

HEC-RAS Mapper Results Visualization

USACE, Institute for Water Resources, Hydrologic Engineering Center

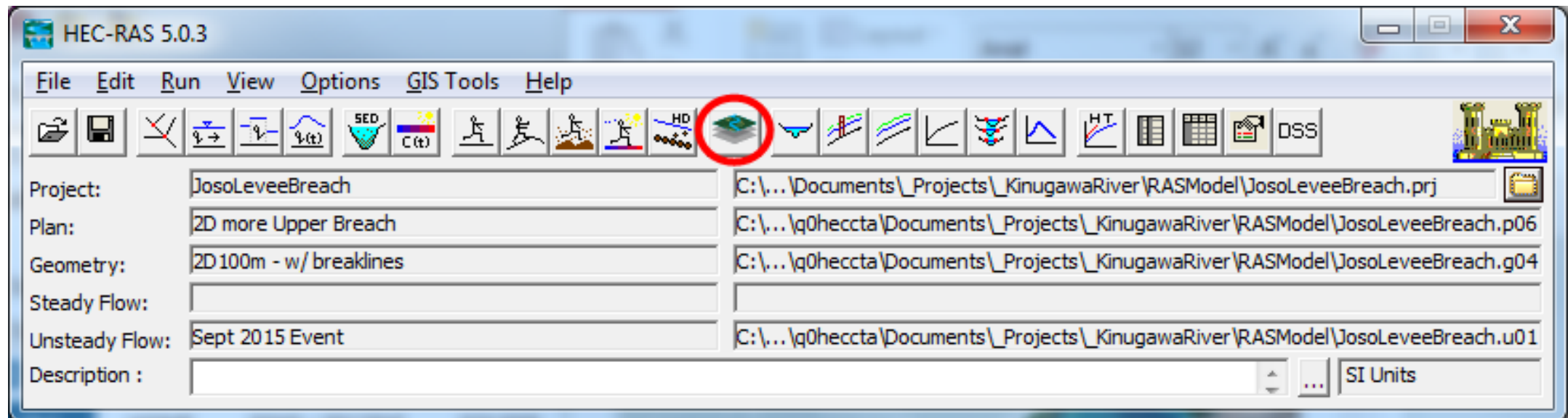




Overview



- How do we visualize RAS results?
- How do we debug our model?
- How do we compare different plans?
- How do we produce maps for publication?





HEC-RAS Mapper Overview



The screenshot displays the HEC-RAS Mapper software interface. The main window is titled "RAS-Mapper" and contains several key components:

- Menu System:** Located at the top left, it includes a "File" menu and a "Selected Layer: Depth" indicator.
- Layers List (the Tree):** A hierarchical tree view on the left side, listing various data layers such as "Features", "Geometries", "Plans", "Event Conditions", "Results", "Map Layers", and "Terrains". The "Depth" layer is currently selected.
- View Tools:** A toolbar at the top center with icons for navigation and zooming, including "Max" and "Min" buttons.
- Animation Controls:** A toolbar at the top right with play and stop icons.
- Mapping Window:** The central area showing a 2D depth map of a river channel. The map is overlaid on a Google Satellite image. A grid is visible, and various elevation values are displayed along the channel. A color scale legend at the bottom right indicates depth values from 145 to 15 feet.
- Status Area:** A panel at the bottom left showing "Profile Line 1" and "FlowLine1". It includes a "Plot Tick Marks" checkbox and a status bar with "Messages", "Views", "Profile Lines", "Active Features", and "Layer Values" tabs. The status bar also displays coordinates: "(410271.56, 1804554.79 1 pixel = 5.11 ft)".



Menu System



RAS-Mapper

File **Menu System**

Selected Layer: Depth

Selected: '2D 50ft Grid - Depth' 02JAN1900 11:20:00

Features

- Geometries
 - Muncie Base Geometry - 9 SAs
 - Muncie Geometry - 2D 50ft Grid
 - Muncie Geometry - 50ft User n Value Regi
- Plans
 - Unsteady Multi 9-SA run
 - Unsteady Run with 2D 50ft Grid
 - Unsteady Run with 2D 50ft User n Value R
- Event Conditions
 - Flow Boundary Conditions
- Results
 - 50ft User n Regions
 - 2D 50ft Grid
 - Event Conditions
 - Geometry
 - Plan
 - Depth (02JAN1900 11:20:00)
 - Velocity (02JAN1900 12:15:00)
 - WSE (Max)
- Map Layers
 - Land Cover
 - LandCoverUSGSGrid
 - LandCoverCombined
 - channel_over_overbank
 - Google Satellite
- Terrains
 - Terrain
 - TerrainWithChannel

Profile Line 1
FlowLine1

Plot Tick Marks

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

(410271.56, 1804554.79 1 pixel = 5.11 ft)

RAS Mapper Options

Project Settings

Projection

General

Render Mode

Global Settings

General

RAS Layers

Map Surface Fill

Editing Tools

Coordinate Reference System

Projection File: [C:\Work_RAS_ExampleProjects\Example_Projects\2D Unsteady F

Definition:

```
PROJCS["NAD_1983_StatePlane_Indiana_East_FIPS_1301_Feet",GEOGCS["GCS_North_American_1983",DATUM["D_North_American_1983",SPHEROID["GRS_1980",6378137.0,298.257222101]],PRIMEM["Greenwich",0.0],UNIT["Degree",0.0174532925199433]],PROJECTION["Transverse_Mercator"],PARAMETER["False_Easting",328083.3333333333],PARAMETER["False_Northing",820208.3333333333],PARAMETER["Central_Meridian",-85.66666666666667],PARAMETER["Scale_Factor",0.9999666666666667],PARAMETER["Latitude_Of_Origin",37.5],UNIT["Foot_US",0.3048006096012192]]
```

Warping Method

- Default Method (GDAL Warp)
- Alternate HEC-RAS Raster Warping Method

Help me find a coordinate reference system: spatialreference.org

RAS Project Units: US Customary

OK Cancel Apply



Mapping Window



Results

- 50ft User n Regions
- 2D 50ft Grid
- Event Conditions
- Geometry
- Plan
- Depth (02JAN1900 11:20:00)
- Velocity (02JAN1900 12:15:00)
- WSE (Max)

Map Layers

- Land Cover
- LandCoverUSGSGrid
- LandCoverCombined
- channel_over_overbank
- Google Satellite

Terrains

- Terrain
- TerrainWithChannel

Selected: '2D 50ft Grid - Depth' 02JAN1900 11:20:00

Mapping Window

Plot Tick Marks

Messages Views Profile Lines Active Features Layer Values

(410271.56, 1804554.79 1 pixel = 5.11 ft)

500 ft



Layers List



RAS Mapper

File Project Tools Help

Selected Layer: Depth

Layers List (the Tree)

- [-] Features
 - [+] Geometries
 - Muncie Base Geometry - 9 SAs
 - Muncie Geometry - 2D 50ft Grid
 - Muncie Geometry - 50ft User n Value Regi
 - Plans
 - Unsteady Multi 9-SA run
 - Unsteady Run with 2D 50ft Grid
 - Unsteady Run with 2D 50ft User n Value R
 - Event Conditions
 - Flow Boundary Conditions
 - [+] Results
 - 50ft User n Regions
 - 2D 50ft
 - Event Conditions
 - Geom
 - Plan
 - Dep (02JAN1900 11:20:00)
 - Velocity (02JAN1900 12:15:00)
 - WSE (Max)
 - Map Layers
 - Land Cover
 - LandCoverUSGSGrid
 - LandCoverCombined
 - channel_over_overbank
 - Google Satellite
 - Terrains
 - Terrain
 - TerrainWithChannel

Profile Line 1
FlowLine1

Plot Tick Marks

Messages Views Profile Lines Active Features Layer Values

(410271.56, 1804554.79 1 pixel = 5.11 ft)

Selected: '2D 50ft Grid - Depth' 02JAN1900 11:20:00

7490.833
7864.487
8110.505
8434.332
8757.405
9081.195
9334.877
9548.851
9854.381
10216.27
10672.75
11188.16
11628.65
11781.69
11958.11
12117.14
12227.69
12492.0
12817.3
13214.8
13490.47
13859.04
14039.64
14166.05
14305.48
14443.72
14535.6
14697.
14787
149
15 (ft)

500 ft



Layers List

Layer Order Dictates Visualization

- Features
 - Profile Lines
 - Custom User Layers (vector)
- Geometries
- Plans
- Event Conditions
- Results
- Map Layers
 - Land Cover/Soils/Infiltration and more
 - Web Imagery
 - Custom User Layers (vector and raster)
- Terrains

Selected Layer: Depth

- Features
 - Profile Lines
 - Polygon Layer
- Geometries
 - Muncie Base Geometry - 9 SAs
 - Muncie Geometry - 2D 50ft Grid
 - Rivers
 - Cross Sections
 - 2D Flow Areas
 - Lateral Structures
 - Reference Areas
 - Manning's n
 - Calibration Regions
 - Final n Values
 - (13 Empty Layers)
 - Muncie Geometry - 50ft User n Value Regi
- Plans
 - Unsteady Multi 9-SA run
 - Unsteady Run with 2D 50ft Grid
 - Unsteady Run with 2D 50ft User n Value R
- Event Conditions
 - Flow Boundary Conditions
- Results
 - 50ft User n Regions
 - 2D 50ft Grid
 - Event Conditions
 - Geometry
 - Plan
 - Depth (02JAN1900 08:05:00)
 - Velocity (02JAN1900 12:15:00)
 - WSE (Max)
 - Duration (hrs)
- Map Layers
 - Land Cover
 - LandCoverUSGSGrid
 - LandCoverCombined
 - channel_over_overbank
- Terrains
 - Terrain
 - TerrainWithChannel

Symbology is shown to the right of any checked layers

The selected layer is highlighted in magenta



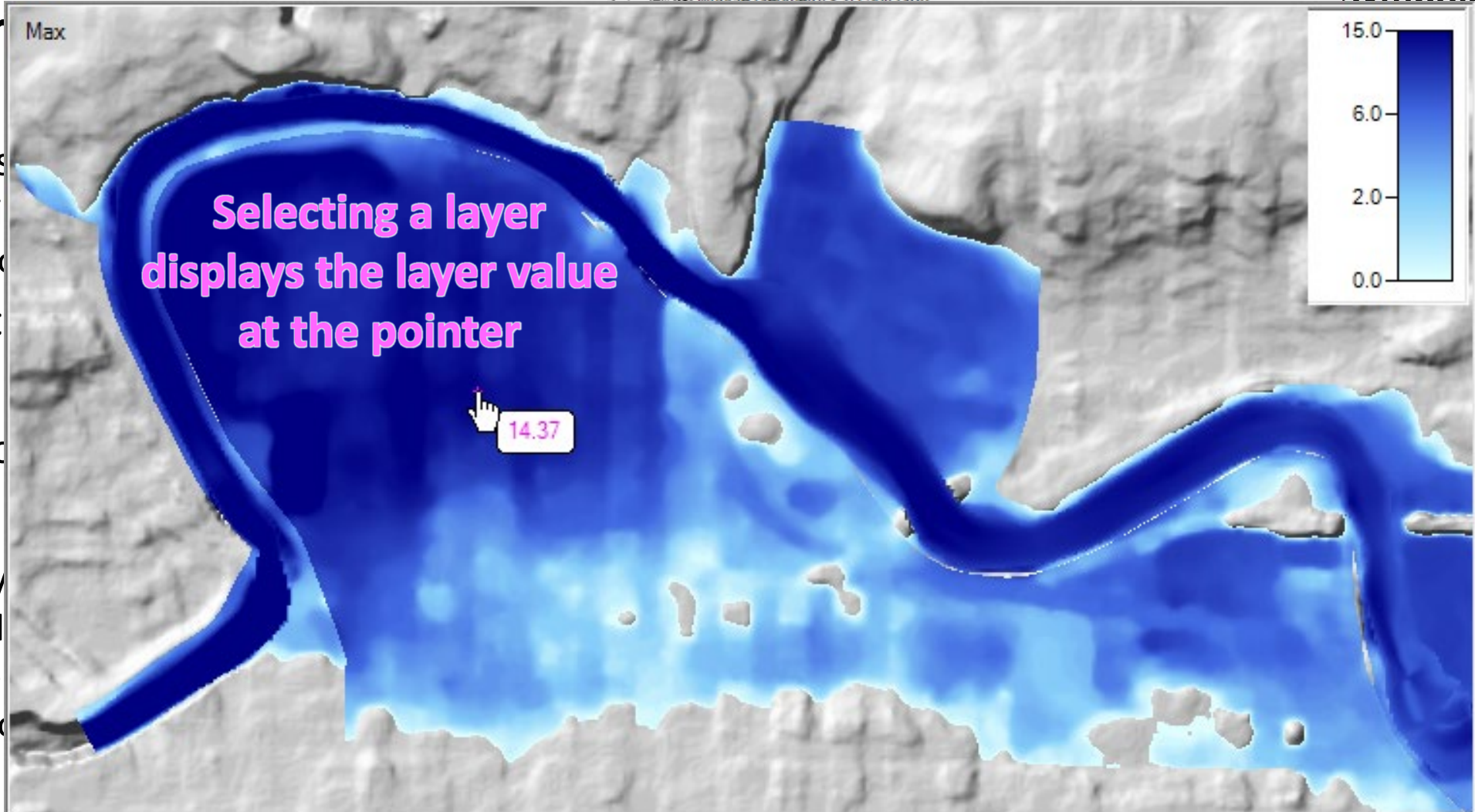
Layers List

Selected Layer: Depth

- Features
 - Profile Lines
 - Polygon Layer
- Geometries
 - Muncie Base Geometry - 9 SAs
 - Muncie Geometry - 2D 50ft Grid

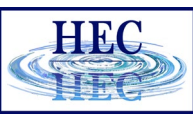
Layer Order

- Features
 - Profile Lines
 - Custom
- Geometries
- Plans
- Event Calculations
- Results
- Map Layers
 - Land Use
 - Web
 - Custom
- Terrains





Layer List: Map Layer | Web Imagery



Add Web Imagery...

- Reference Layers
- Create a New RAS Layer
- Add an Existing RAS Layer
- Manage Geometry Associations ...

GDALWMS

Select WMS image server

- ArcGIS NatGeo World Map**
- ArcGIS Ocean Basemap
- ArcGIS USA Topo Maps
- ArcGIS World Imagery
- ArcGIS World Physical Map
- ArcGIS World Shaded Relief
- ArcGIS World Street Map
- ArcGIS World Terrain Base
- ArcGIS World Topo Map
- Bing Satellite
- Google Hybrid
- Google Map
- Google Satellite
- Google Terrain Streets Water
- Google Terrain
- OpenStreetMaps
- USGS Imagery
- USGS Topo

Reprojection Resample Method: near

OK Close

RAS Mapper

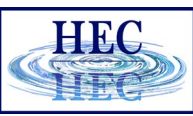
File Tools Help

Selected Layer: Depth

- Modified Channel Geometry
- Results**
 - 500 Yr Dam Break
 - Geometry
 - Depth (01SEP2020 12:00:00)**
 - WSE (03SEP2020 00:30:00)
 - Velocity (Max)
 - Arrival Time (0.1ft hrs)
 - Sunny Day Dam Break
 - Geometry
 - Depth (None)
 - Velocity (None)
 - WSE (None)
 - Montecello DamBreak Run 100Yr Event
 - Geometry
 - Depth (None)
 - Velocity (None)
 - WSE (None)
 - Map Layers**
 - Google Hybrid
 - Google Map
 - Google Satellite

Creating Post Process completed [109927 ms]
Stored map 'Arrival Time (0.1ft hrs)' created.

Messages Views Profile Lines



Results Visualization: Layer Properties

RAS Mapper

File Project Tools Help

Selected Layer: Depth

Features

- Geometries
 - Muncie Base Geometry - 9 SAs
 - Muncie Geometry - 2D 50ft Grid
 - Rivers
 - Cross Sections
 - 2D Flow Areas
 - Lateral Structures
 - Reference Areas
 - Manning's n
 - (13 Empty Layers)
 - Muncie Geometry - 50ft User n Value Regi
- Plans
- Event Conditions
- Results
 - 50ft User n Regions
 - 2D 50ft Grid
 - Layer Properties
 - Edit Map Parameters
 - Zoom to Layer
 - Add Watch to Layer Values
 - Remove Layer
 - Move Layer
 - Export Layer
 - Export RAS Tiles for Web Mapping
 - View Map in 3D Viewer
 - Plan
 - Velocity (M)
 - WSE (Ma)
- Map Layers
 - Land Cover
 - LandCoverUS
 - LandCoverCo
 - channel_over
 - Google Satell
- Terrains
 - Terrain
 - TerrainWithC

Depth - Layer Properties

Visualization and Information | Features | Source Files

Vector

Point: Line: Fill:

Symbology By Attribute Column

Label Features by Attribute Column(s)

Surface

Plot Surface Update Legend with View

15.0
11.3
7.5
3.8
0.0

Stretched

Opacity: 73%

Contours / Hillshade

Plot Contours Interval: 5 Color:

Plot Hillshade Z Factor: 3

Select Surface Fill

Surface Symbol Settings

Available Color Ramps: RAS Defaults User Defined

Color Ramp:

Surface Symbol

Max: Use Dataset Min/Max

Min: No. Values:

Keep user Values with color ramp change

	Value	Color	Red (0-255)	Green (0-255)	Blue (0-255)	Alpha (0-255)
1	0.00		0	255	255	255
2	15.00		0	0	139	255

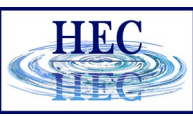
Profile Line 1
FlowLine1

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

(408110.69, 1805766.16 1 pixel = 5.23 ft)



Results Visualization: Layer Properties



Selected Layer: Arrival Time

Features

- Geometries
 - Muncie Base Geometry - 9 SAs
 - Muncie Geometry - 2D 50ft Grid
 - Rivers
 - Cross Sections
 - 2D Flow Areas
 - Lateral Structures
 - Reference Areas
 - Manning's n
 - (13 Empty Layers)
- Plans
- Event Conditions
- Results
 - 50ft User n Regions
 - 2D 50ft Grid
 - Layer Properties
 - Edit Map Parameters
 - Zoom to Layer
 - Add Watch to Layer Values
 - Remove Layer
 - Move Layer
 - Export Layer
 - Export RAS Tiles for Web Mapping
 - View Map in 3D Viewer
- Map Layer
 - Land Co
 - LandCo
 - LandCo
 - channel
 - Google Satellite
- Terrains

Arrival Time - Layer Properties

Visualization and Information | Features | Source Files

Vector

Point: Line: Fill:

Symbology By Attribute Column

Label Features by Attribute Column(s)

Surface

Plot Surface Update Legend with View

Discrete

Opacity: 100%

Contours / Hillshade

Plot Contours Interval: 5 Color:

Plot Hillshade Z Factor: 3

Select Surface Fill

Surface Symbol Settings

Available Color Ramps: RAS Defaults User Defined

Color Ramp:

Surface Symbol

Max: 8.00 Use Dataset Min/Max

Min: 0.00 No. Values: 6

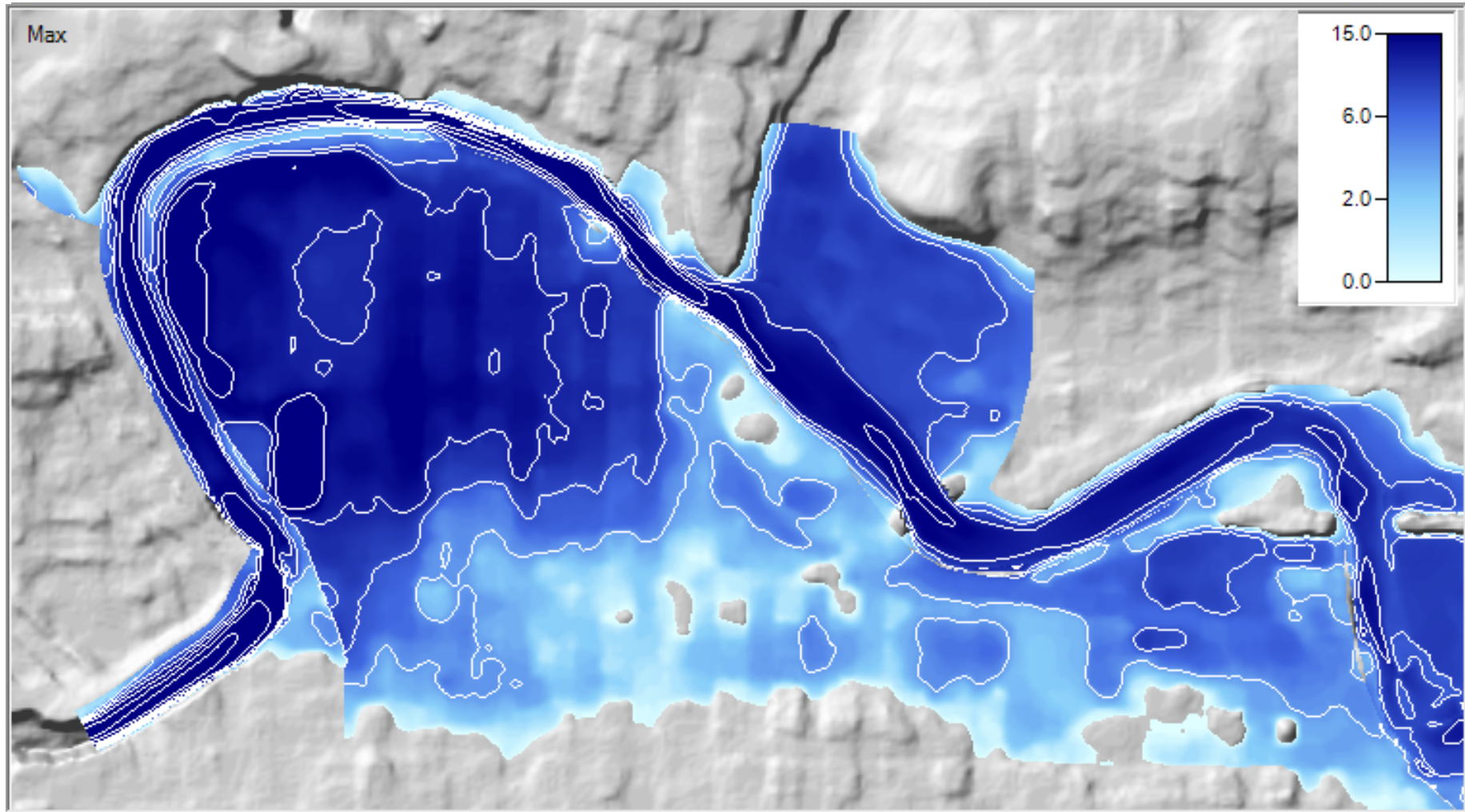
Keep user Values with color ramp change

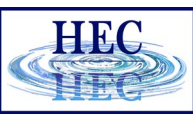
	Value	Color	Red (0-255)	Green (0-255)	Blue (0-255)	Alpha (0-255)
1	0.00		255	0	0	255
2	1.00		205	92	92	255
3	2.00		255	165	0	255
4	4.00		255	255	0	255
5	6.00		144	238	144	255
6	8.00		0	128	0	255

Results Visualization: Example



Stretched with Contours





Results Mapping: Adding a New Result Layer

The screenshot shows the RAS Mapper application window. The title bar reads "RAS Mapper". The menu bar includes "File", "Project", "Tools", and "Help". The status bar at the top indicates "Selected Layer: 2D 50ft Grid". The left sidebar contains a tree view with the following categories and items:

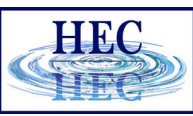
- Features
 - Geometries
 - Muncie Base Geometry - 9 SAs
 - Muncie Geometry - 2D 50ft Grid
 - Muncie Geometry - 50ft User n Value Regi
 - Plans
 - Event Conditions
 - Results
 - 50ft User n Regions
 - 2D 50ft Grid (highlighted)
 - Event Conditions
 - Geometry
 - Plan
 - Depth (02JAN1900 12:50:00)
 - Velocity (02JAN1900 12:15:00)
 - WSE (02JAN1900 12:10:00)
 - Map Layers
 - Terrains
 - Terrain
 - TerrainWithChannel

The main map area shows a river channel with a blue water surface and a grid overlay. A context menu is open over the map, listing the following options:

- RAS Results Information
- Plot Results Profile
- Show Results Table
- Zoom to Layer
- Remove Layer
- Remove Layer and Delete Source Files
- Move Layer
- Open Folder in File Explorer
- Show Compute Messages ...
- Create a New Results Map Layer... (highlighted)
- Create a New Calculated Layer...
- Manage Results Map Layers...
- View Result in 3D

The bottom of the window shows a "Profile Lines" section with "Profile Line - Longitudinal" and "Profile Line - Section" options. The status bar at the bottom left indicates coordinates and scale: "(409181.30, 1805852.72 1 pixel = 8.55 ft)".

Default Maps: Depth, Velocity, and Water Surface Elevation



Results Mapping: Adding a New Result Layer

Map Type

Profile/
Parameter

Output 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 * Velocity²
 - ... 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:

Point Feature Layer:

Polygon Boundary at Value:

	Map Type	Layer Name
▶	Arrival Time	Arrival Time

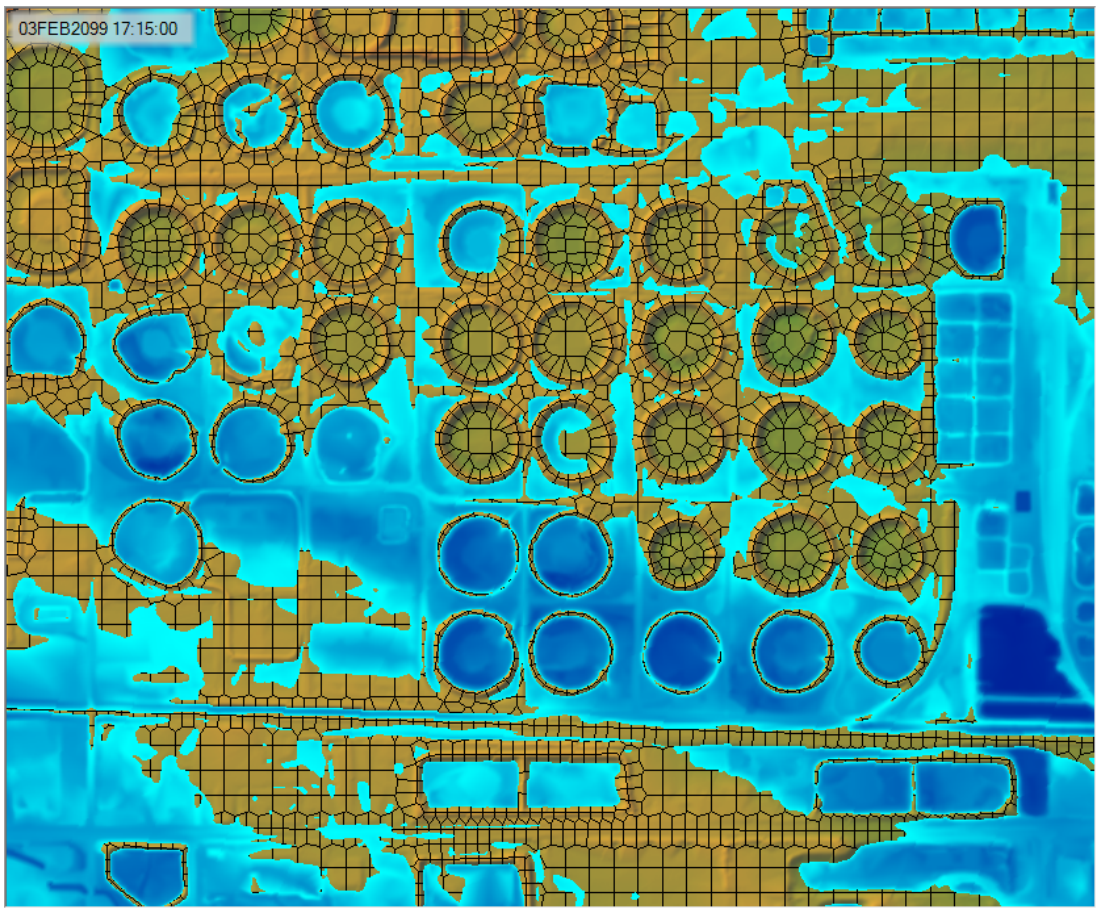
Map Type: A Map layer will be created for The time (from a specified Start Time) for water to reach a specified flood depth.
 Map Mode: Map results are generated on-the-fly for the current view.

Default Maps: Depth, Velocity, and Water Surface Elevation

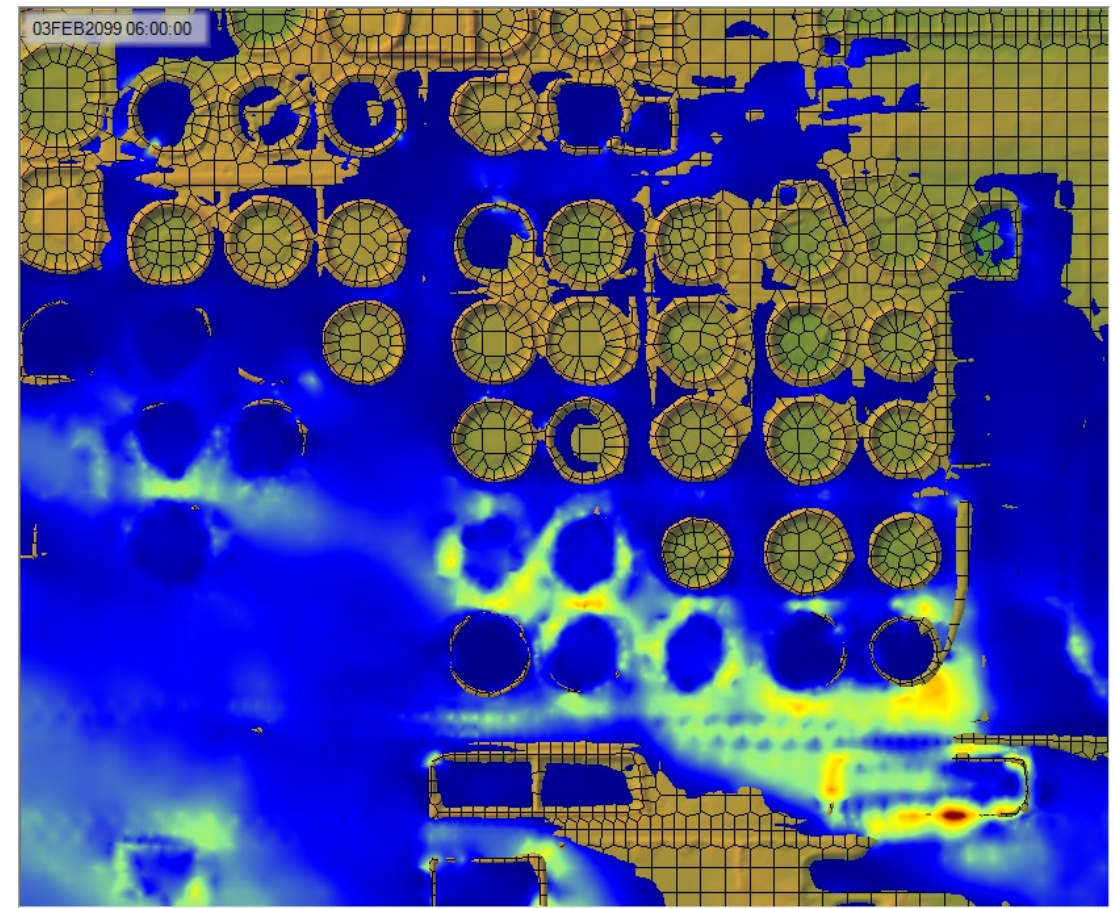


Example Maps: Depth and Velocity

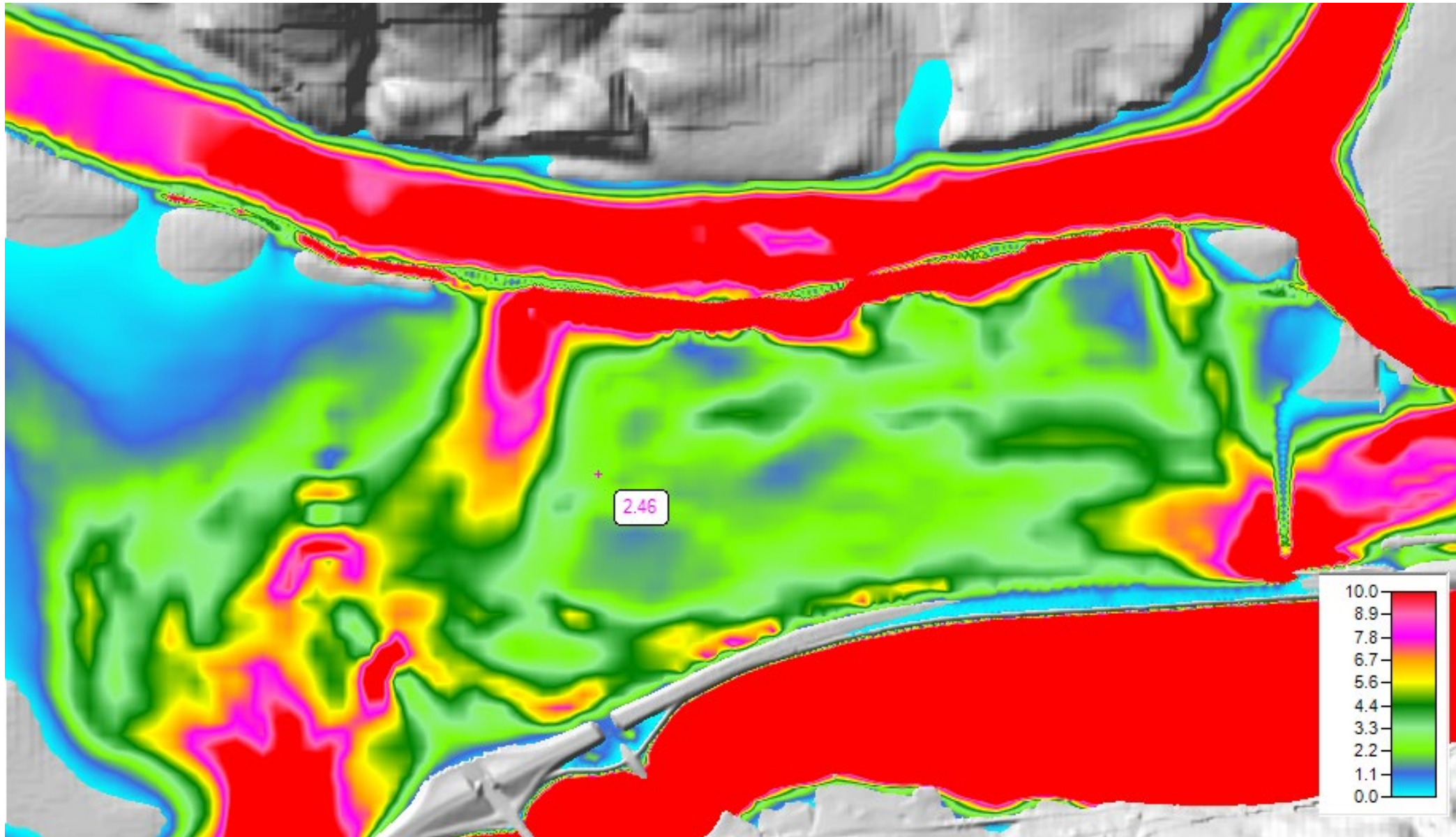
- Depth



- Velocity

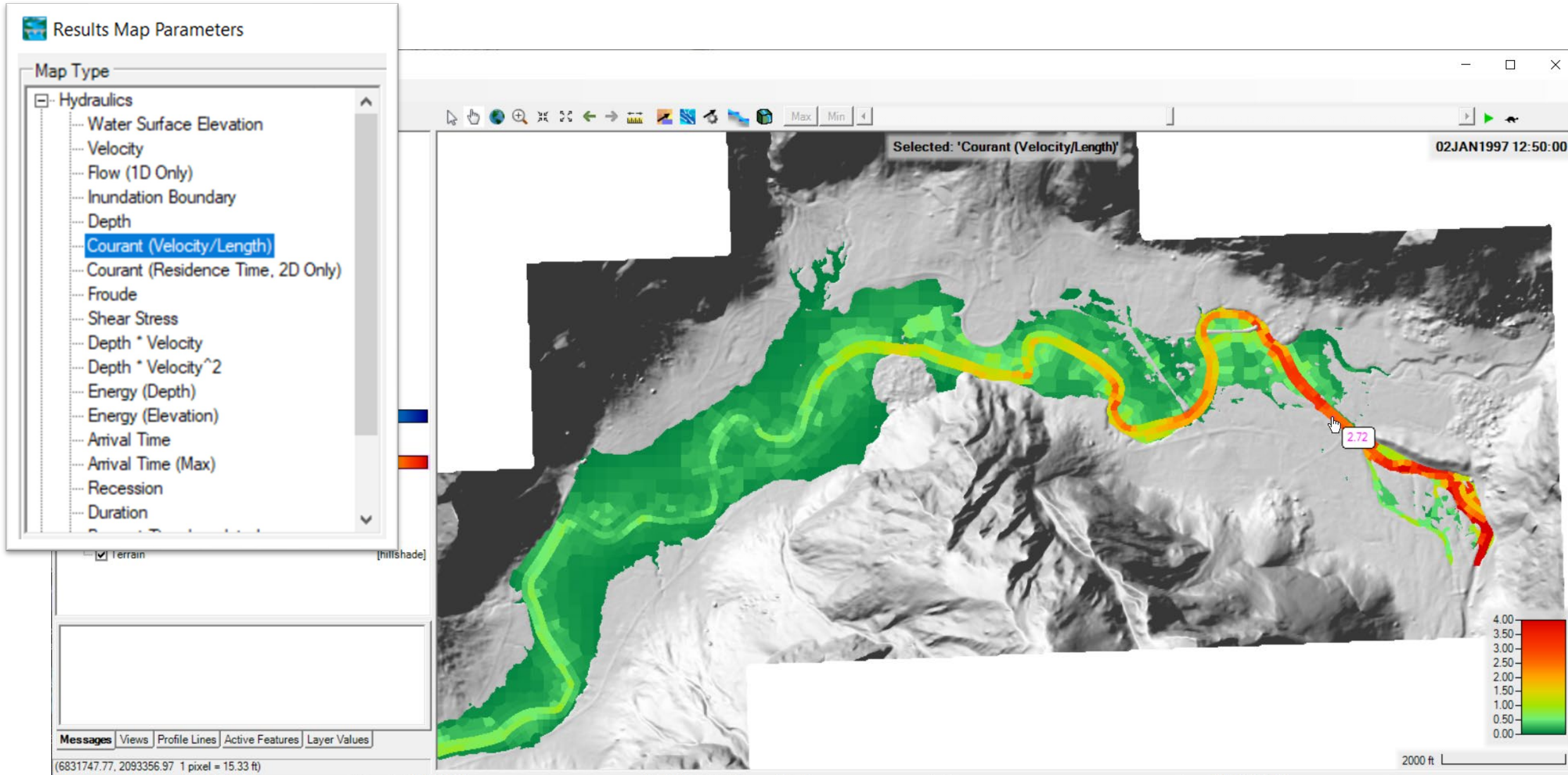


Example Maps: Hazard Mapping



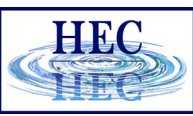


Example Maps: Courant Number Map



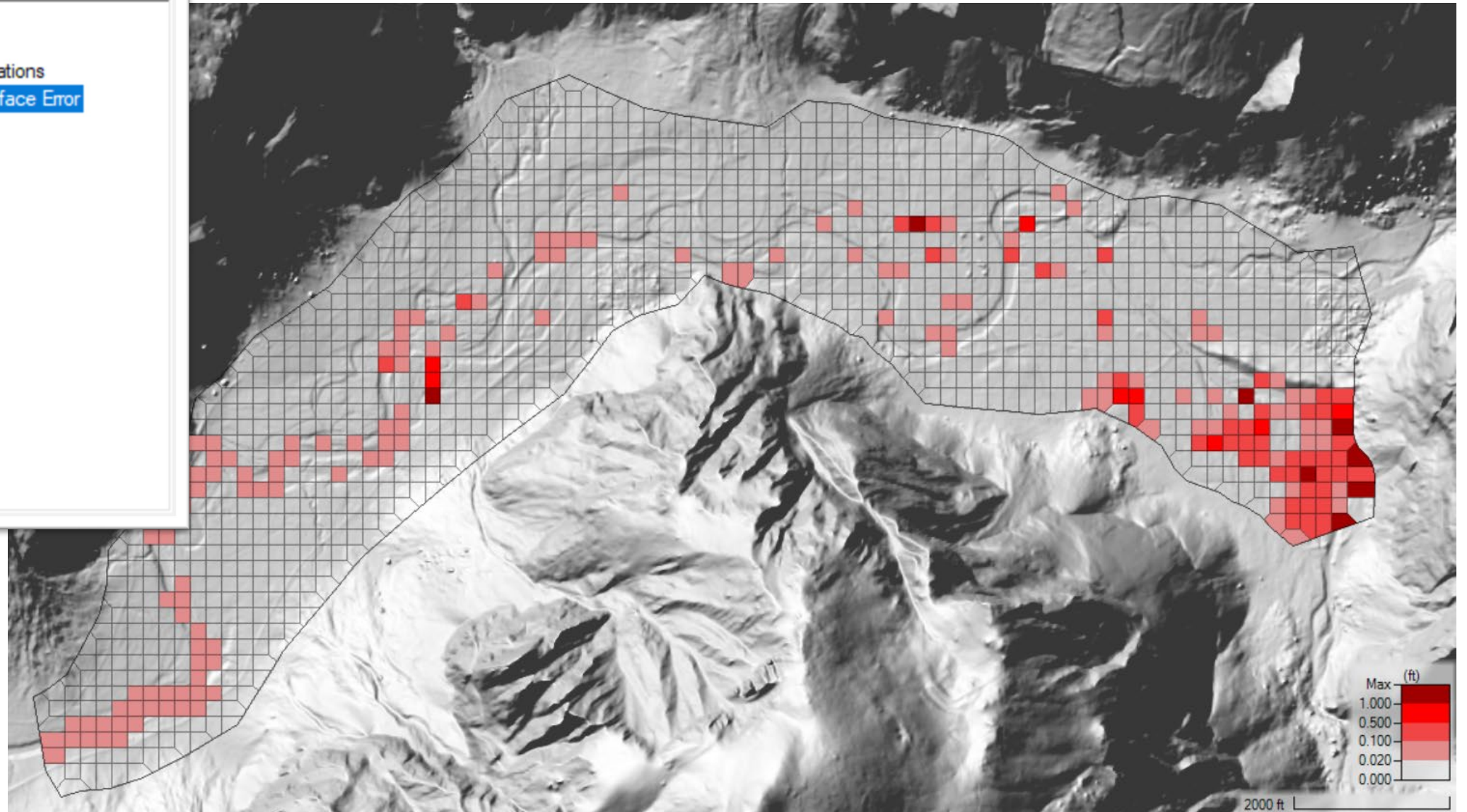


Example Maps: Maximum Water Surface Error



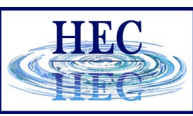
Map Type

- Hydraulics
- Additional 2D Variables
 - Cumulative Max Iterations
 - Maximum Water Surface Error





Additional Options



• Terrain

Terrain - Layer Properties

Visualization and Information | Source Files

Vector

Point: Line: Fill:

Symbology By Attribute Column

Label Features by Attribute Column(s)

Surface

Plot Surface Update Legend with View

Opacity:

Contours / Hillshade

Plot Contours Interval: Color:

Plot Hillshade Z Factor:

Additional Options

- Plot Contour At Cursor
- Plot raster file outlines
- Plot raster file names
- Plot tile outlines
- Plot cell outlines (when zoomed in)
- Plot cell values (when zoomed in)
- Plot stitch TIN edges
- Plot Level0 stitch TIN edges
- Remove Stitch Rendering

• Depth, WSE

Additional Options

- Plot Contour At Cursor
- Plot 2D Hydraulic Connectivity
- Plot 2D Water Surface Gradient (Arrow: WSEL High->Low)
- Draw Map Values
- Draw Perpendicular Face Values
- Draw True Face Values (interpolated)
- Face Low-Elevation Centroid
- Display Arrival Times as Dates
- Plot Model Boundary Deficiencies

• River, Cross Sections

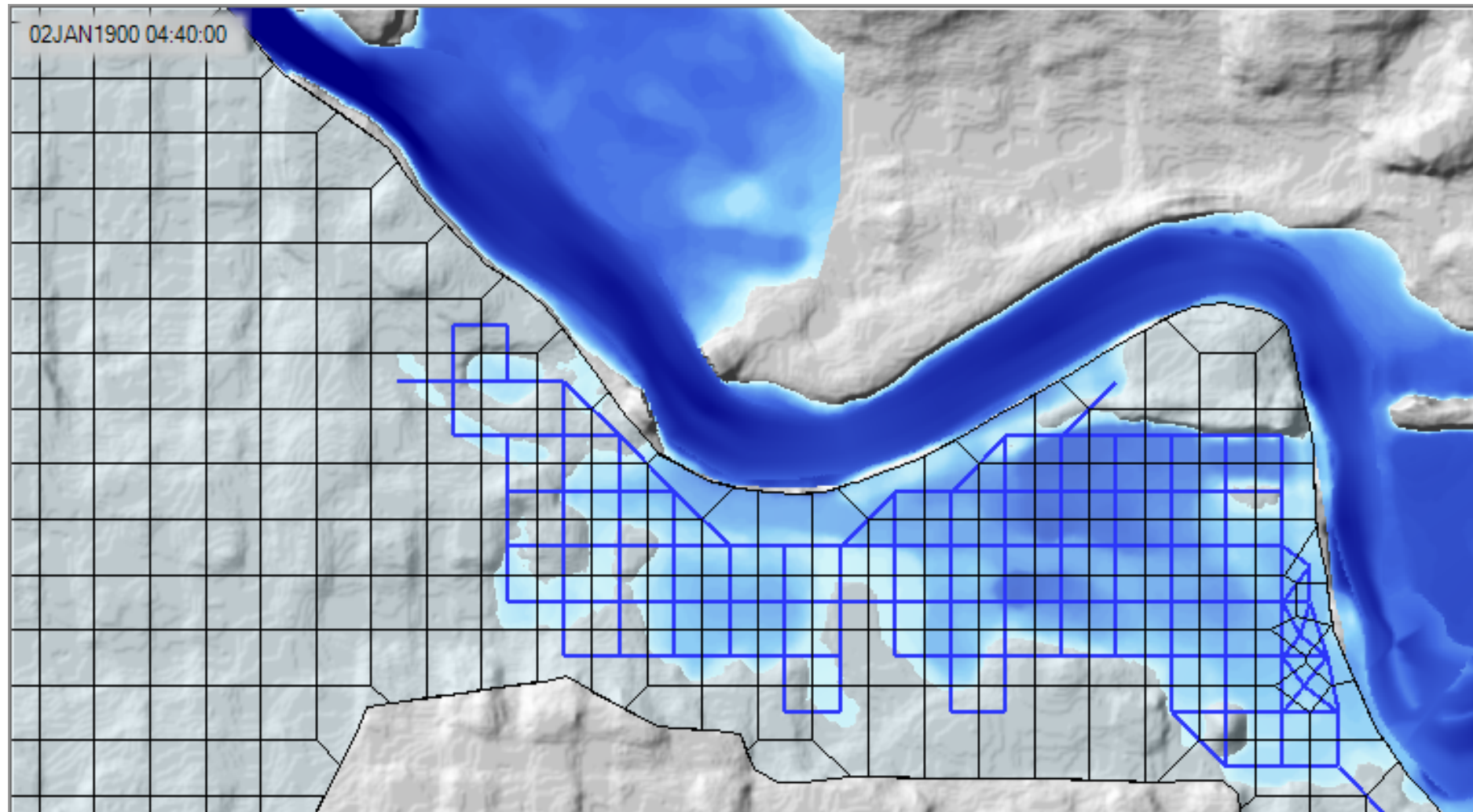
Additional Options

- Bank Stations
- Manning's n Values
- Reach Lengths
- Ineffective Areas
- Blocked Obstructions
- Ratio of Cut Line to XS Line
- Directional Arrows
- Stationing Tick Marks
- Draw Points
- Label Points
- Label Segment Indexes

Additional Options Depth Results

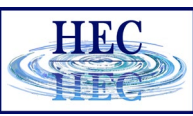


- Hydraulic Connectivity from Mesh





Animation Controls

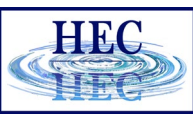


The screenshot displays the RAS Mapper interface with several key components:

- Animation Controls Panel:** Located at the top right, it includes a 'Max' button, a 'Min' button, a slider, and a play button. A red dashed circle highlights the play button.
- Animation Delay Dialog:** A smaller dialog box with a play button and a '0.00s' display.
- Computation Settings Dialog:** A dialog box with a red border containing the following settings:
 - Computation Interval: 20 Second
 - Hydrograph Output Interval: 1 Hour
 - Mapping Output Interval: 1 Hour
 - Detailed Output Interval: 1 Hour
- Main Interface:** Shows a map with a blue depth overlay, a 'Selected: '2D 50ft Grid - Depth'' label, and a timestamp '02JAN1900 11:20:00'. The left sidebar lists various layers like Geometries, Plans, Results, and Map Layers.



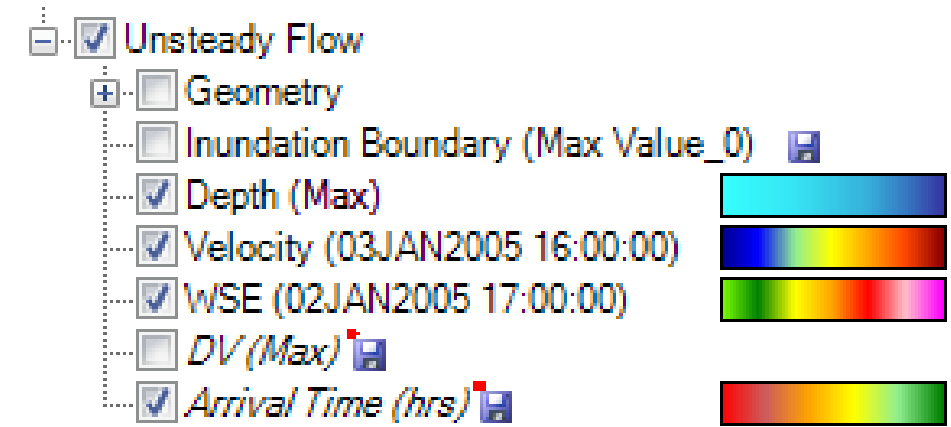
Animation: Dynamic Mapping Example



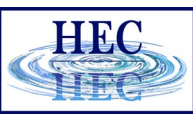
Map Types: Dynamic vs Stored



- Dynamic: Computed On-The-Fly
 - Animation of results without waiting
 - Smooth: Computes to screen-resolution
 - Doesn't use disk space
- Stored: Computed to Terrain Resolution
 - Stored to disk
 - These maps can be exported and shared
 - Faster rendering for slow map types



* = There was a problem reading data



Map Types: Dynamic vs Stored

Map Type Profile/
Parameter Output Mode

Map Type: A Map layer will be created for Water Surface Elevations.
Map Mode: Map results are generated on-the-fly for the current view.

Map Type	Layer Name
Water Surface Elevation	Water Surface Elevation

← Dynamic Maps

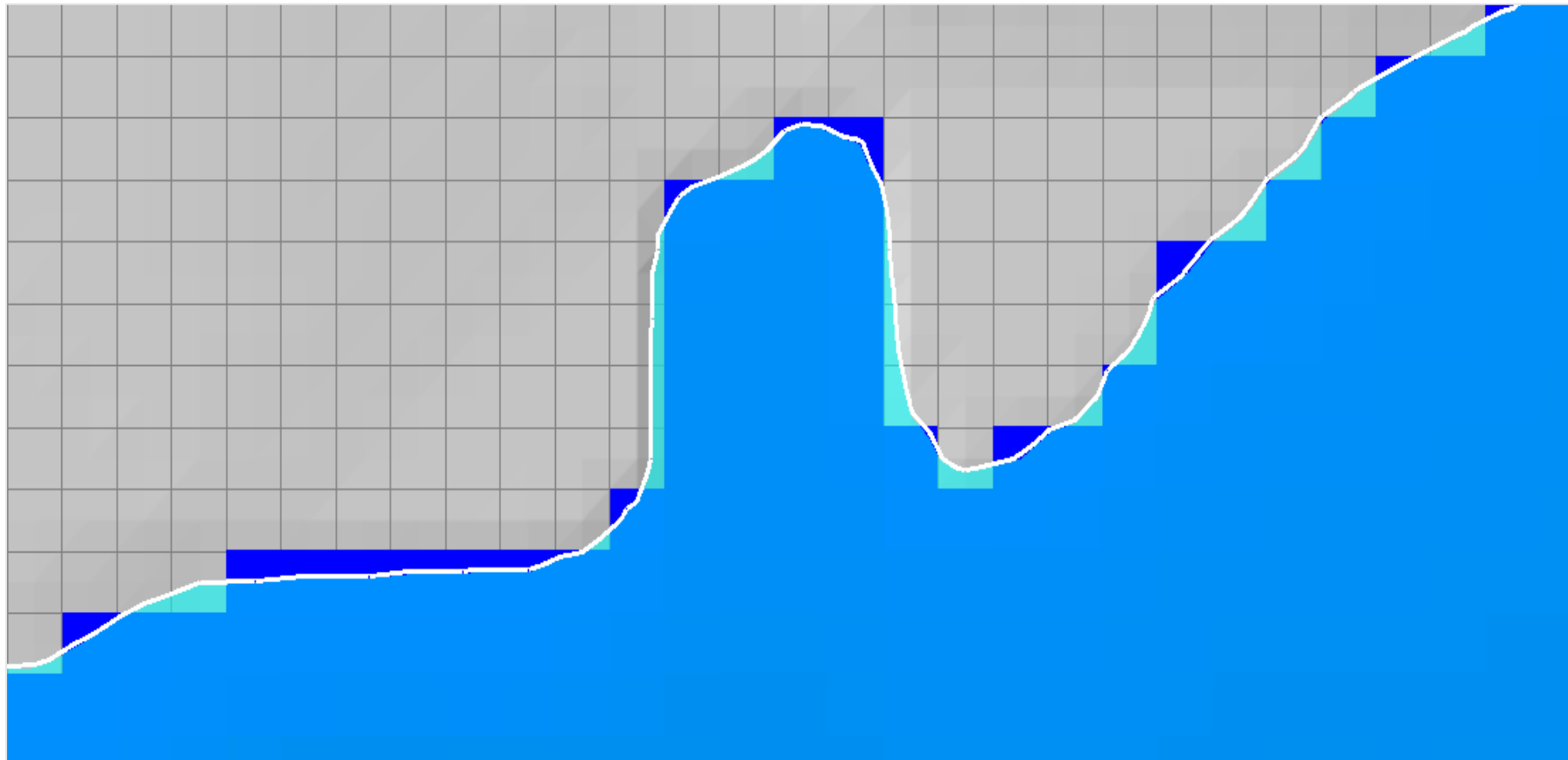
← Stored Maps

Default maps: Depth, Water Surface Elevation, Velocity ← Default Maps are Dynamic Maps



Map Types: Dynamic vs Stored

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

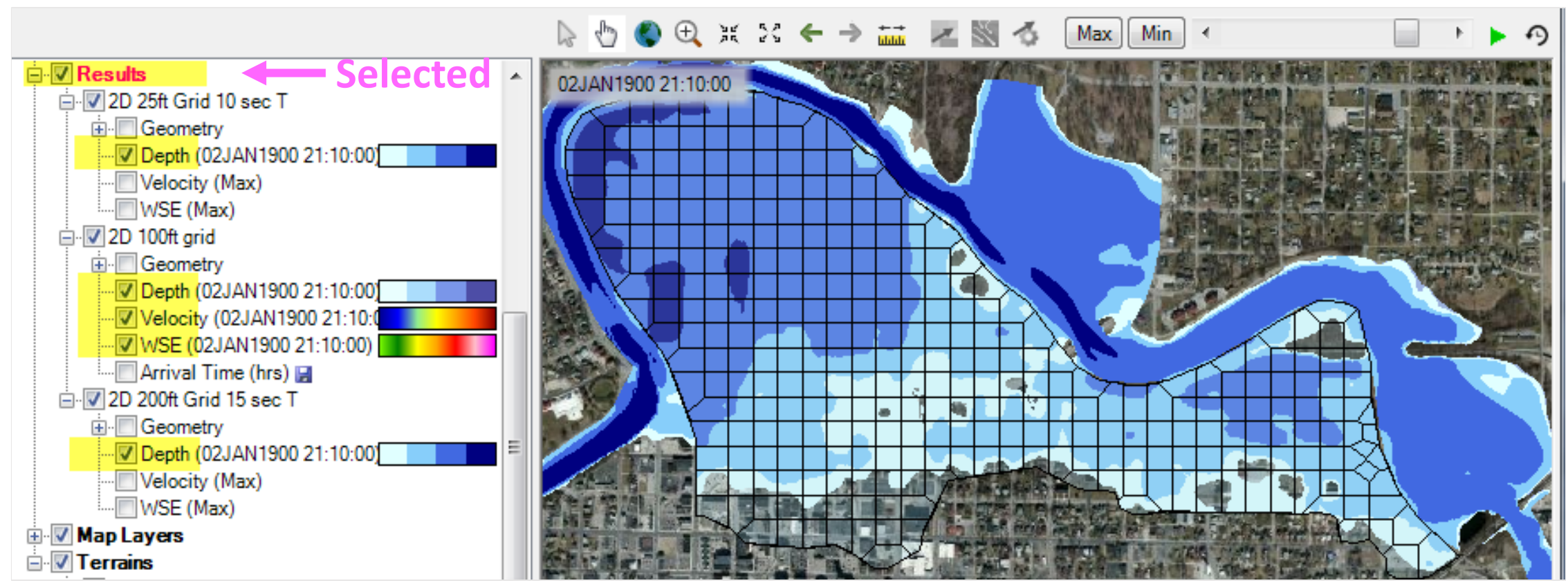




Map Types: Dynamic Maps

Animation Toolbar works on a selected layer

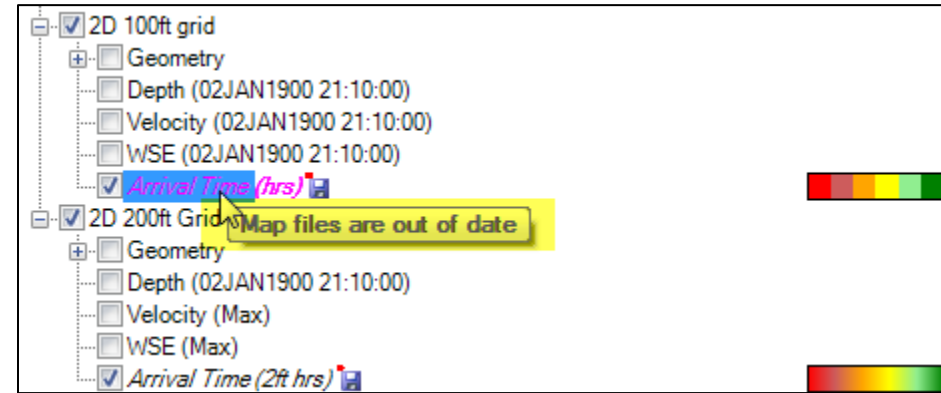
... or group layers and sync the timestep





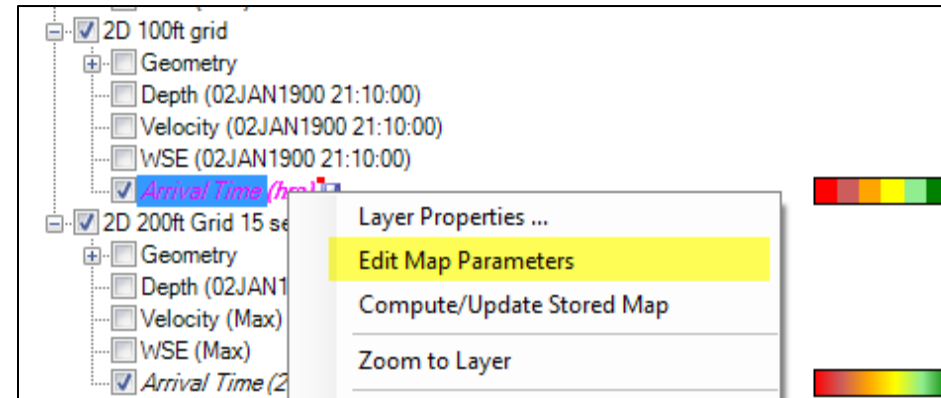
Map Types: Stored Maps

- Map status message on cursor tool tip

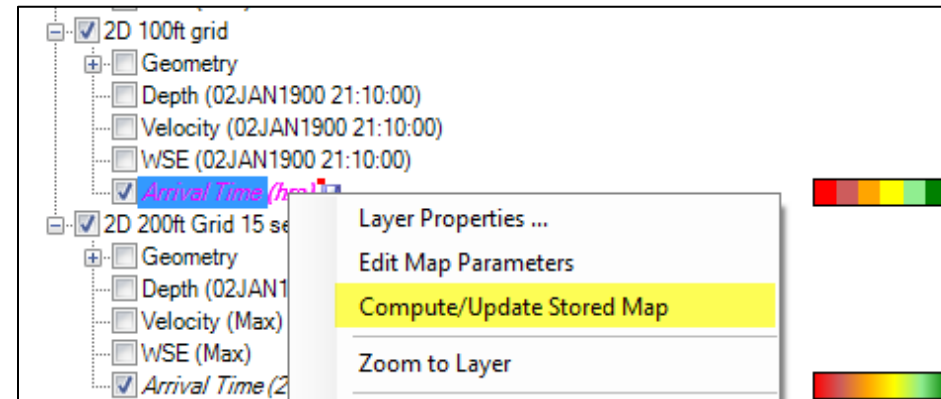


Right-click options:

- Edit Map Parameters



- Compute Map



* = *There was a problem reading data*



Map Types: Manage Results Maps



Manage Results Maps

View Result Maps for: All Plan Results

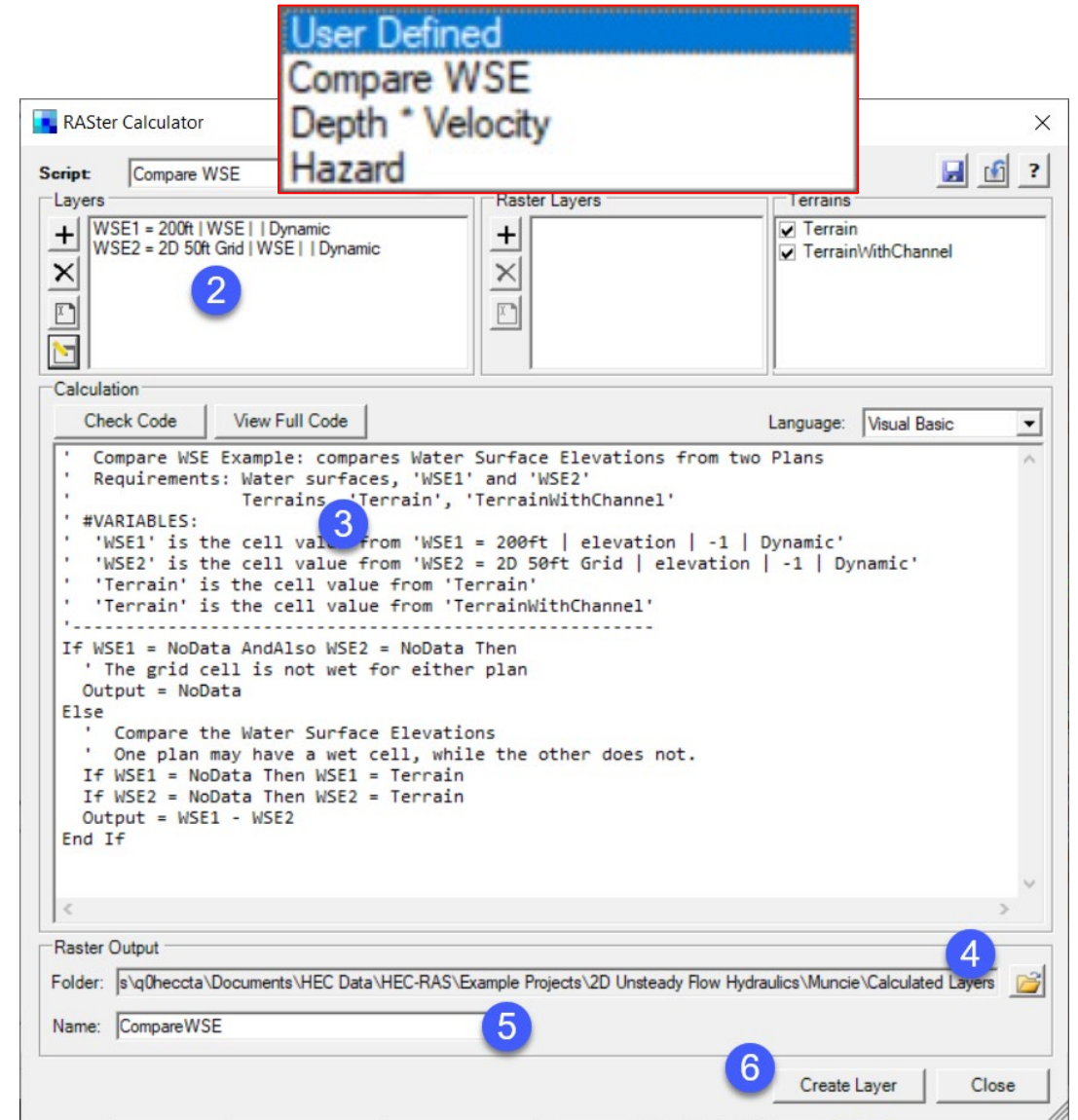
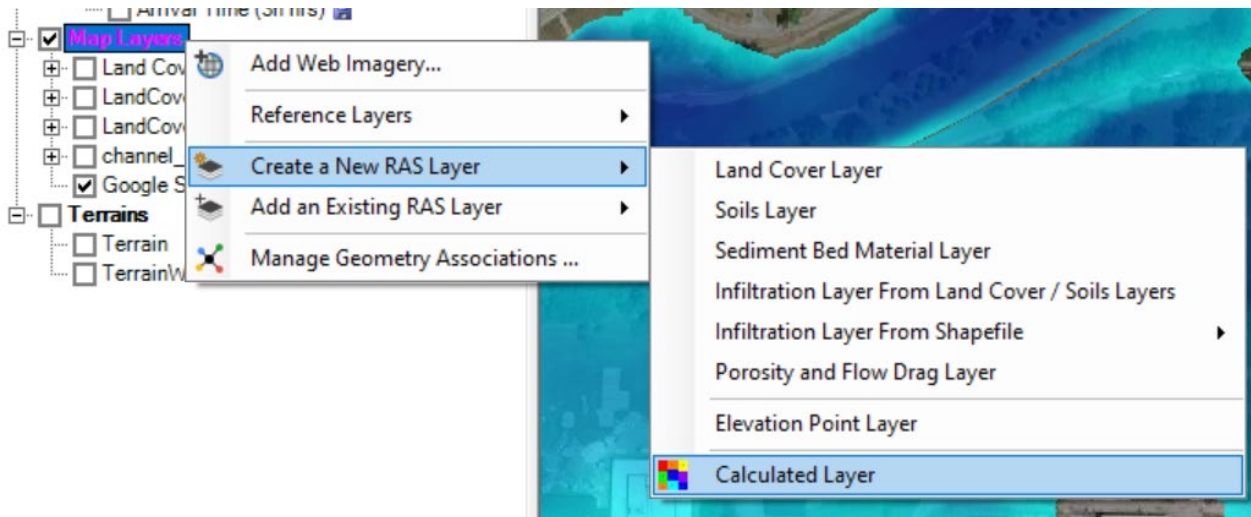
Compute/Update Stored Maps

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



Calculated Layer: User Defined Dynamic or Static

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





View Tools



RAS Mapper

File Project Tools Help

Selected Layer: Depth

View Tools

Max Min

Selected: '2D 50ft Grid - Depth' 02JAN1900 11:20:00

Features

- Geometries
 - Muncie Base Geometry - 9 SAs
 - Muncie Geome
 - Muncie Geome
- Plans
 - Unsteady Multi
 - Unsteady Run v
 - Unsteady Run v
- Event Conditions
 - Flow Boundary Conditions
- Results
 - 50ft User n Regions
 - 2D 50ft Grid
 - Event Conditions
 - Geometry
 - Plan
 - Depth (02JAN1900 11:20:00)
 - Velocity (02JAN1900 12:15:00)
 - WSE (Max)
- Map Layers
 - Land Cover
 - LandCoverUSGSGrid
 - LandCoverCombined
 - channel_over_overbank
 - Google Satellite
- Terrains
 - Terrain
 - TerrainWithChannel

Profile Line 1
FlowLine1

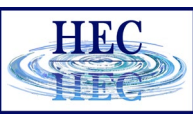
Plot Tick Marks

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

(410271.56, 1804554.79 1 pixel = 5.11 ft)



View Tools: Velocity Map Static Arrows



Velocity Map Parameters

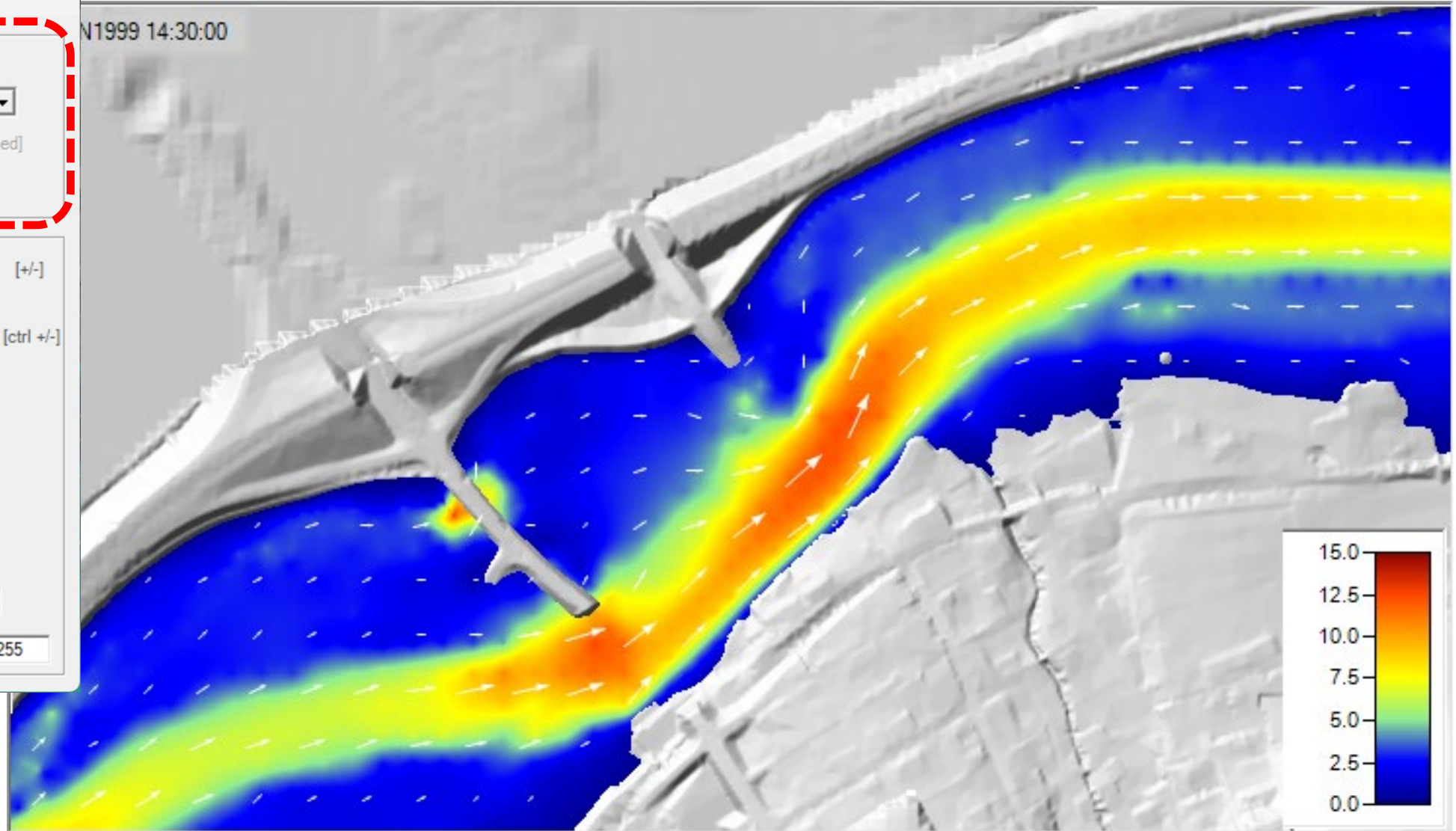
Static Arrows

- Regular Interval
 - Spacing: 32
- Computation Points [Disabled]

Color: Black

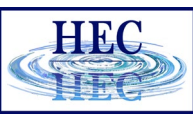
Particle Tracing

- Speed: 1 [+/-]
- Density: 1.5 [ctrl +/-]
- Width: 0.8
- Lifetime: 100
- Speed Relative To Zoom [?]
- Anti-Aliasing: Yes
- R 255 G 255 B 255





View Tools: Velocity Map Particle Tracing



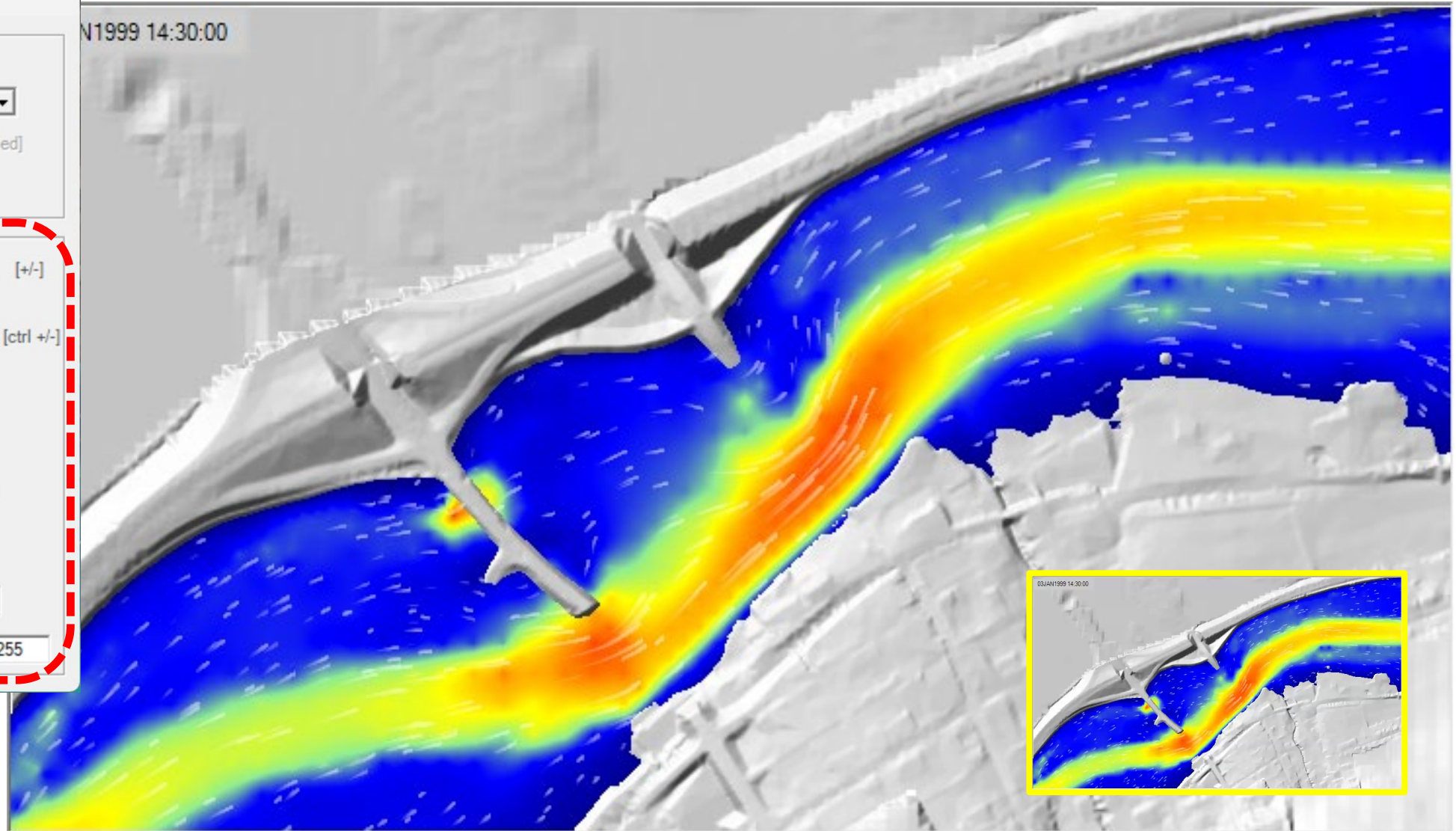
Velocity Map Parameters

Static Arrows

- Regular Interval
- Spacing: 32
- Computation Points [Disabled]
- Color: Black

Particle Tracing

- Speed: 1 [+/-]
- Density: 1.5 [ctrl +/-]
- Width: 0.8
- Lifetime: 100
- Speed Relative To Zoom [?]
- Anti-Aliasing: Yes
- R 255 G 255 B 255

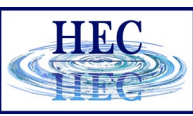




View Tools: Render Mode



The screenshot displays the RAS Mapper interface. The 'View Tools' toolbar is highlighted with a red dashed box and contains the following icons from left to right: a mouse cursor, a hand, a globe, a magnifying glass, a four-way arrow, a left arrow, a right arrow, a double-headed arrow, a color gradient bar, a 3D cube, a 2D grid, a 3D cube, and a 3D cube. The main map area shows a 2D depth grid with a color scale from blue (low) to red (high). A profile line is drawn across the map, with numerical values at various points: 8110.505, 8434.332, 8757.405, 9081.195, 9334.877, 9548.851, 9854.381, 10216.27, 10672.75, 11188.16, 11628.65, 11781.69, 11958.11, 12117.14, 12227.69, 12492.0, 12817.3, 13214.8, 13490.47, 13859.04, 14039.64, 14166.05, 14305.48, 14443.72, 14535.6, 14697, 14787, 149, 0, 15 (ft). A scale bar at the bottom right indicates 500 ft. The status bar at the bottom left shows coordinates (410271.56, 1804554.79) and a resolution of 1 pixel = 5.11 ft.



Render Mode: Options

Tools | Options

RAS Mapper Options

Project Settings

Projection

General

Render Mode *

Global Settings

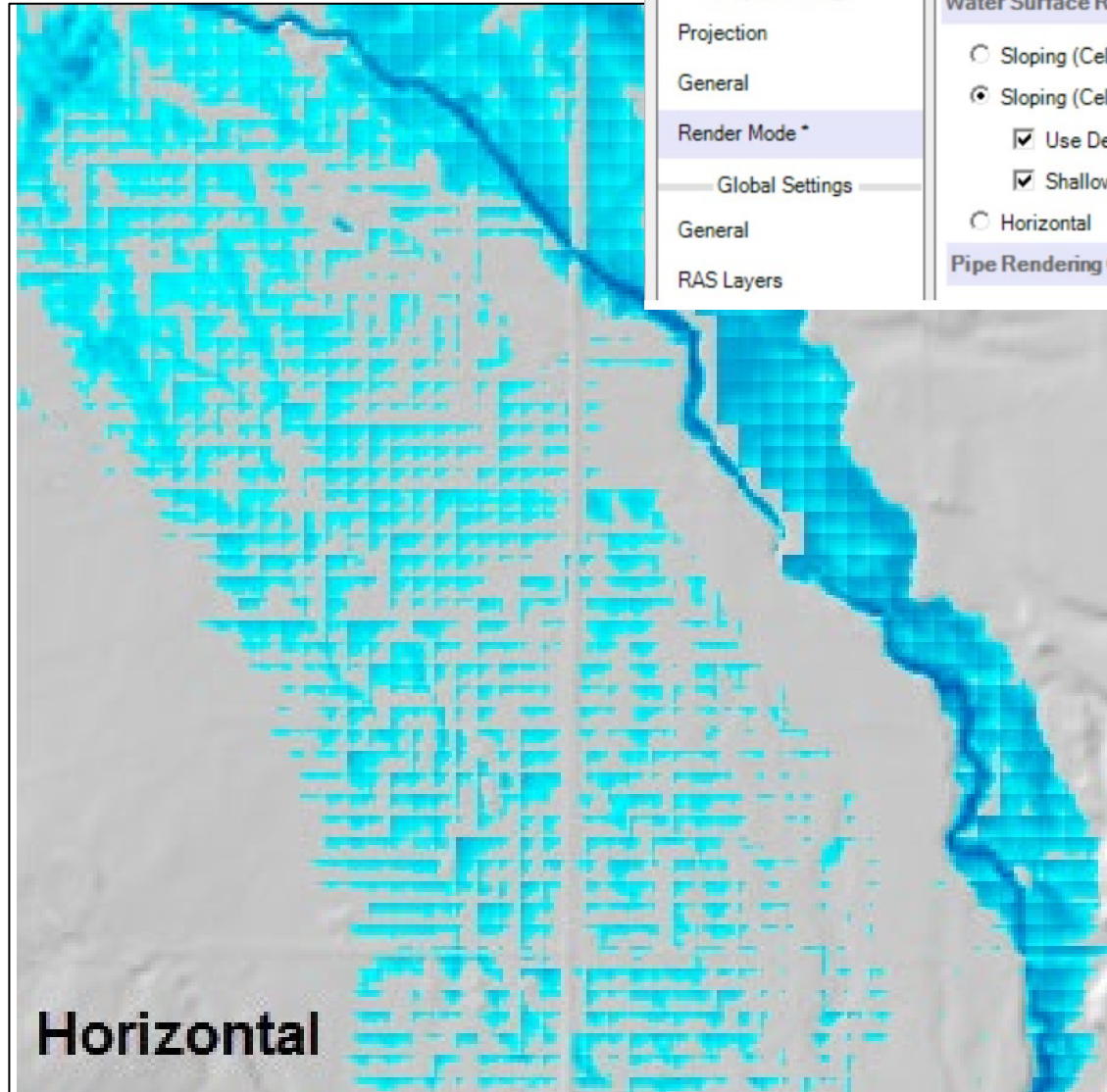
General

RAS Layers

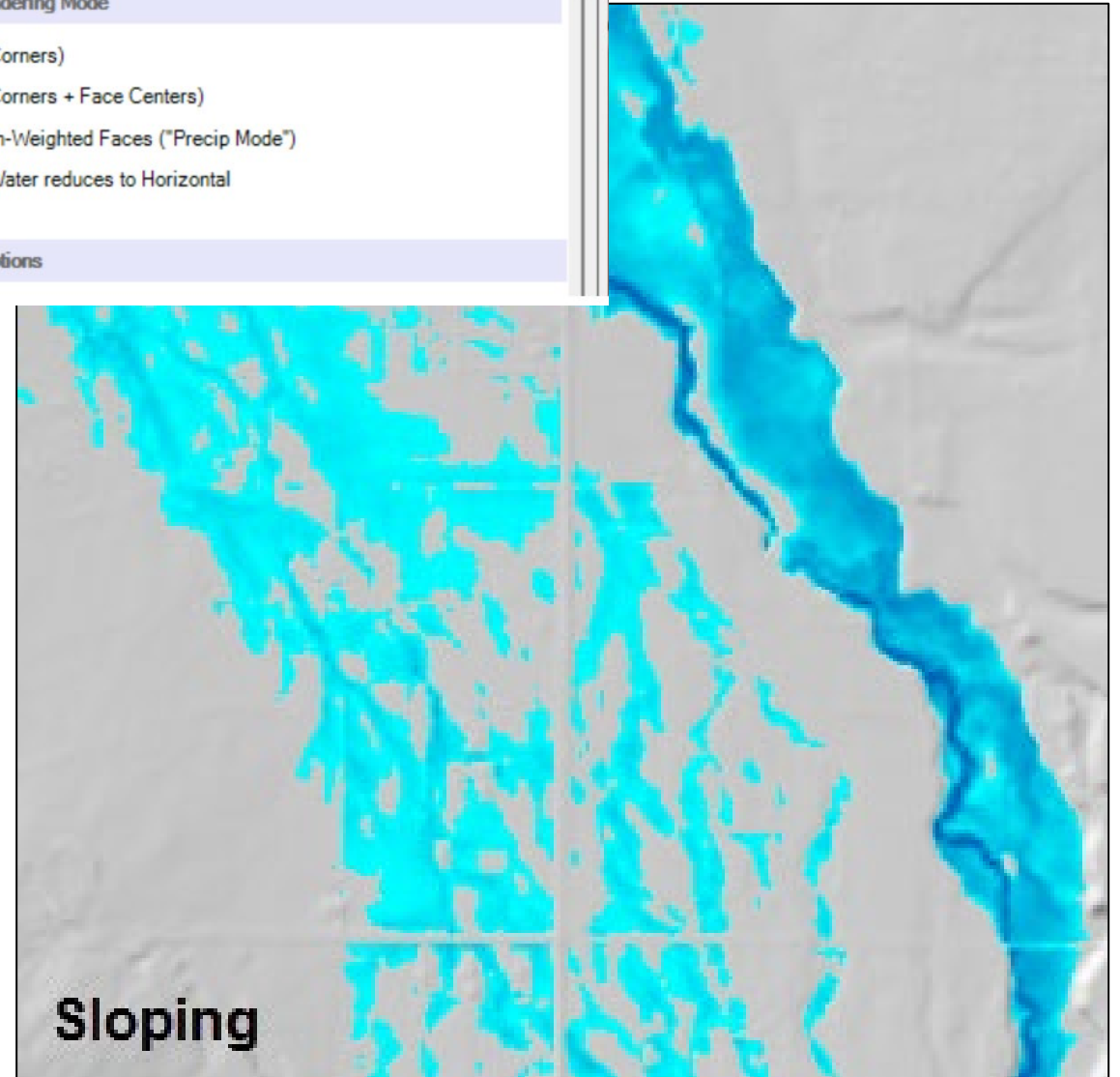
Water Surface Rendering Mode

- Sloping (Cell Corners)
- Sloping (Cell Corners + Face Centers)
 - Use Depth-Weighted Faces ("Precip Mode")
 - Shallow Water reduces to Horizontal
- Horizontal

Pipe Rendering Options



Horizontal



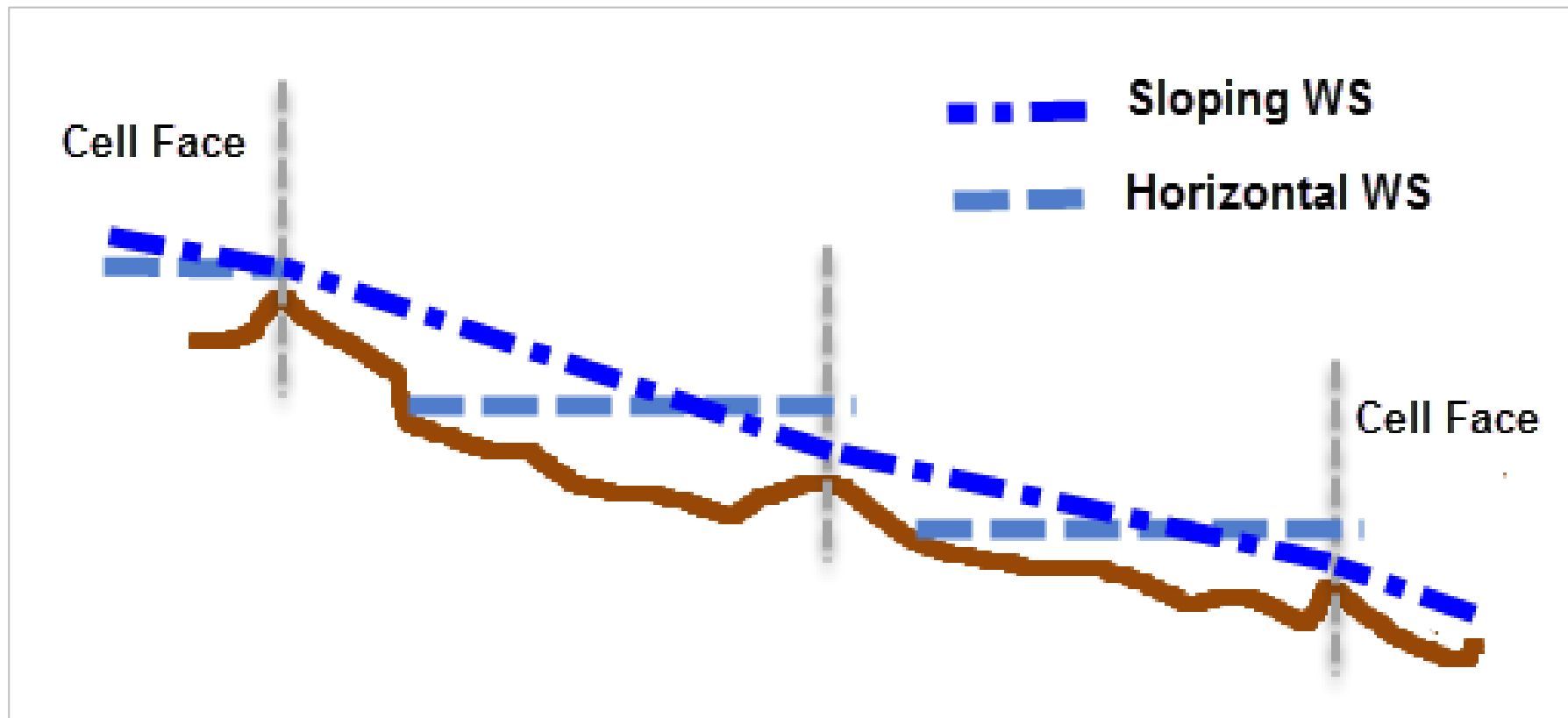
Sloping



Render Mode: Results Interpolation

- Render mode options allow for plotting a single water surface elevation per cell **or** interpolation of water surface elevation values
- Which method best represents the computation?

Horizontal The compute engine only solves for one elevation per cell

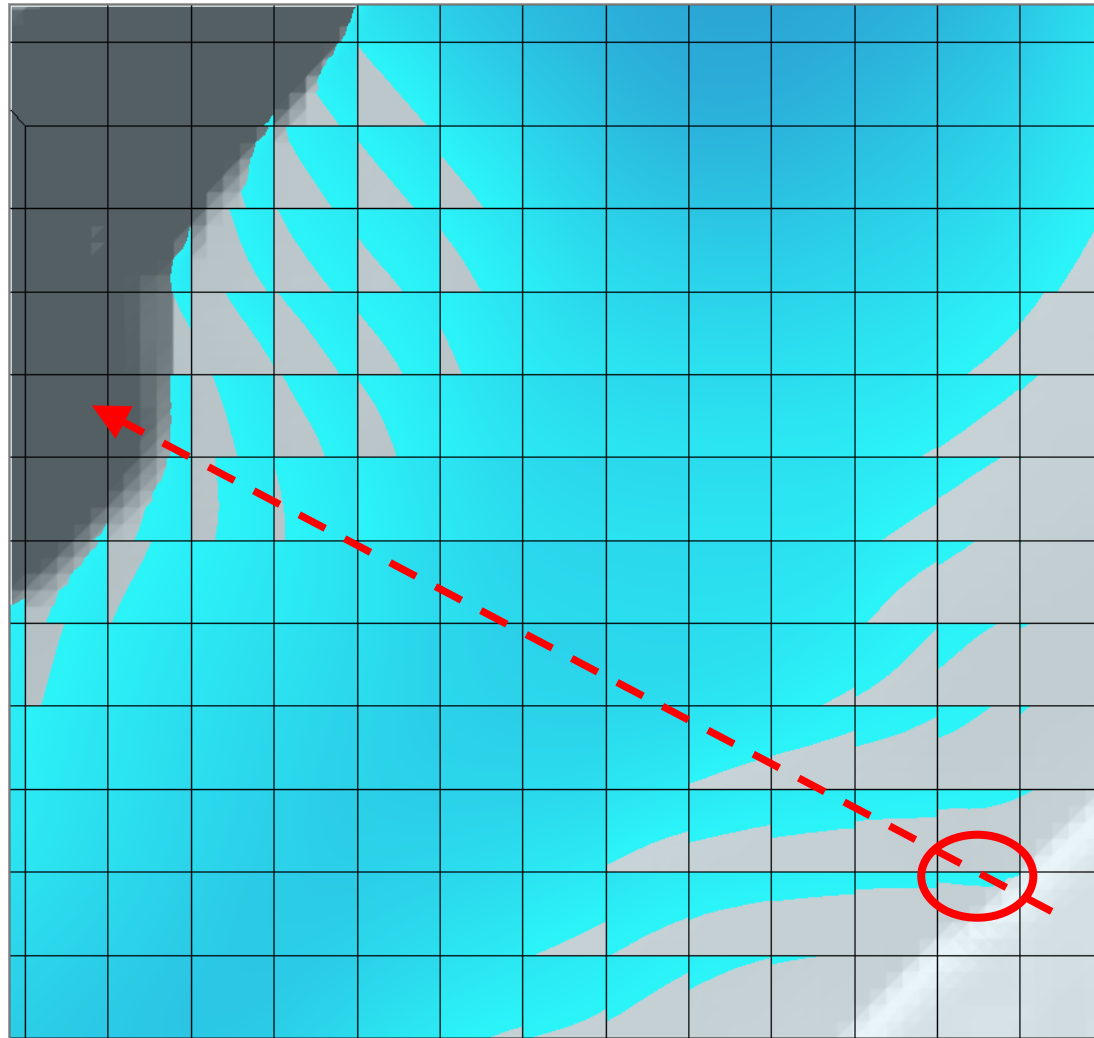




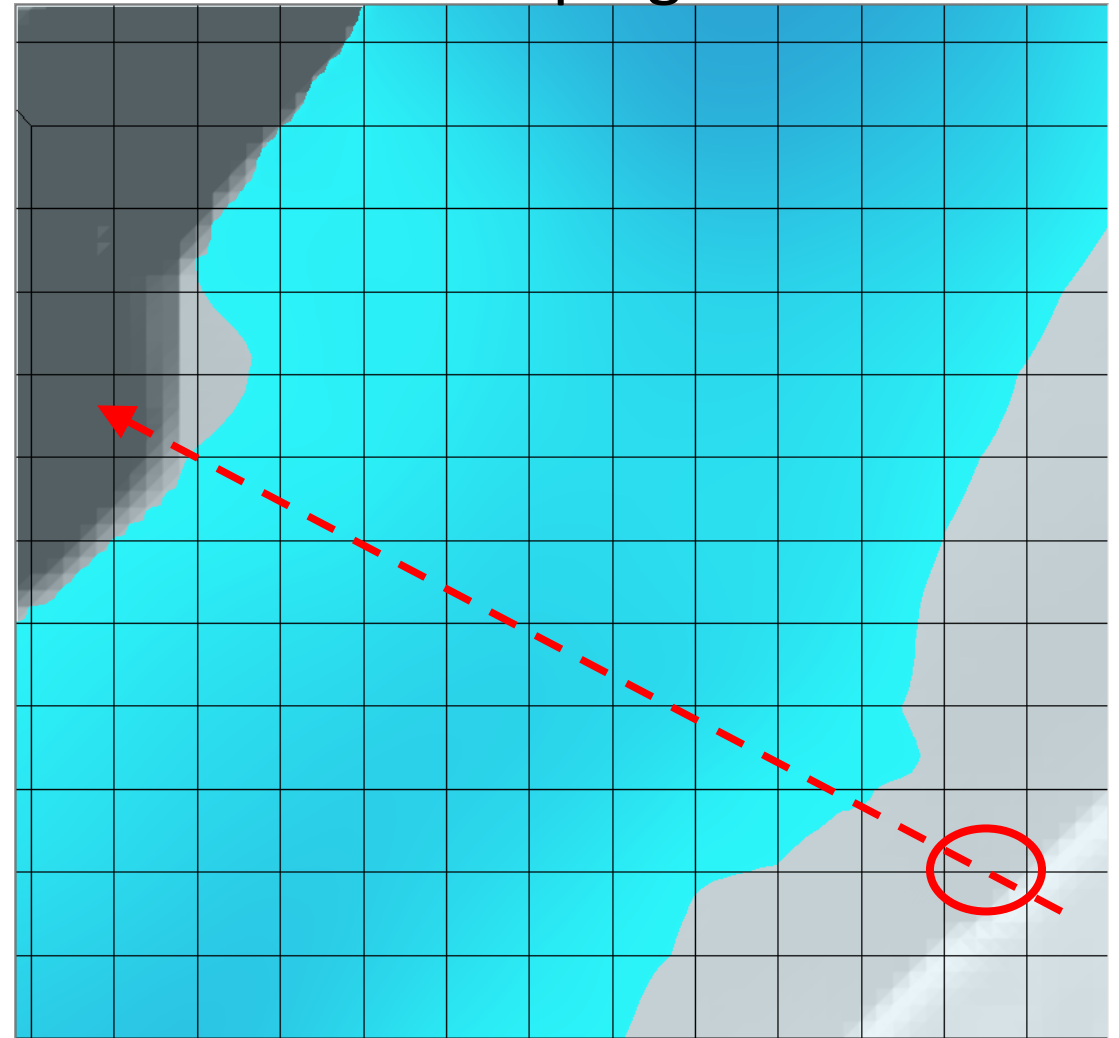
Render Mode: Sloping vs Horizontal Surface



Horizontal



Sloping

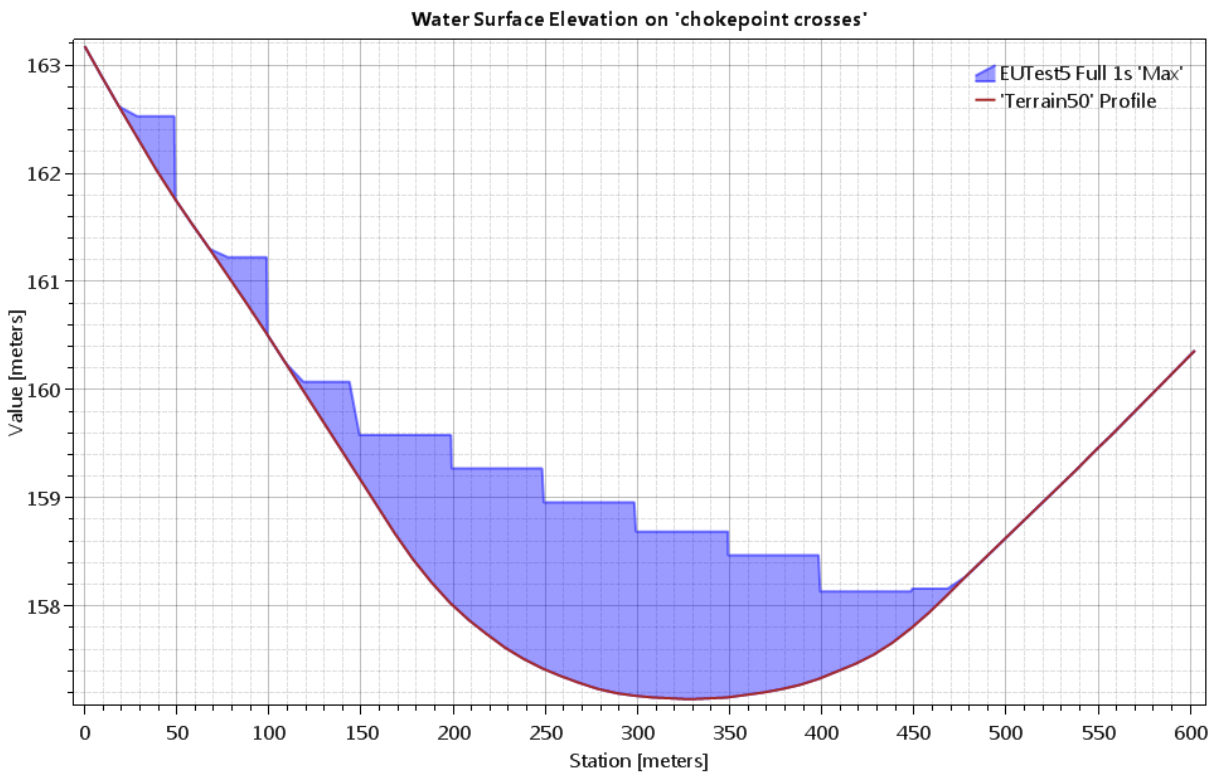




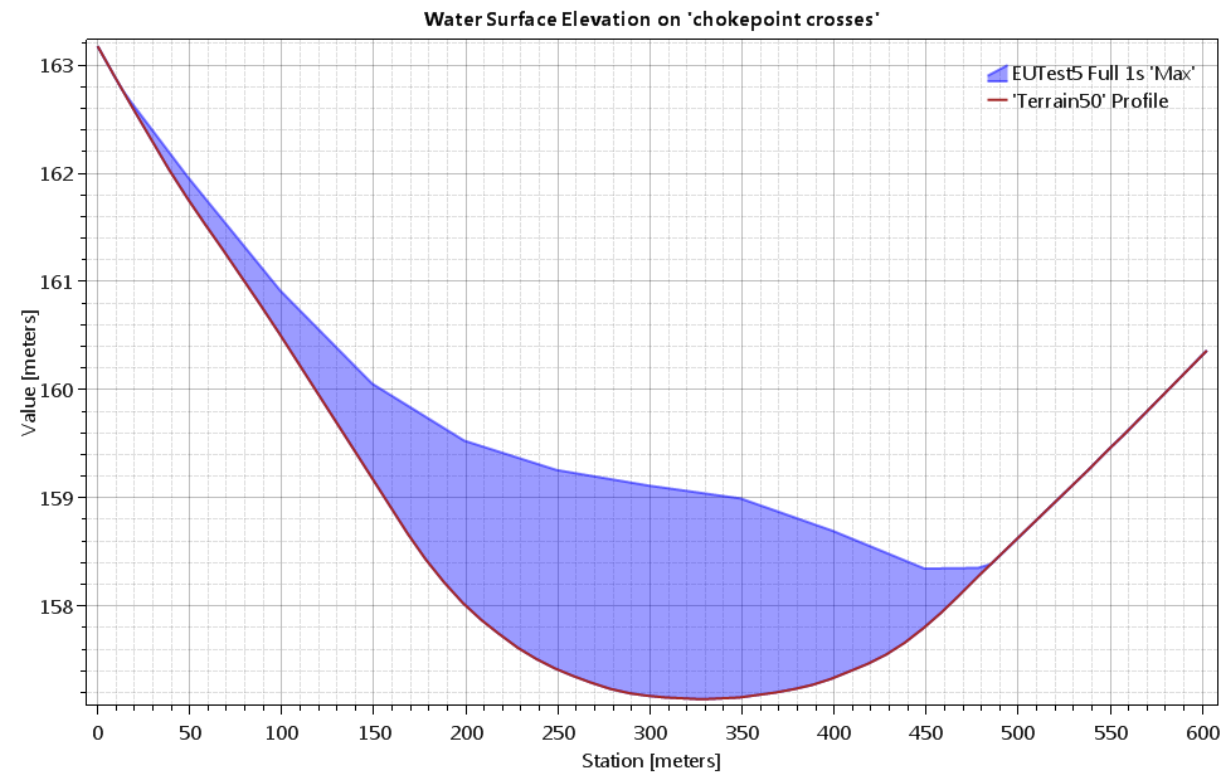
Render Mode: Sloping vs Horizontal Surface

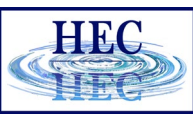


Horizontal



Sloping



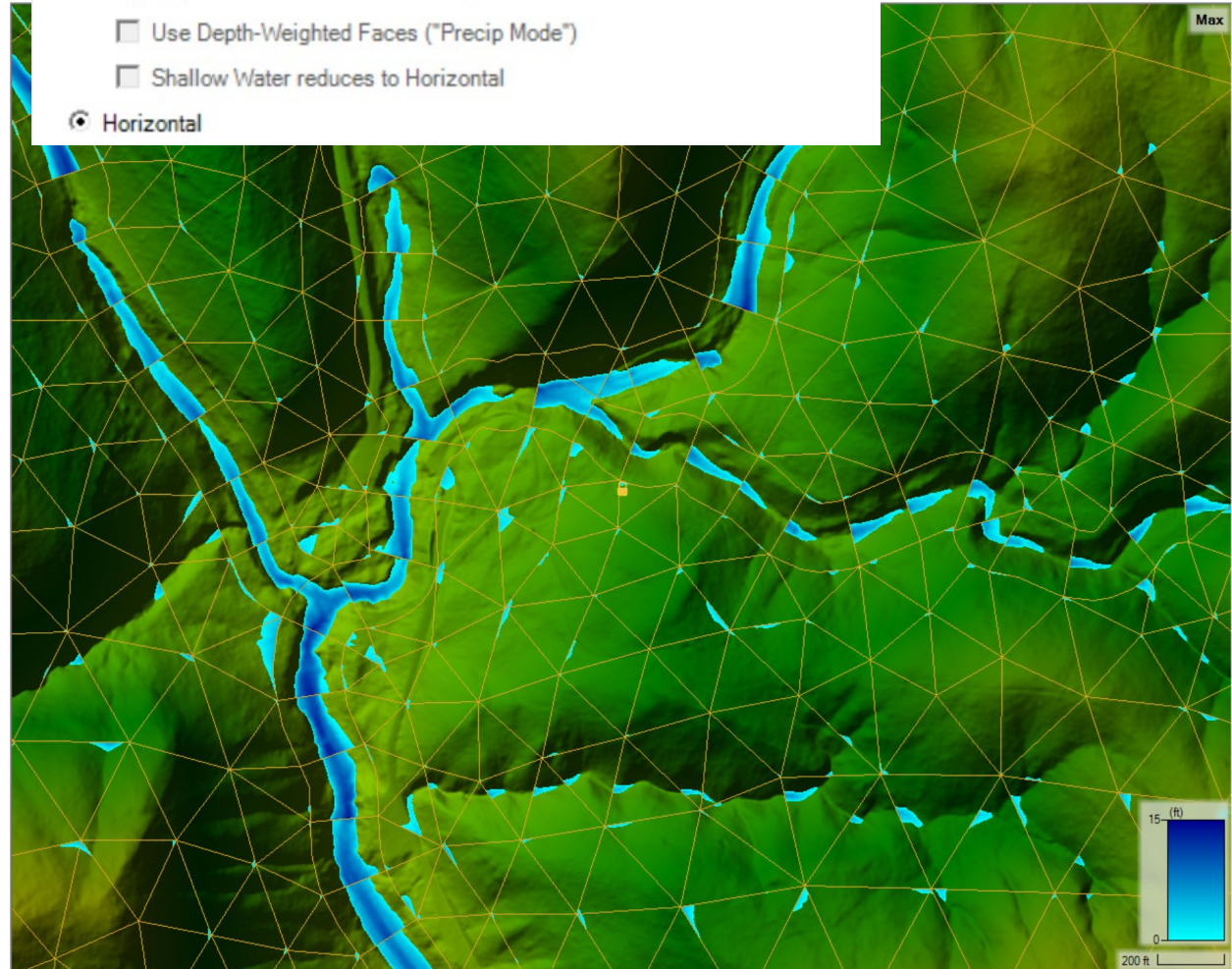


Render Mode: Sloping Surface Errors

Horizontal

Water Surface Rendering Mode

- Sloping (Cell Corners)
- Sloping (Cell Corners + Face Centers)
 - Use Depth-Weighted Faces ("Precip Mode")
 - Shallow Water reduces to Horizontal
- Horizontal

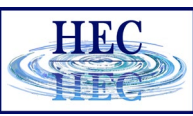


Sloping Basic

Water Surface Rendering Mode

- Sloping (Cell Corners)
- Sloping (Cell Corners + Face Centers)
 - Use Depth-Weighted Faces ("Precip Mode")
 - Shallow Water reduces to Horizontal
- Horizontal





Render Mode: Sloping Surface Errors

Horizontal

Water Surface Rendering Mode

- Sloping (Cell Corners)
- Sloping (Cell Corners + Face Centers)
 - Use Depth-Weighted Faces ("Precip Mode")
 - Shallow Water reduces to Horizontal
- Horizontal



Sloping Precip Mode

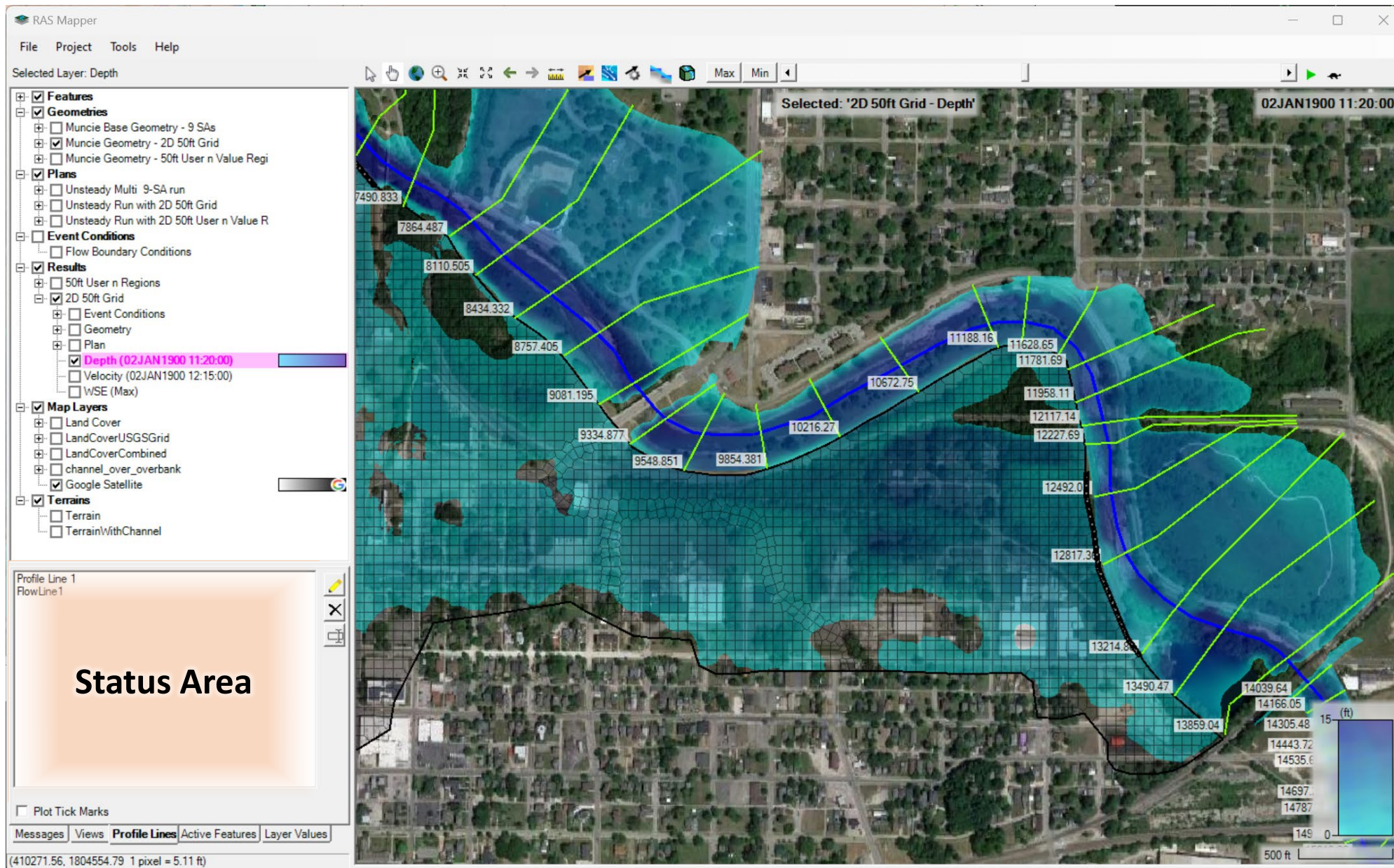
Water Surface Rendering Mode

- Sloping (Cell Corners)
- Sloping (Cell Corners + Face Centers)
 - Use Depth-Weighted Faces ("Precip Mode")
 - Shallow Water reduces to Horizontal
- Horizontal





Status Area





Status Area Tabs

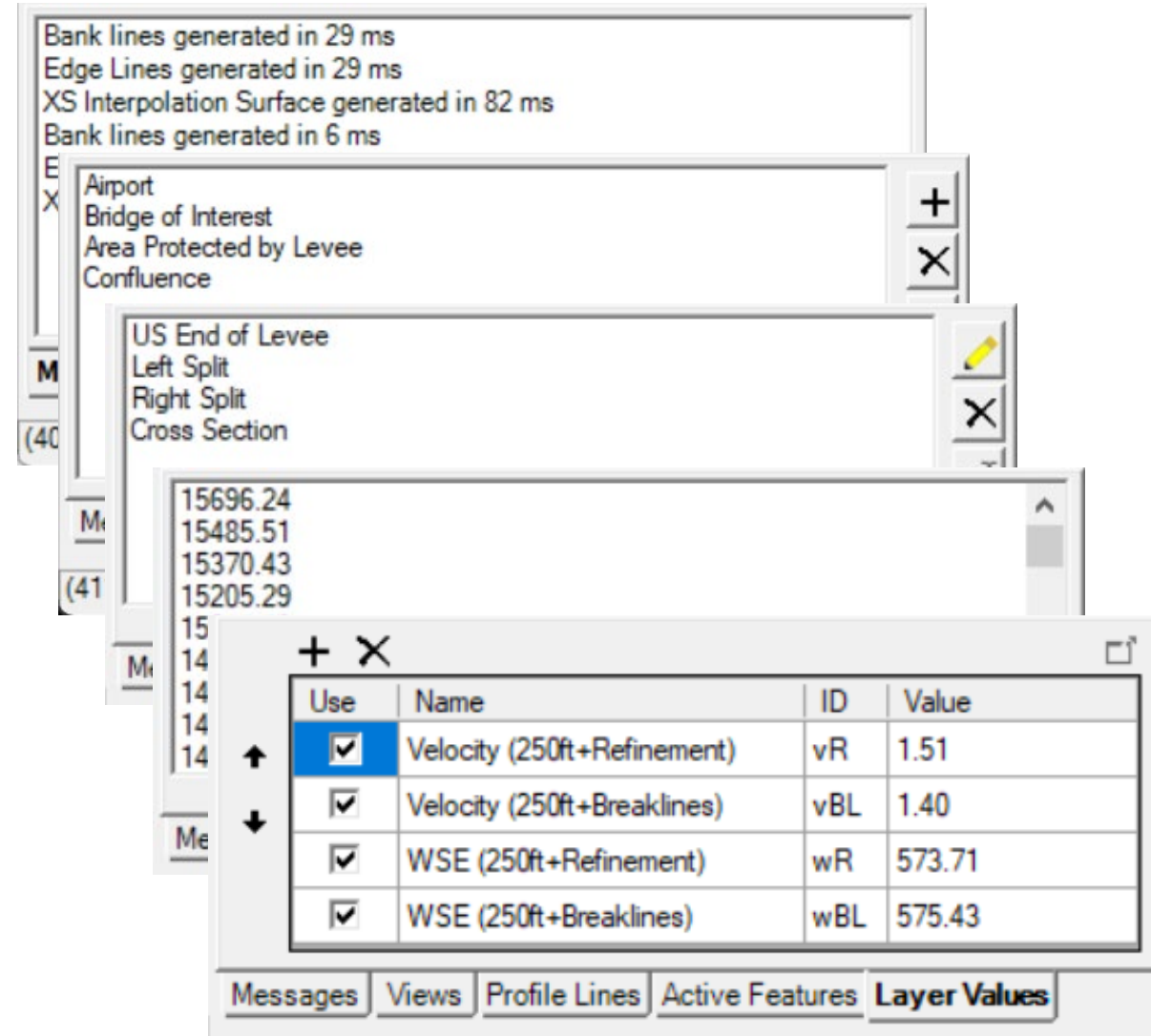
Messages: What just happened

Views: 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



The screenshot shows a stack of status area tabs. The top tab displays messages: "Bank lines generated in 29 ms", "Edge Lines generated in 29 ms", "XS Interpolation Surface generated in 82 ms", and "Bank lines generated in 6 ms". Below it is a "Views" tab with options: "Airport", "Bridge of Interest", "Area Protected by Levee", and "Confluence". The next tab is "Profile Lines" with options: "US End of Levee", "Left Split", "Right Split", and "Cross Section". The "Layer Values" tab is active and shows a table of data:

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

At the bottom of the interface, there are five tabs: "Messages", "Views", "Profile Lines", "Active Features", and "Layer Values".



Status Area: Profile Lines

User-defined/editable linear features

2 plotting options, **Profiles** and **Time Series**

Features

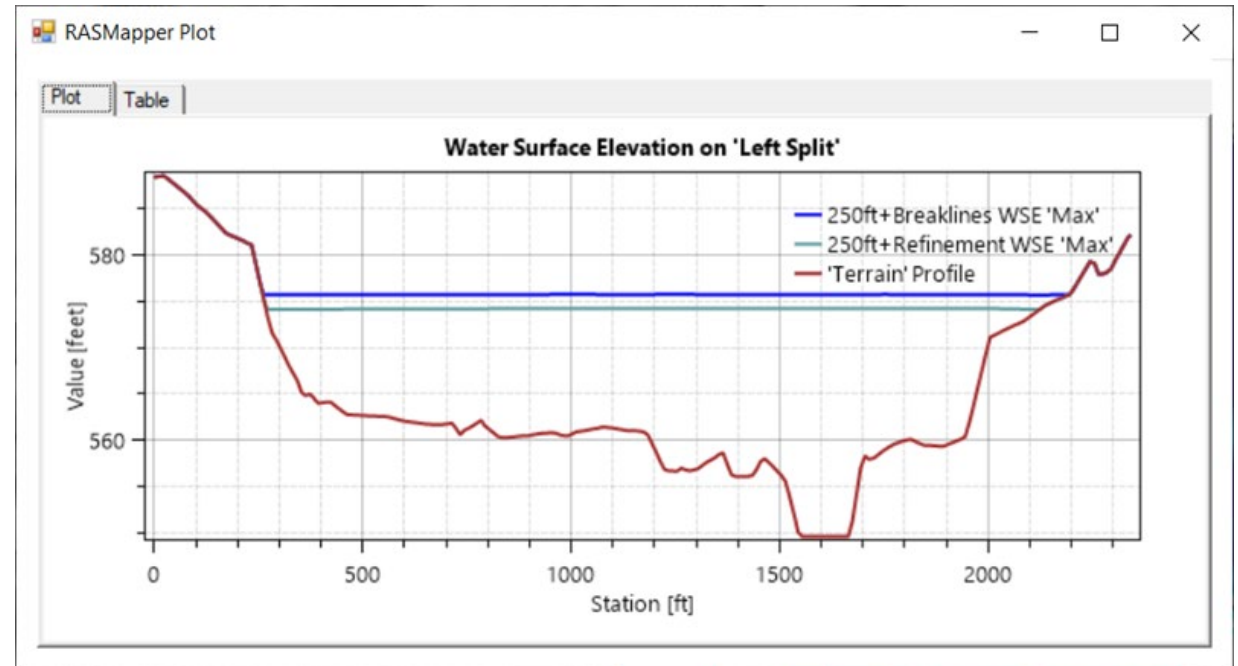
- Profile Lines
- Geometries
 - Simple Geometry
 - 250ft
 - 250ft+Breaklines
 - 250ft+Refinement
- Event Conditions
- Results
- Map Layers
 - CompareCellSize
 - Google Satellite
- Terrains
 - Terrain

US End of Levee
Left Split
Right Split
Cross Section

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

Left Split
Right Split
Cross Section

- Plot Profile
 - Terrain
 - WSE**
 - Depth
 - Velocity against Terrain
 - Sediment
- Plot Time Series
- Rename
- Delete
- Import Polylines from Shapefile
- Export Polylines to Shapefile





Status Area: Profile Lines

User-defined/editable linear features

Direction of **flow** depends on how the profile line was drawn. Left to right, looking downstream is positive flow

Features

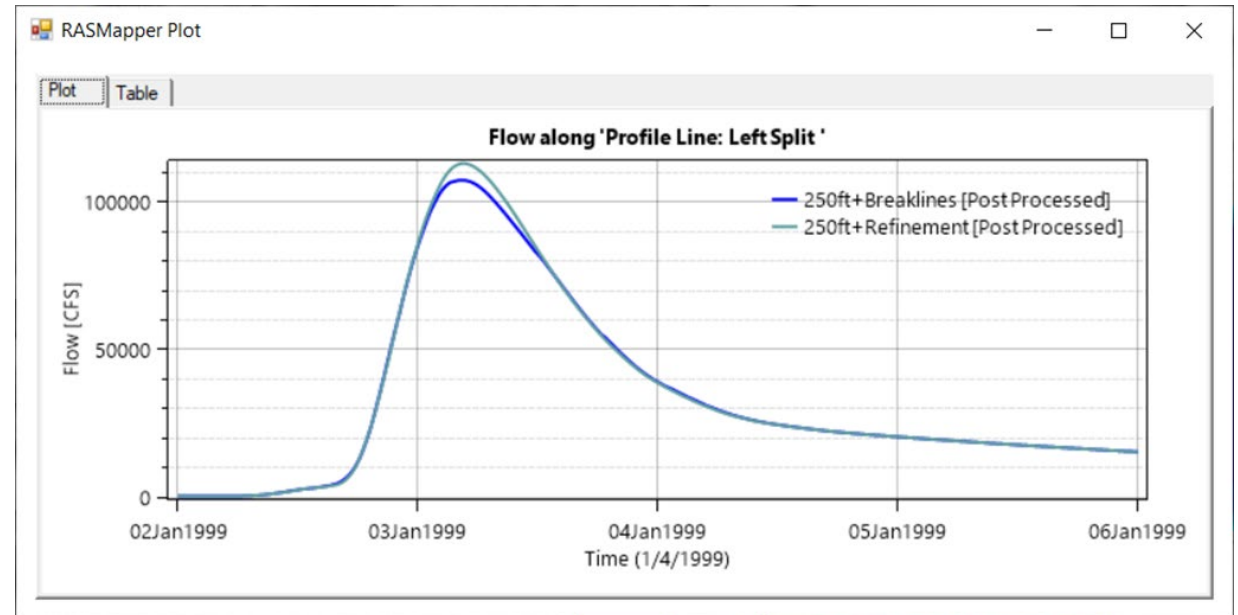
- Profile Lines
- Geometries
 - Simple Geometry
 - 250ft
 - 250ft+Breaklines
 - 250ft+Refinement
- Event Conditions
- Results
- Map Layers
 - CompareCellSize
 - Google Satellite
- Terrains
 - Terrain

US End of Levee
Left Split
Right Split
Cross Section

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

US End of Levee
Left Split
Right Split
Cross Section

- Plot Profile
- Plot Time Series
- Flow**
- Volume Accumulation
- Rating Curve (Beta, 2D only)
- Rename
- Delete
- Import Breaklines from Shapefile





Status Area: Active Features



RAS Mapper

File Project Tools Help

Selected Layer: Cross Sections

Features

- Geometries
 - Muncie Base Geometry - 9 SAs
 - Muncie Geometry - 2D 50ft Grid
 - Rivers
 - Cross Sections**
 - 2D Flow Areas
 - Lateral Structures
 - Reference Areas
 - Manning's n
 - (13 Empty Layers)
 - Muncie Geometry - 50ft User n Value Regi
- Plans
 - Unsteady Multi 9-SA run
 - Unsteady Run with 2D 50ft Grid
 - Unsteady Run with 2D 50ft User n Value R
- Event Conditions

6295.048
5925.654
5688.906
5382.517
5124.979
4850.811
4570.628
4185.719
3952.406
3690.809
3268.276
2920.440
2582.948
2290.221
1980.776
1743.103
1469.294

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

(404246.37, 1804120.38 1 pixel = 7.45 ft)

Selected: 'Cross Sections'

Cross Section: 5688.906 (Muncie Geometry - 2D 50ft Grid)

Selected Features (5 of 61)

Find... Ctrl+F

- Copy Selected Ctrl+C
- Zoom to Selected
- Select All Ctrl+A
- Invert Selection
- Plot Terrain Profile
- Save Selected as Profile Lines
- Buffer Selected Lines Into Clipboard Polygon

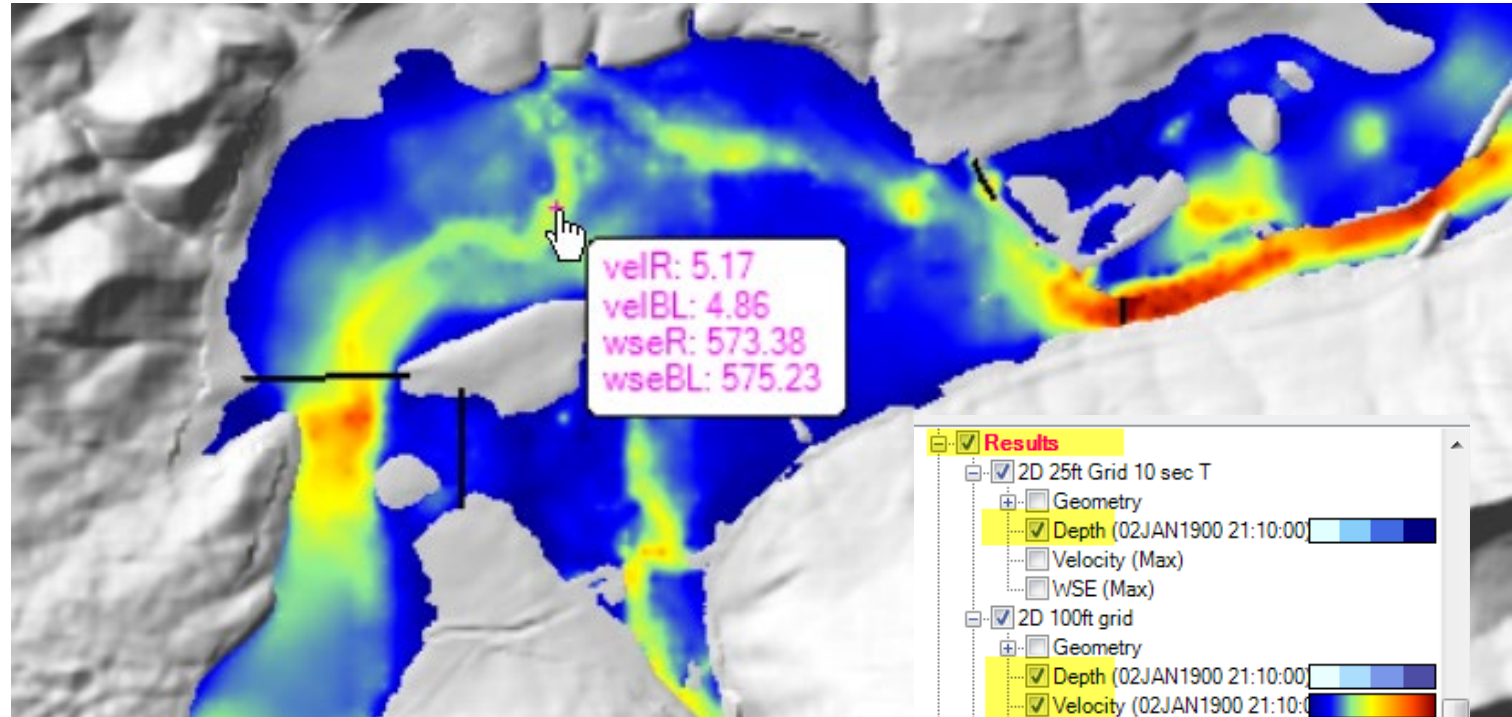
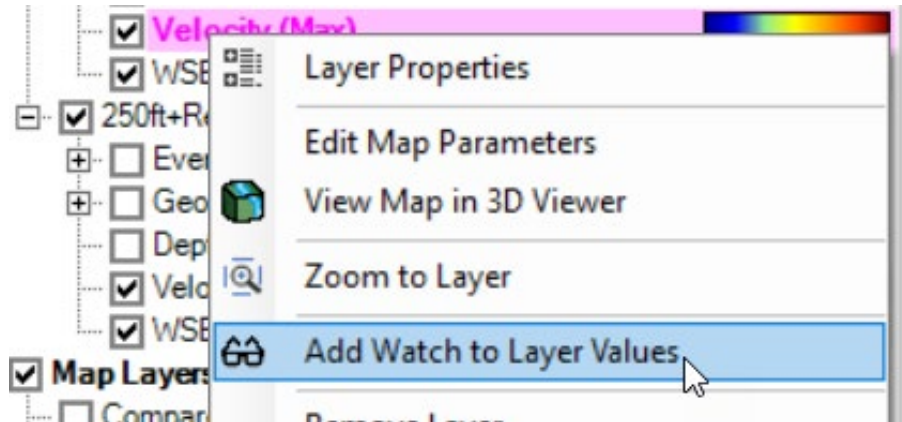
4185.719 3952.406 3690.809 3268.276 2920.440 2582.948 2290.221 1980.776 1743.103 1469.294 1174.213

4850.811 5382.517 5925.654 6295.048 6626.553 6868.344 7158.903 7490.833 7864.487 8110.505 8851 9854.381

1000 ft

Status Area: Watch Layer Values

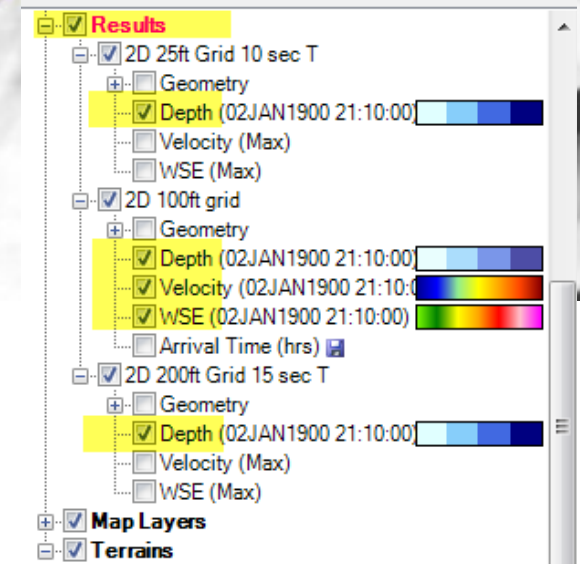
View Values from multiple layers simultaneously



Use	Name	ID	Value
<input checked="" type="checkbox"/>	Velocity (250ft+Refinement)	velR	5.14
<input checked="" type="checkbox"/>	Velocity (250ft+Breaklines)	velBL	5.00
<input checked="" type="checkbox"/>	WSE (250ft+Refinement)	wseR	573.78
<input checked="" type="checkbox"/>	WSE (250ft+Breaklines)	wseBL	575.47

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

(2037649.22, 346306.26 1 pixel = 42.29 ft)



Remember that you can sync datasets!



Profiles and Tabular Data



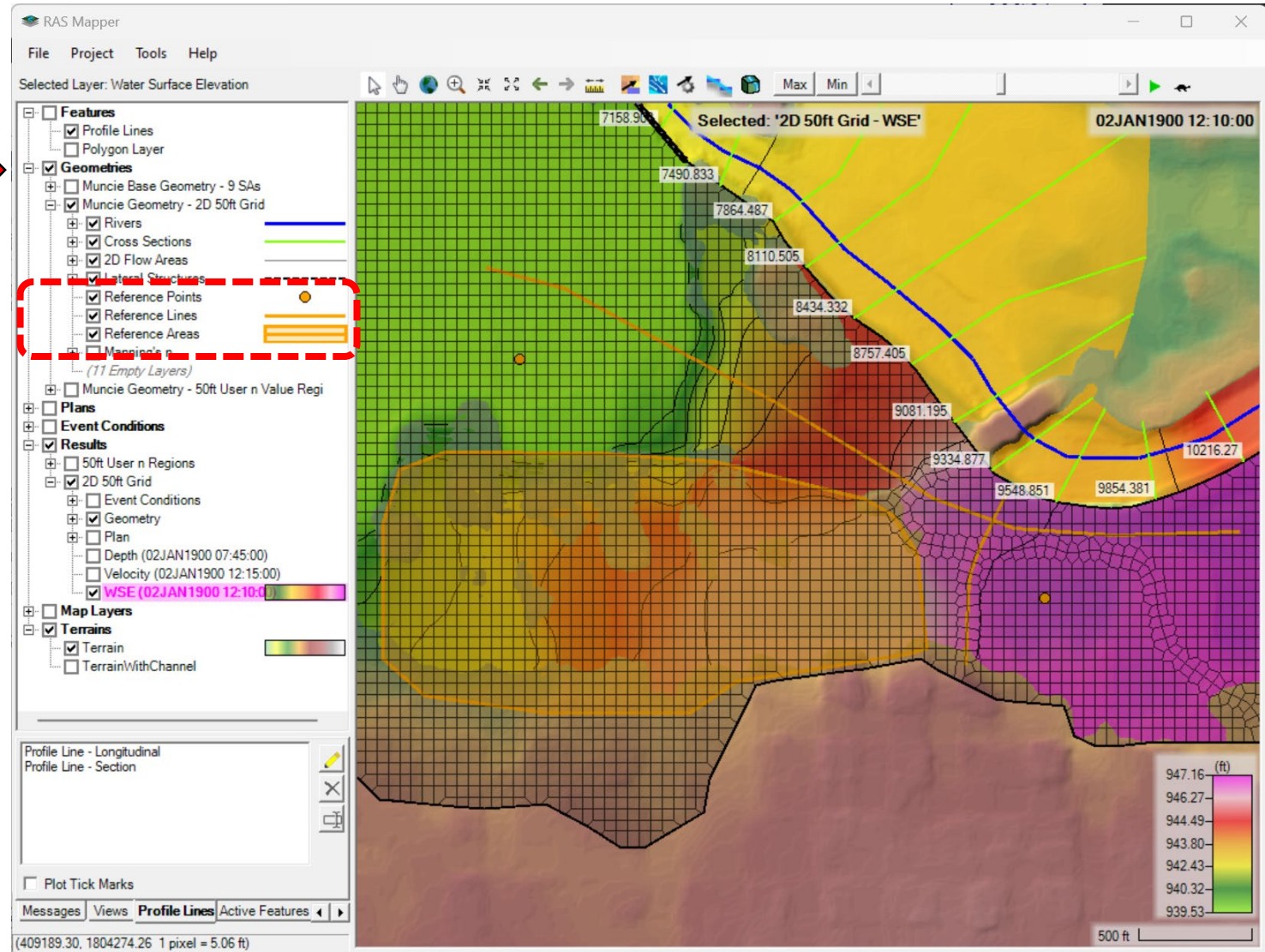
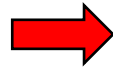
There are multiple ways to extract charts and tabular data from RAS

- Compute Engine Data (generally)
 - Reference Locations (points, lines and areas)
 - 2D Flow Area Queries (points, cells and cell faces)
- Rendered Data (generally)
 - Profile Lines
 - Polygon and Polyline Features



Reference Locations

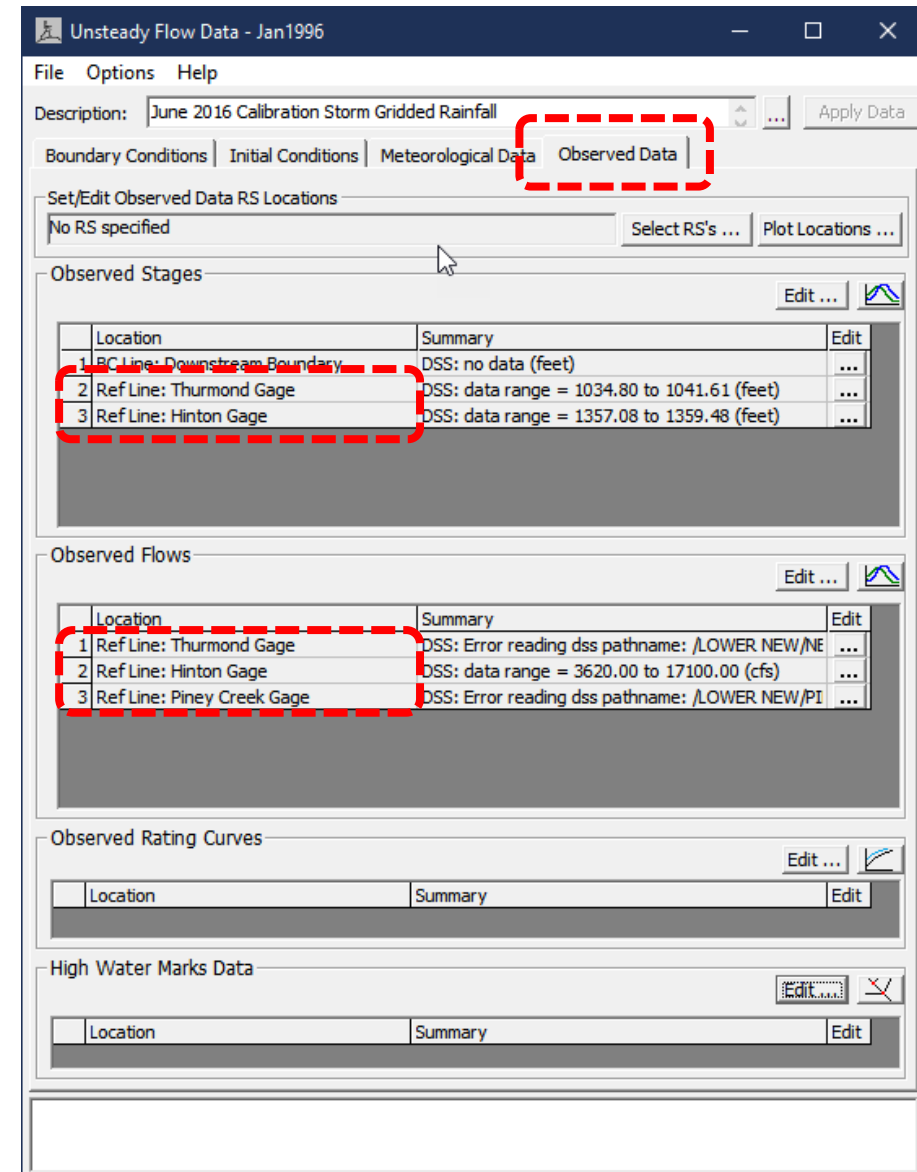
- Reference Points
 - Stage (good for HWM)
 - Velocity
- Reference Lines
 - Stage (Weighted-Ave)
 - Velocity (Weighted-Ave)
 - Flow
 - Rating Curves
- Reference Areas
 - Volume
 - Inflow/Outflow





Reference Locations: Data Visualization

- Reference Locations must be established prior to compute. Data is generated during the compute.
- Reference Locations are the recommended data extraction method for calibration. Data is computed directly in the compute engine.
- Reference Locations can be associated with observed data.



Unsteady Flow Data - Jan1996

File Options Help

Description: June 2016 Calibration Storm Gridded Rainfall

Boundary Conditions | Initial Conditions | Meteorological Data | **Observed Data**

Set/Edit Observed Data RS Locations

No RS specified

Observed Stages

Location	Summary	Edit
1 BC Line: Downstream Boundary	DSS: no data (feet)	...
2 Ref Line: Thurmond Gage	DSS: data range = 1034.80 to 1041.61 (feet)	...
3 Ref Line: Hinton Gage	DSS: data range = 1357.08 to 1359.48 (feet)	...

Observed Flows

Location	Summary	Edit
1 Ref Line: Thurmond Gage	DSS: Error reading dss pathname: /LOWER NEW/NE
2 Ref Line: Hinton Gage	DSS: data range = 3620.00 to 17100.00 (cfs)	...
3 Ref Line: Piney Creek Gage	DSS: Error reading dss pathname: /LOWER NEW/PI

Observed Rating Curves

Location	Summary	Edit

High Water Marks Data

Location	Summary	Edit



Reference Locations

Optional Method for Creating Reference Lines

Velocity Layer Additional Properties

Additional Options

- Plot Contour At Cursor
- Plot 2D Hydraulic Connectivity
- Plot 2D Water Surface Gradient (Arrow: WSEL High->Low)
- Draw Map Values
- Draw Perpendicular Face Values
- Draw True Face Values (interpolated)
- Face Low-Elevation Centroid
- Display Arrival Times as Dates
- Plot Model Boundary Deficiencies
- Track Transverse Velocity at Cursor
- Track Longitudinal Velocity at Cursor

The screenshot shows the RAS Mapper interface with a velocity map. The left sidebar contains a tree view of layers:

- Features
 - Geometries
 - Muncie Base Geometry - 9 SAs
 - Muncie Geometry - 2D 50ft Grid
 - Rivers
 - Cross Sections
 - 2D Flow Areas
 - Lateral Structures
 - Reference Points
 - Reference Lines
 - Reference Areas
 - Manning's n
 - (11 Empty Layers)
 - Muncie Geometry - 50ft User n Value R
 - Plans
 - Event Conditions
 - Results
 - 50ft User n Regions
 - 2D 50ft Grid
 - Event Conditions
 - Geometry
 - Plan
 - Depth (02JAN1900 12:50:00)
 - Velocity (02JAN1900 16:20:00)
 - WSE (02JAN1900 12:10:00)
 - Map Layers
 - Terrains
 - Terrain
 - TerrainWithChannel

The main map area shows a velocity contour plot with a grid. A context menu is open over the map, listing options under "All Enabled Results":

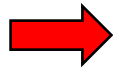
- Plot Time Series
- Plot Property Table
- Velocity Track (Longitudinal)
- Velocity Track (Transverse)
- Create Profile Line
- Create Reference Line

The "Create Reference Line" option is highlighted in blue. The map also shows several numerical values: 9334.877, 9548.851, 9854.381, and 10216.27.



Reference Locations: Data Visualization

Optional Method for Plotting Results



RAS Mapper

File Project Tools Help

Selected Layer: 2D 50ft Grid

- Features
 - Geometries
 - Muncie Base Geometry - 9 SAs
 - Muncie Geometry - 2D 50ft Grid
 - Muncie Geometry - 50ft User n Value Regi
 - Plans
 - Event Conditions
 - Results
 - 50ft User n Regions
 - 2D 50ft Grid
 - Event Conditions
 - Geometry
 - Rivers
 - Cross Sections
 - 2D Flow Areas
 - Lateral Structures
 - Reference Points
 - Reference Lines
 - Reference Areas
 - Manning's n
 - Plan
 - Depth (02JAN1900 12:50:00)
 - Velocity (02JAN1900 12:15:00)
 - WSE (02JAN1900 12:10:00)
 - Map Layers
 - Terrain
 - TerrainWithChannel

Context Menu:

- RAS Results Information
- Plot Results Profile
- Show Results Table
- Zoom to Layer
- Remove Layer
- Remove Layer and Delete Source Files
- Move Layer
- Open Folder in File Explorer
- Show Compute Messages ...
- Create a New Results Map Layer...
- Create a New Calculated Layer...
- Manage Results Map Layers...
- View Result in 3D

02JAN1900 16:20:00

File Type Options

Max

Name	Mode
Longitudinal Track	Longitudinal
Lateral Track	Transverse

Plan: Unsteady Run with 2D 50ft Grid Reference Line: Lateral Track

Ordinate	WS Flow Avg Max Station (ft)	WS Flow Avg Ma Elevation (ft)
1	0.00	947.3
2	3.65	947.3
3	4.53	947.3
4	9.08	947.3
5	13.63	947.3
6	14.88	947.3
7	16.70	947.3
8	26.77	947.3
9	31.83	947.3
10	57.13	947.3
11	57.83	947.3
12	62.17	947.3
13	72.23	947.3
14	77.23	947.3
15	82.24	947.3
16	83.34	947.3
17	86.03	947.3
18	87.24	947.3
19	91.80	947.3

Ordinate	Velocity Avg Max Station (ft)	Velocity Avg Max Velocity (ft/s)
1	0.00	0.74
2	847.04	0.74
3		
4		

Elevation (ft) vs Station (ft) Profile Plot

Velocity (ft/s) vs Station (ft) Plot

Legend 1:

- WS Flow Avg Max
- WS Conv Avg Max
- WS Mapped Max
- Ground

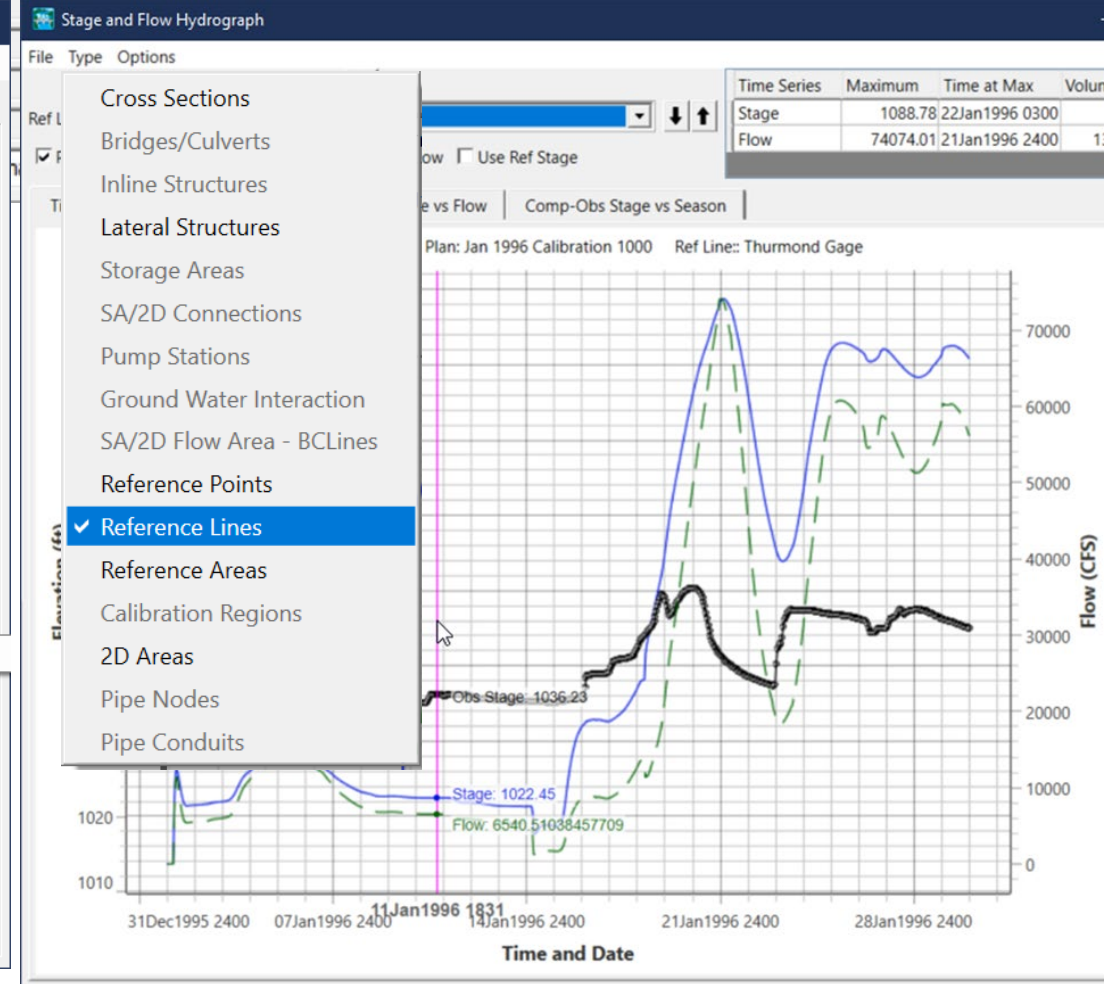
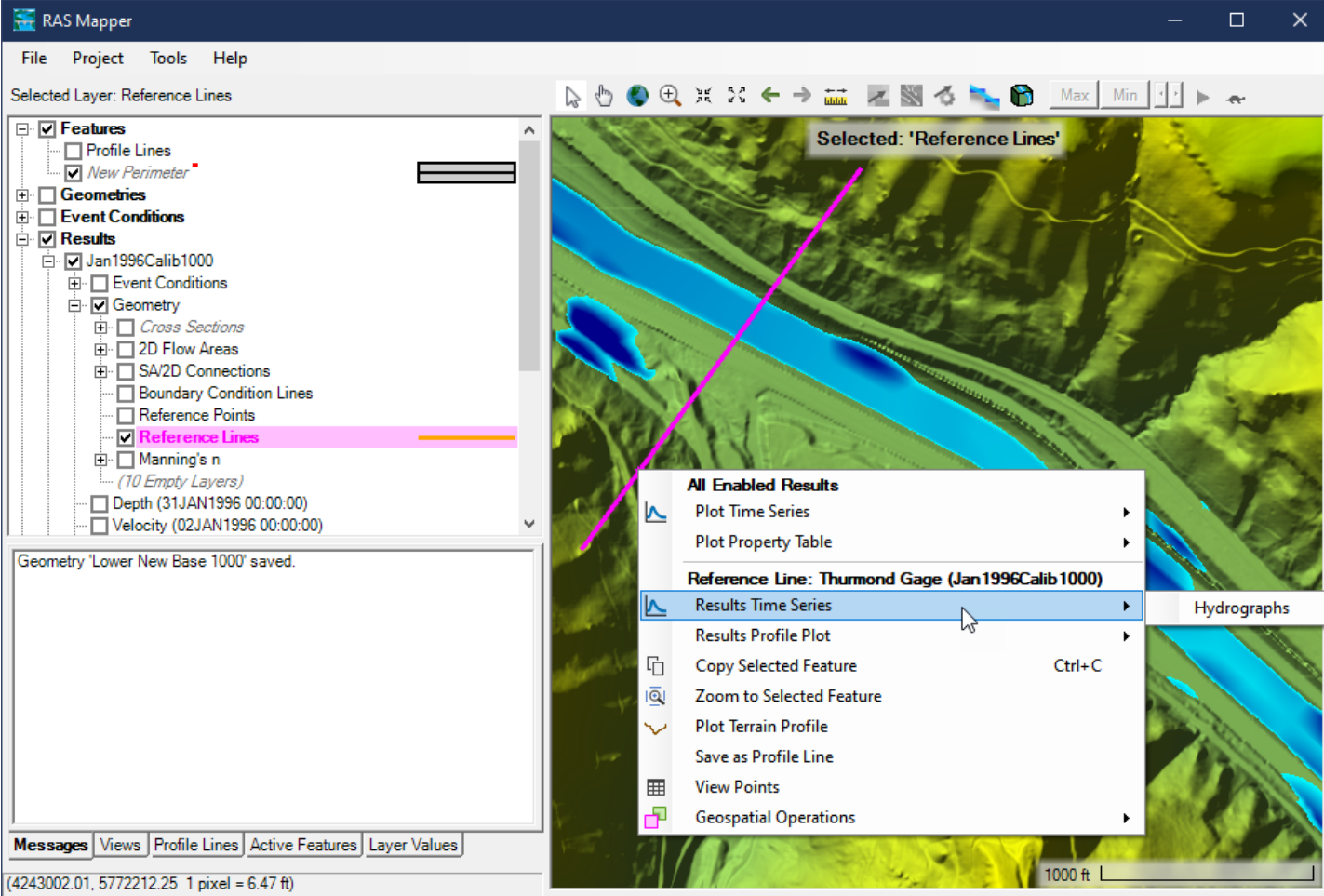
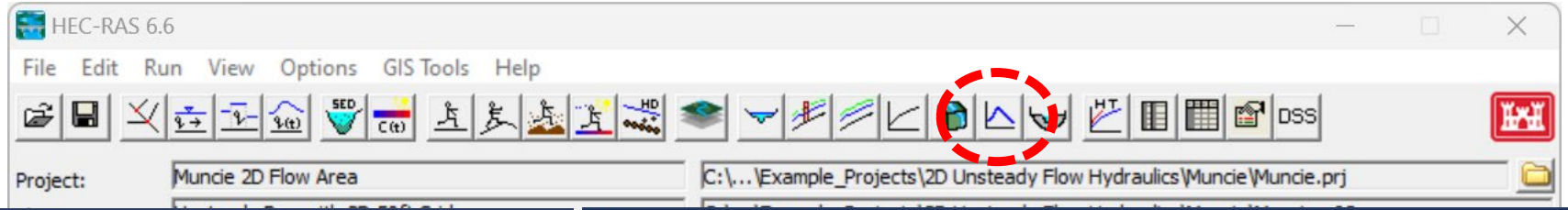
Legend 2:

- Velocity Avg Max
- Velocity Mapped Max



Reference Locations: Data Visualization

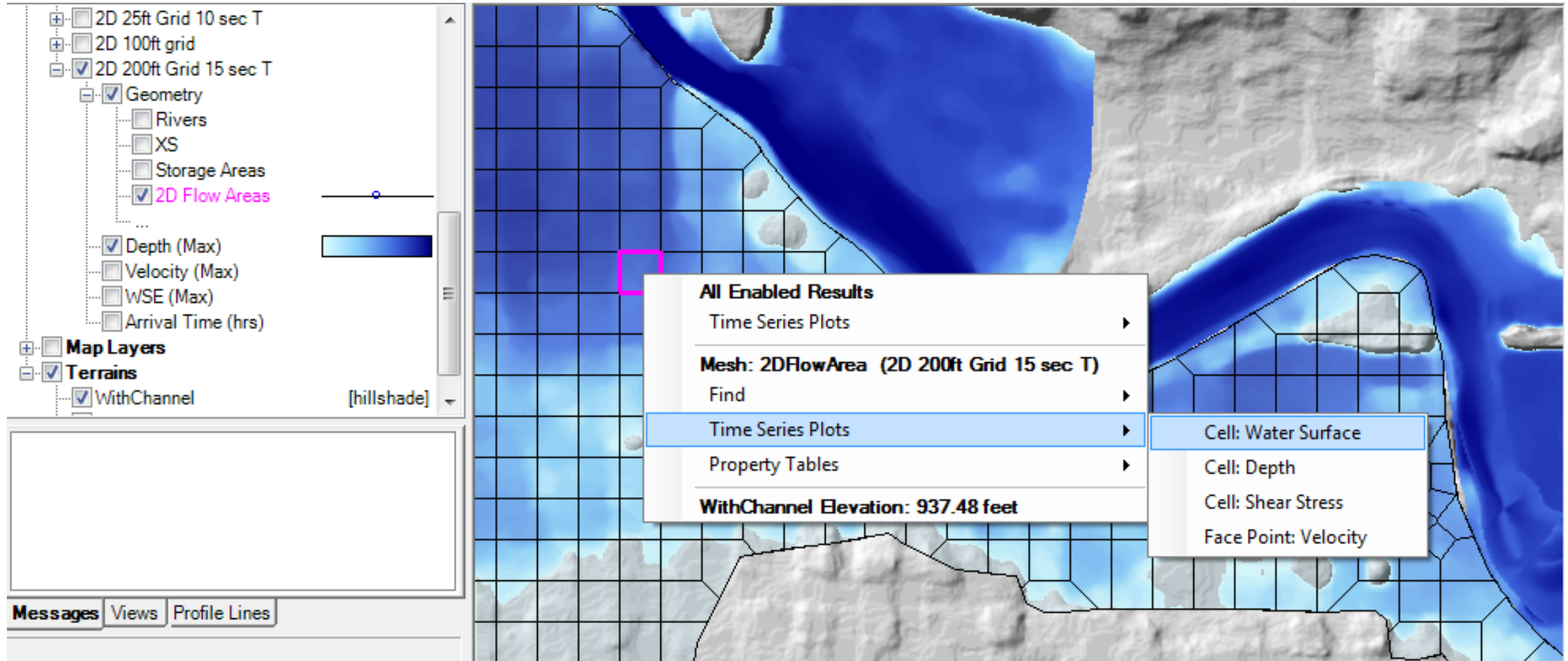
Optional Method for Plotting Results





2D Flow Area Queries

- Data can be queried from cells, cell faces, and point locations



The screenshot displays the HEC-RAS software interface for a 2D flow area query. On the left, the 'Layers' tree shows the following structure:

- 2D 25ft Grid 10 sec T
- 2D 100ft grid
- 2D 200ft Grid 15 sec T (checked)
 - Geometry (checked)
 - Rivers
 - XS
 - Storage Areas
 - 2D Flow Areas (checked)
 - Depth (Max) (checked)
 - Velocity (Max)
 - WSE (Max)
 - Arrival Time (hrs)
- Map Layers
- Terrains (checked)
 - WithChannel (checked) [hillshade]

The main map area shows a 2D flow area with a grid overlay. A pink square highlights a specific cell. A context menu is open over this cell, displaying the following options:

- All Enabled Results
 - Time Series Plots
- Mesh: 2DFlowArea (2D 200ft Grid 15 sec T)
 - Find
 - Time Series Plots
 - Property Tables
- WithChannel Elevation: 937.48 feet
 - Cell: Water Surface
 - Cell: Depth
 - Cell: Shear Stress
 - Face Point: Velocity

At the bottom of the interface, there are tabs for 'Messages', 'Views', and 'Profile Lines'.



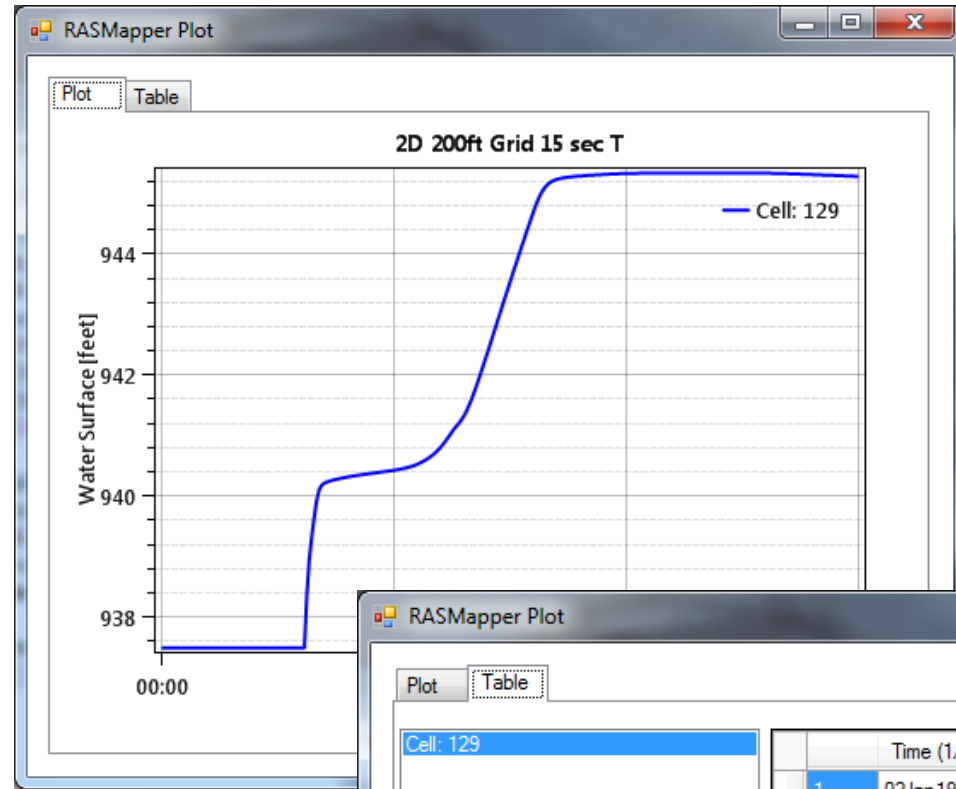
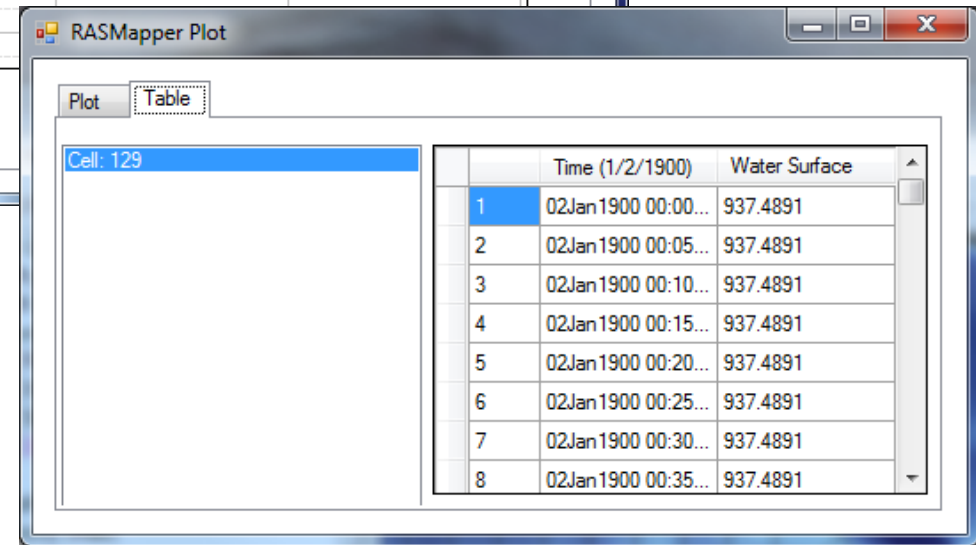
2D Flow Area Queries

- 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

RASMapper Plot

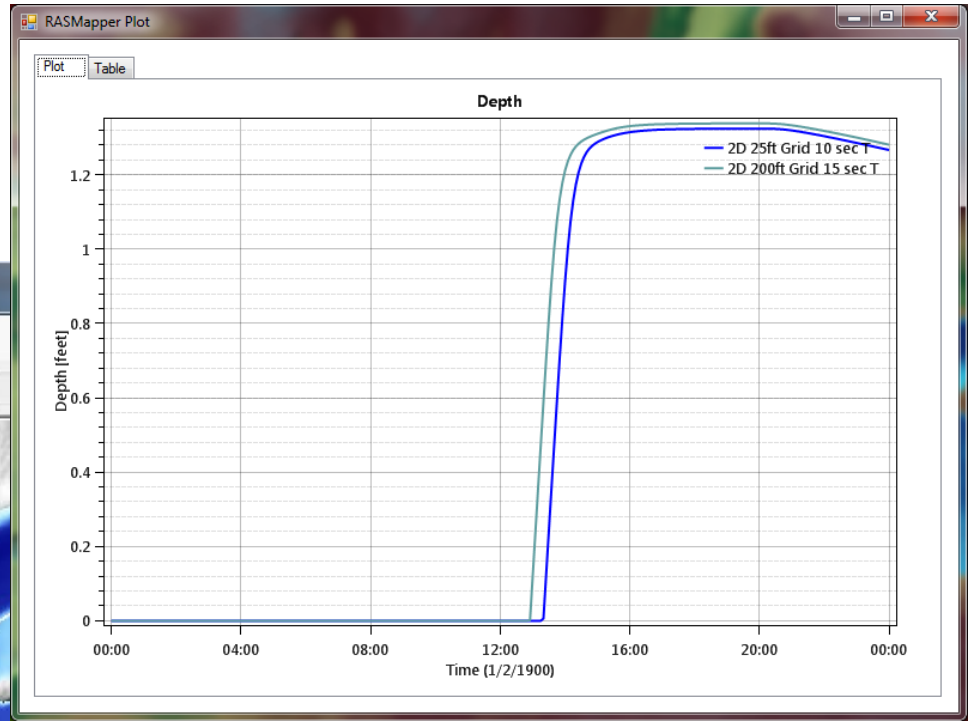
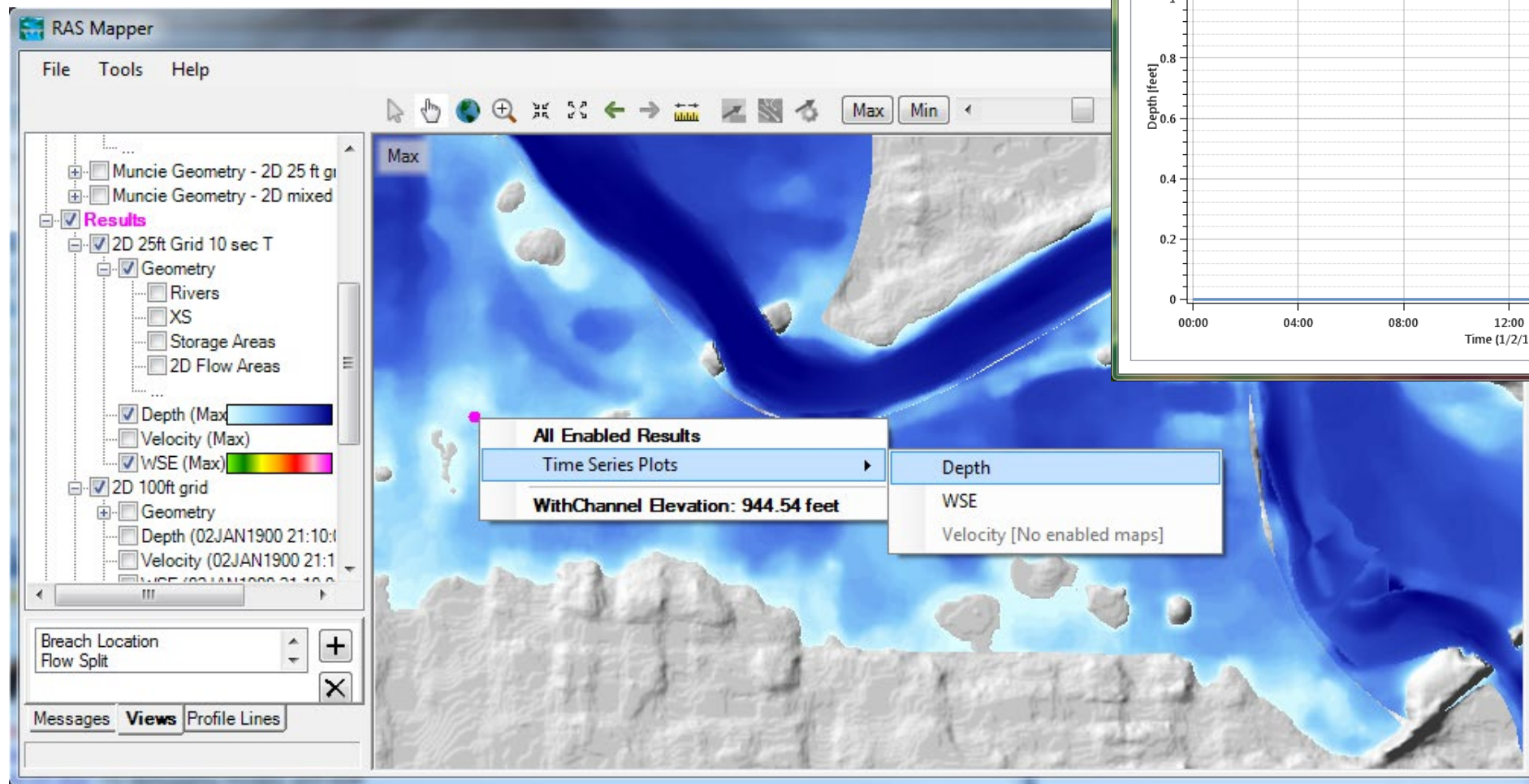
Cell: 129

	Time (1/2/1900)	Water Surface
1	02Jan1900 00:00...	937.4891
2	02Jan1900 00:05...	937.4891
3	02Jan1900 00:10...	937.4891
4	02Jan1900 00:15...	937.4891
5	02Jan1900 00:20...	937.4891
6	02Jan1900 00:25...	937.4891
7	02Jan1900 00:30...	937.4891
8	02Jan1900 00:35...	937.4891



2D Flow Area Queries

- Time Series Plot from a Point





Profile Lines



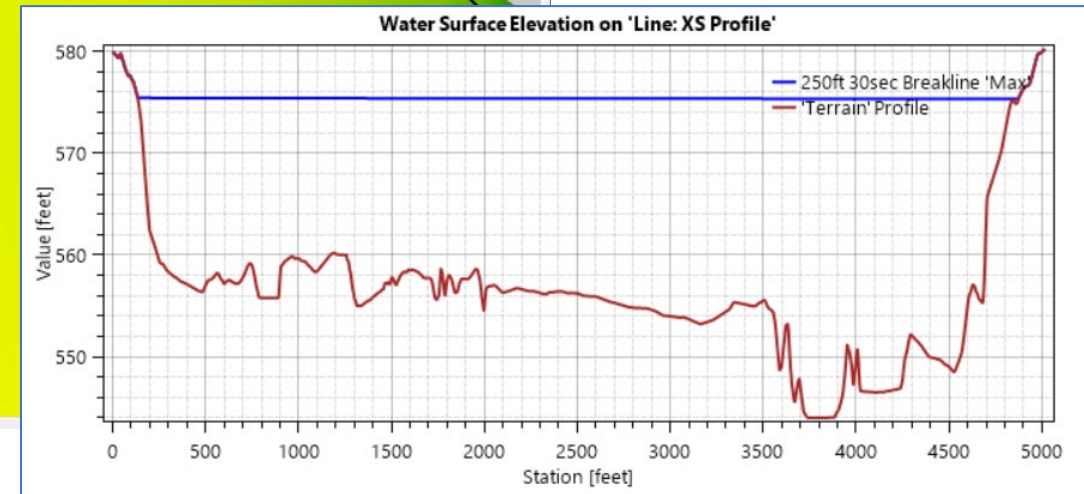
The screenshot shows the RAS Mapper software interface. The main window displays a map with a yellow and orange shaded area representing a river channel. A profile line labeled 'XS Profile' is drawn across the channel. The left sidebar contains a 'Layer List' with the following categories and items:

- Features**
 - Profile Lines
- Geometries**
 - Initial Geometry
 - 250 ft Geometry
 - 250 ft Geometry - Breaklines
- Results**
 - 500ft-1min
 - 500ft - 10min
 - 500ft - 30 sec
 - 250 ft - 30 sec
 - 250ft 30sec Breakline
 - Geometry
 - Depth (02JAN1999 20:00:00)
 - Velocity (02JAN1999 20:00:00)
 - WSE (Max)
 - Courant (02JAN1999 20:00:00)
- Map Layers**
 - Google Hybrid
 - breakline
 - ArcGIS World Imagery
 - Google Satellite
- Terrains**
 - Terrain [hillshade]

A context menu is open over the 'XS Profile' line, showing the following options:

- Copy Selected Feature Ctrl+C
- Plot Profile
 - Terrain
 - WSE**
 - Velocity against Terrain
- Plot Time Series

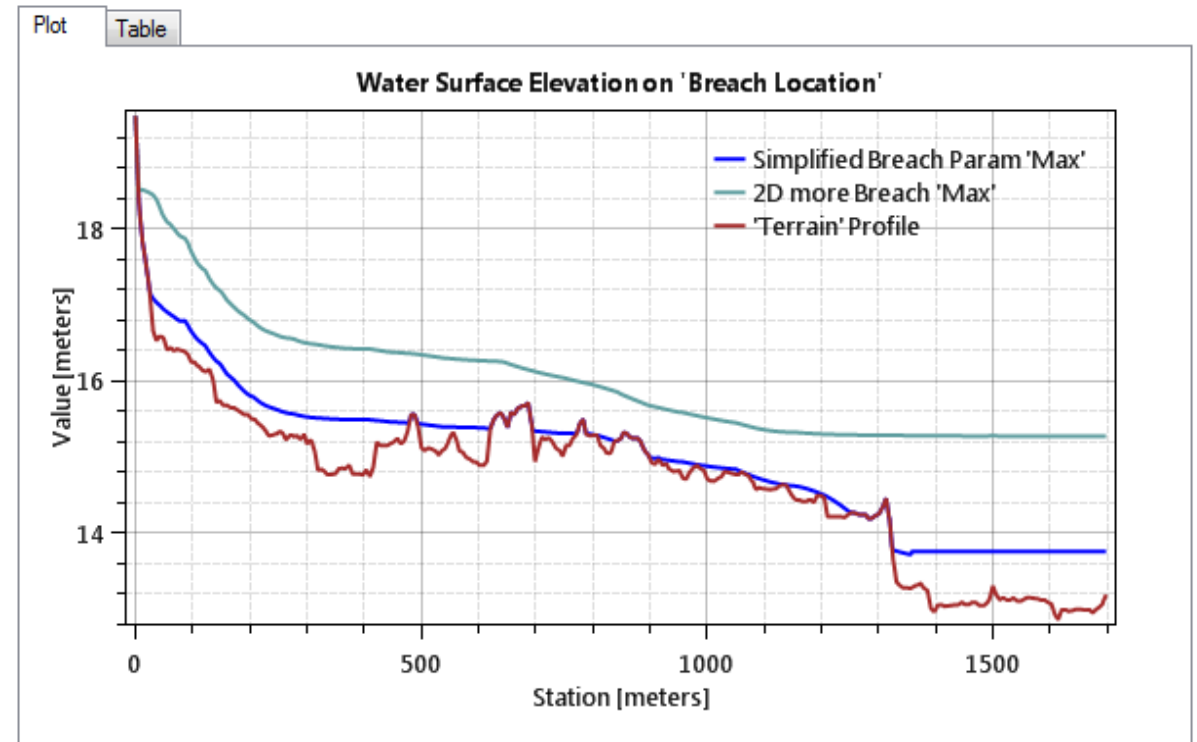
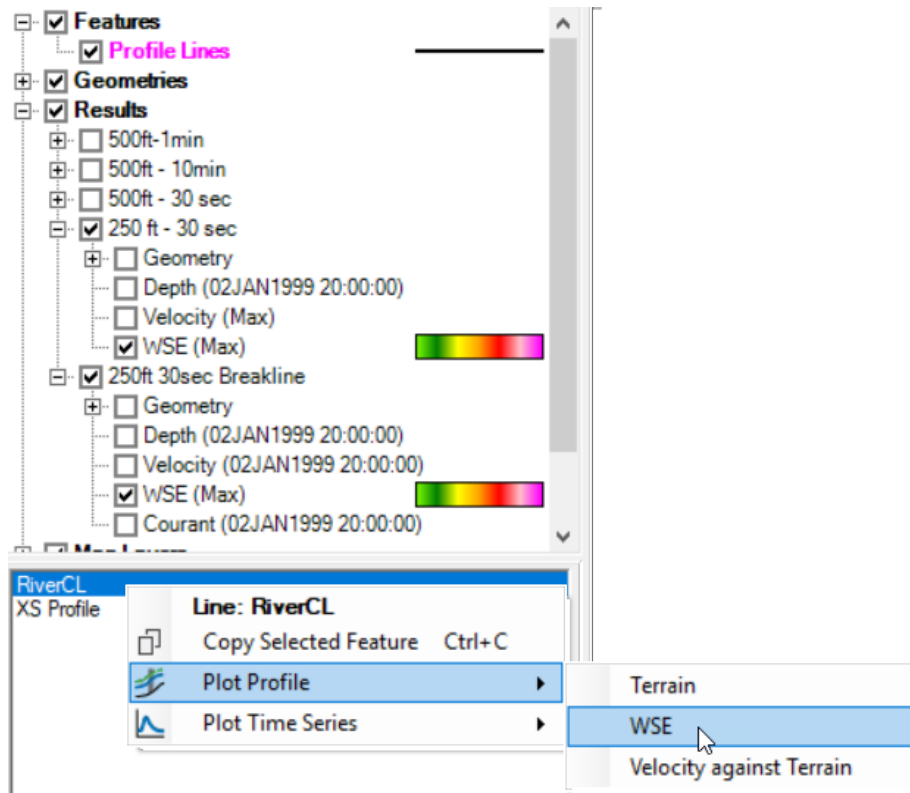
You can only plot data that is turned on in the Layer List





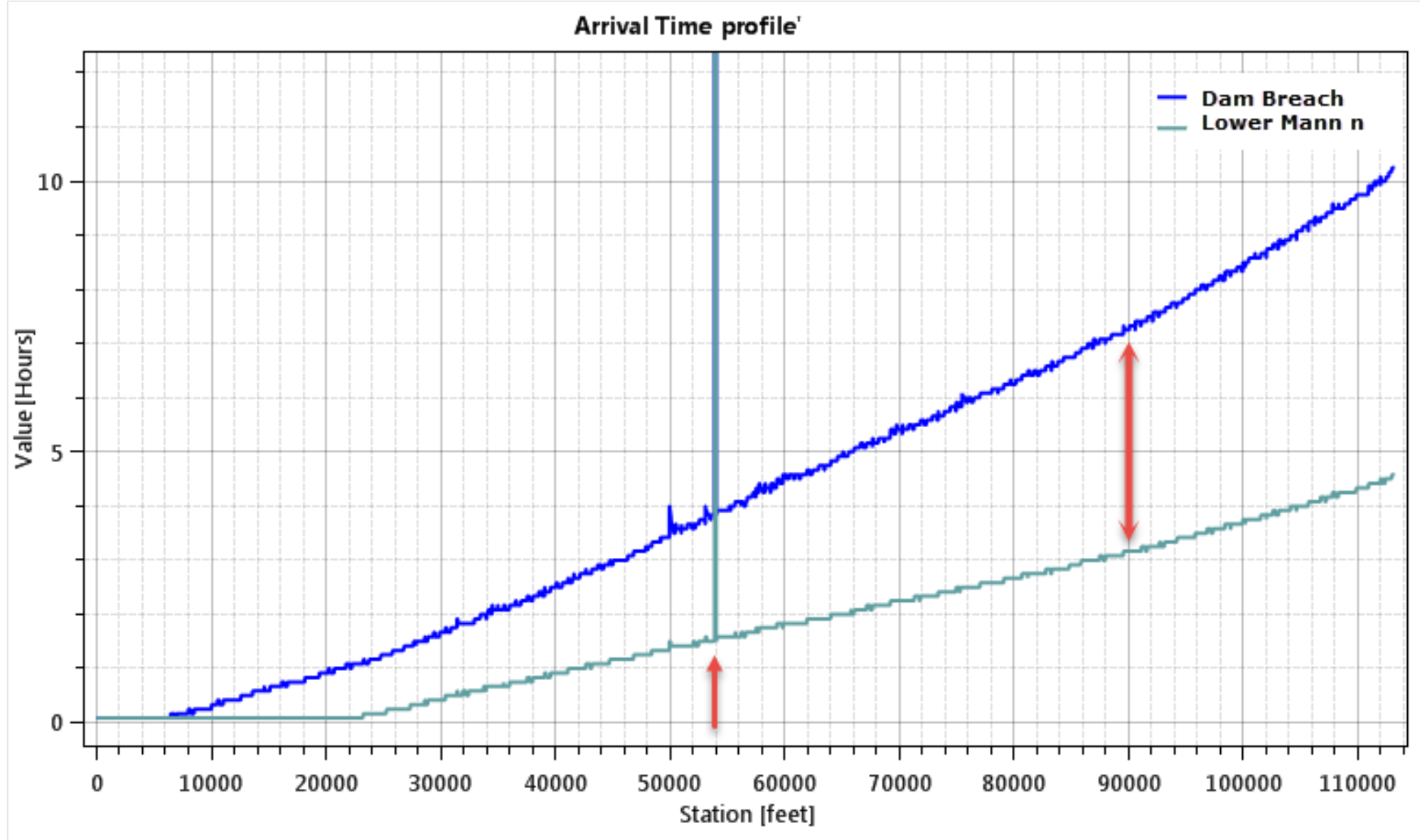
Profile Line: Result Comparison

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



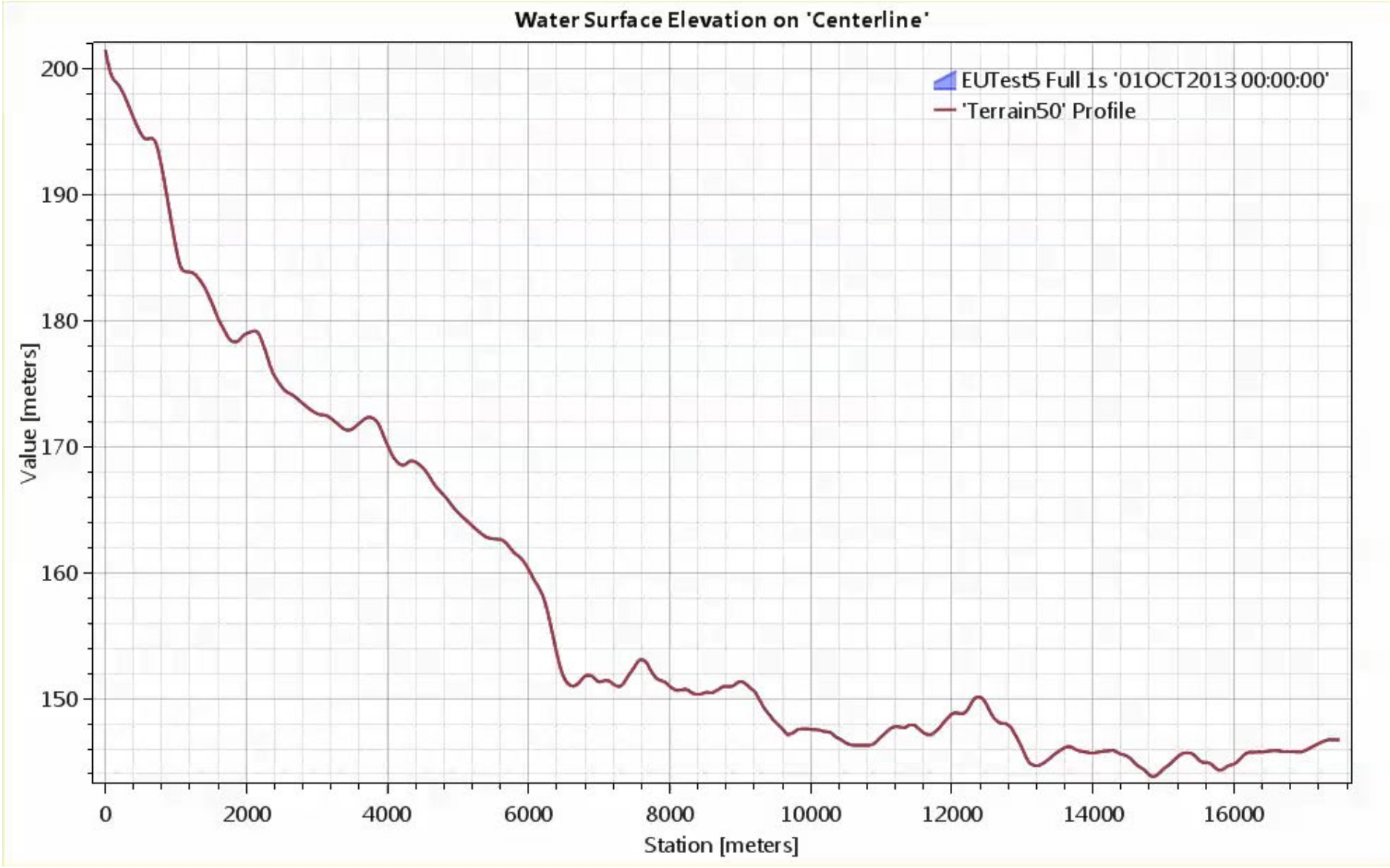


Profile Lines: Comparison of Calculated Data



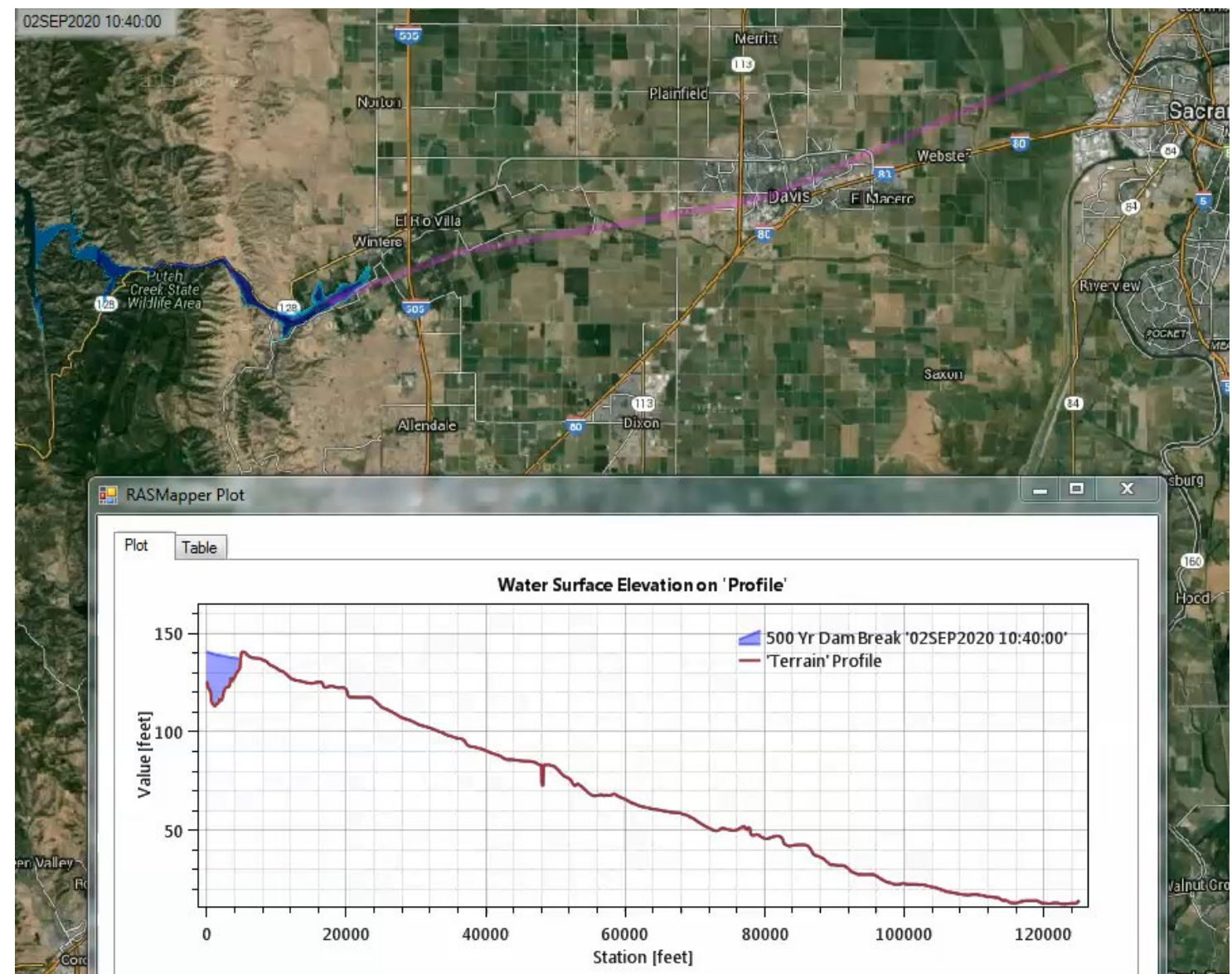


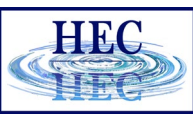
Profile Lines: Animating



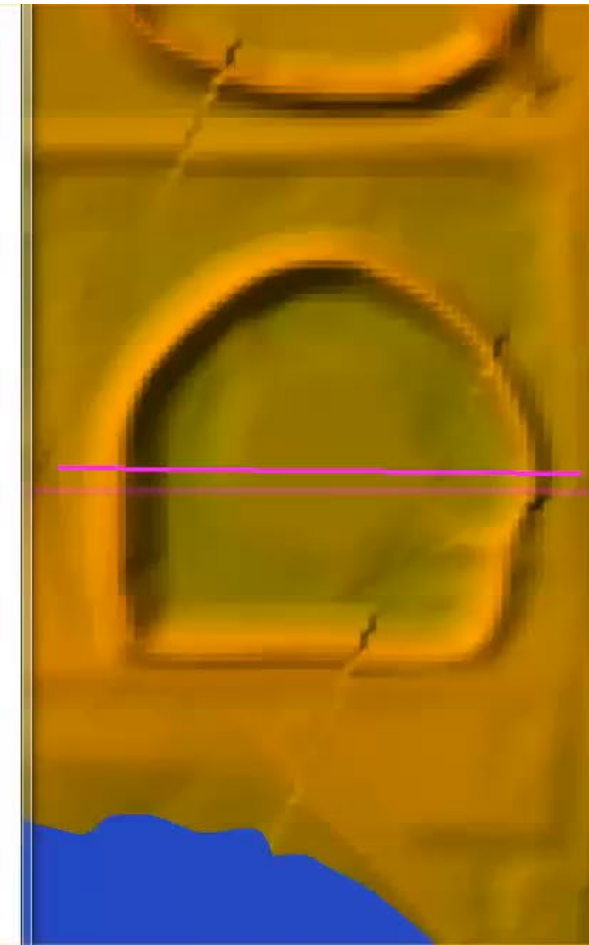
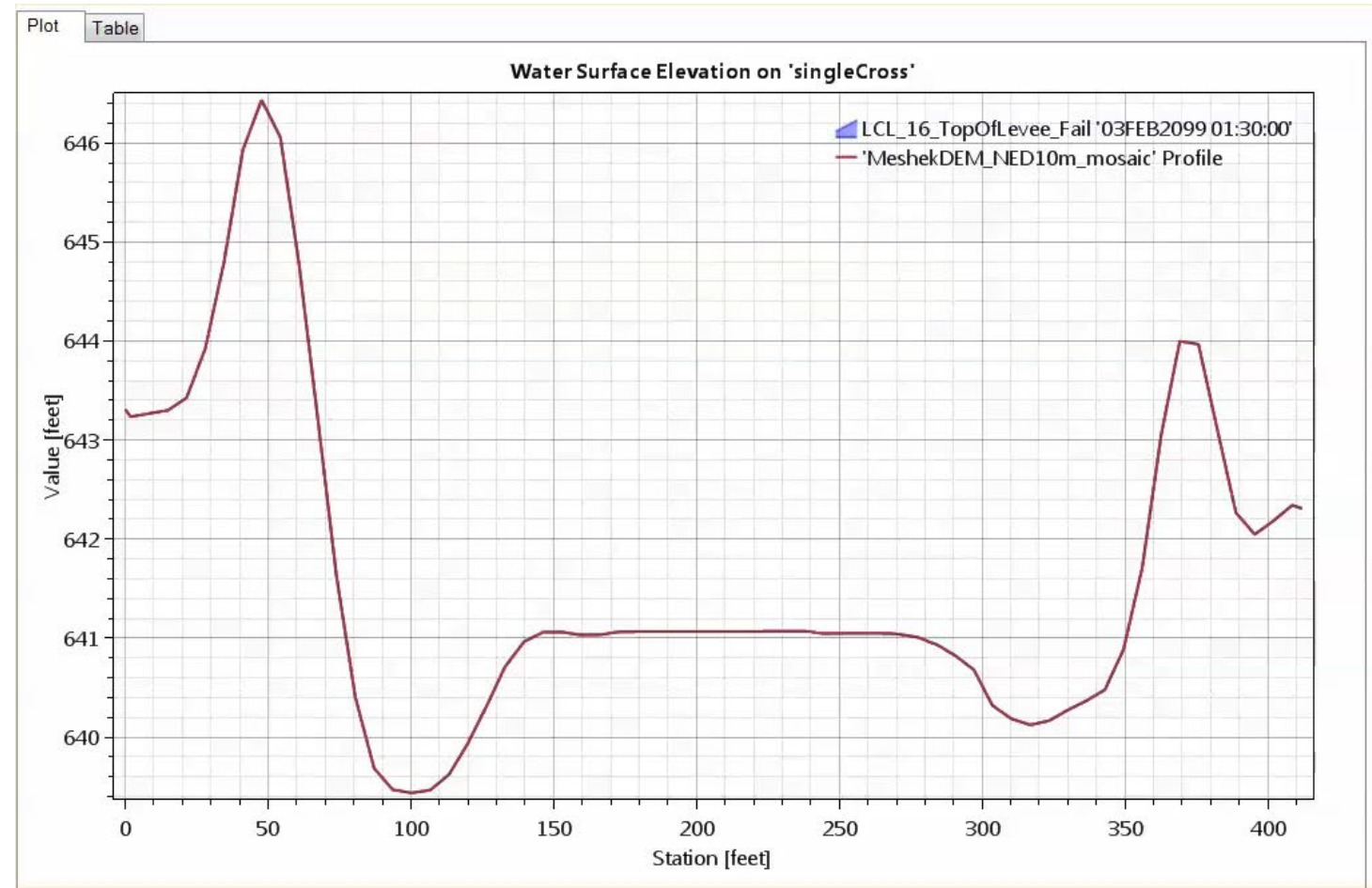


Profile Lines: Sync Animation with Spatial Results



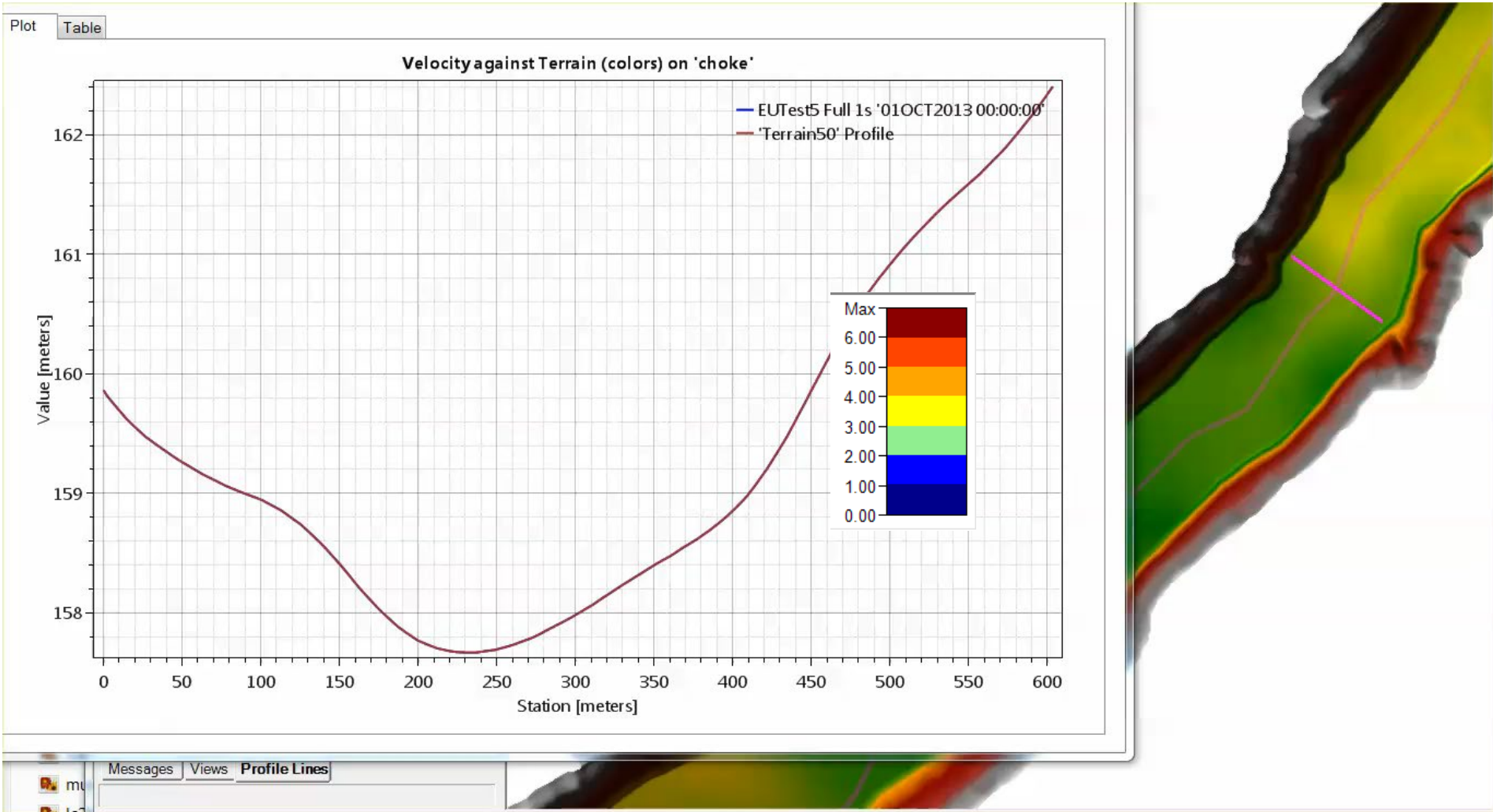


Profile Lines: Sync Animation with Spatial Results





Profile Lines: Velocity Animation

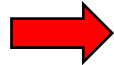




Polygon and Polyline Features

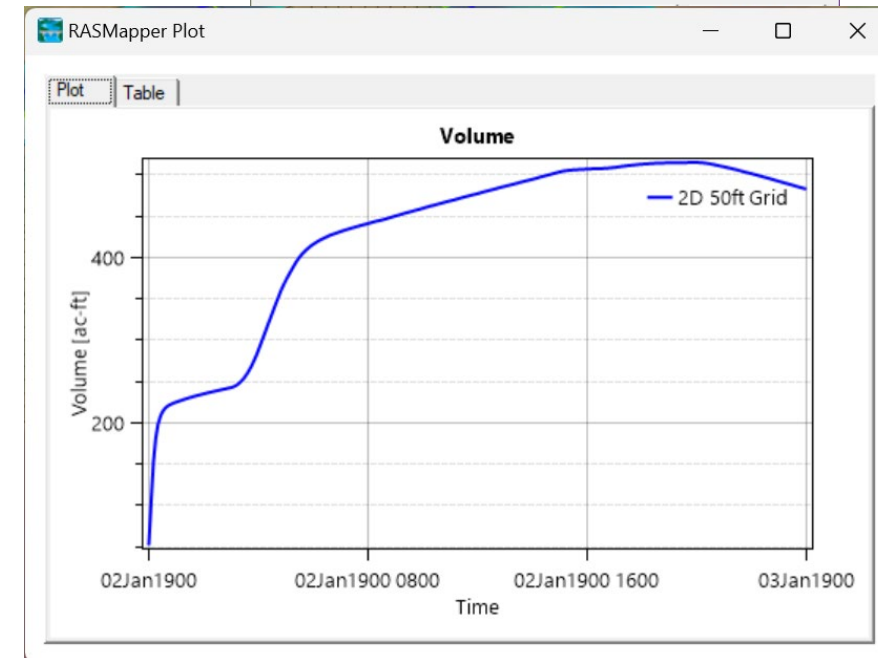
Ability to extract data across combined 1D and 2D domains

Use with Caution!



The screenshot shows the RAS Mapper interface. The 'Features' tree on the left includes 'Polygon Layer' and 'Polyline Layer'. The map displays a river channel with a pink polygon overlaid. A context menu is open over the polygon, showing options for 'All Enabled Results' and 'Plot Time Series'. The 'Plot Time Series' option is selected, and a list of results is shown below, including WSE, Velocity, and Depth.

The 'Polygon Time Series' dialog box is shown. It has two sections: 'Map Resample Parameters' and 'Map Options'. In the 'Map Resample Parameters' section, 'Extent' is set to 'Polygon' and 'Cell Size (ft)' is set to '3.2'. The 'Current Screen Cell Size' is 6.01ft. In the 'Map Options' section, 'Volume' is checked, and 'Max', 'Surface Area', and 'Average' are unchecked.



Questions?