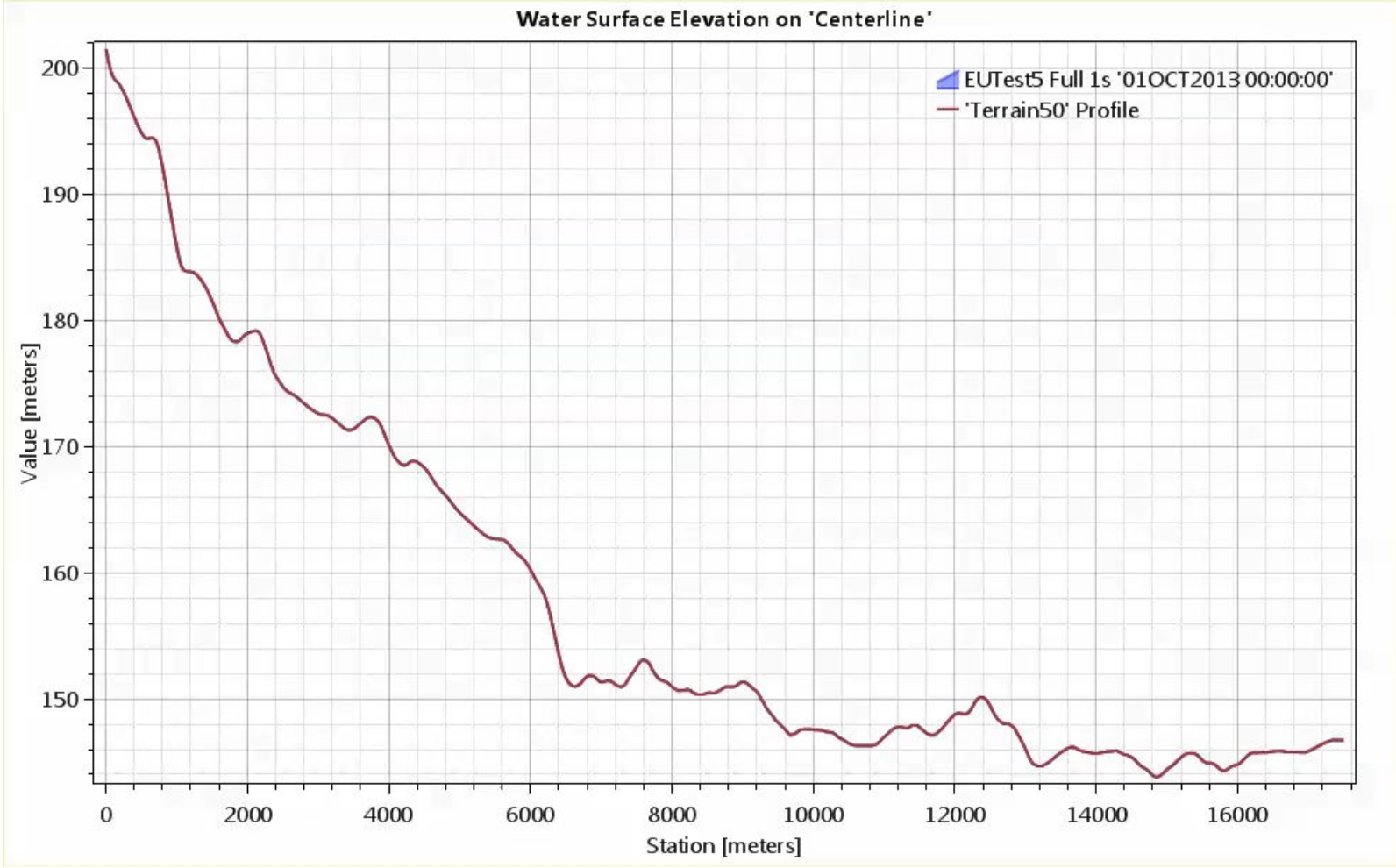


# Profile Lines - Comparison



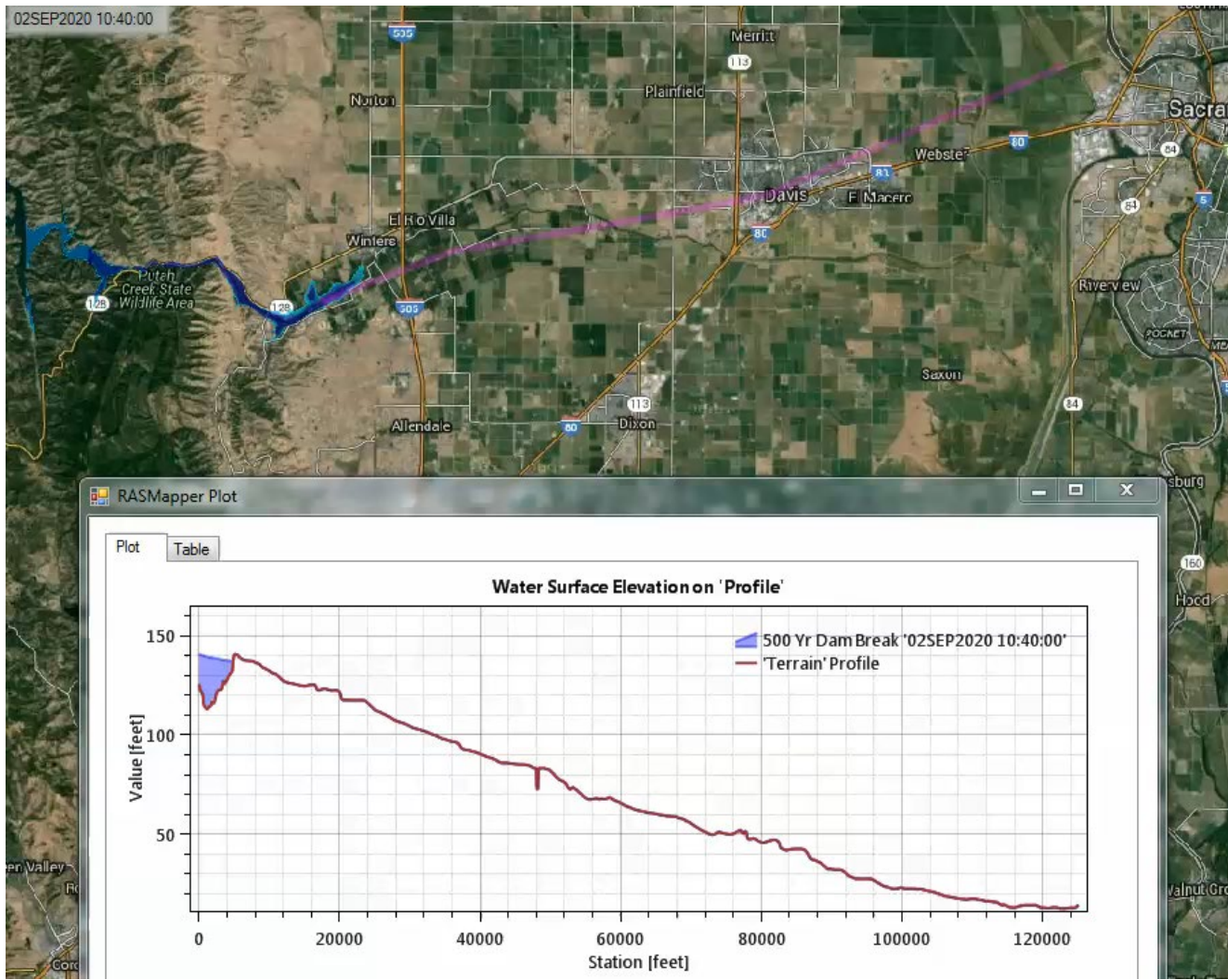


# Profile Lines - Animating





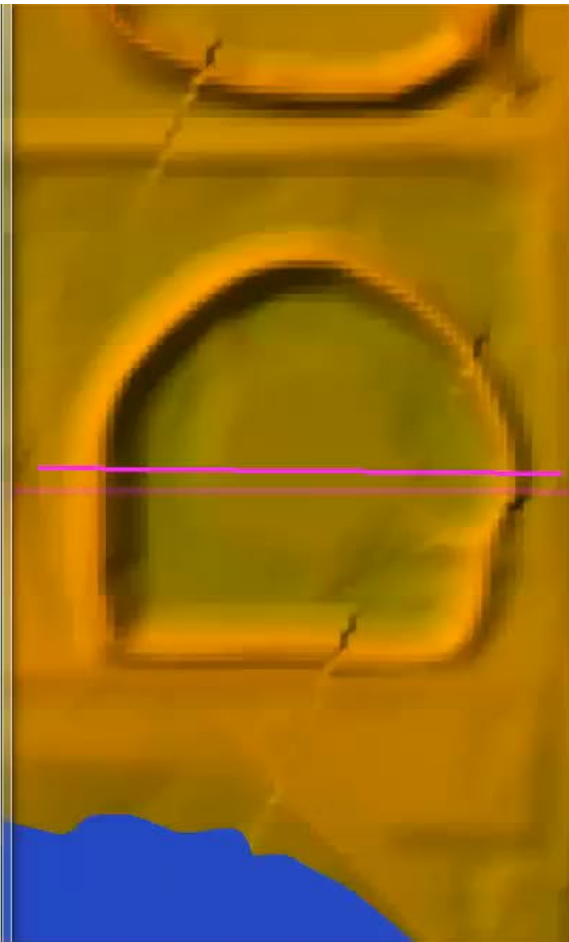
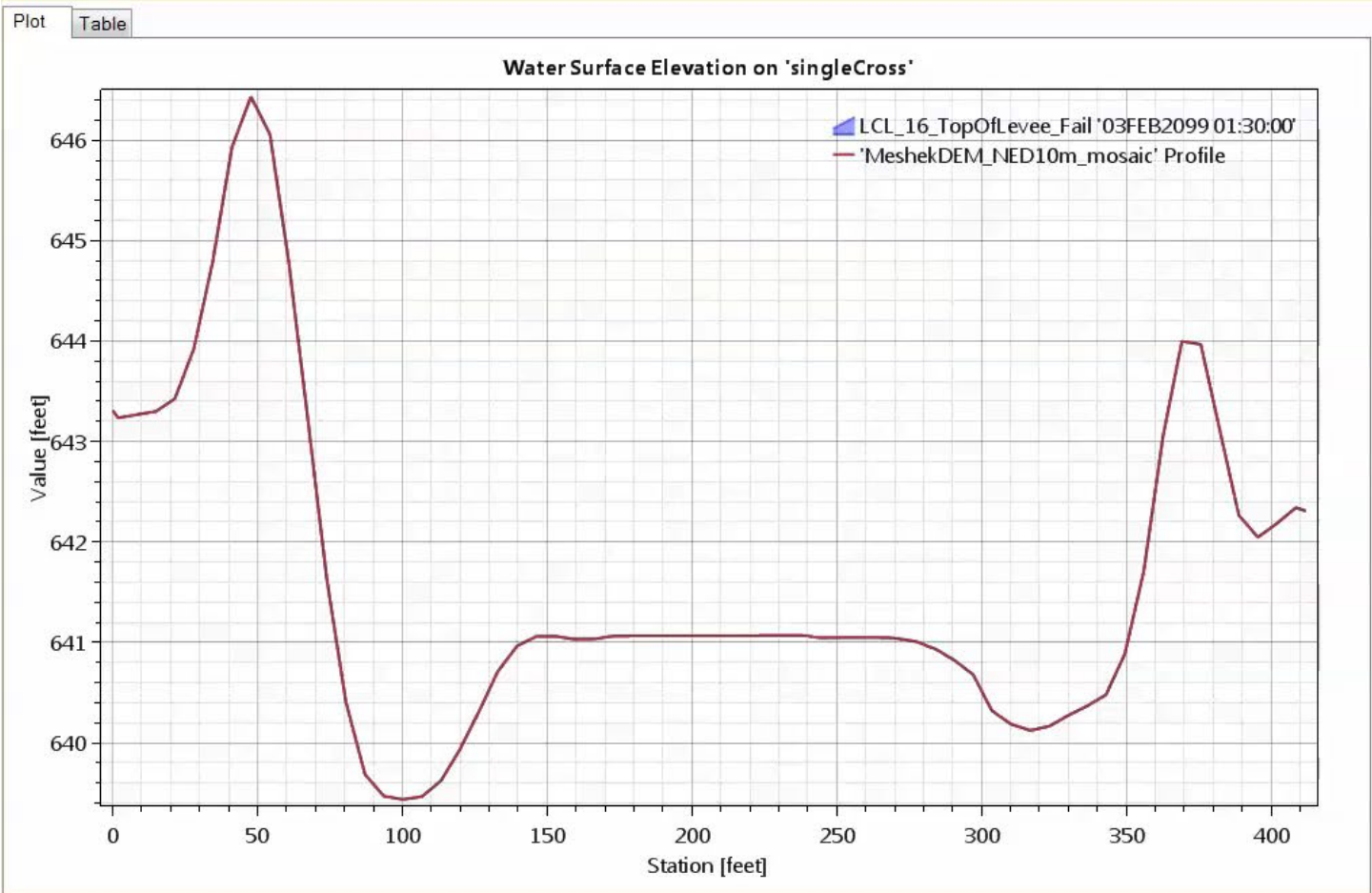
# Profile Lines + Spatial Results







# Profile Lines - Animating



A satellite image showing a large, irregularly shaped ice floe in the center of the frame. The ice is light gray/white. The surrounding ocean is dark blue. White lines, likely representing sea ice motion vectors, are visible across the entire image, showing a complex flow pattern around the ice floe. The word "Questions?" is written in black text in the center of the image, over the ice floe.

Questions?