

2017 Montana Floodplain Resource Seminar: Lecture 6 Reviewing Results

Eli Gruber, PE



Identify *Hazards*, Interpret *Risks*, Integrate *Mitigation*

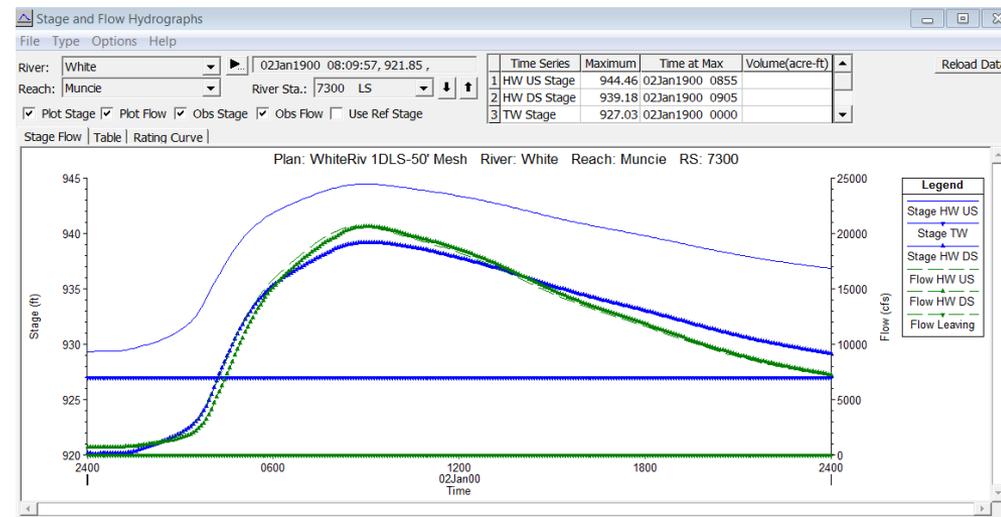
Lecture 6 Overview

- Model Outputs
- RAS Mapper Functionality
- Flow Checks
- Flow and Stage Hydrograph Output
- Render Mode
- Export Results



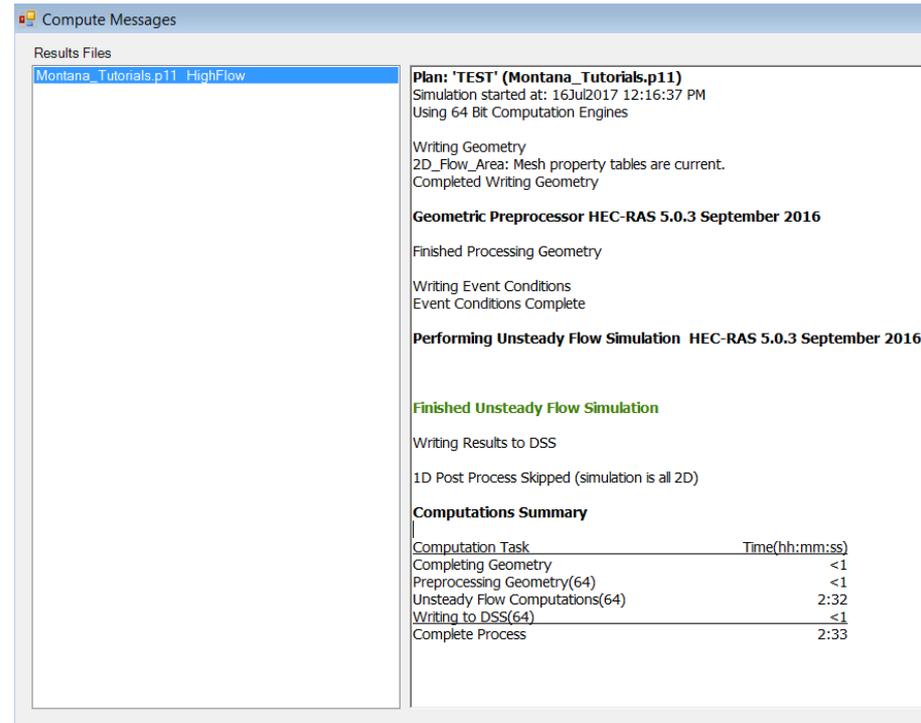
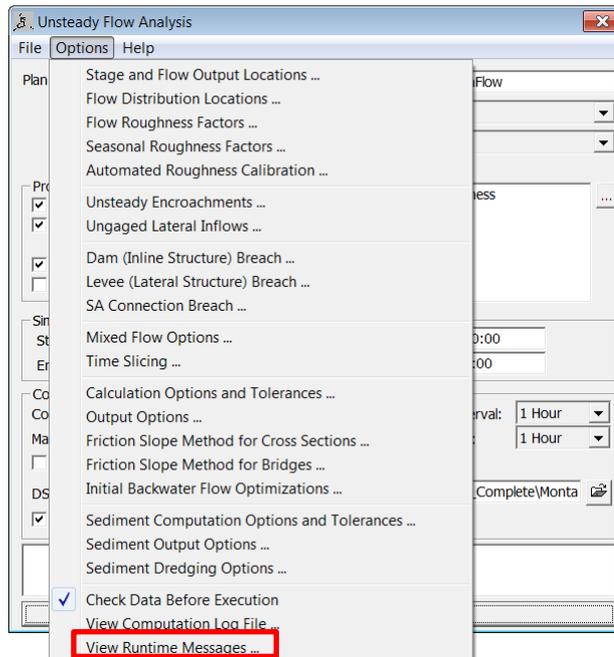
Model Outputs

- RAS Mapper
 - Depth, WSEL, velocity
 - Animate results
 - Flow Check
- Hydrograph outputs
 - Internal connections
 - Boundary conditions
- Errors and volume conservation



Results Check

- *Runtime messages*
 - Convergence errors above the tolerance will show up here



Volume Accounting



- **Computation log file**

- Shows final volume accounting
- Acceptable error is application dependent

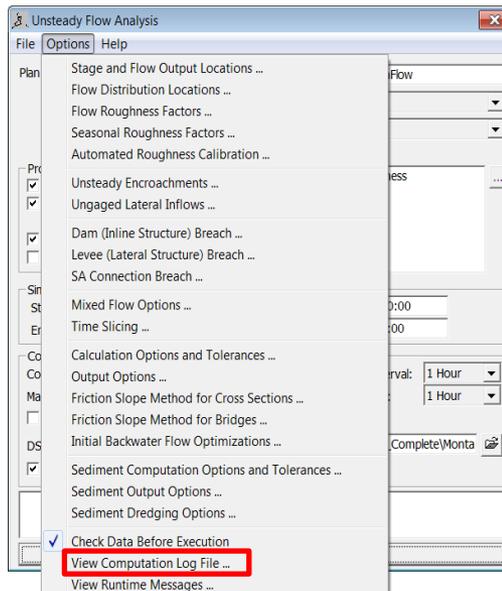
```
#####
#
#      1D and 2D Unsteady Flow Module
#
#      HEC-RAS 5.0.3 September 2016
#
#      16JUL17 at 12:16:38
#
#####
```

Volume Accounting in Acre Feet

External Boundary Flux of Water						
US Inflow	Lat Hydro	DS Outflow	SA Hydro	Groundwater	2D Inflow	2D Outflow
*****	*****	*****	*****	*****	*****	*****
					10063.	6909.
River Reaches, Storage Areas, and 2D Areas						
Start 1D Reach	Starting SA's	Starting 2D	Final 1D Reach	Final SA's	Final 2D Areas	
*****	*****	*****	*****	*****	*****	*****
					3157.	
Error	Percent Error					
****	*****					
2.357	0.02342					

Volume Accounting for 2D Flow Area in Acre Feet

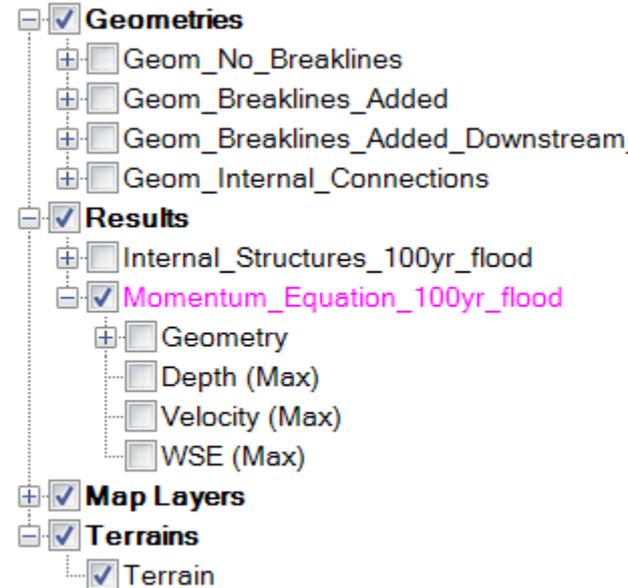
2D Area	Starting Vol	Ending Vol	Cum Inflow	Cum Outflow	Error	Percent Error
*****	*****	*****	*****	*****	****	*****
2D_Flow_Area		3157.	10063.	6909.	2.357	0.02342





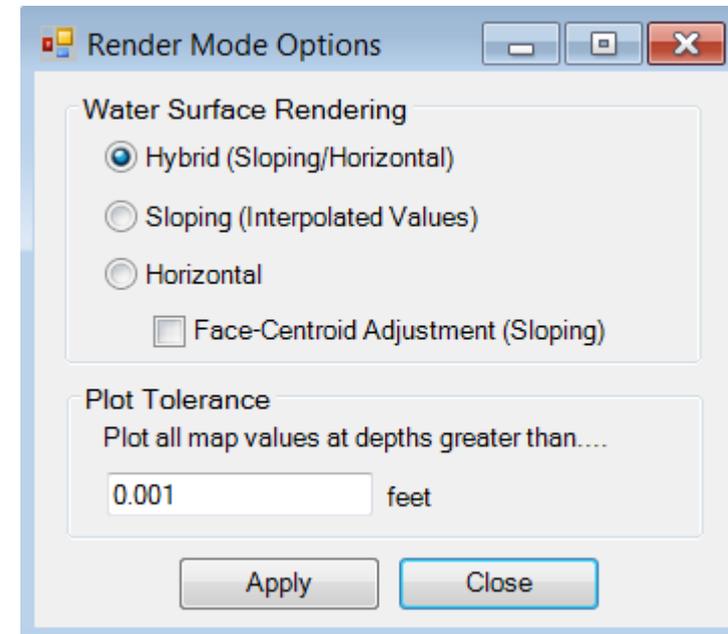
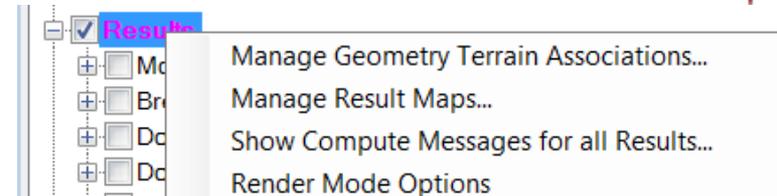
Viewing Results in RAS Mapper

- After a model is run, the plan short ID will show up in the TOC in RAS Mapper under **Results**
- Each plan can be expanded to toggle on/off different map results
- Dynamic maps
 - Results available based on output interval selected in plan setup



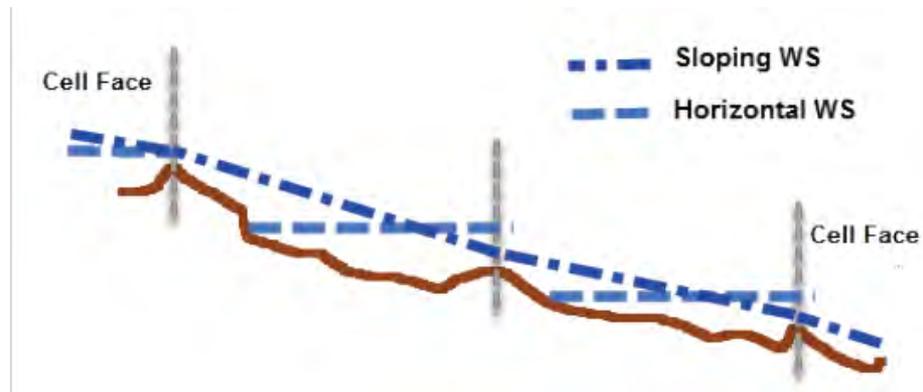
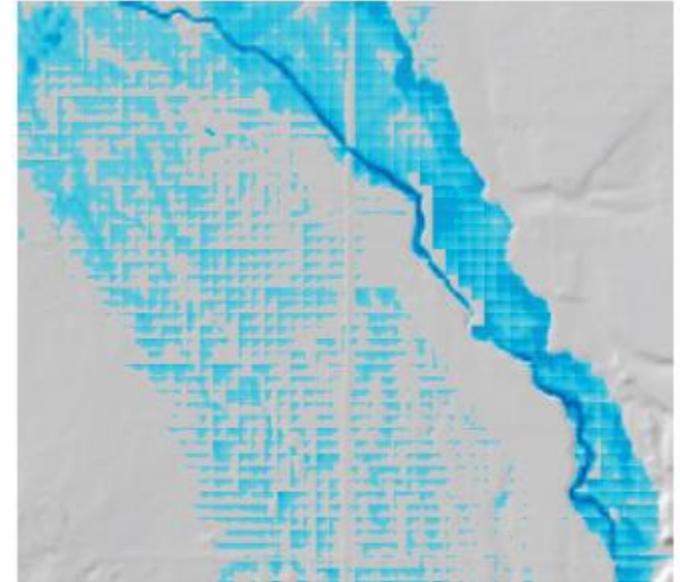
Render Mode Options

- Right click results in TOC
- Three options
 - Horizontal
 - Sloping
 - Hybrid
- Important to understand how each of these relate to model computations and actual results



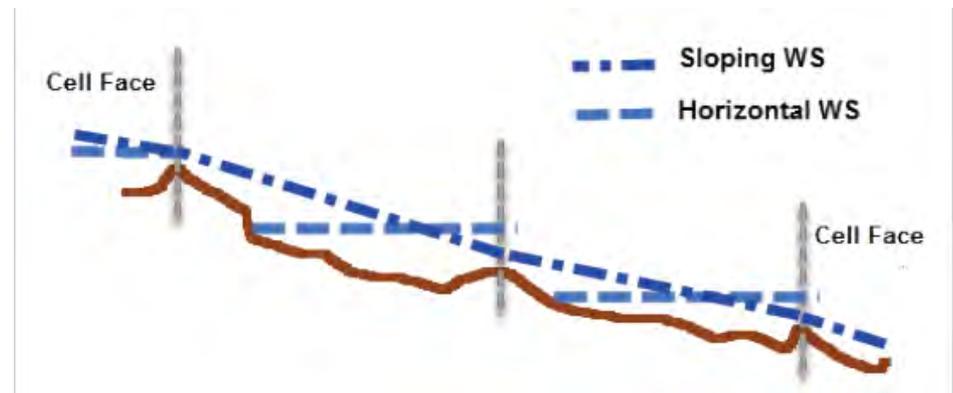
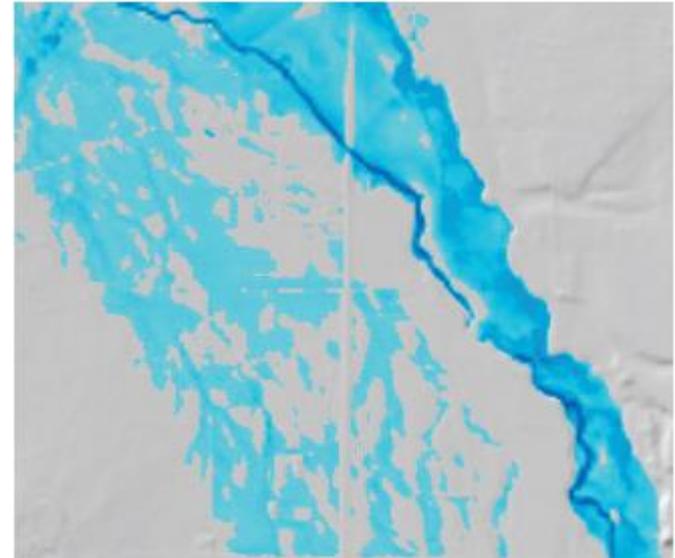
Horizontal Render Mode

- Fills each 2D cell to the water surface as computed in the 2D simulation
- Can produce “patchwork” in areas of significant relief
- Fails to represent hydraulic gradient



Sloping Render Mode

- Interpolates water surface elevations from each cell face
- Provides visualization of continuous flooding
- Exaggerates flooding in some areas and under-represents in others



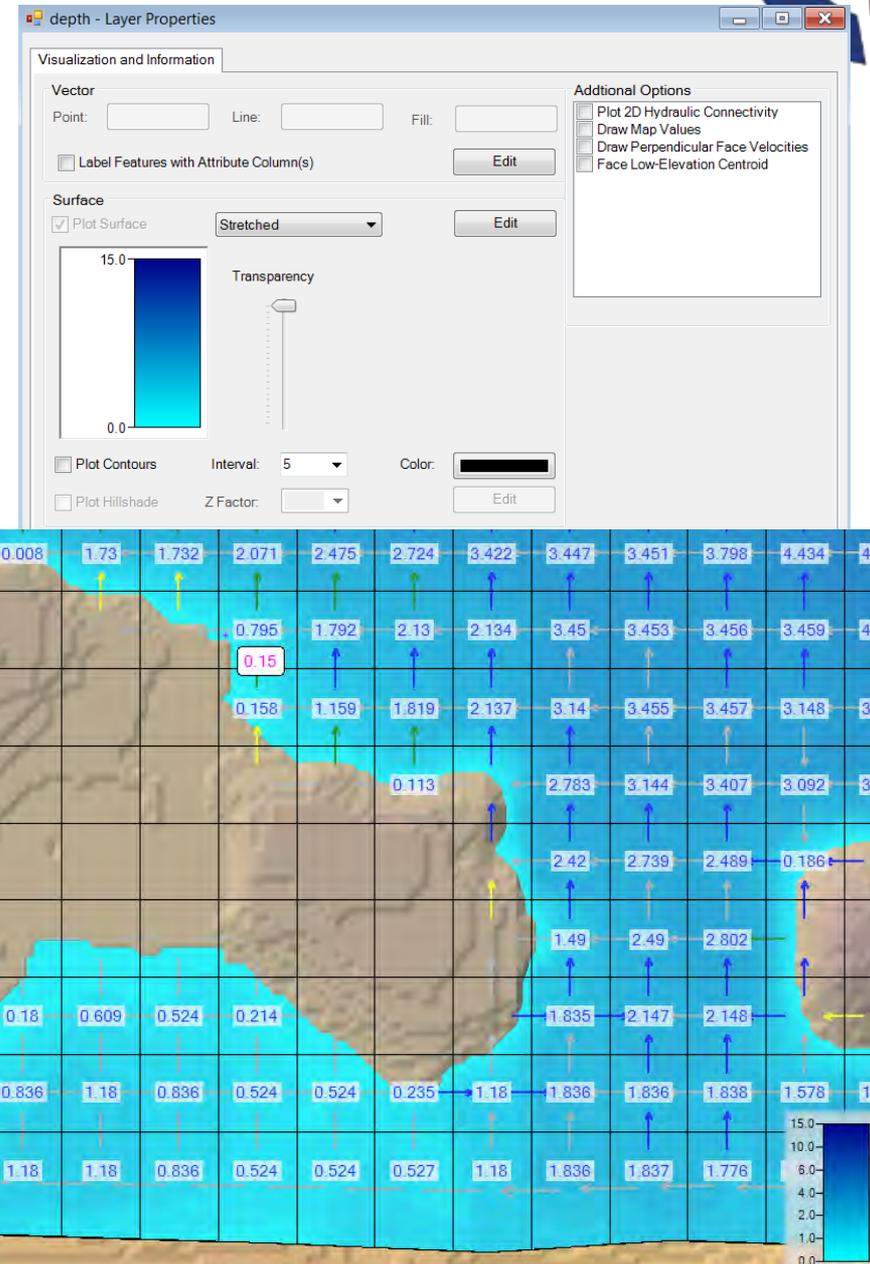


Hybrid Render Mode

- Attempts to utilize both sloping and horizontal and apply the “correct” option for different areas
- Uses metrics to determine when one of the render mode options is failing and switches to the other
- Can’t export these results in the current version (5.0.3)

Layer Visualization

- Adjust color scheme and transparency
- ***Display Map Values*** shows computed value
- ***Plot 2D Hydraulic Connectivity*** shows how water is moving between cells



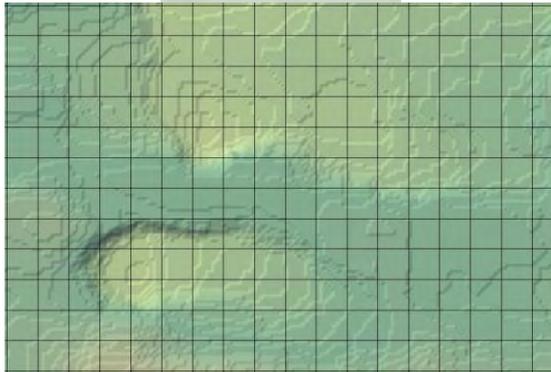


Animations

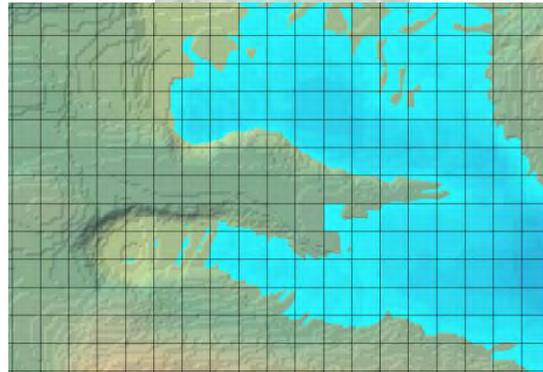
- Dynamic map allows user to view simulation results for each output point
 - Specify output interval in plan file



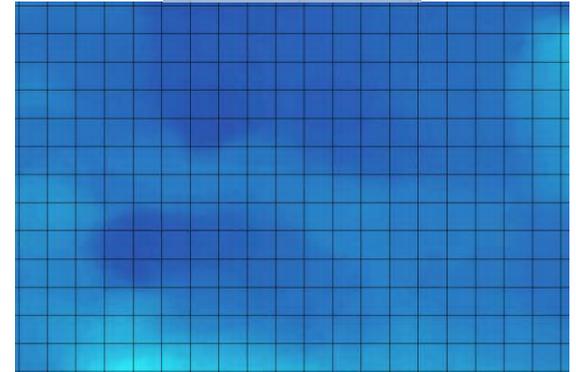
02JAN1900 05:15:00



02JAN1900 05:50:00



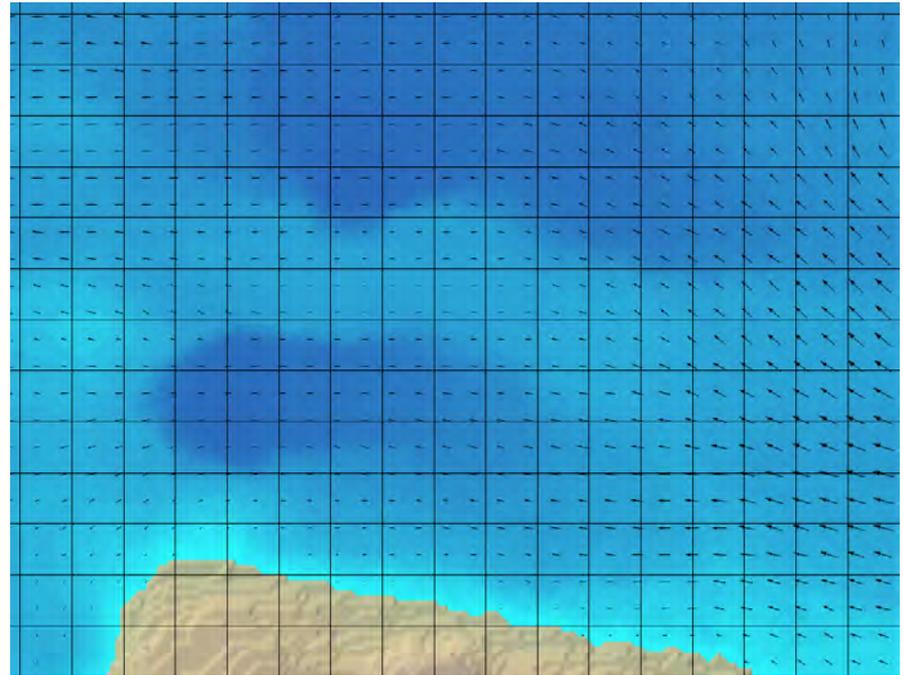
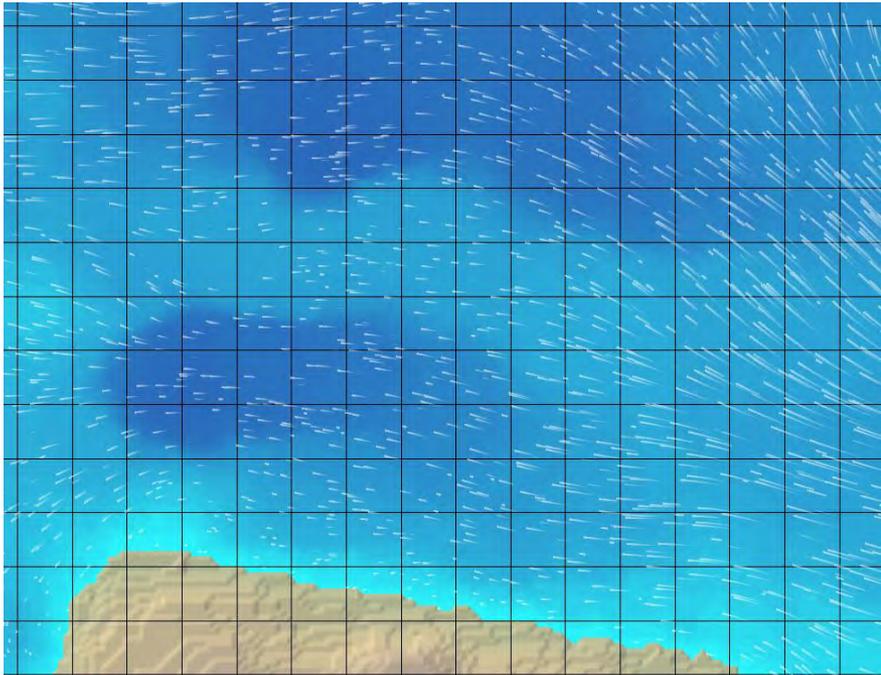
02JAN1900 10:05:00





More Animations

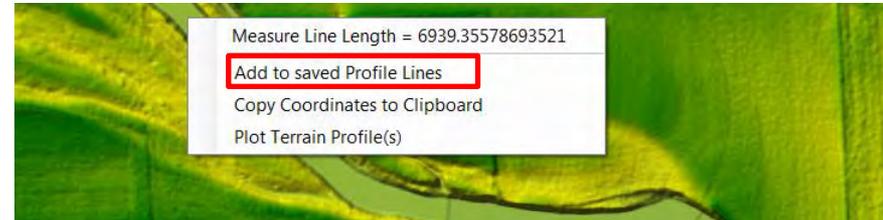
- Velocity particle tracer and vector arrows
 - Visualize flow patterns; direction and magnitude



Profile Lines

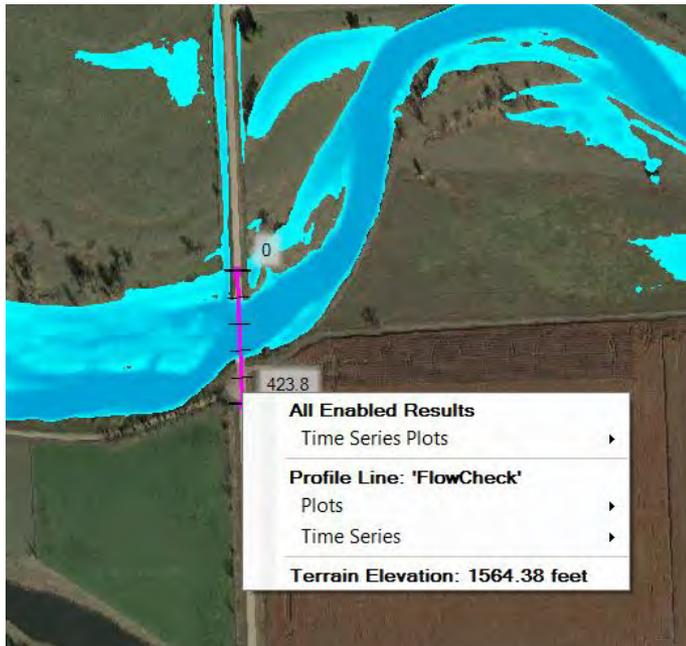


- Draw profile lines using the measure tool in RAS Mapper

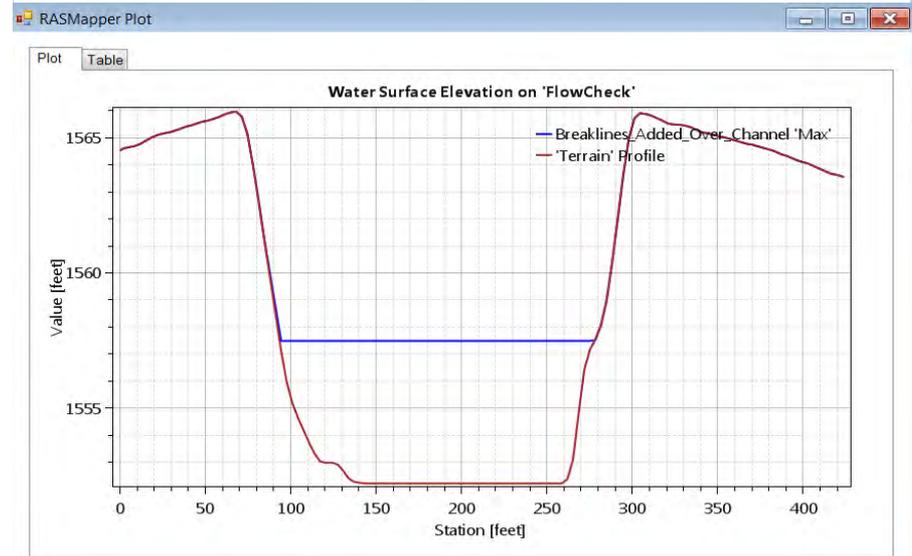
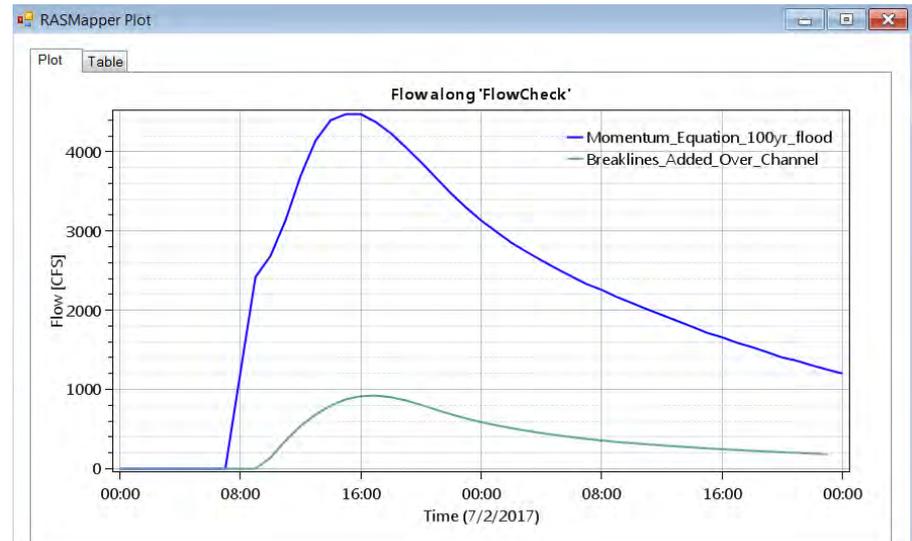


- Cut terrain profile
- Save profile line and use to view results
- Plot WSEL with terrain → cross section
- Plot depth or velocity profiles
- Extract flow or stage time-series results

Profile Lines Plotting

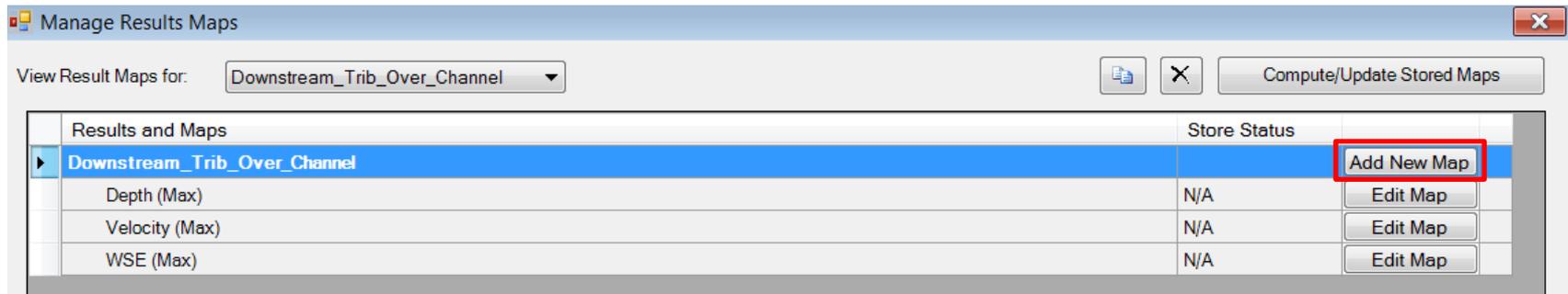
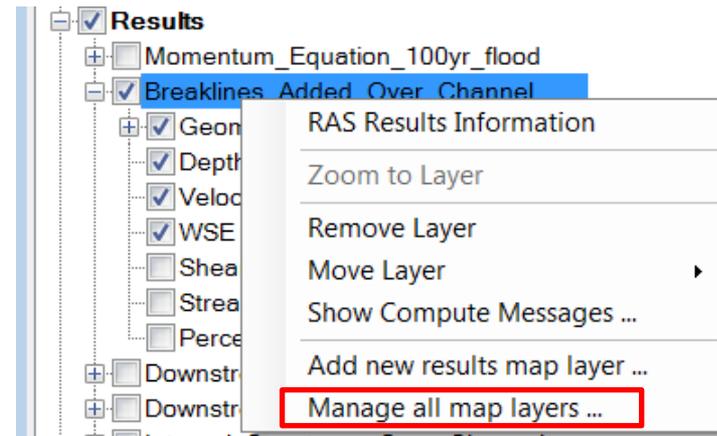


Dynamic: Scroll through different output interval data points, or min/max



Exporting Results

- Static datasets can be exported from RAS Mapper in raster format
 - Right click desired plan



Selecting Export File and Output



- Select map type and desired profile
- Can add dynamic maps to RAS (only viewable inside RAS Mapper)
- To create a static exported dataset, needs to be ***Stored*** option

Results Map Parameters

Map Type (select one)

- Depth
- Water Surface Elevation
- Velocity
- Inundation Boundary
- Flow (1D Only)
- Shear Stress
- Depth * Velocity
- Depth * Velocity²
- Arrival Time
- Recession
- Duration
- Percent Time Inundated
- Stream Power
- Depth Max Extent
- Wet Cells

Unsteady Profile

- Maximum
- Minimum
- Profile

01 JUL 2017 00:00:00
01 JUL 2017 01:00:00
01 JUL 2017 02:00:00
01 JUL 2017 03:00:00
01 JUL 2017 04:00:00
01 JUL 2017 05:00:00
01 JUL 2017 06:00:00
01 JUL 2017 07:00:00
01 JUL 2017 08:00:00
01 JUL 2017 09:00:00

Map Output Mode

Generated for Current View (in memory)

- Raster (with Associated Terrain)
- Point Feature Layer:

Stored (saved to disk)

- Raster based on Terrain: Terrain
- Point Feature Layer:
- Polygon Boundary at Value: 0

Layer Name: Depth

Map Type: A Map layer will be created for Flood Inundation Depths.
Map Mode: Map results are computed using the specified Terrain and stored to disk.

Add Map Cancel

Executing Export



Manage Results Maps

View Result Maps for: Downstream_Trib_Over_Channel

Compute/Update Stored Maps

Results and Maps	Store Status	
Downstream_Trib_Over_Channel		Add New Map
Depth (Max)	N/A	Edit Map
Velocity (Max)	N/A	Edit Map
WSE (Max)	N/A	Edit Map
Depth (Max)	Map not created	Edit Map

Computing 'Depth'

File 1 of 1: 63% processed

Depth (Max) Map files up to date. Edit Map

RAS Mapper

Downstream_Trib_Over_Channel

- Geometry
- Depth (Max)
- Velocity (Max)
- WSE (Max)
- Depth (Max)

Windows Explorer

Name	Date	Type	Size	Tags
Depth (Max).Examp...	7/16/2017 2:25 PM	TIFF image	5,850 KB	
Depth (Max).vrt	7/16/2017 2:25 PM	VRT File	4 KB	



Exported Results

- The exported rasters will have a generic name
 - Depth (Max).Example_Terrain.tif
 - *Dataset (Profile).TerrainName.tif*
- They will be saved to a folder with the plan name
- Rename the rasters outside of RAS for file management
 - The max depth file for two different plans will have the same name

Notes on Results in RAS Mapper



- Results render differently at different zoom levels – pyramids
- Maximum and minimum do not represent snapshots in time; max/min for each cell regardless of when it occurs
 - Floodplain mapping limit
- Review results carefully to ensure hydraulics make sense

Questions



Photo from FEMA

