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HEC-GeoRAS Walkthrough Workshop

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Welcome
(Who is in the Audience?)

Engineers

- HEC-RAS experts

GIS Professionals

- GIS experts

City Planners

Flood Plain Managers

Engineering + GIS = HEC-GeoRAS

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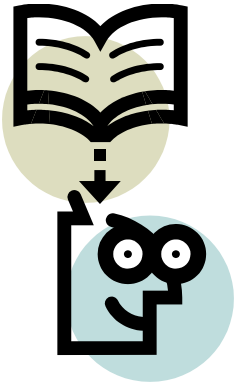
Why Are We Here?

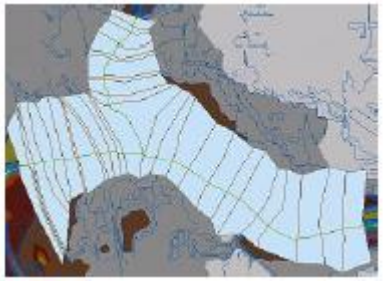


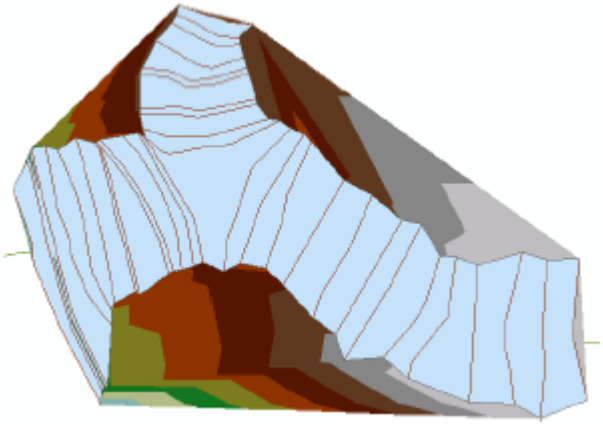
Learn about:

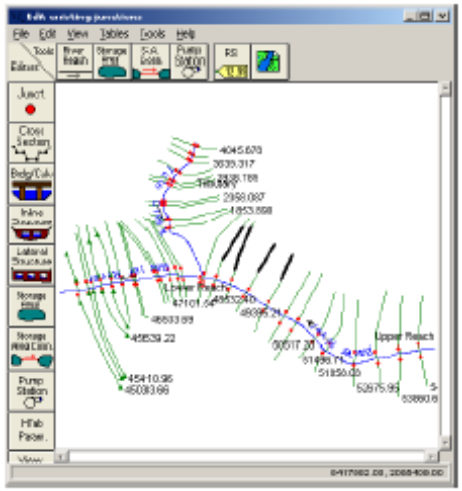
- Data
- GIS
- Engineering
- Geo-RAS
- HEC-RAS
- TROUBLESHOOTING

Geo-RAS Walkthrough

- Not a live DEMO
- Screenshots captured at each step







Agenda

- Introduction to HEC-GeoRAS and Spatial Data
- Generating Required Data in HEC-GeoRAS
- HEC-GeoRAS to HEC-RAS
- Tools and Tips for modeling & managing spatial data in HEC-RAS
- HEC-RAS to HEC-GeoRAS
- Post Processing in GIS
- Additional HEC-GeoRAS capabilities (as time allows)

Benefits of Using HEC-GeoRAS

- Spatial Relationships
  - Link input data, hydraulic modeling, and final floodplain mapping
- Better utilize detailed topographic information
  - Make use of LiDAR / survey data
  - Increase accuracy and precision in overbank
- Improve modeling efficiency
  - Quickly identify impacts of modeling changes and areas of concern
  - Utilize GIS staff to aid in model development and mapping
- Visualize results to improve model accuracy
  - Easily identify areas of basin interaction

Software Requirements

- HEC-GeoRAS
  - HEC-GeoRAS 4.3.93 for use with ArcGIS 9.3
  - HEC-GeoRAS 10 for use with ArcGIS 10.0 (today's discussion)
  - HEC-GeoRAS 10.1 for use with ArcGIS 10.1 (just released)
- ArcGIS
  - Required Extensions
    - Spatial Analyst
    - 3D Analyst
- HEC-RAS
  - Full functionality of HEC-GeoRAS 4.3.93 requires HEC-RAS 4.0 or later
  - RAS Mapper Utility requires HEC-RAS 4.1.0

Identify the Scope of Work

Type \ Level of Analysis

- Regulatory Use
  - Detailed Floodplain Study
  - Approximate Floodplain Study
- Sediment Transport
- Research and Scientific Analysis

Study *Extents*

- Upstream and downstream extents, tributaries, etc.
- Available data
- Access to survey data
- Metadata (digital data is useless without it!)

Metadata, Metadata, Metadata

(We hate it until we need it)

What is Metadata?

- Descriptive
- Data about data
- Content about content
- Data about content

Why do you need Metadata?

- It answers questions about the integrity / quality of data used in modeling.
  - Where did it come from
  - Who created it
  - How was it created
  - When was it created
  - Why was it created
  - Who published the data
  - Was the data ever published
  - Did data go through a QA/QC process
  - What is the RMS \ Error

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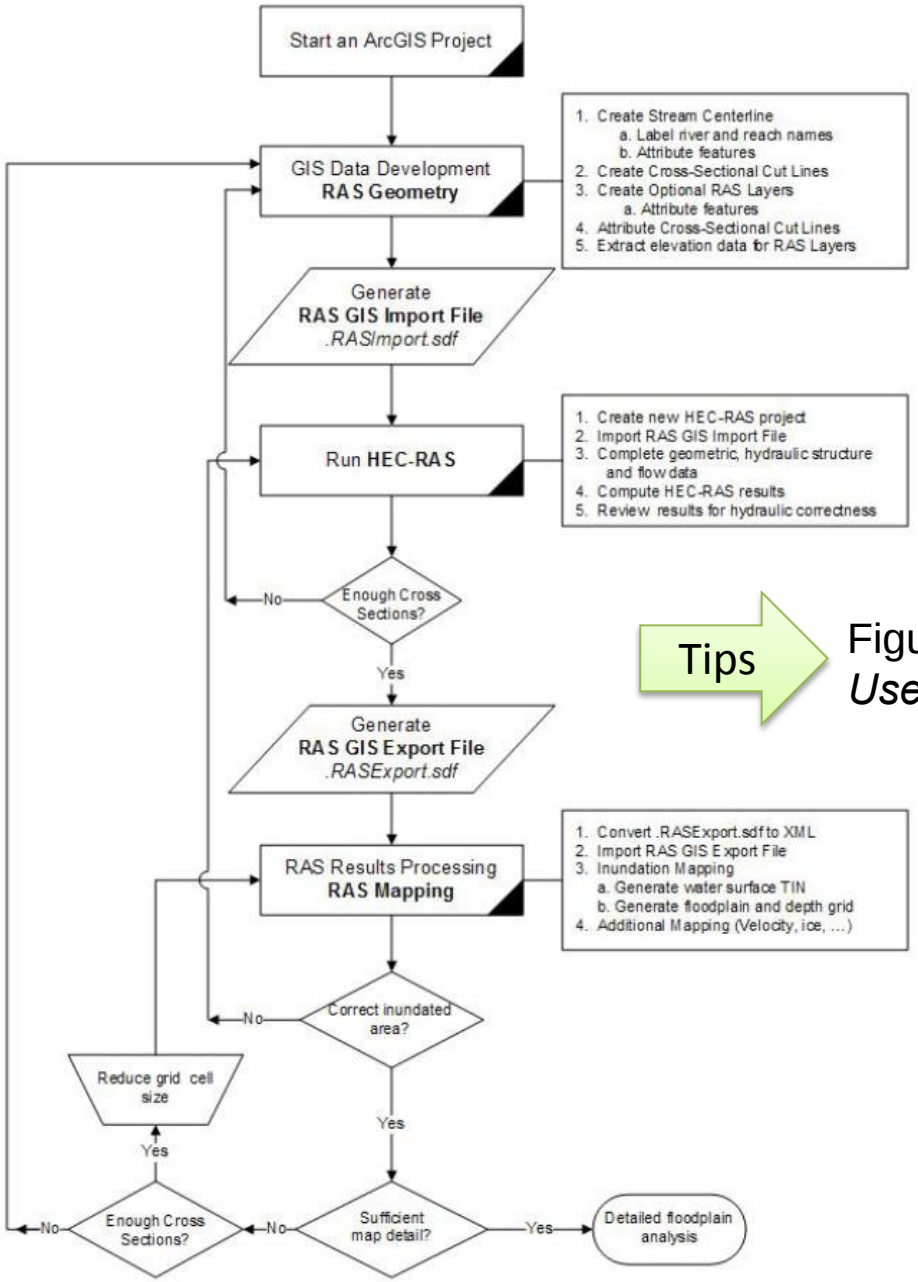
Digital Data Creation - Flowchart



Tips

Figure 3-1 from *HEC-GeoRAS User's Manual v10*

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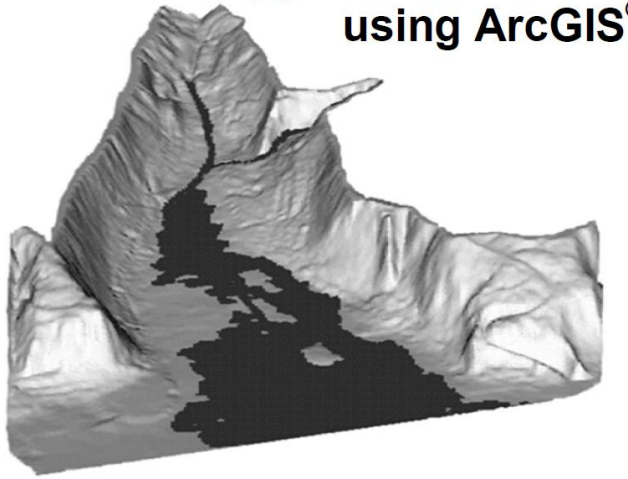
GIS Geo-RAS Walkthrough

US Army Corps
of Engineers
Hydrologic Engineering Center

HEC-GeoRAS
GIS Tools for Support of HEC-RAS using ArcGIS®



Version 10.0

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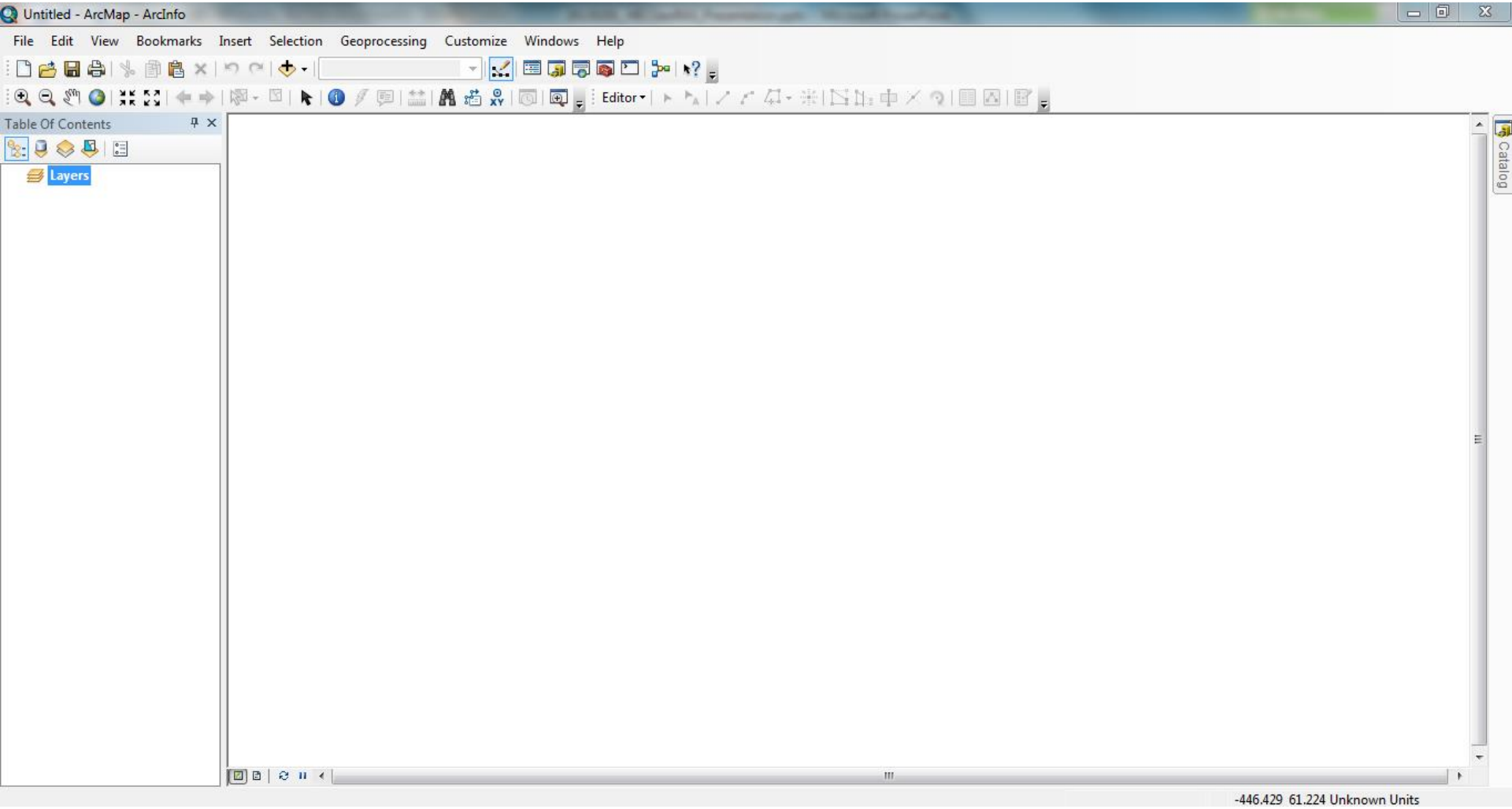
New MXD



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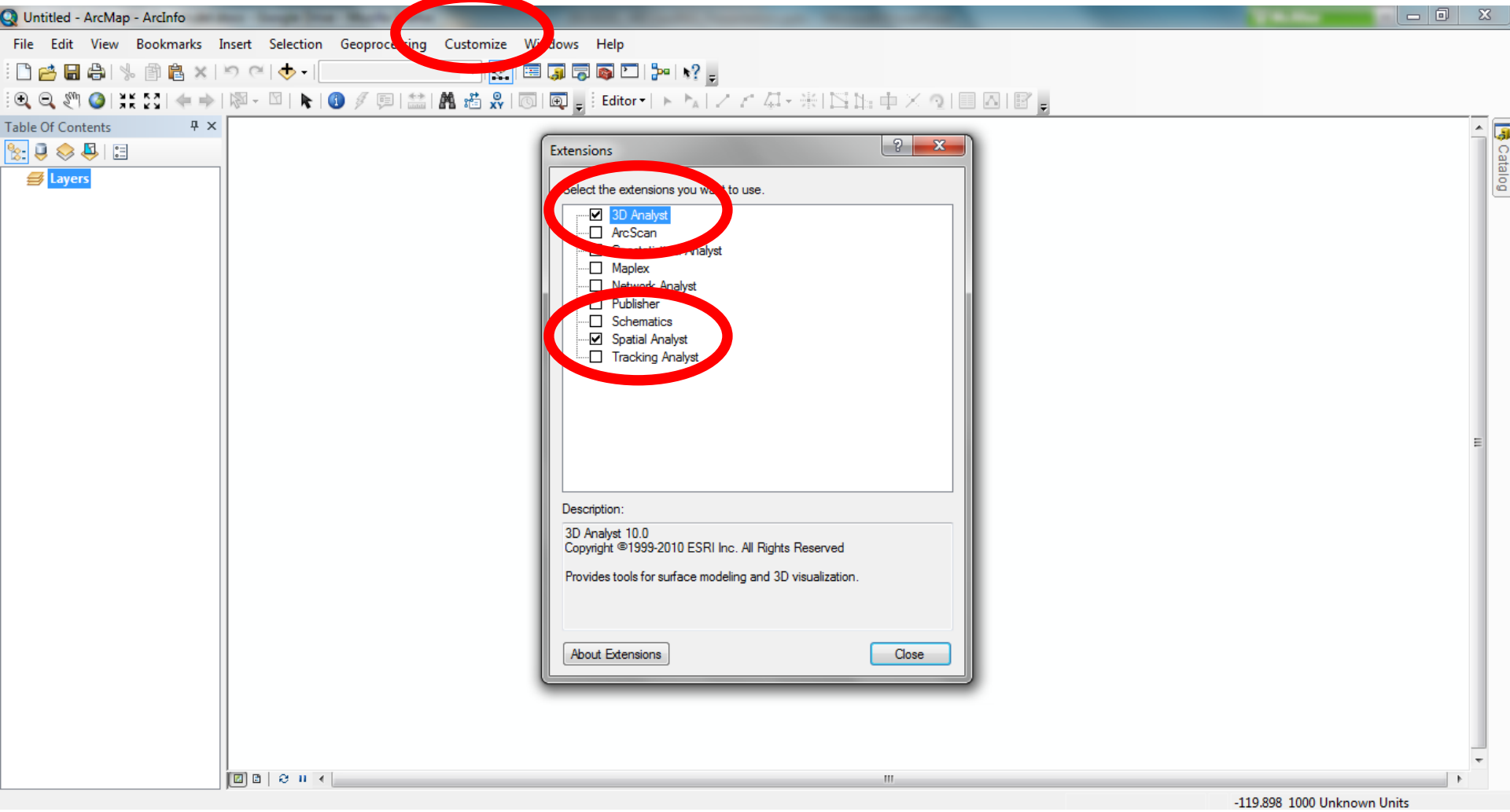
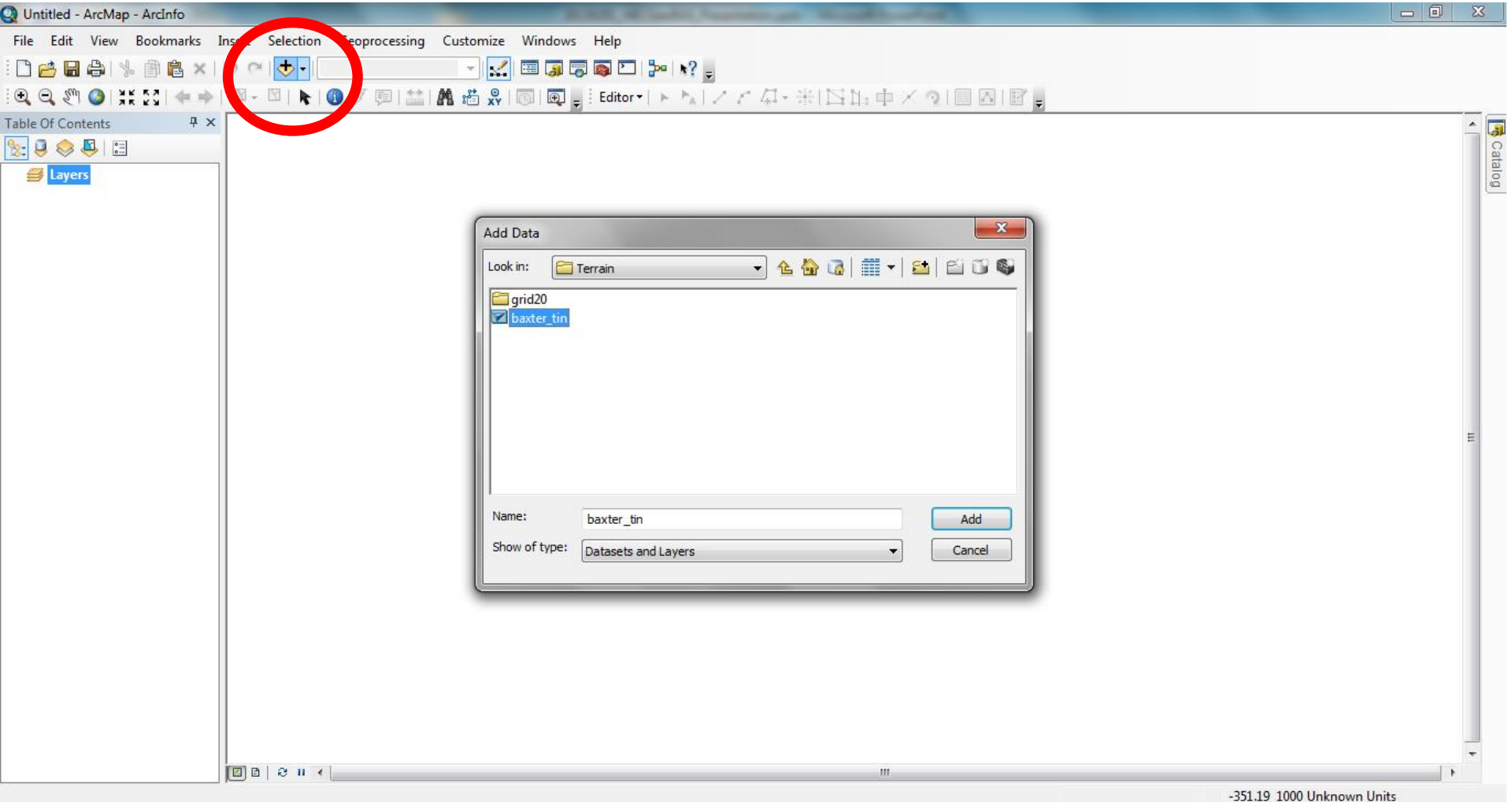
Turn on Extensions



Add Data


Untitled - ArcMap - ArcInfo
File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help
Editor
Table Of Contents
Layers
Catalog
Add Data
Look in: Terrain
grid20
baxter_tin
Name: baxter_tin
Add
Show of type: Datasets and Layers
Cancel
-351.19 1000 Unknown Units

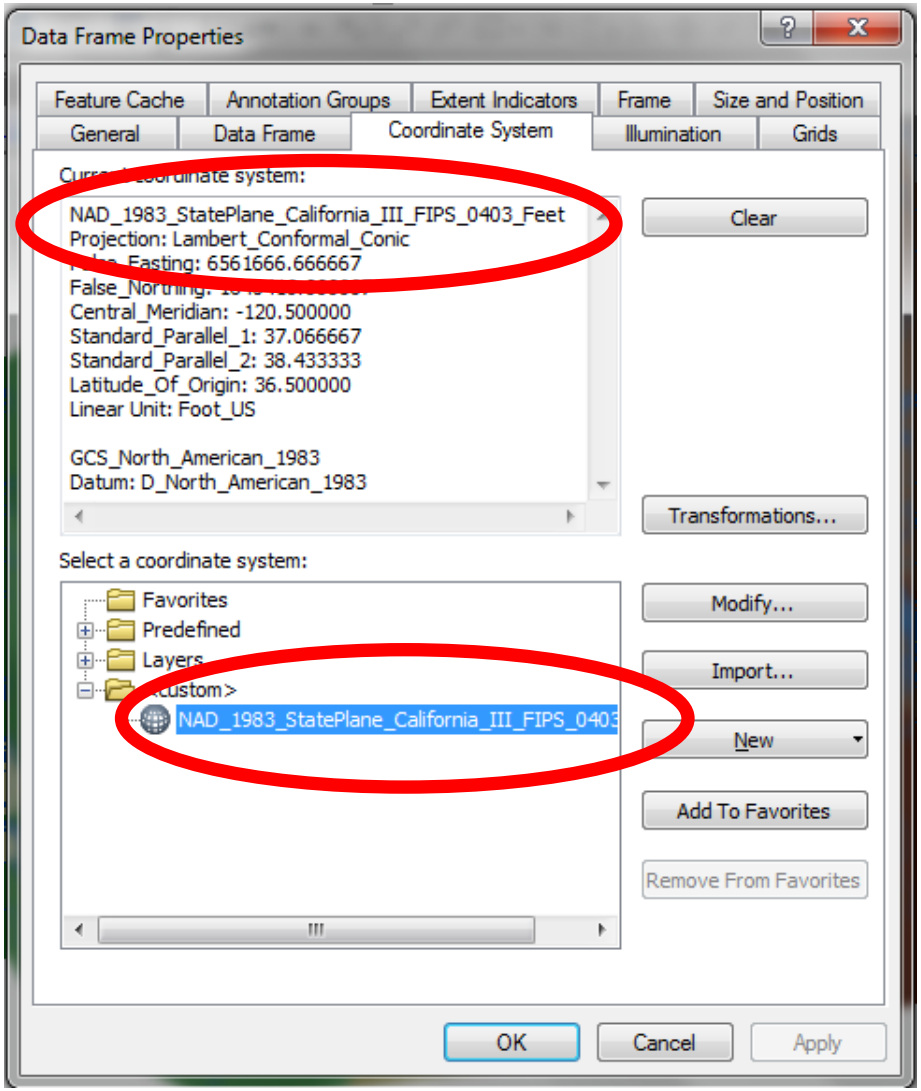
Digital Data Creation

Projections \ Coordinate Systems

- Units
  - Feet
  - Meters

File Management

- File location affects processing time
- File paths are limited to <128 characters with no “wildcard” characters



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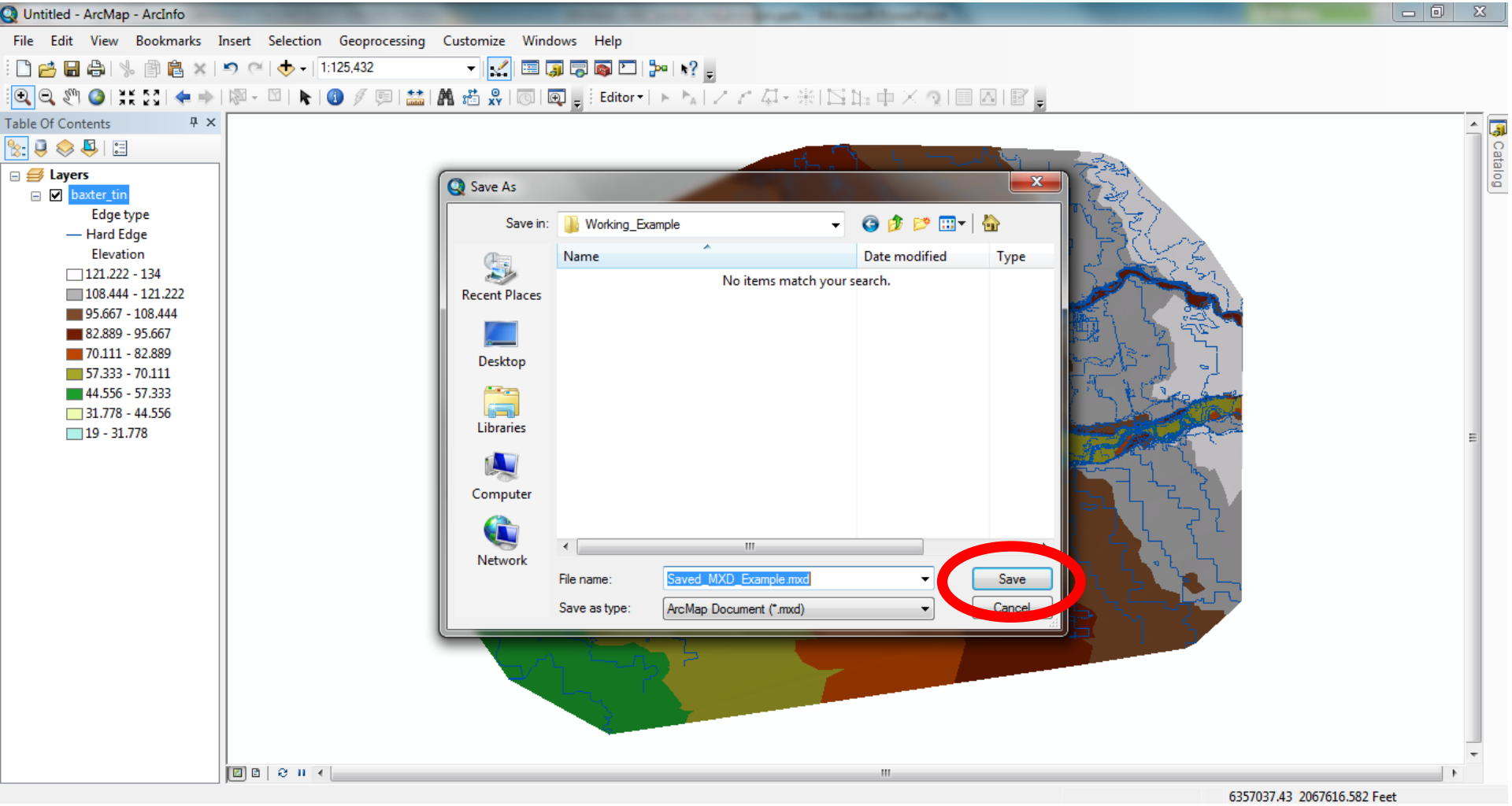
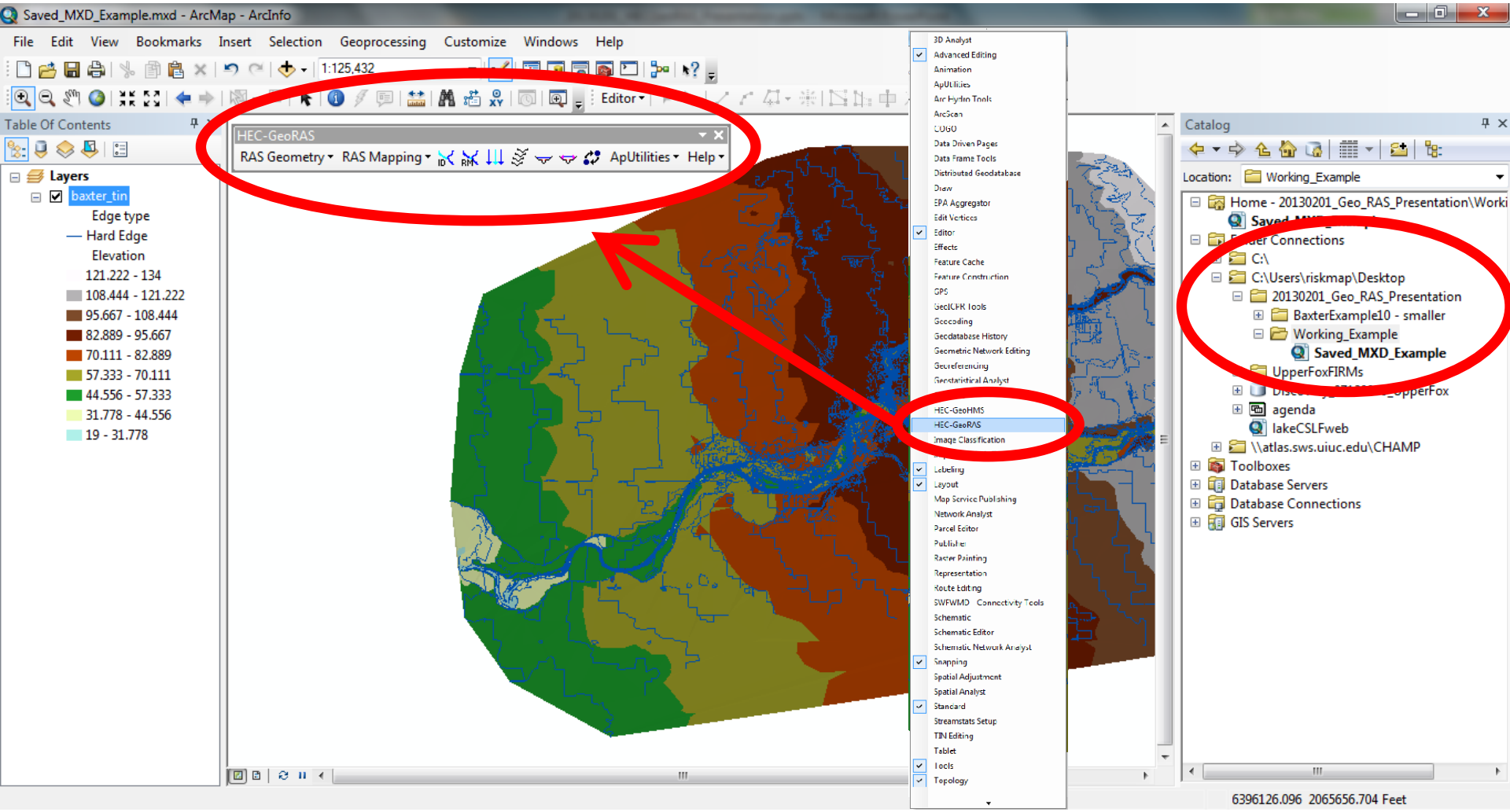
Save MXD – Set File Path



Turn on Hec-GeoRAS Toolbar



HEC Geo-RAS Toolbar

- Create RAS Layers
- Layer Setup
- Stream Centerline Attributes
- XS Cut Line Attributes
- Manning's n Values
- Levees
- Ineffective Flow Areas
- Blocked Obstructions
- Bridges/Culverts
- Inline Structures
- Lateral Structures
- Storage Areas
- Storage Area Connections
- Export RAS data
- Terrain Tiles
- Utilities

- Layer Setup
- Import RAS Data
- Inundation Mapping
- Velocity Mapping
- Ice Mapping
- Shear Stress Mapping
- Stream Power Mapping
- Visualization
- Postprocessing Utilities

Allows the user to assign *River* and *Reach* names to the stream network.

Allows the user to assign station values to a stream endpoint.

Assigns a *LineType* (Left, Channel, Right) value to the Flow Paths feature class.

Generates cross-sectional cut lines perpendicular to a stream centerline at a specified interval.

Interactively plots a selected cross section.

Assigns elevation values to a levee alignment for interpolation.

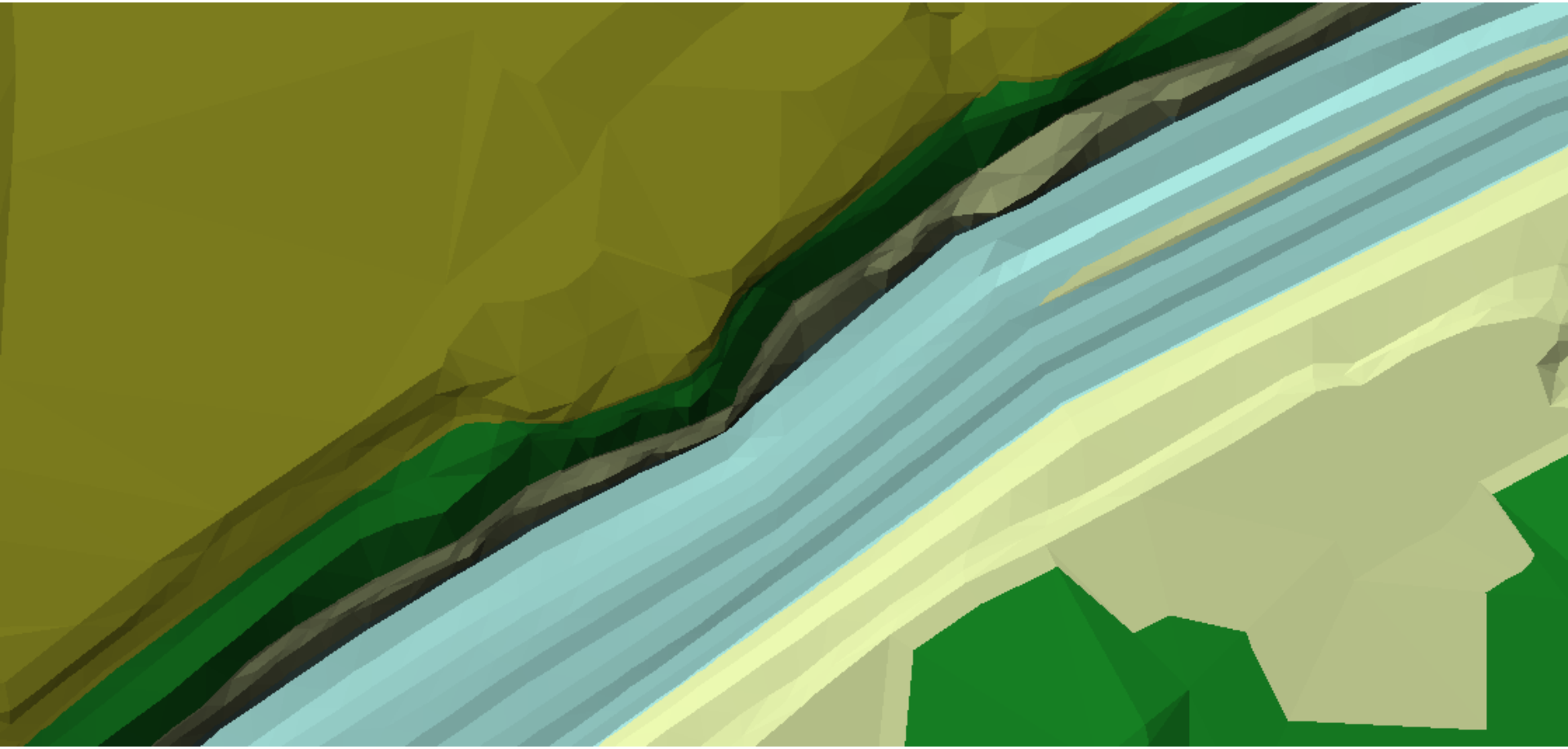
Converts HEC-RAS output in SDF format to XML file. Necessary prior to post-processing RAS results.

Digital Data Creation

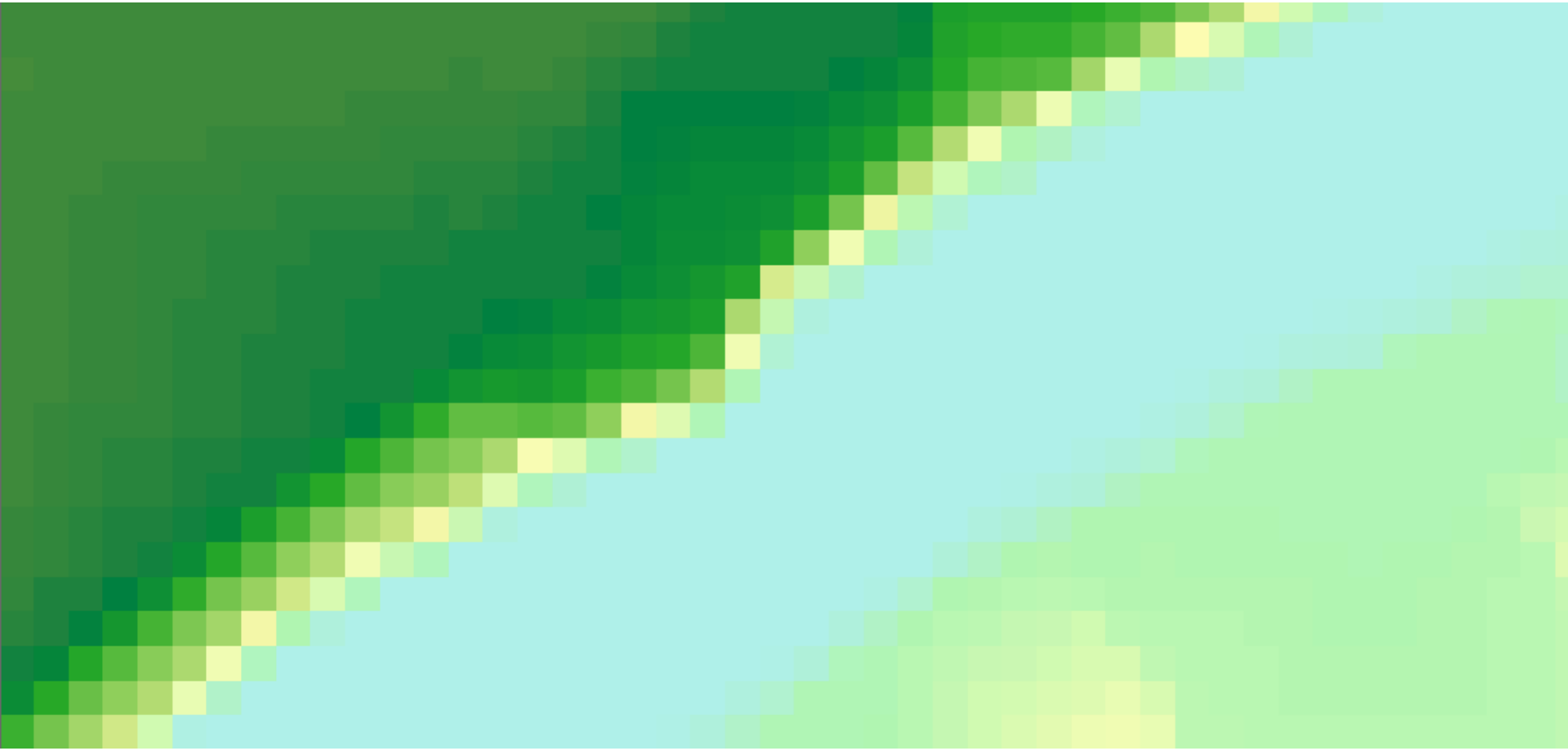
Supported topographic data

- DTM
  - DEM \ GRID
    - Can be tiled to improve processing
  - TIN
    - May allow for faster processing over large areas
    - Should be generated from the LiDAR points
- Survey Points
  - Supplement the DTM within the channel
- Manual Elevations
  - For lateral structures (with interpolation between points), ineffective flow areas, blocked obstructions, levees

TIN



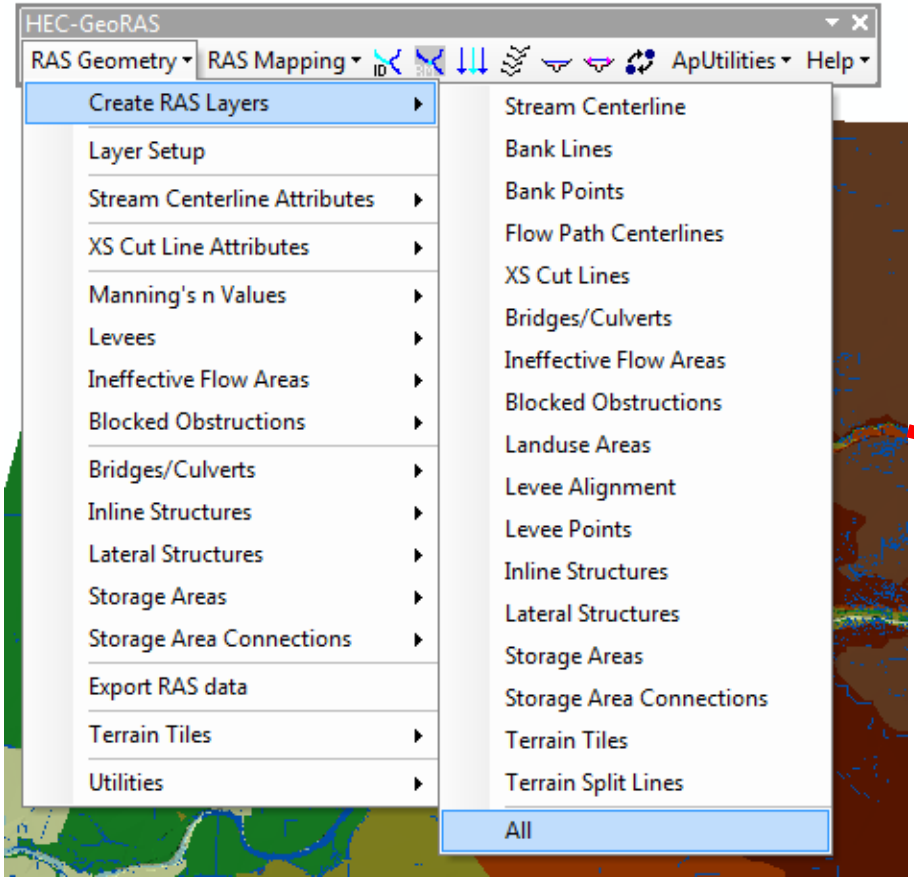
DEM



Orthophoto

Create RAS Layers

"make it if you need it" (walk through) **or** *"all at once"* (this slide only)



And it didn't do anything?!?

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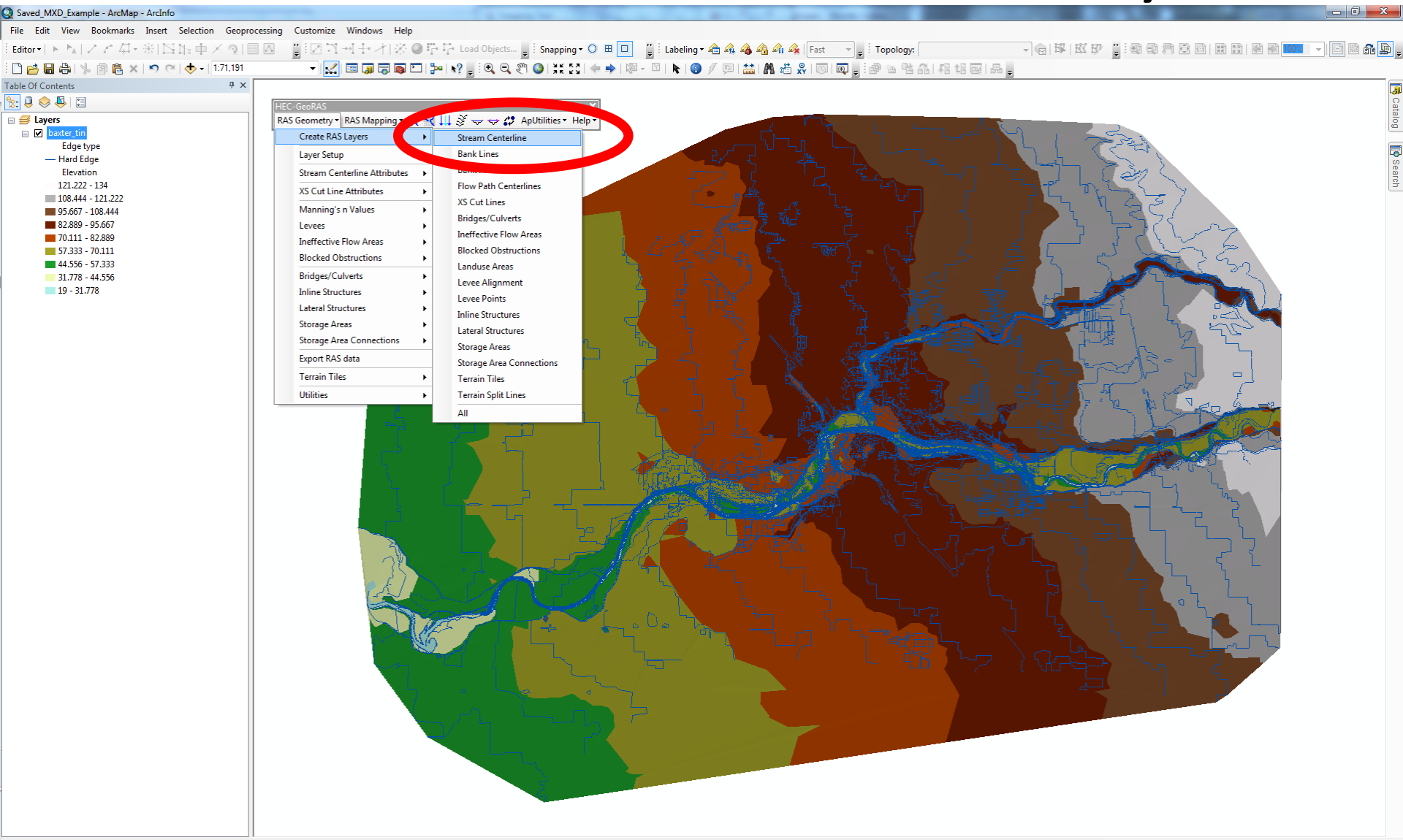
Create Stream Centerline Layer



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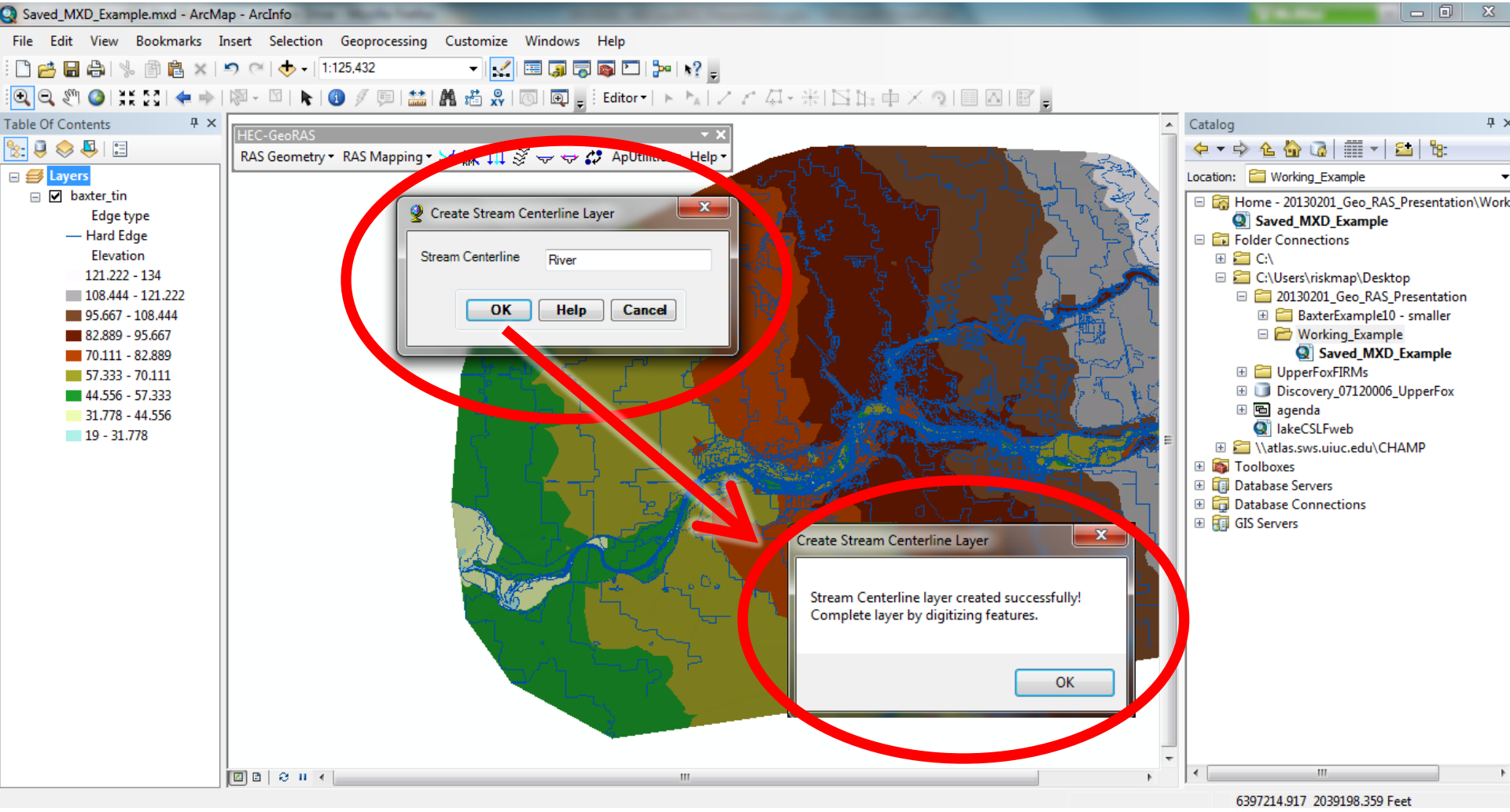
Layer Name and Filepath



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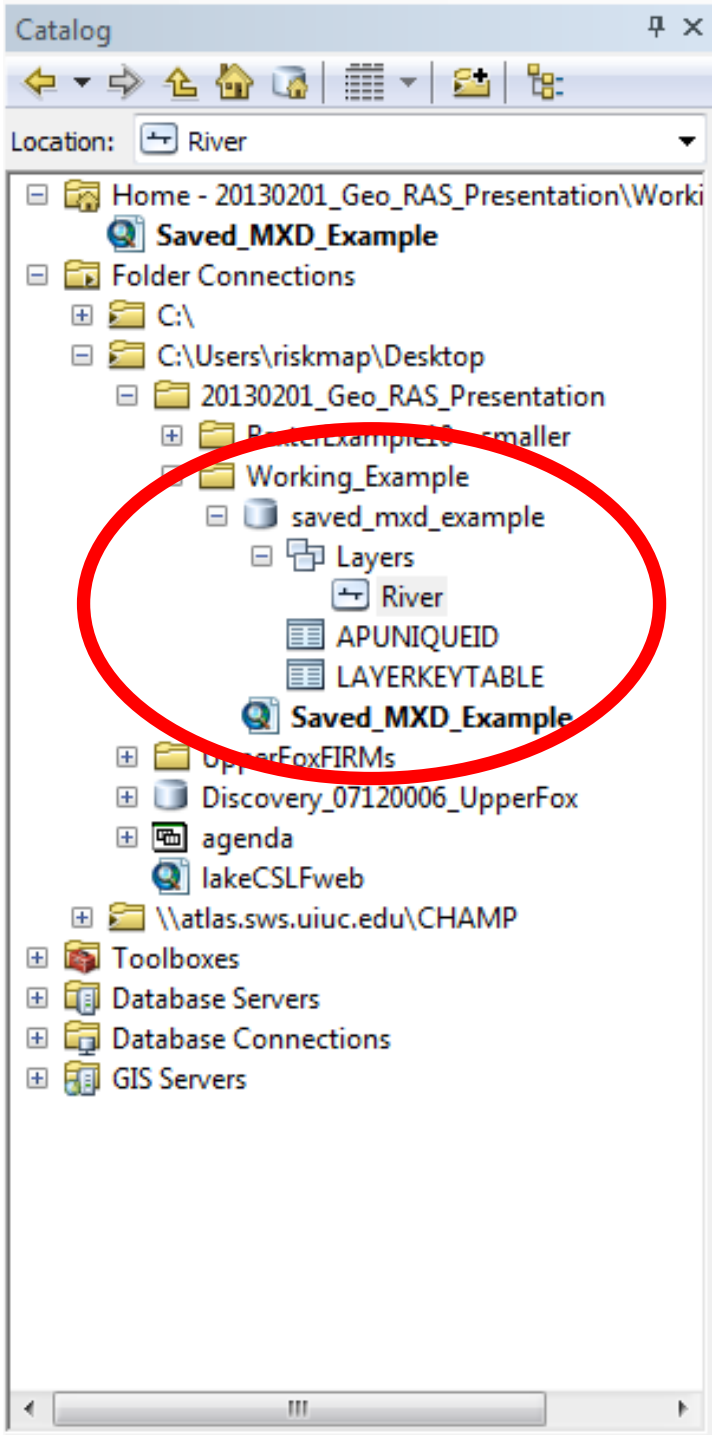

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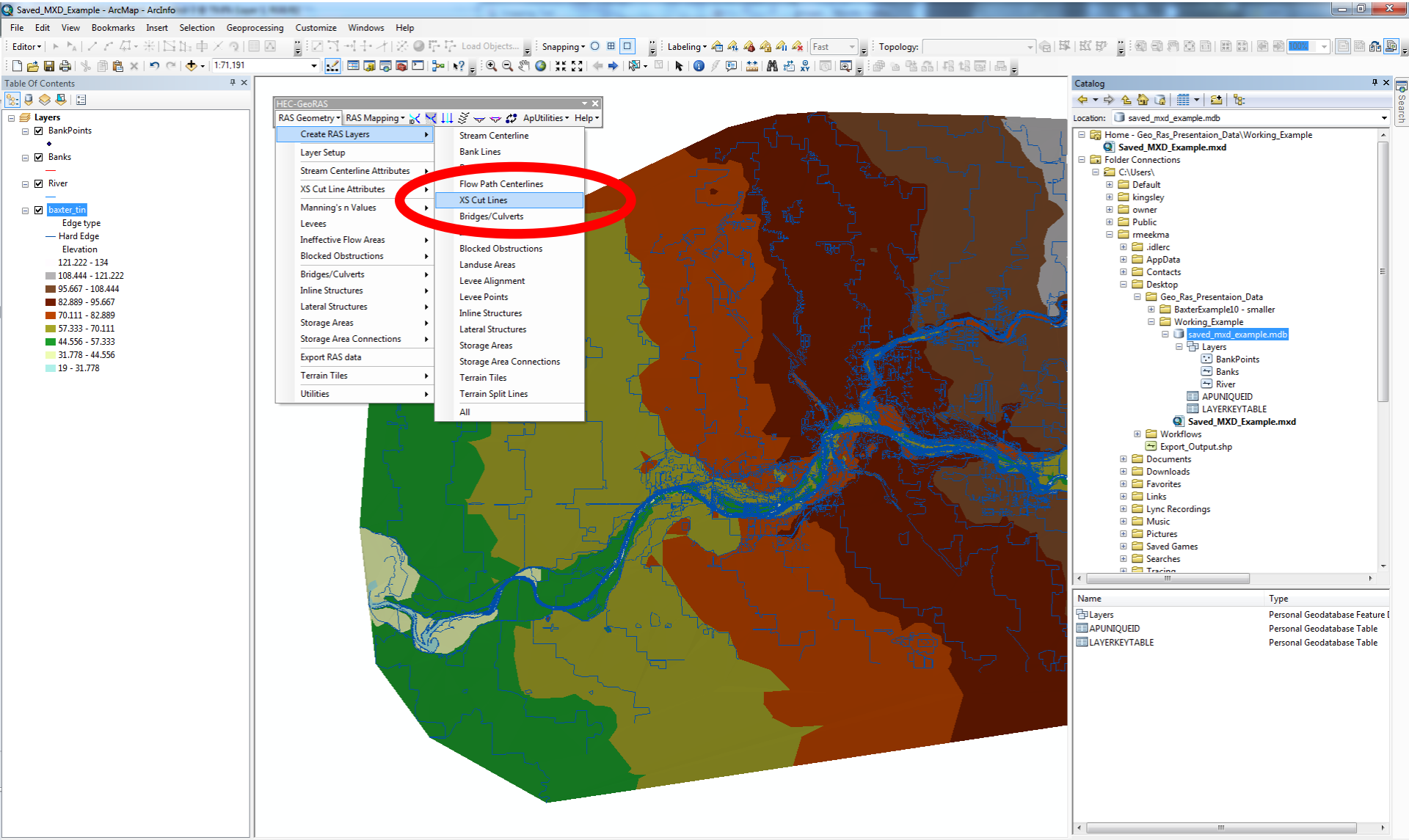
Create XS Cut Lines Layers



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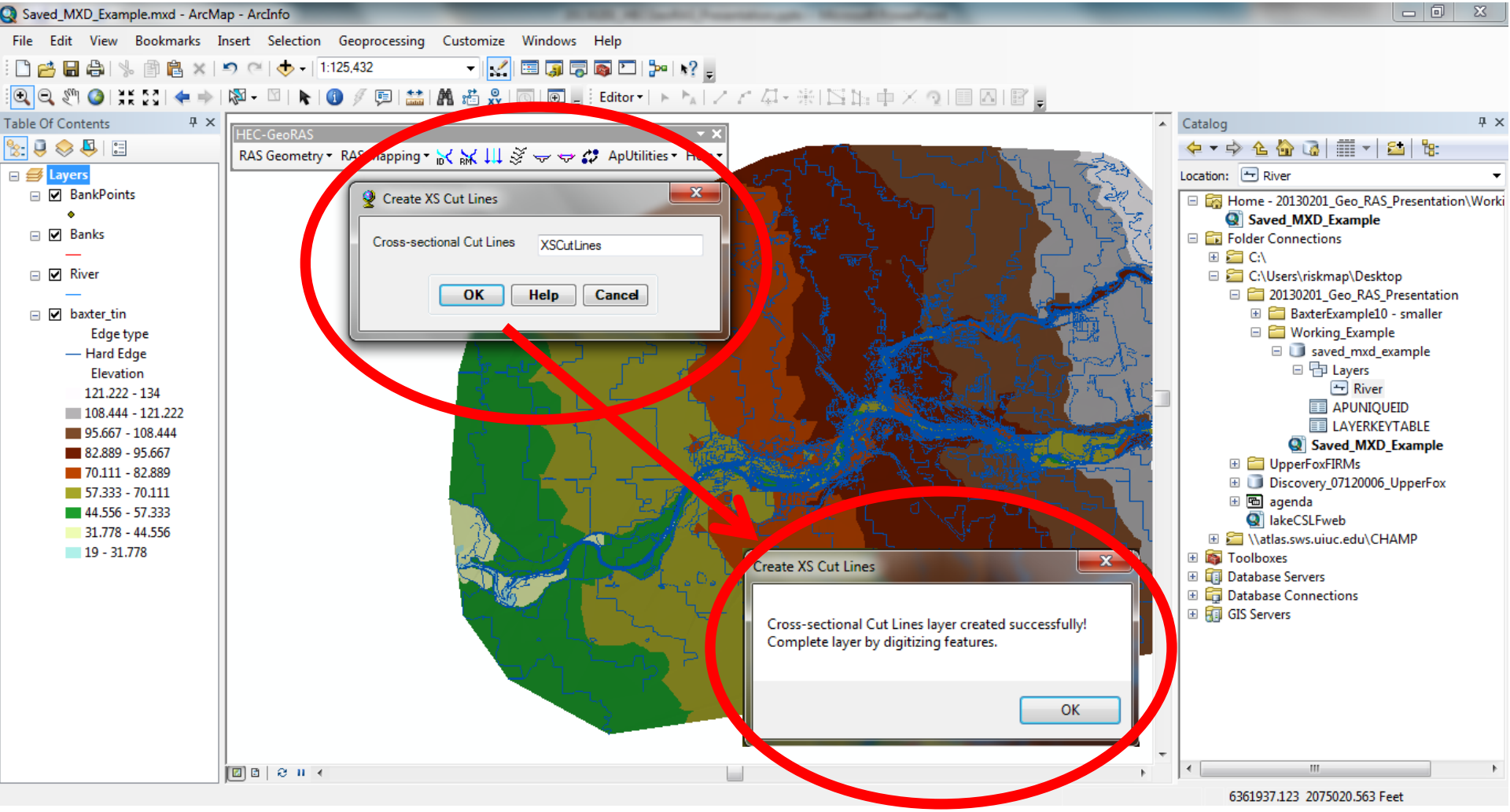
Layer Name and Filepath



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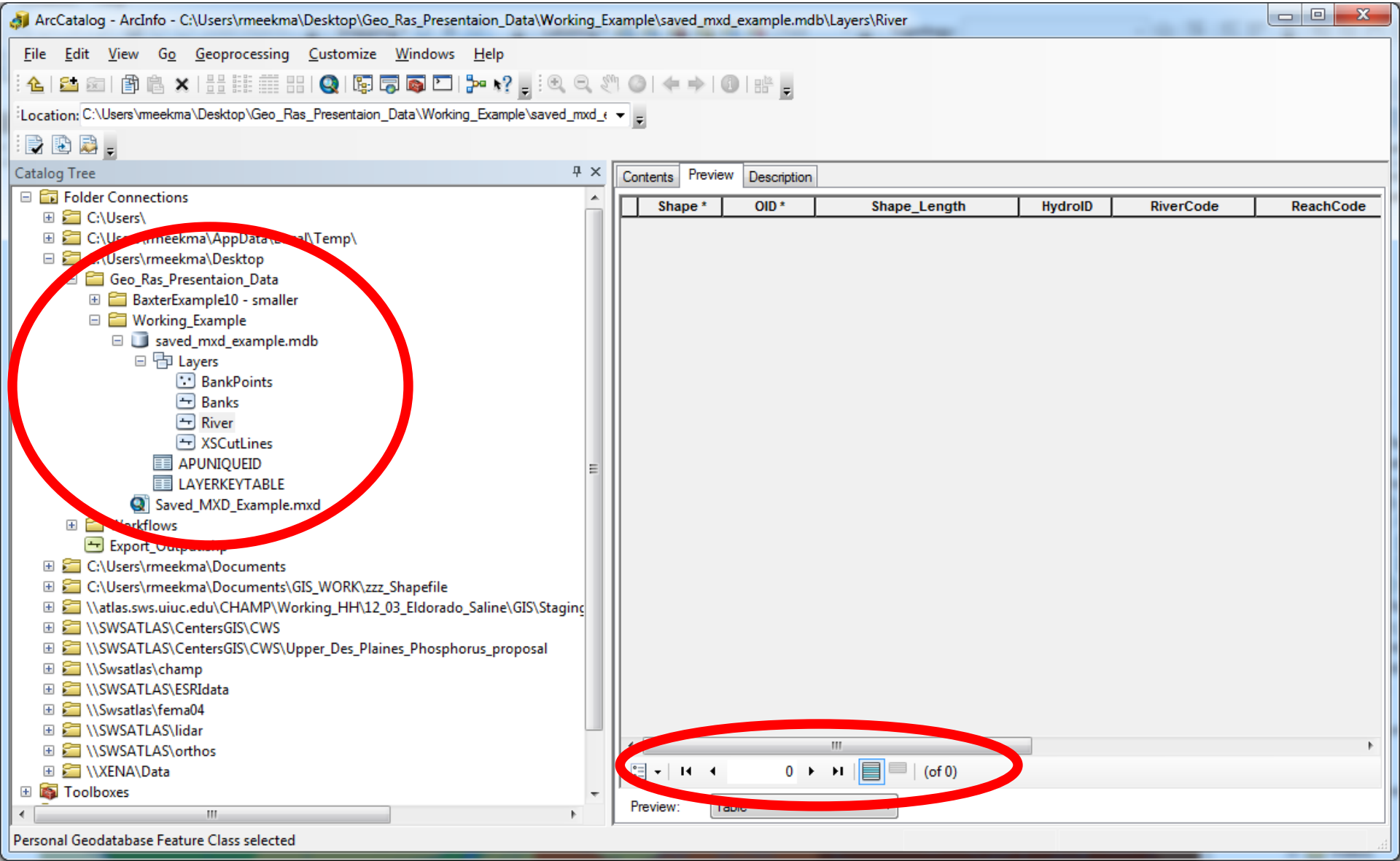
What Have We Created?



Geo-RAS Data Requirements

Minimum Requirements

- **DTM** (single or multiple)
- Stream Centerline
- Cross Section Cut Lines

Tips

Existing Data can be loaded / copied to blank feature classes

Optional Data

- Flow Path Centerlines
- Main Channel Banks
- Land Use (for Manning's n)
- Bridges/Culverts
- Inline Structures
- Levee Alignments
- Ineffective Flow Area
- Lateral Structures
- Storage Areas
- Storage Area Connections

Digital Data Creation

General Editing Rules

- Stream centerlines and flow paths are digitized upstream to downstream
- Cross sections, inline structures, and bridges/culverts are digitized from left to right looking downstream

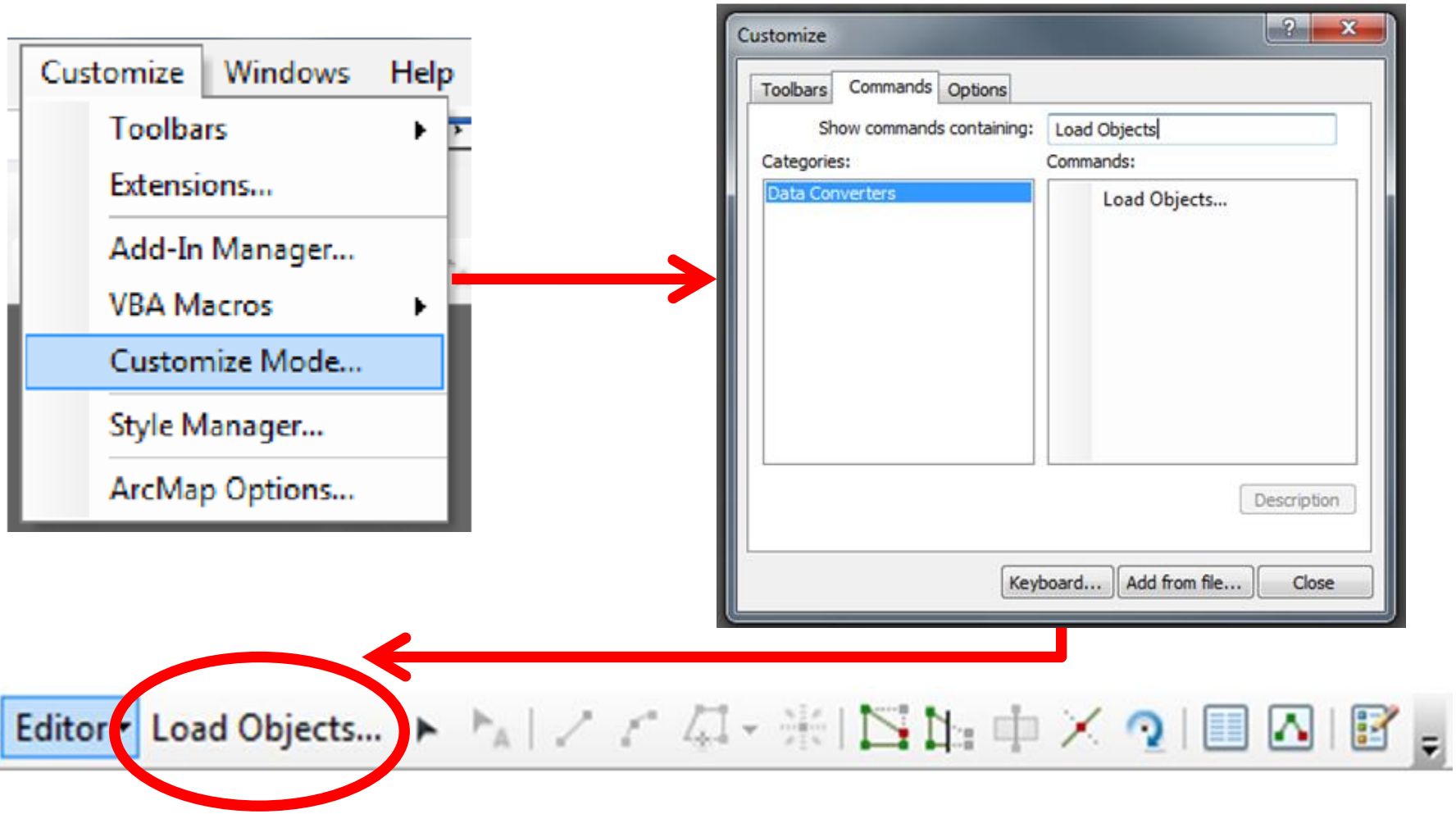
Tips

- Use directional symbology for cross sections and stream centerlines during digitization
  - Layer Properties -> Symbology -> Symbol -> Arrow at End
- Flip reversed cross sections rather that re-digitizing

Developing Stream Centerline

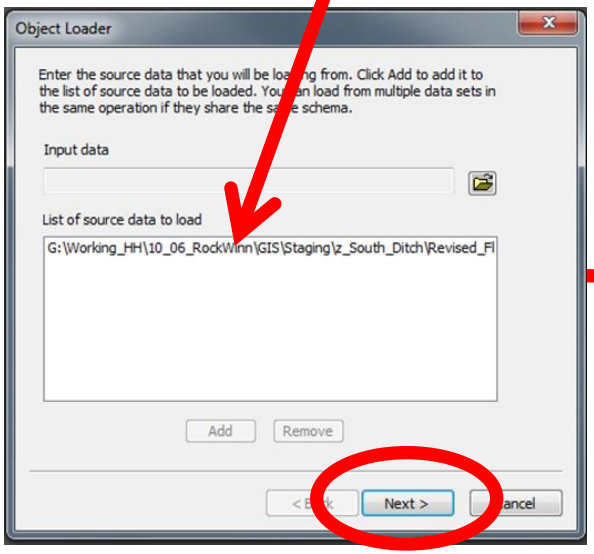
- River stationing is based on the Stream Centerline
  - Use the most up to date aerial photography available to check for development since the most recent orthophotography
  - Ensure agreement between the aerial photography and DTM
- Junctions (aka confluences)
  - Snapping
- River \ Reach naming
- Downstream reach lengths are based on the Flow Path Centerlines (Profile Baseline), which may or may not follow the Stream Centerline for large events

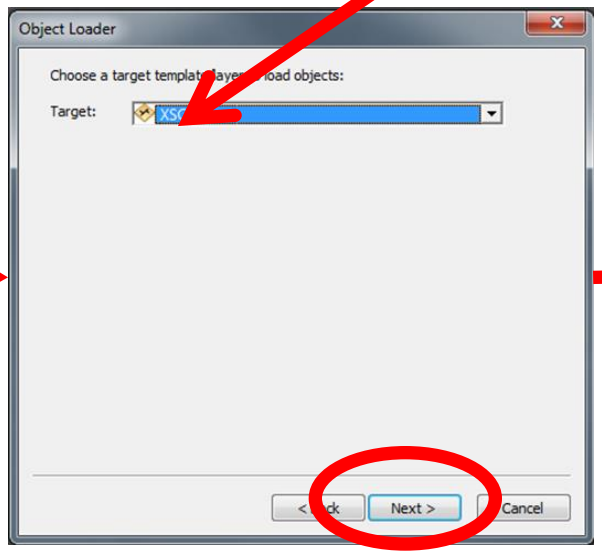
Simple Data Loader

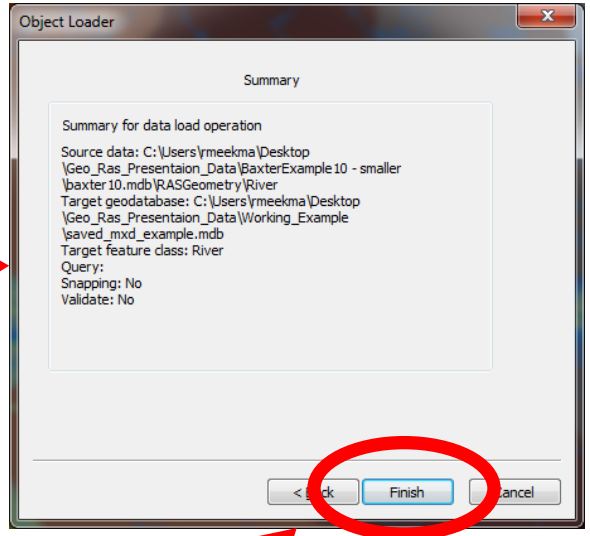


Simple Data Loader

- Start ArcMap Edit session
- Select your “Input data”
- Select your “Target”
  - River







- Object Loader Summary
- & Repeat for other Layers

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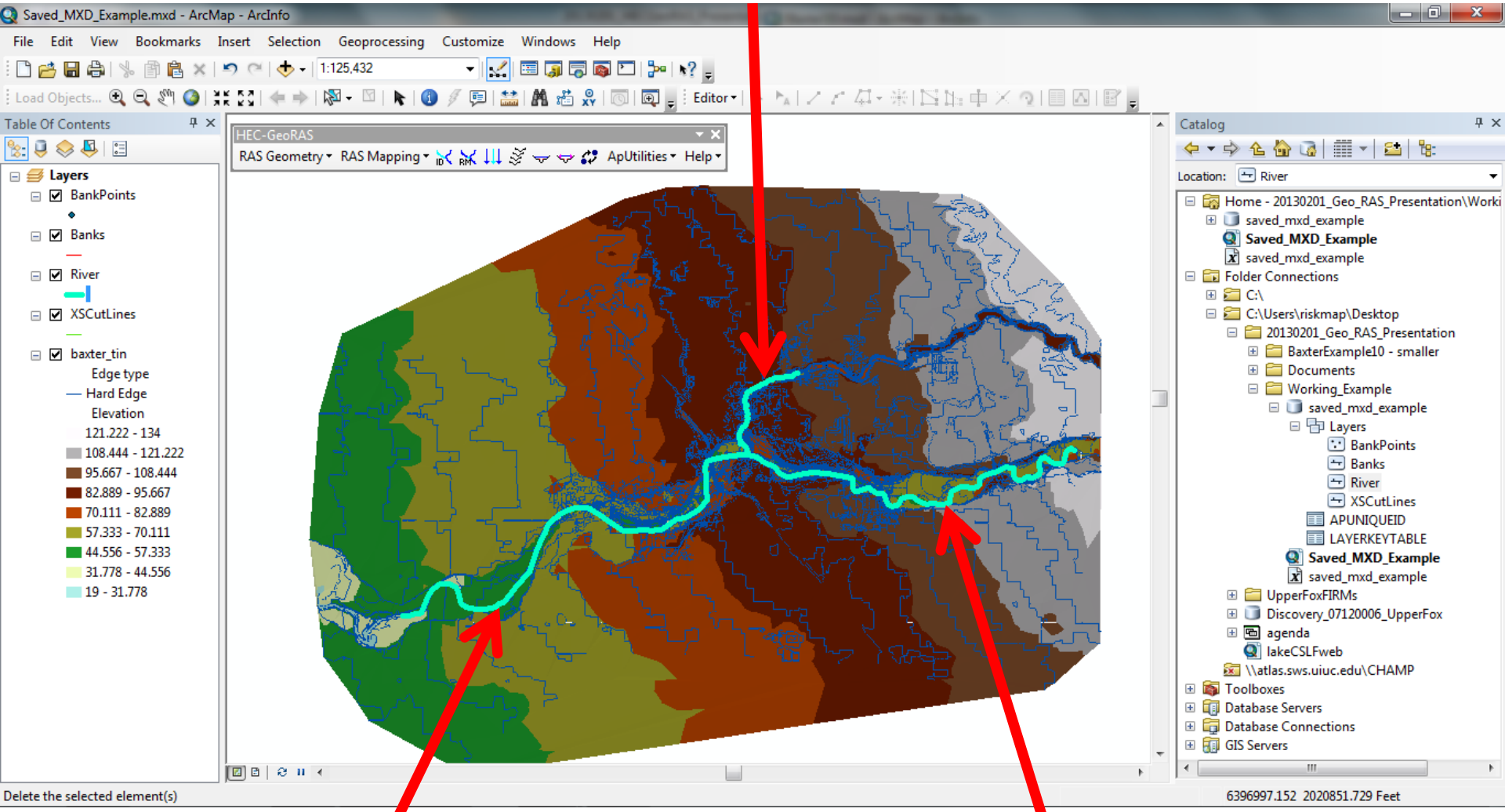
Tule Creek - Tributary



Baxter River – Lower Reach

Baxter River – Upper Reach

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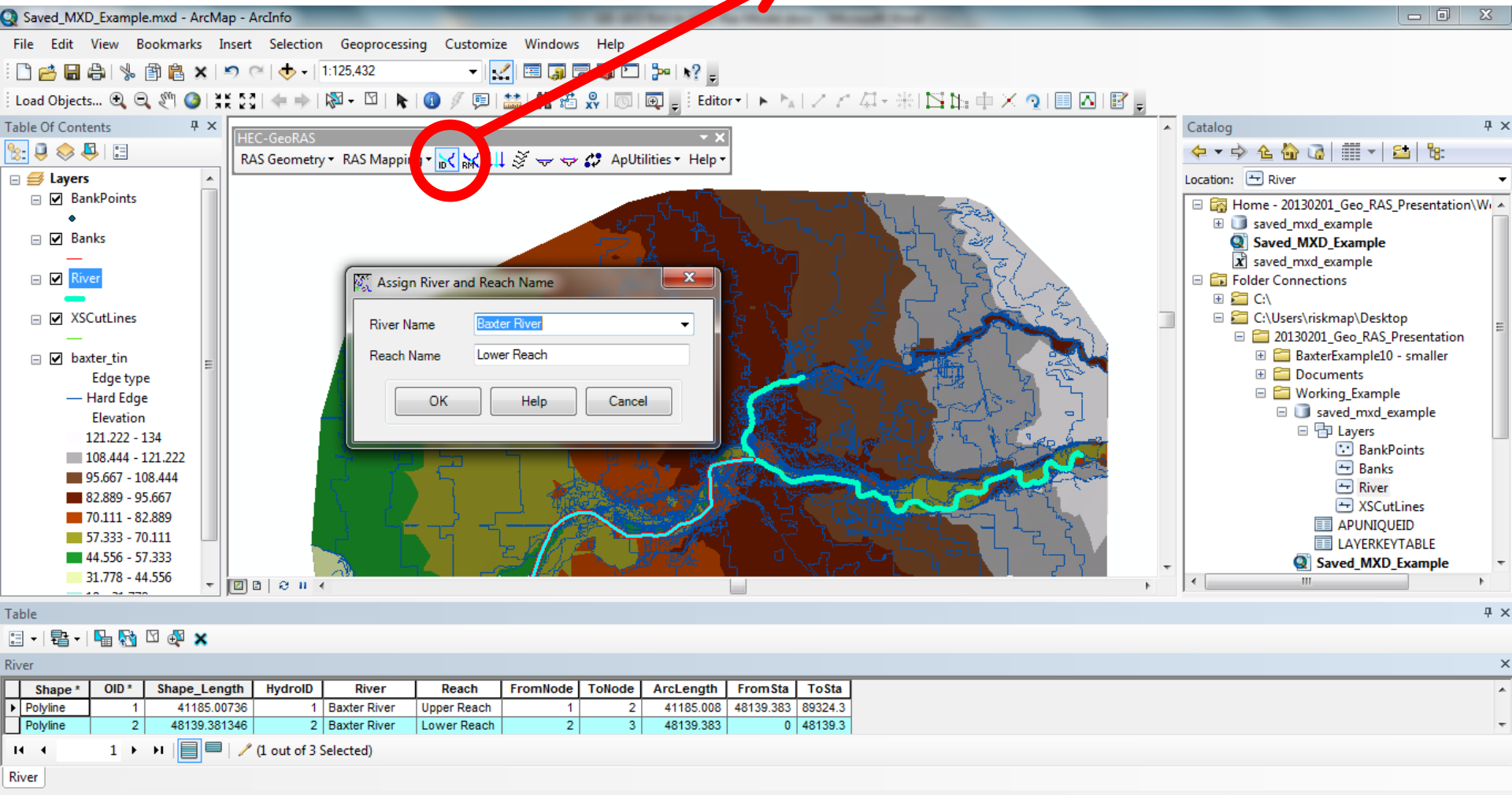
Assign River and Reach Names

- Flow Path ID Icon



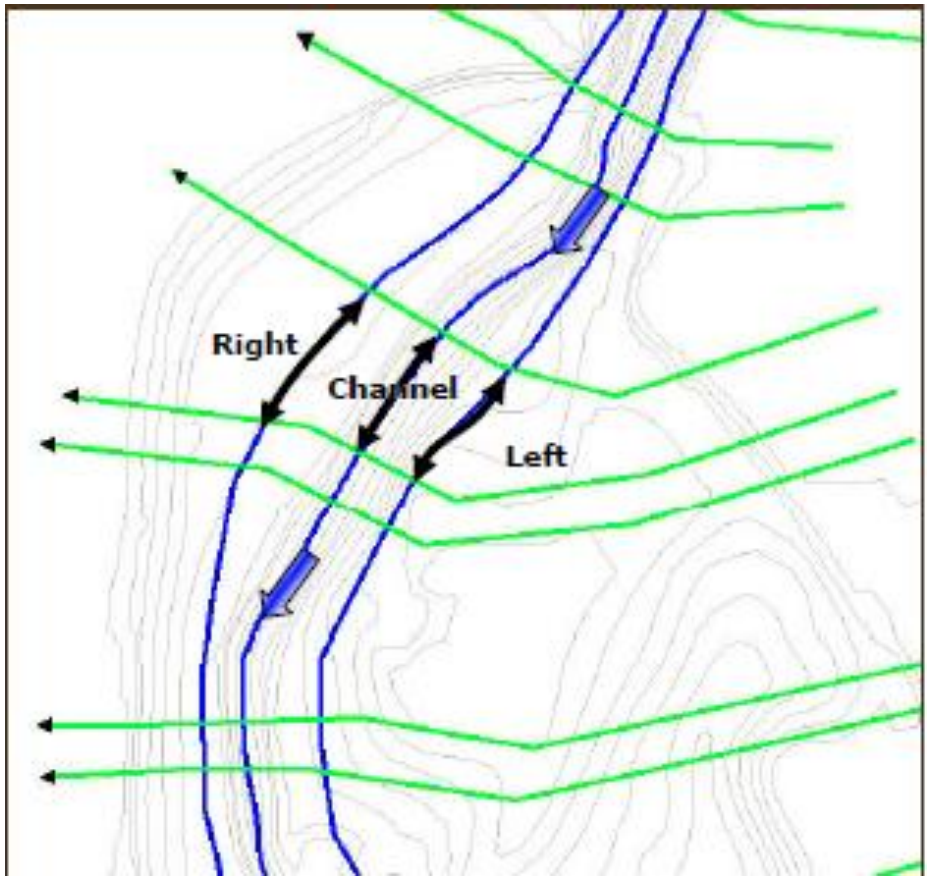
Shape *	OID *	Shape_Length	HydroID	River	Reach	FromNode	ToNode	ArcLength	FromSta	ToSta
Polyline	1	41185.00736	1	Baxter River	Upper Reach	1	2	41185.008	48139.383	89324.3
Polyline	2	48139.381346	2	Baxter River	Lower Reach	2	3	48139.383	0	48139.3

Line Direction and Label

Developing Cross Section Data

Manual Cross Sections

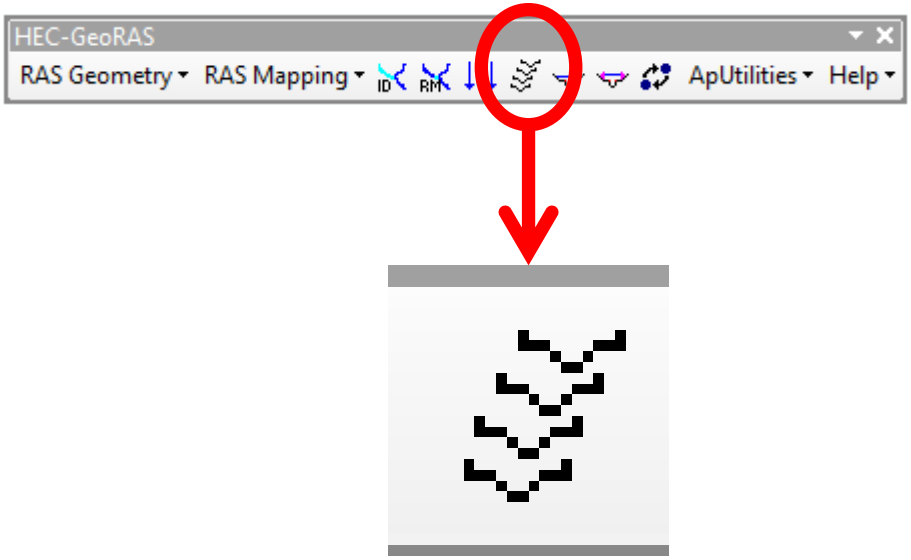
- Digitized left to right looking downstream
- Perpendicular to the direction of flow (cross sections can have bends)
- Must not intersect
- Cross the stream line only once
- Must be contained within DTM
- Can be imported from previously digitized data



Developing Cross Section Data

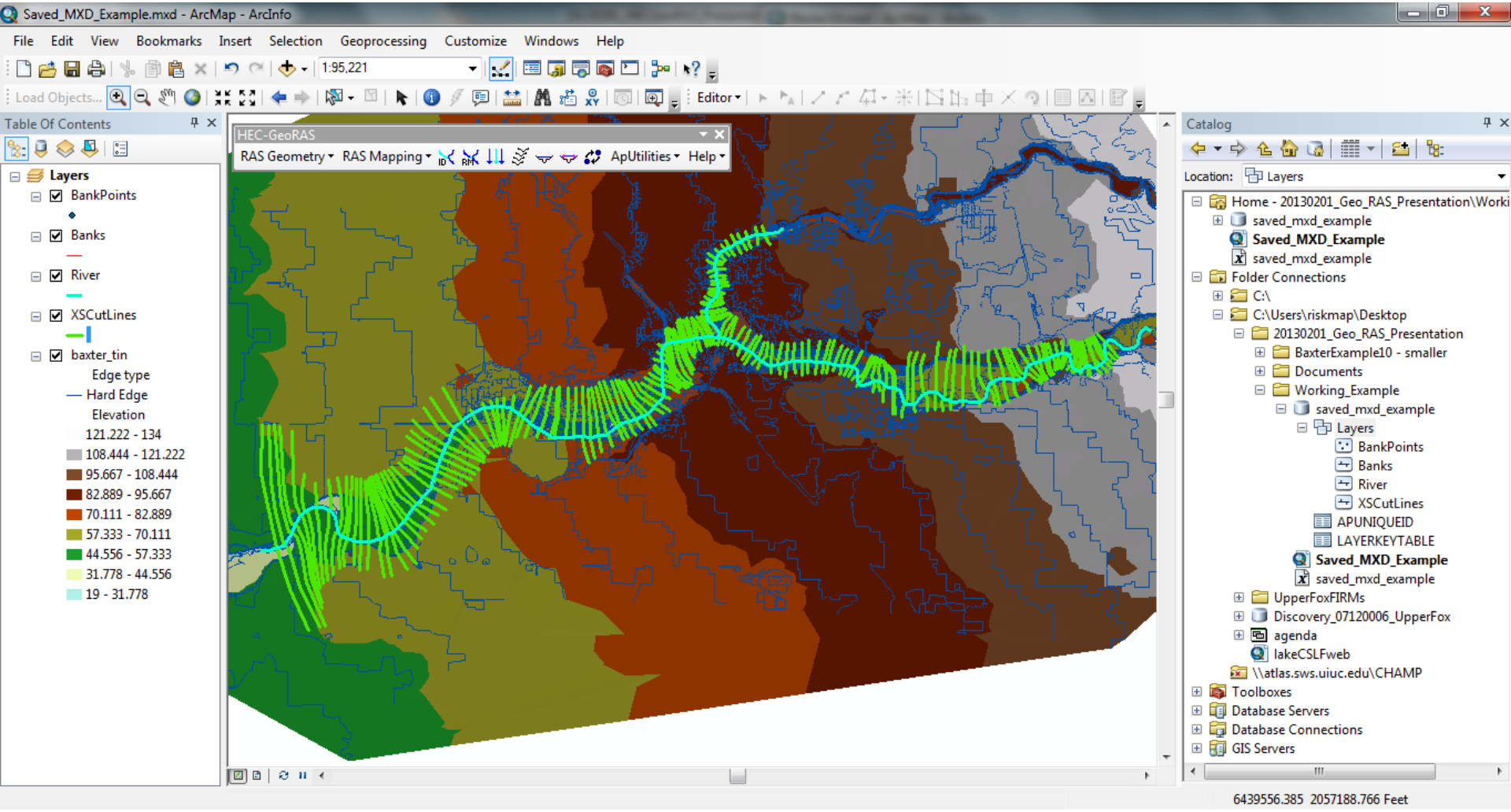
Automated Cross Sections

- Specified interval and width
- Perpendicular to stream centerline
- "This is NOT the preferred method and should be used with caution because the lines are not generated following the guidelines necessary for modeling one-dimensional flow." - *HEC-GeoRAS User's Manual v10*



Load Cross Sections

(using simple data loader, same process as Stream Centerline)



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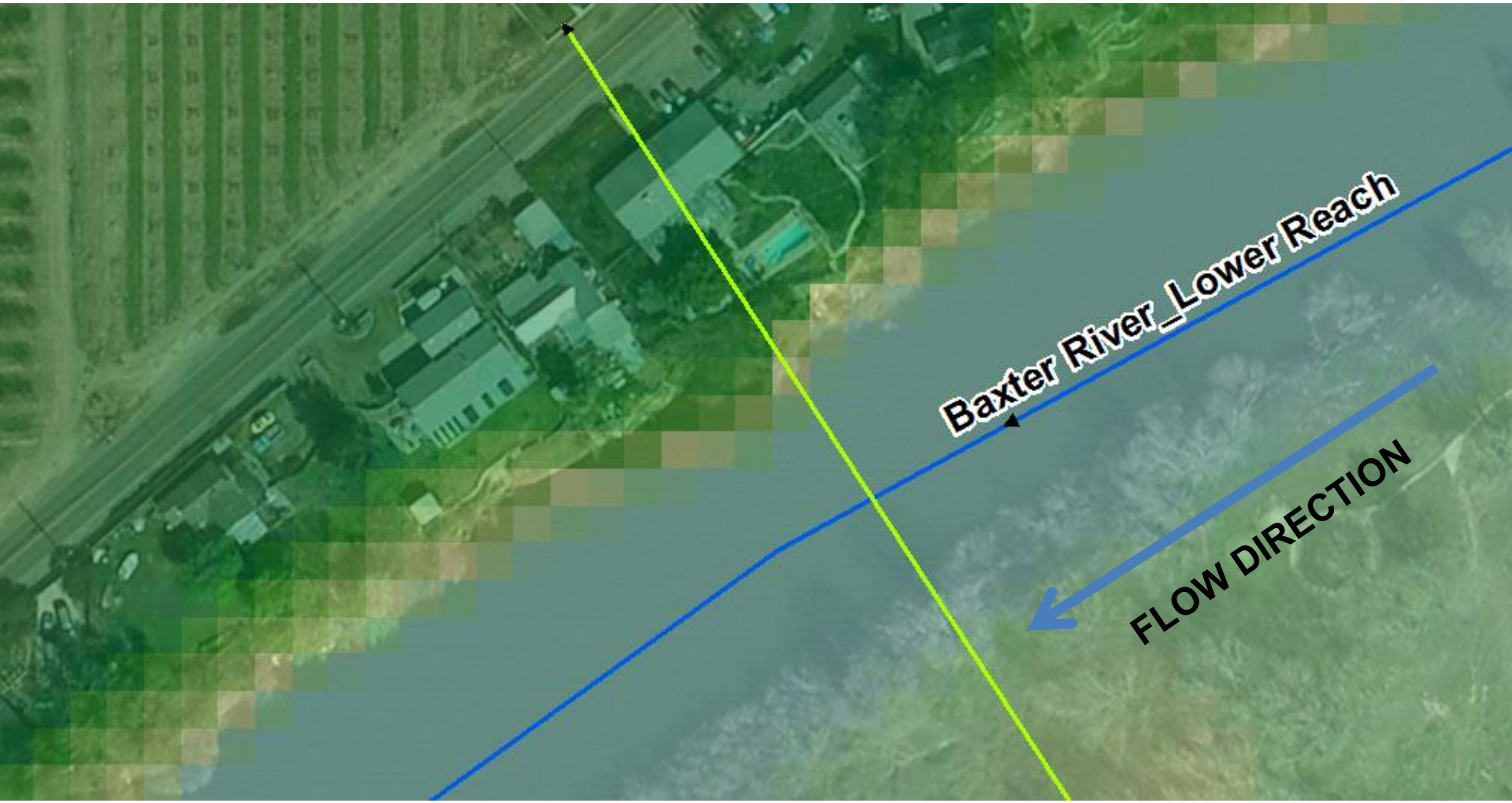
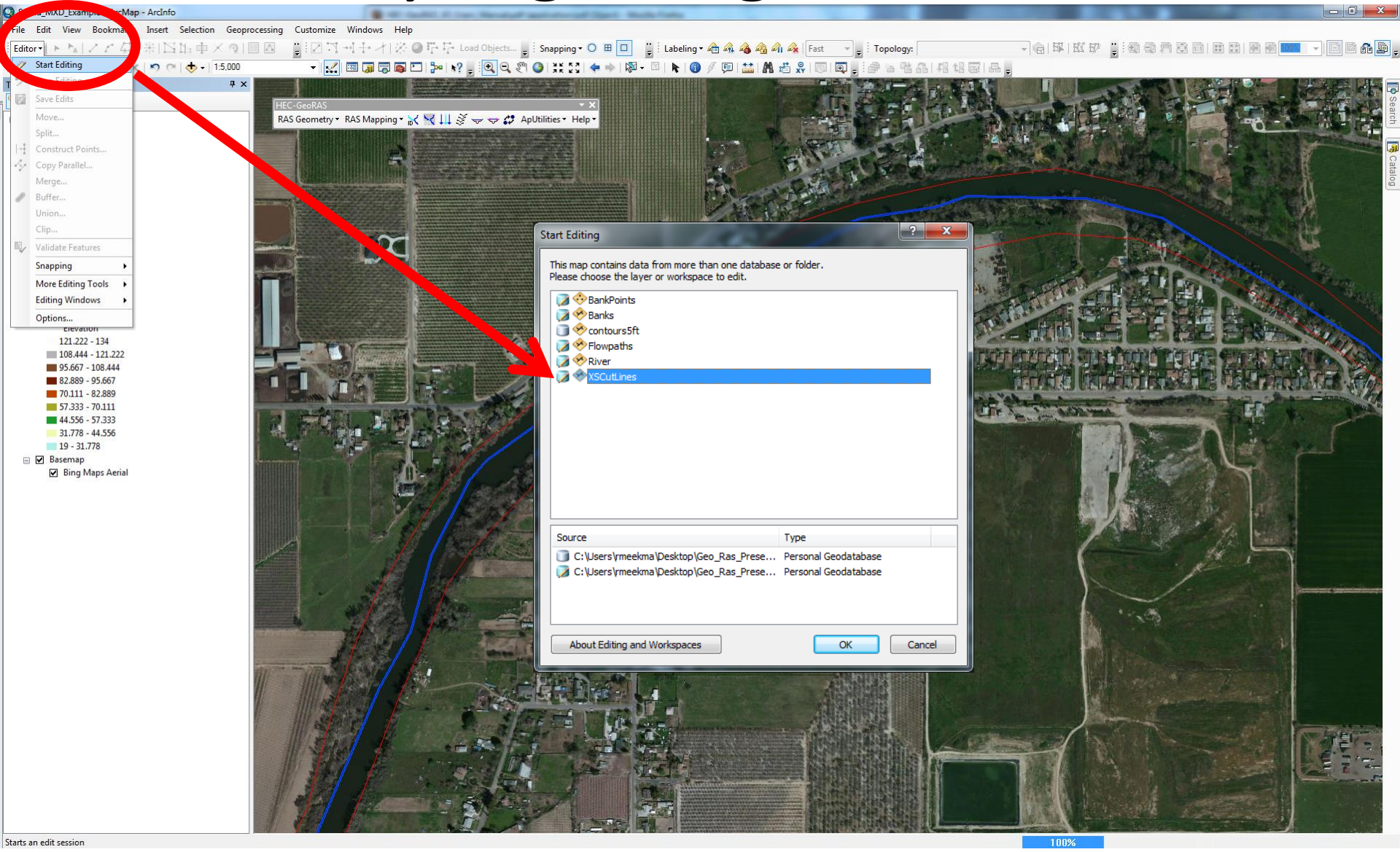
Line Direction and Label



- NOTE: XS has not been attributed yet

Manually Digitizing Cross Sections



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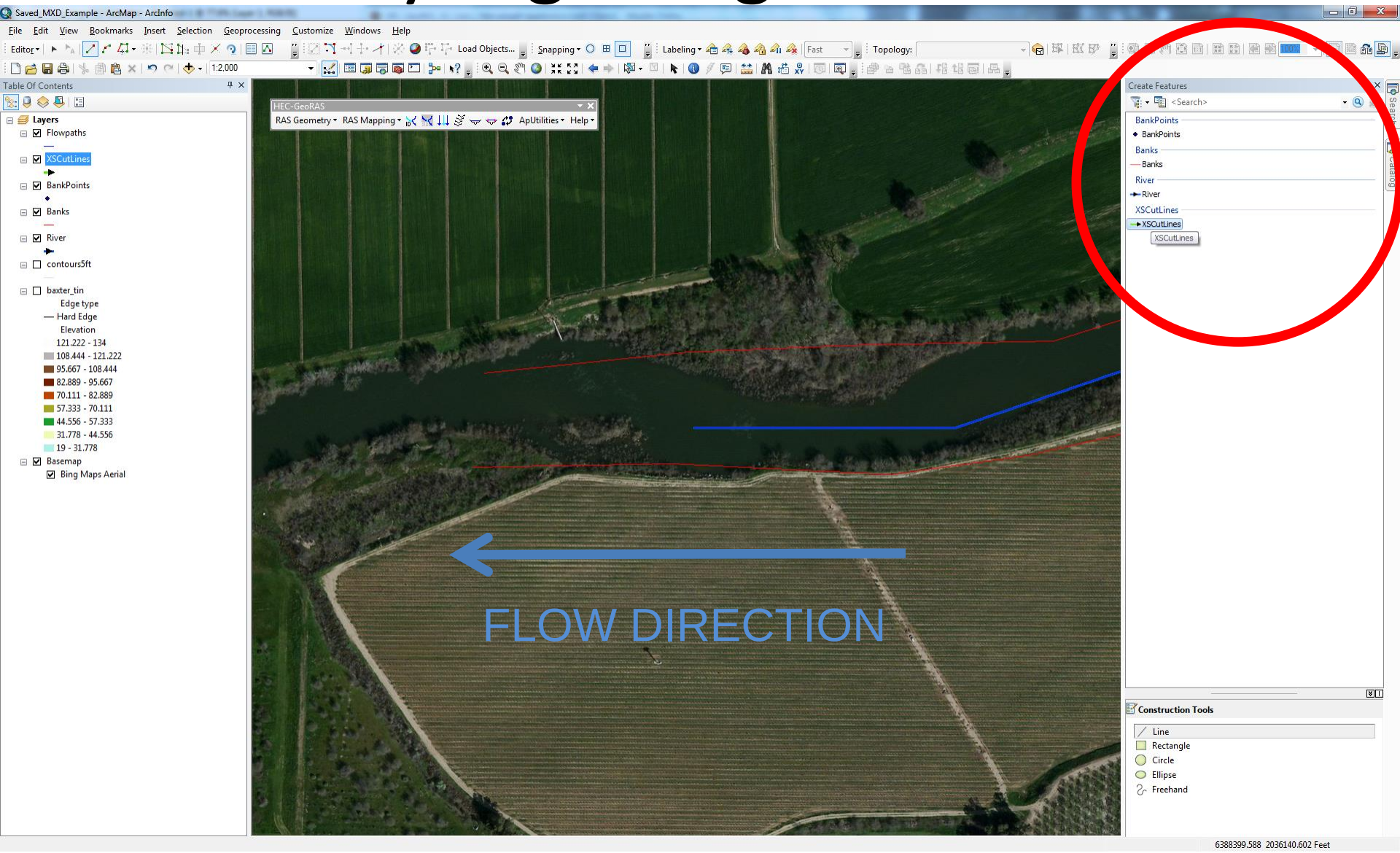
- Begin Edit Session
- Choose Layer to Edit

Manually Digitizing Cross Sections



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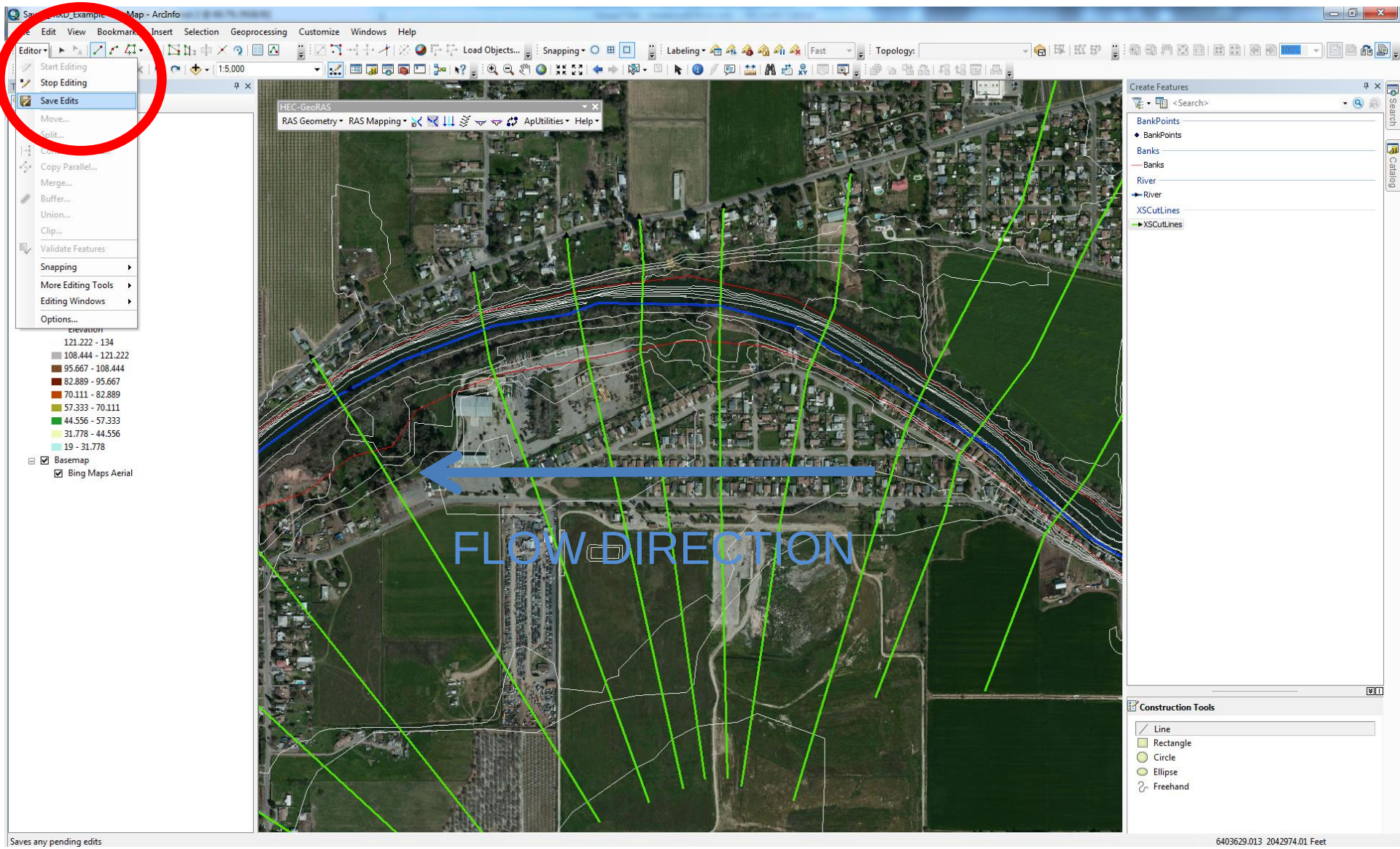
- Click on XSCutlines
- Begin Digitizing

Manually Digitizing Cross Sections



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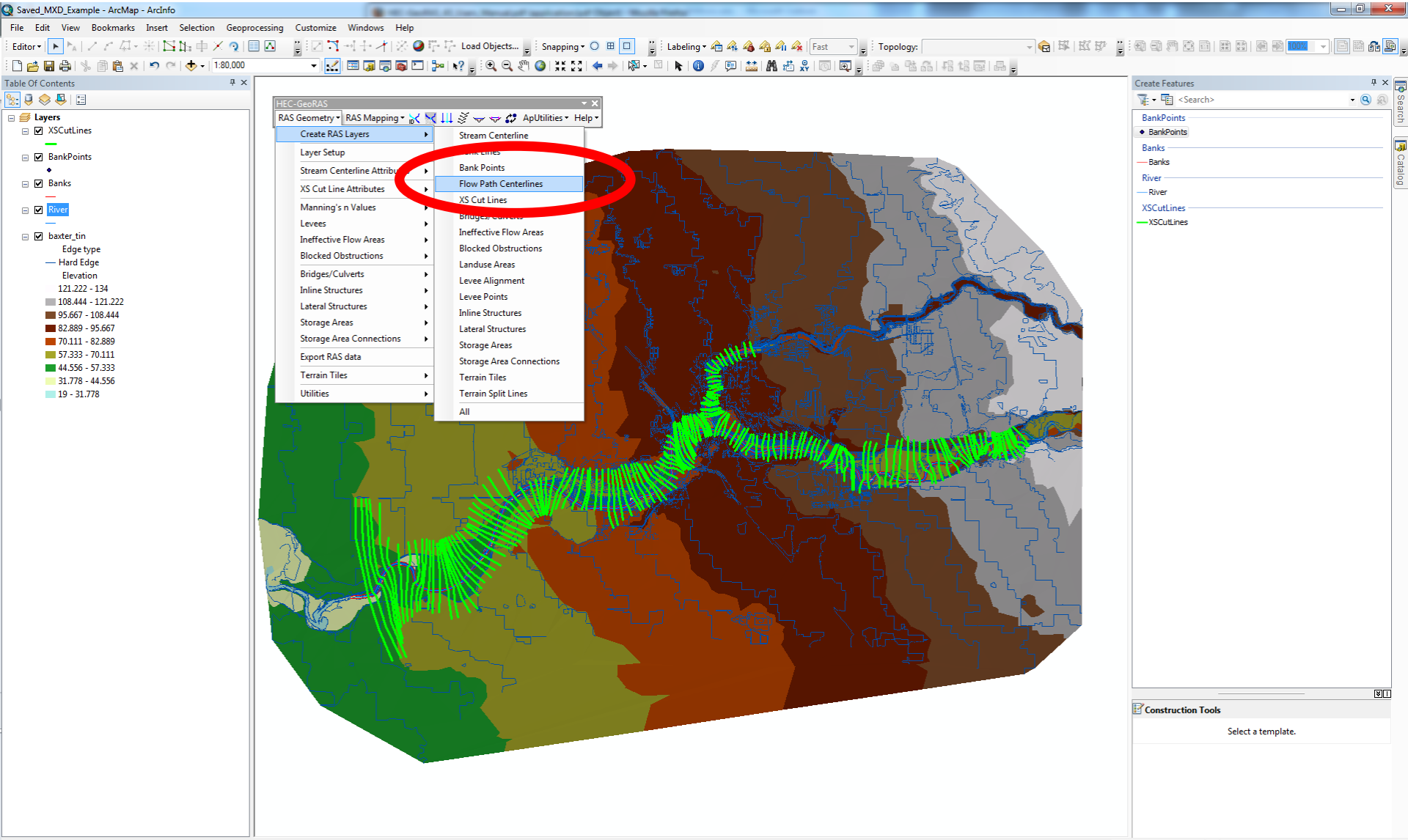
- Double Click to End Sketch
- Save Edits

Developing Flow Path Centerlines

(optional … sort of)

- Necessary for downstream reach length extraction
- May specify either:
  - Main channel flow path
  - Main channel, left overbank, right overbank flow paths
- **Main channel flow path may utilize stream centerline**
- Consider the flow path over the range of discharges to be modeled

Create Flow Path



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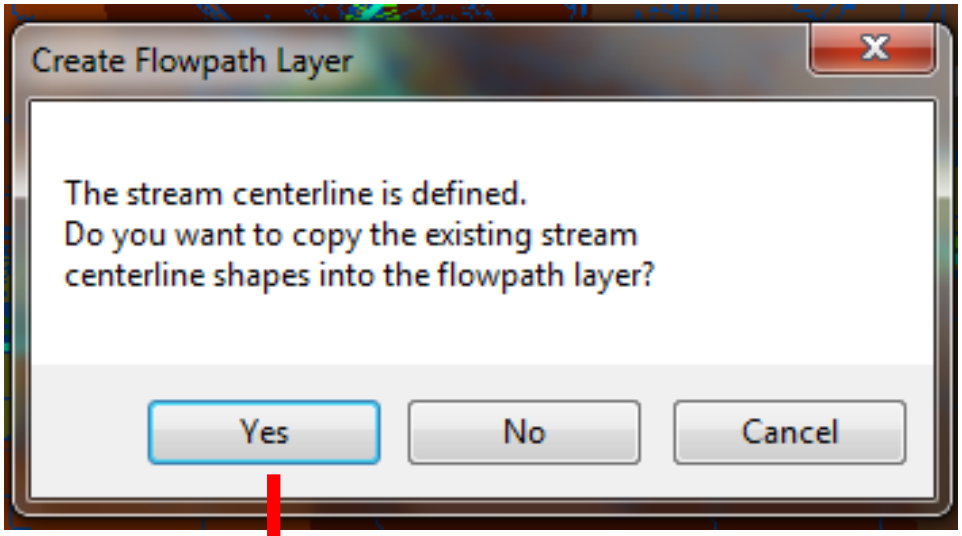
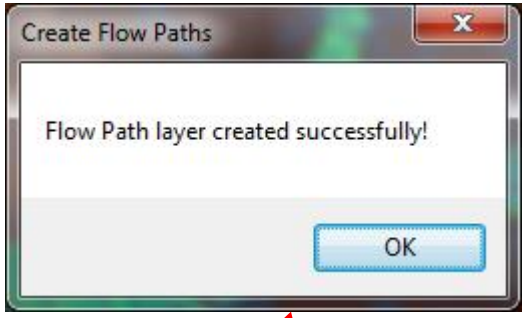
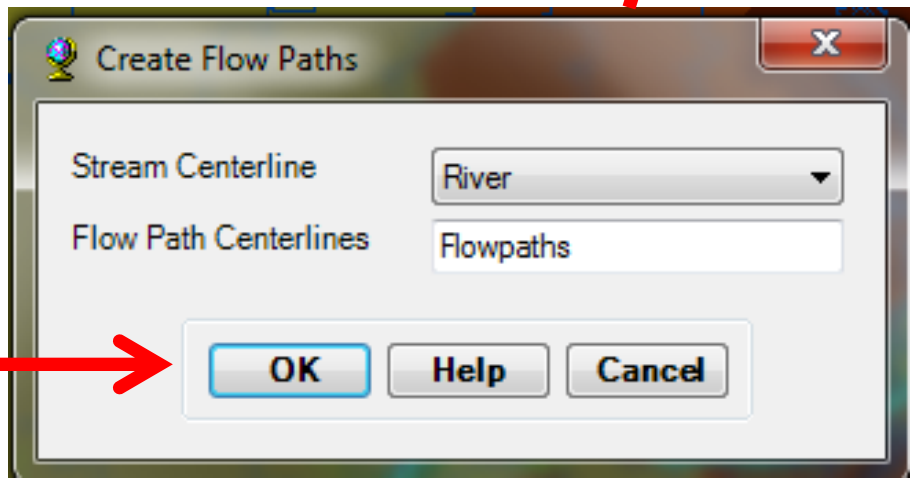
Flow Path Layer







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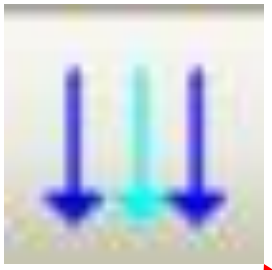
Select Flowpath & Linetype button

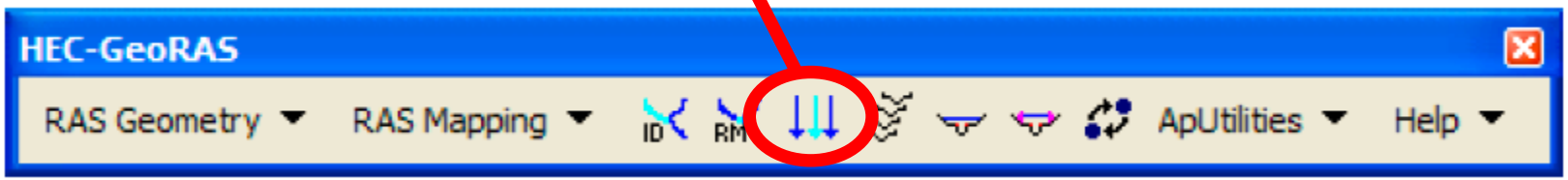
Types of Flowpaths

- Three types of lines
  - Centerline
  - Left overbank
  - Right overbank

Flowpath Usage

- Defines the downstream reach lengths between cross-sections in the main channel and over bank areas





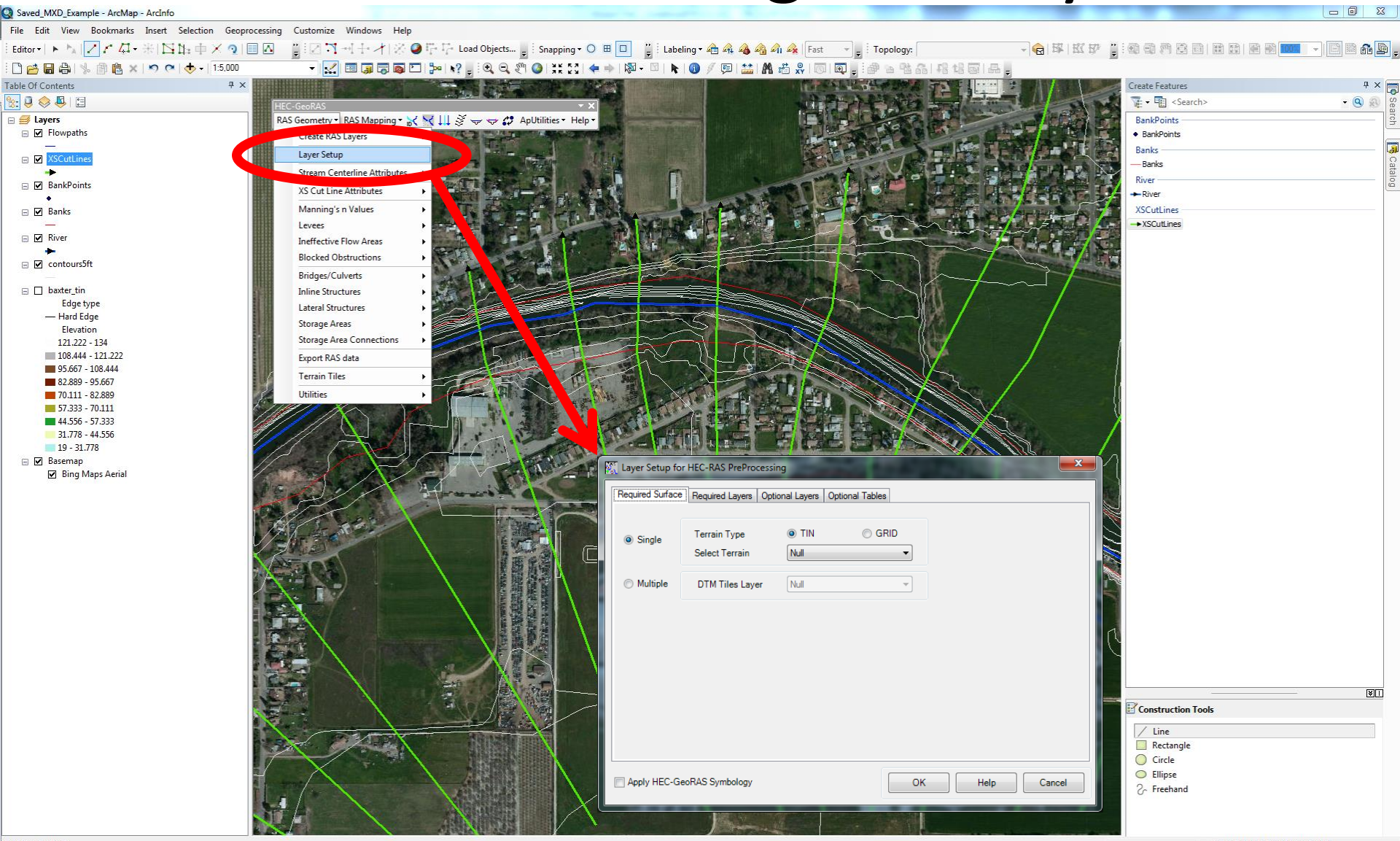
Developing Channel Bank Data

(optional)

Bank Lines = RED **Bank Points = YELLOW**

(Bank points are created where bank lines intersect cross section line)

Finished Creating RAS Layers



- Layer Setup

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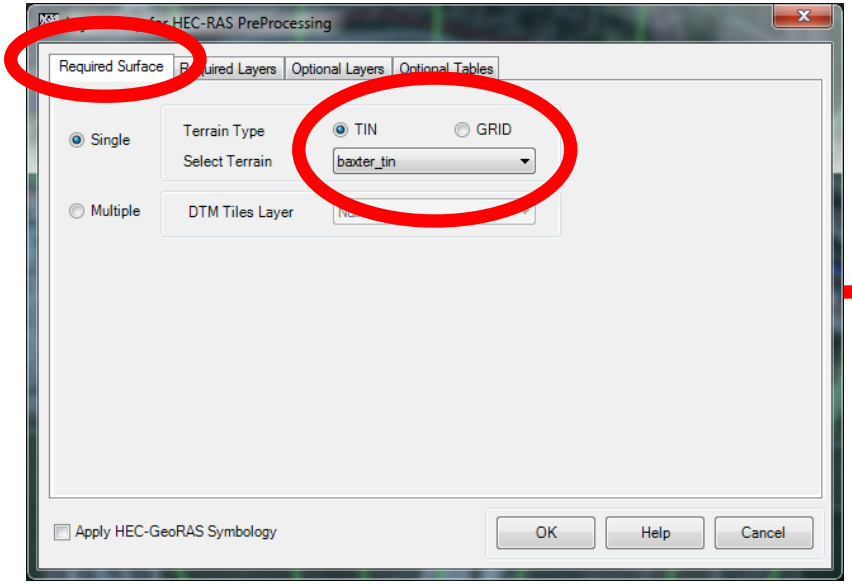
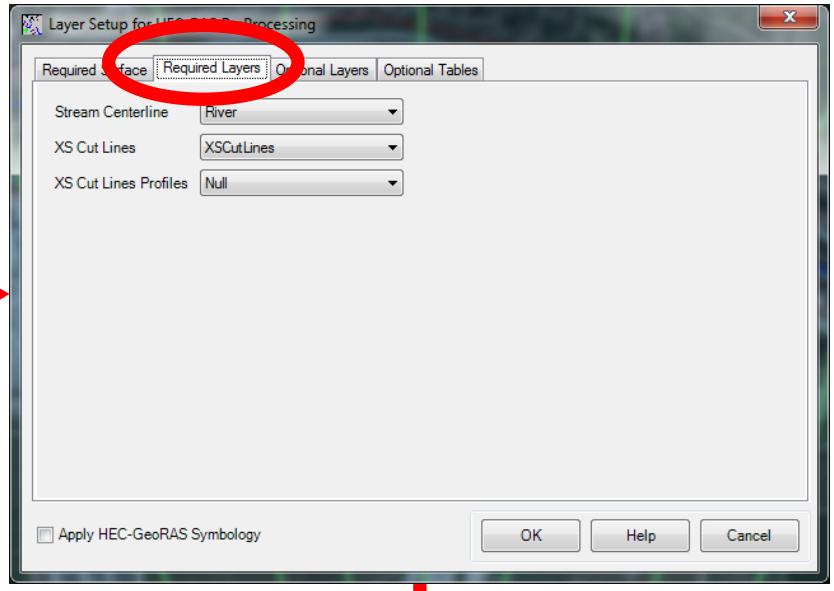
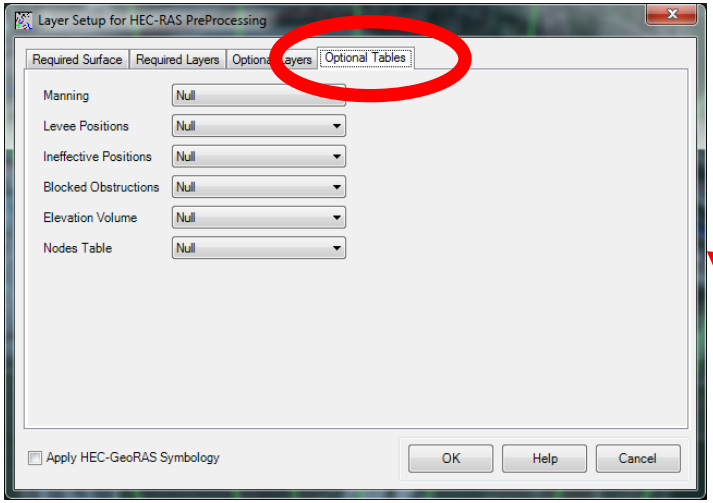
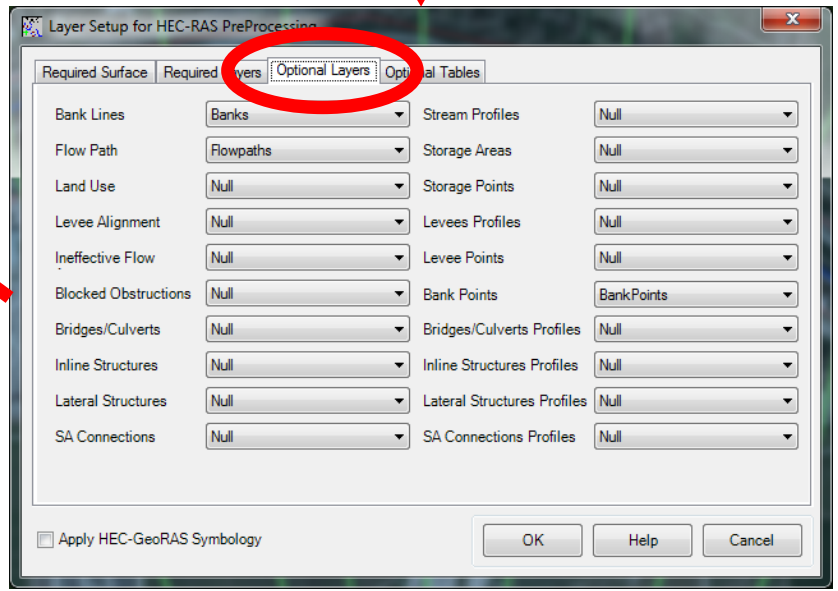
RAS Layer Setup









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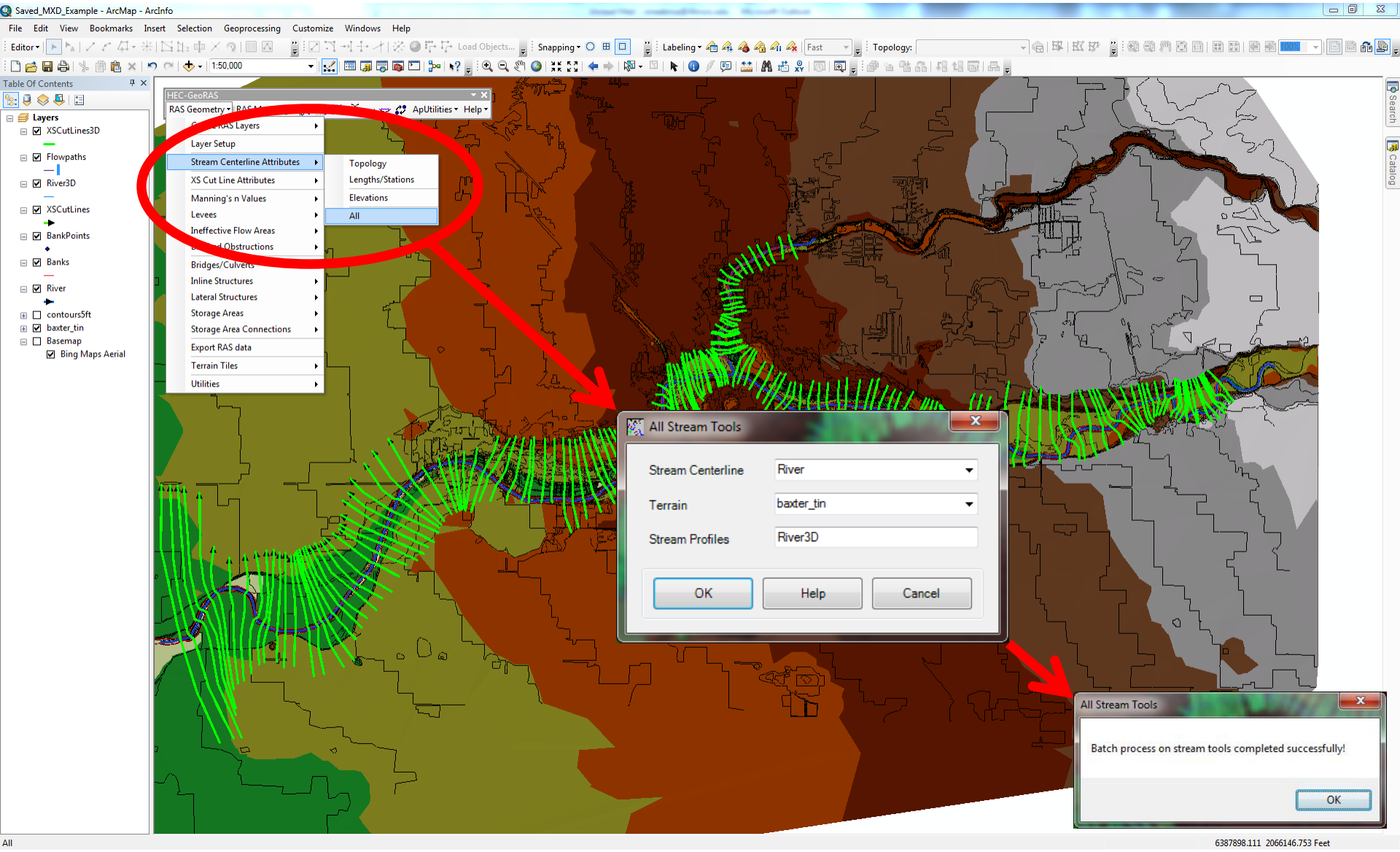
Stream Centerline Attributes



- Layer Name = River (feature class name)
- Terrain = Source selected in Layer Setup (TIN)

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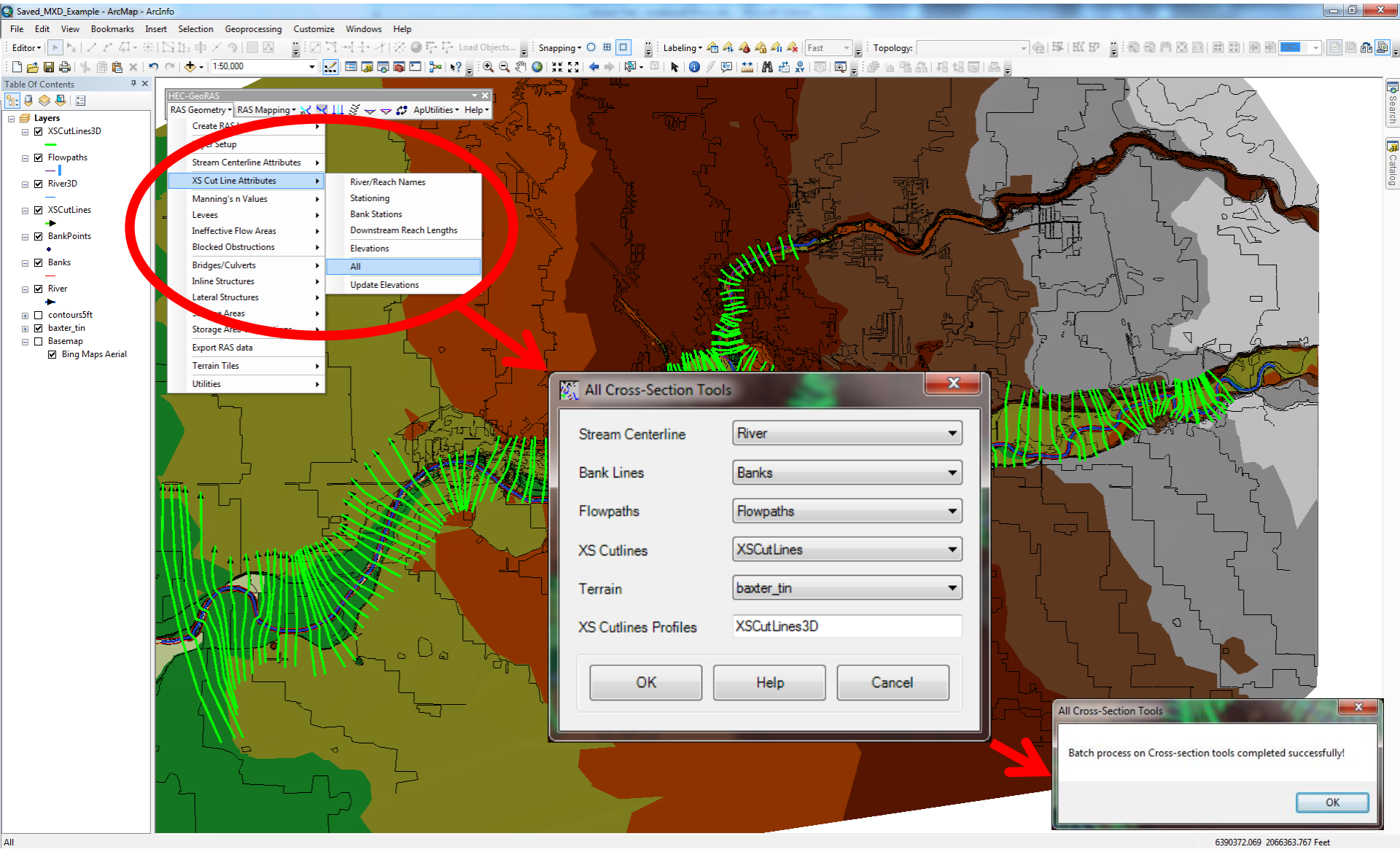
What Have We Created for the Water Line?

- RiverCode
- ReachCode
- FromNode
- ToNode
- FromSta (From Station)
- ToSta (To Station)

	Shape *	OID *	Shape_Length	HydroID	RiverCode	ReachCode	FromNode	ToNode	ArcLength	FromSta	ToSta
▶	Polyline	1	41185.0073598126	1	Baxter River	Upper Reach	1	2	41185.01	48139.38	89324.39
	Polyline	2	48139.3813461552	2	Baxter River	Lower Reach	2	3	48139.38	0	48139.38
	Polyline	3	12506.9489725563	3	Tule Creek	Tributary	4	2	12506.95	0	12506.95

XS Cut Line Attributes



- Only showing Required Layers above

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What Have We Created for the XS Layer?

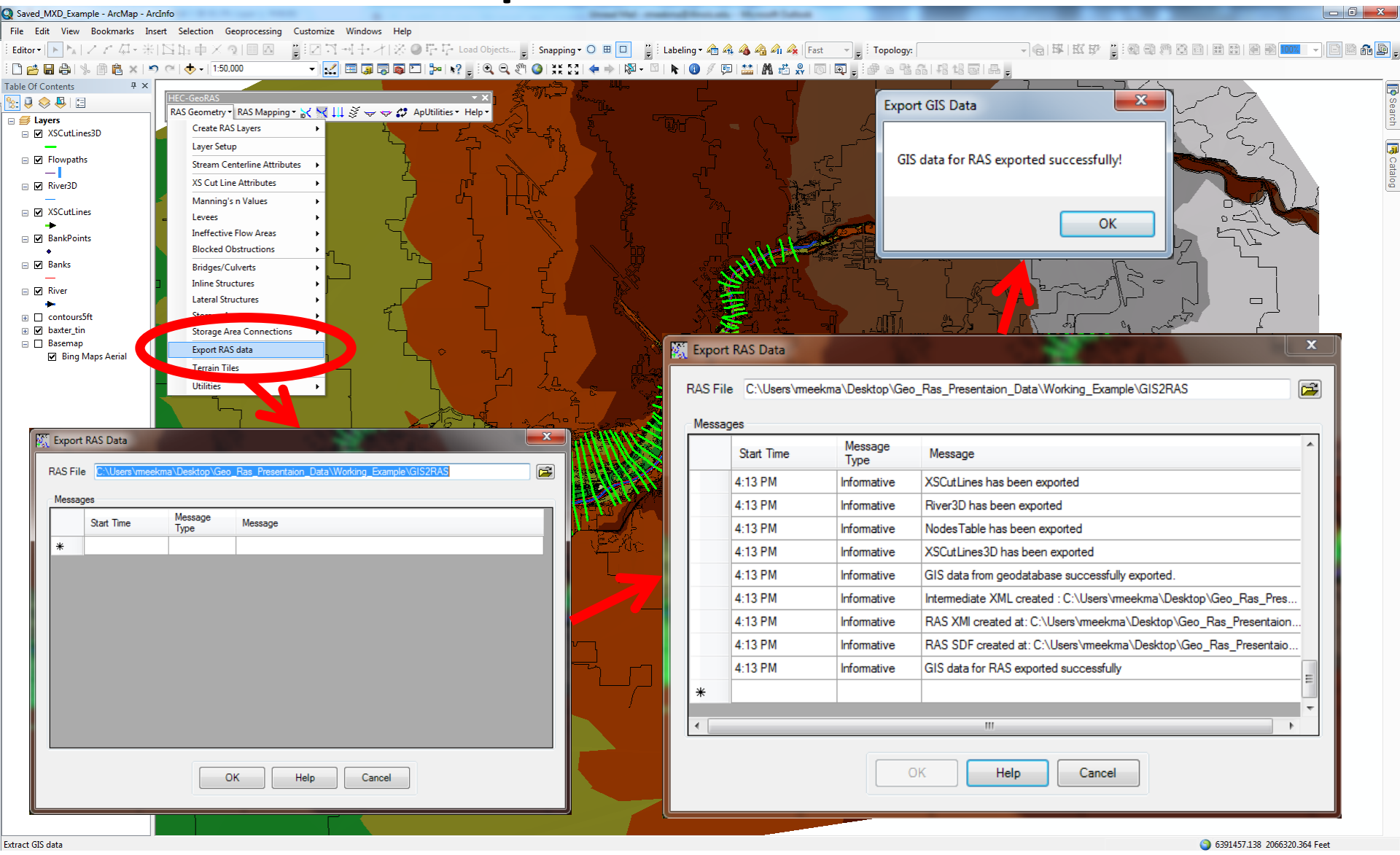
(EVERYTHING! To get started with modeling at least…)

Contents | Preview | Description

Shape *	OID *	Shape_Length	HydroID	ProfileM	RiverCode	ReachCode	LeftBank	RightBank	LLength	ChLength	RLength	NodeName
Polyline	1	2385.42611004266	10	47341.08	Baxter River	Lower Reach	0.2320041	0.3491059	0	254.5117	0	
Polyline	2	3625.61291418831	11	43370.52	Baxter River	Lower Reach	0.8811635	0.921231	0	634.7012	0	
Polyline	3	4054.21629516504	12	43813.12	Baxter River	Lower Reach	0.8224729	0.9195772	0	442.6034	0	
Polyline	4	2528.99248964729	13	41353.68	Baxter River	Lower Reach	0.5281703	0.6126689	0	427.0851	0	
Polyline	5	3645.95587154191	14	38999.21	Baxter River	Lower Reach	0.1892742	0.2407814	0	700.7122	0	
Polyline	6	4272.96509071099	15	37930.35	Baxter River	Lower Reach	0.2103818	0.2583597	0	576.7894	0	
Polyline	7	4486.93116613369	16	36795.45	Baxter River	Lower Reach	0.2343741	0.2752751	0	651.6782	0	
Polyline	8	4668.10963853476	17	35811.23	Baxter River	Lower Reach	0.1922656	0.2493992	0	848.8646	0	
Polyline	9	3854.7159056844	18	32317.51	Baxter River	Lower Reach	1.258031E-02	8.125903E-02	0	599.9683	0	
Polyline	10	3810.85880528305	19	30535.93	Baxter River	Lower Reach	5.038665E-02	0.1214577	0	886.4666	0	
Polyline	11	3452.67475957464	20	26389.31	Baxter River	Lower Reach	0.7563735	0.8601218	0	468.6689	0	
Polyline	12	4194.32063625726	21	28106.68	Baxter River	Lower Reach	0.3715049	0.428724	0	390.5627	0	
Polyline	13	3421.21199889804	22	25920.64	Baxter River	Lower Reach	0.7616481	0.8792181	0	393.059	0	
Polyline	14	6013.39974123862	23	21600.63	Baxter River	Lower Reach	0.4753043	0.5358933	0	793.0063	0	
Polyline	15	5822.67952760415	24	19791.64	Baxter River	Lower Reach	0.4499364	0.4974848	0	555.5542	0	
Polyline	16	6390.6861060829	25	13611.56	Baxter River	Lower Reach	0.2912195	0.3397141	0	512.7276	0	
Polyline	17	7467.59618776127	26	12784.37	Baxter River	Lower Reach	0.3806371	0.4127015	0	367.1151	0	
Polyline	18	7516.90076458007	27	12417.26	Baxter River	Lower Reach	0.3745977	0.4113203	0	546.7901	0	
Polyline	19	6592.59749577053	28	11078.69	Baxter River	Lower Reach	0.295545	0.3384417	0	620.2083	0	
Polyline	20	6499.97266644101	29	9977.704	Baxter River	Lower Reach	0.2615629	0.3022763	0	598.1946	0	
Polyline	21	6951.93810706039	30	8998.785	Baxter River	Lower Reach	0.3343608	0.3751281	0	532.4047	0	
Polyline	22	7609.40560852313	31	6756.076	Baxter River	Lower Reach	0.6751778	0.7154278	0	991.2301	0	
Polyline	23	8726.16243572662	32	4906.474	Baxter River	Lower Reach	0.6818853	0.6907241	0	521.7406	0	
Polyline	24	14265.9159453121	33	3550.27	Baxter River	Lower Reach	0.4532575	0.4784853	0	673.7538	0	
Polyline	25	15784.4246732439	34	1858.401	Baxter River	Lower Reach	0.4078268	0.4330727	0	666.4758	0	
Polyline	26	5092.25422755774	35	15892.35	Baxter River	Lower Reach	0.2967086	0.3612061	0	436.0033	0	
Polyline	27	5603.61660307026	36	14652.94	Baxter River	Lower Reach	0.2912767	0.3270018	0	444.8954	0	
Polyline	28	2563.40404641879	37	42093.07	Baxter River	Lower Reach	0.678942	0.7533616	0	372.5734	0	
Polyline	29	4793.46964665737	38	34241.54	Baxter River	Lower Reach	0.2088515	0.2746628	0	652.4493	0	
Polyline	30	2367.30500868542	39	84762.11	Baxter River	Upper Reach	0.5417203	0.6313727	0	814.6006	0	
Polyline	31	2659.77581266978	40	81867.62	Baxter River	Upper Reach	0.2142992	0.3492356	0	200.9608	0	
Polyline	32	2124.56810045358	41	79037.7	Baxter River	Upper Reach	0.5169015	0.618249	0	424.6483	0	
Polyline	33	2402.92721431298	42	77866.79	Baxter River	Upper Reach	0.4635276	0.5729238	0	230.7679	0	
Polyline	34	2522.67722056591	43	77636.02	Baxter River	Upper Reach	0.4603144	0.5607281	0	410.6801	0	
Polyline	35	3068.04318899281	44	76338.7	Baxter River	Upper Reach	0.4444283	0.546317	0	725.3594	0	
Polyline	36	3816.14469080963	45	75057.3	Baxter River	Upper Reach	0.2675146	0.3416504	0	595.4948	0	
Polyline	37	4090.97483677502	46	73707.44	Baxter River	Upper Reach	0.3872696	0.4683503	0	853.7266	0	
Polyline	38	4466.62023654799	47	72164.27	Baxter River	Upper Reach	0.2986413	0.365611	0	1279.964	0	
Polyline	39	4319.83658213149	48	70884.3	Baxter River	Upper Reach	6.173877E-02	0.1186184	0	1237.056	0	
Polyline	40	4409.4405673074	49	69647.25	Baxter River	Upper Reach	3.327393E-02	0.1024007	0	908.4877	0	
Polyline	41	5090.00384691071	50	67439.83	Baxter River	Upper Reach	0.2321038	0.2875602	0	878.2062	0	
Polyline	42	4461.67796037319	51	65410.33	Baxter River	Upper Reach	7.426728E-02	0.1519662	0	640.962	0	
Polyline	43	5042.14432412349	52	64769.37	Baxter River	Upper Reach	0.2069289	0.2366251	0	1502.523	0	
Polyline	44	4204.85046630928	53	63266.84	Baxter River	Upper Reach	0.4507527	0.4777469	0	144.7351	0	
Polyline	45	3156.51136160043	54	62480.29	Baxter River	Upper Reach	0.379128	0.4327502	0	531.0543	0	
Polyline	46	2475.32400032809	55	61949.23	Baxter River	Upper Reach	0.2734742	0.3481379	0	470.2292	0	
Polyline	47	2700.52694720728	56	60330.6	Baxter River	Upper Reach	7.780459E-02	0.1293979	0	558.2018	0	
Polyline	48	2190.56789445913	57	58888.4	Baxter River	Upper Reach	0.3438624	0.4002528	0	487.7868	0	
Polyline	49	2007.74856205432	58	57996.54	Baxter River	Upper Reach	0.3184963	0.4013508	0	559.9416	0	
Polyline	50	2538.12374521945	59	56976.13	Baxter River	Upper Reach	0.2296745	0.324212	0	350.9986	0	
Polyline	51	2465.29460730781	60	56083.74	Baxter River	Upper Reach	0.3263625	0.4210567	0	622.0948	0	
Polyline	52	2483.4941133375	61	55036.83	Baxter River	Upper Reach	0.3750848	0.4839594	0	685.9155	0	
Polyline	53	2531.03627857658	62	53840.34	Baxter River	Upper Reach	0.3696082	0.4768925	0	594.1134	0	
Polyline	54	2179.41061615471	63	52656.83	Baxter River	Upper Reach	0.2405843	0.3966975	0	818.1044	0	
Polyline	55	2151.4347542767	64	51838.72	Baxter River	Upper Reach	0.2477212	0.3596867	0	361.4491	0	
Polyline	56	2488.77548086253	65	50851.57	Baxter River	Upper Reach	0.331898	0.4650413	0	353.6066	0	
Polyline	57	2098.89721488775	66	50497.97	Baxter River	Upper Reach	0.2702278	0.4174466	0	515.7763	0	

1 (of 173)

Export RAS Data



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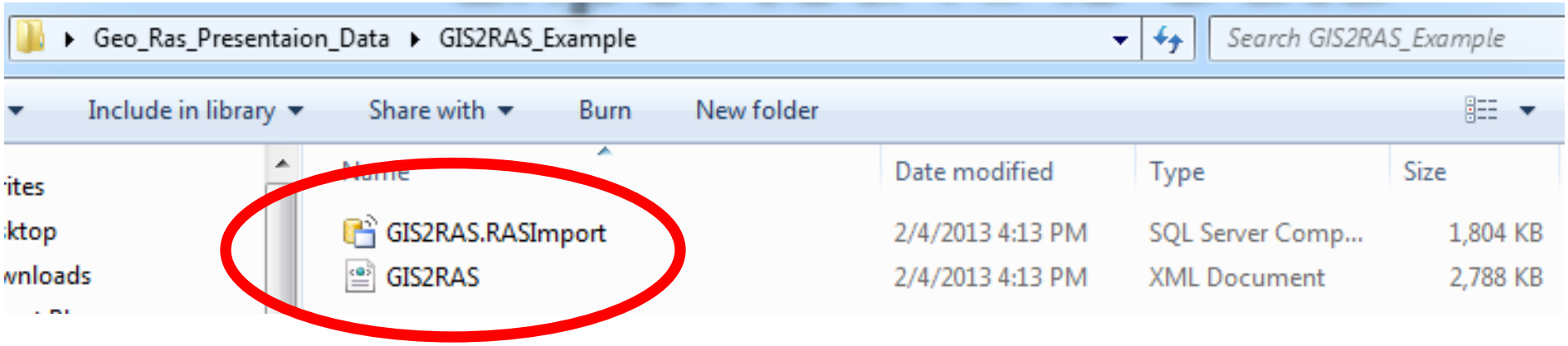
- Select Output Folder
- Name File

Exported RAS Data

Two files were created:

- Next step is importing data into a HEC-RAS model



Transitioning from Geo-RAS to RAS

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(217) 244-0360

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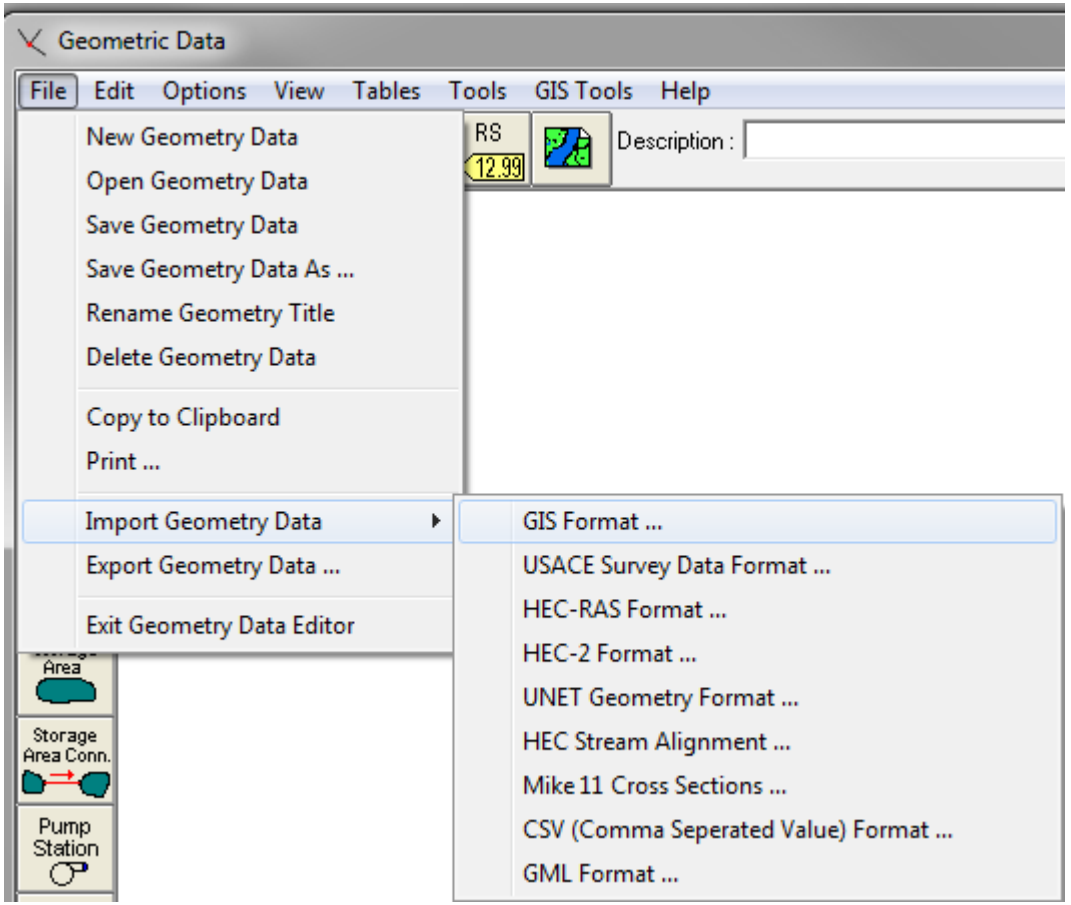
Transitioning from Geo-RAS to RAS

Open HEC-RAS

- Start a new project in HEC-RAS
- From the Geometric Data Editor, import the RAS GIS Import File
- Select the appropriate .sdf file

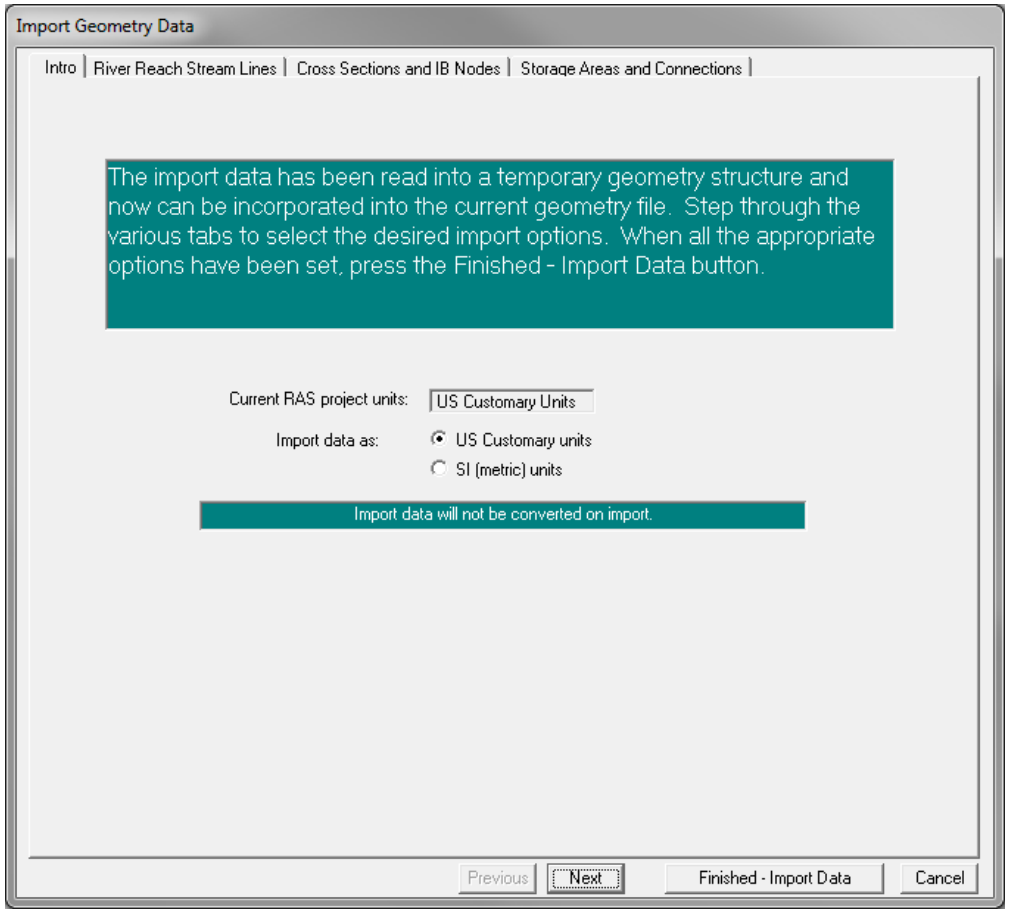


Import Geometry Data

Select Unit System

- Consider the linear units of the DTM
- Consider units of data with which to merge

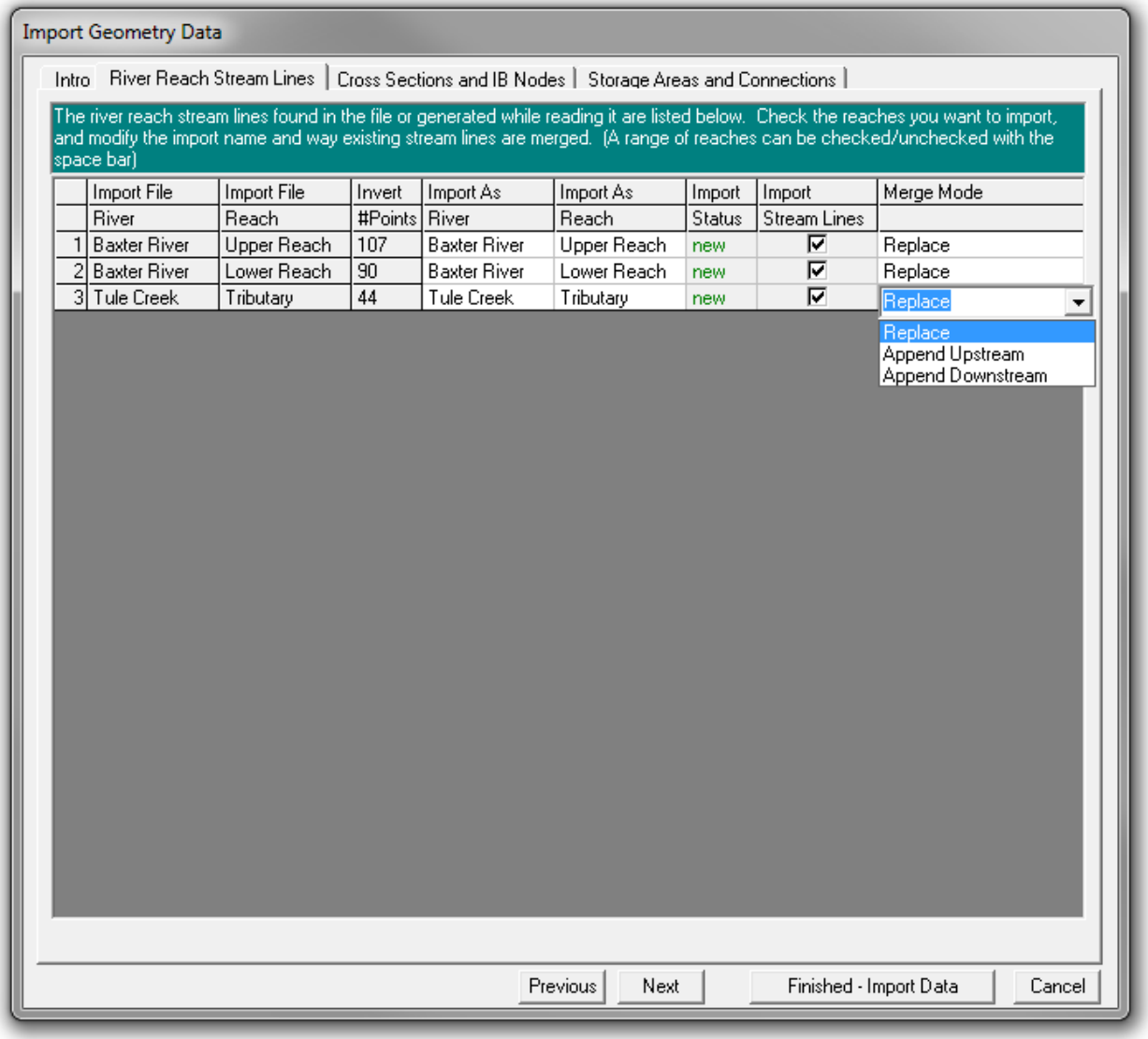
- Select ‘Next’



Import Geometry Data

River Reach Stream Lines

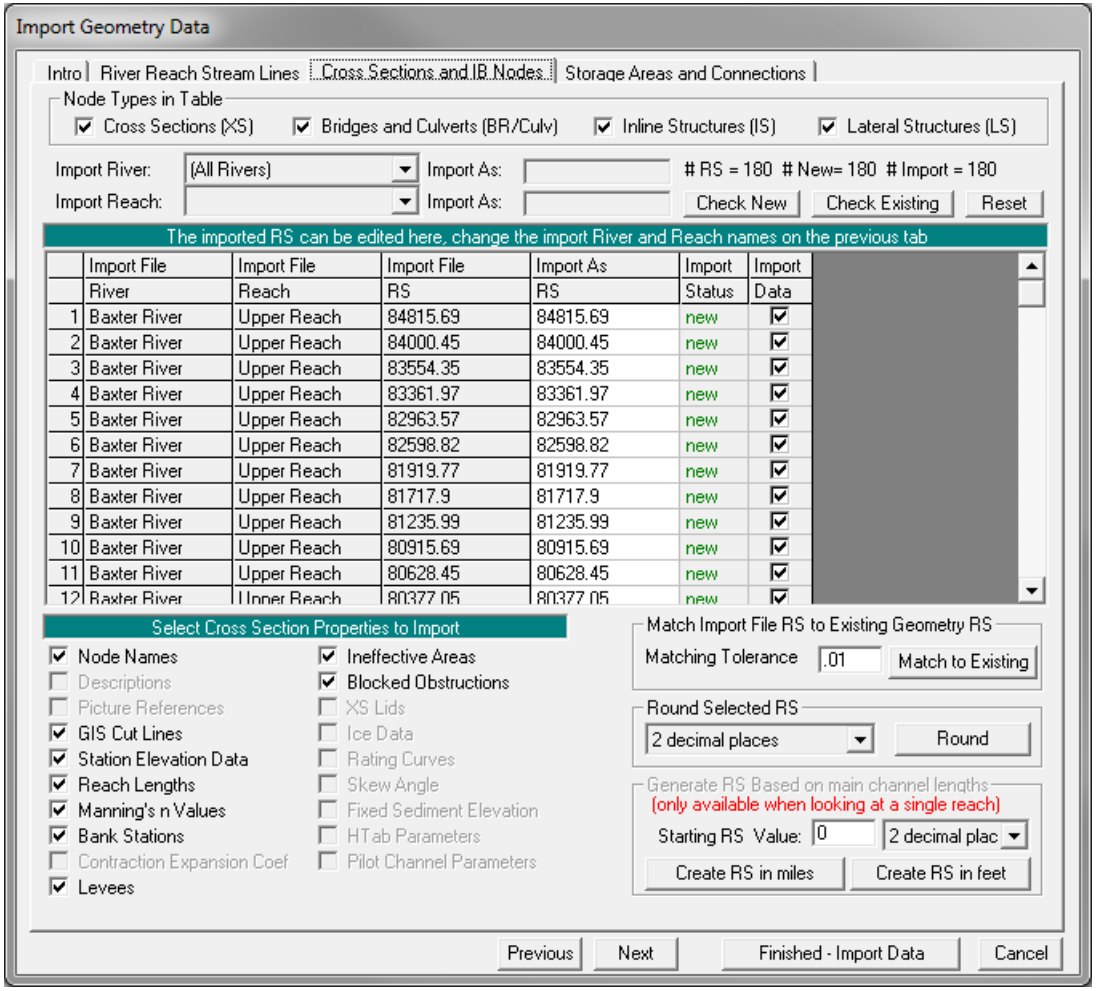
- Revise river and reach names as necessary
- Select which stream lines to import
- Select the merge mode
- Select ‘Next’



Import Geometry Data

Cross Sections and IB Nodes

- Choose which cross sections, bridge/culvert, inline structure, and lateral structure to import
- Select cross section properties to import
- Assign river stations
- Assign stationing offsets
- Select ‘Next’

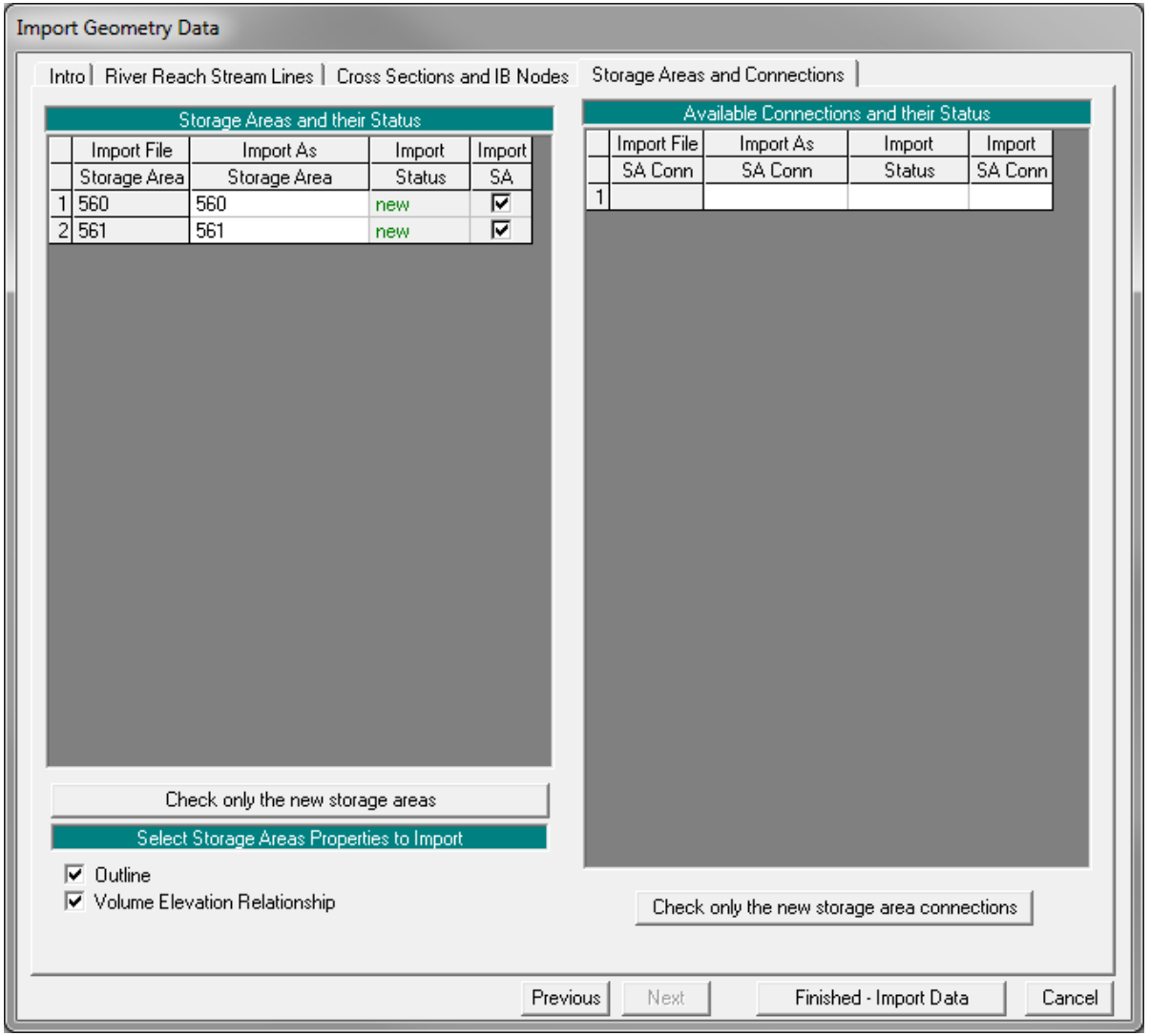


Import Geometry Data

Storage Areas and Connections

- Choose which to import
- Assign names
- Select volume-elevation or outline

- Select ‘Finished-Import Data’
- Save geometry file

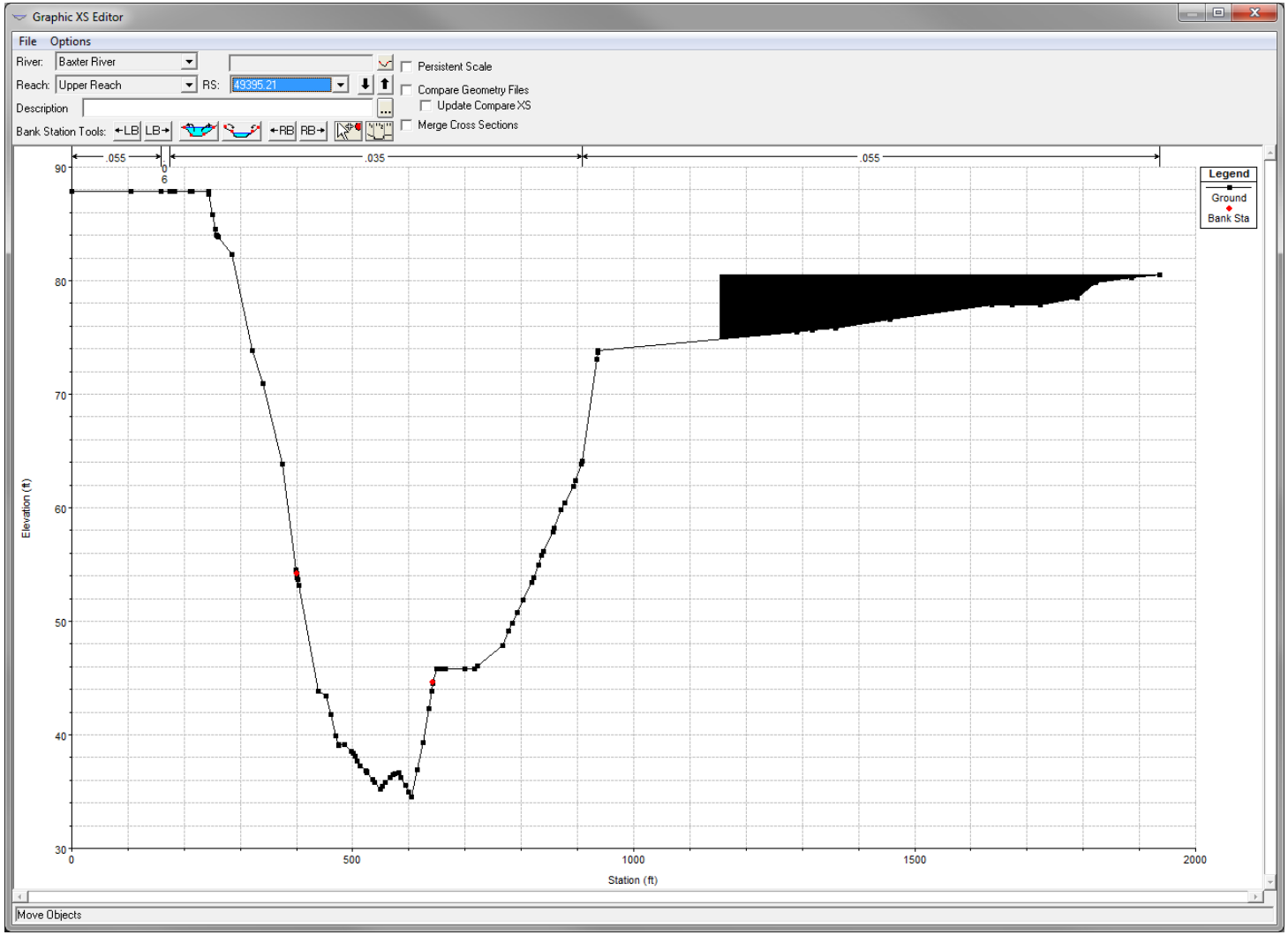


Review Imported Data

Things to review

- Expanse of Manning's n values
- Location of bank station data
- Add/move/delete ground points (check for gaps, erroneous data)
- Add/move/delete levees, ineffective flow areas, and blocked obstructions
- Compare and merge cross section elevation data
- Junction connection and length

Graphical Cross Section Editor



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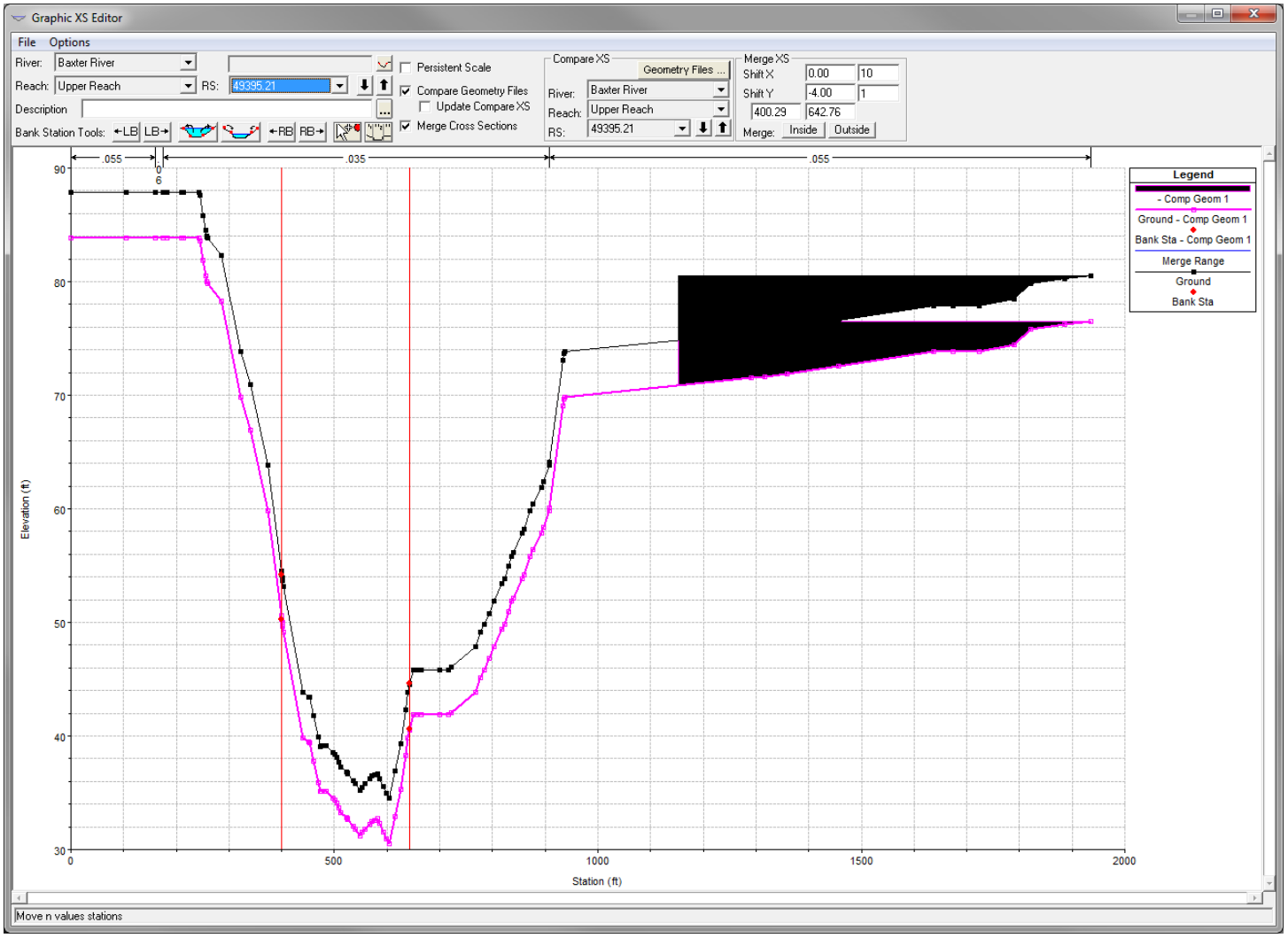
Tip

Throughout HEC-RAS

Hold ‘Ctrl’ to activate measure tool
Hold ‘Shift’ to activate pan tool

Graphical Cross Section Editor



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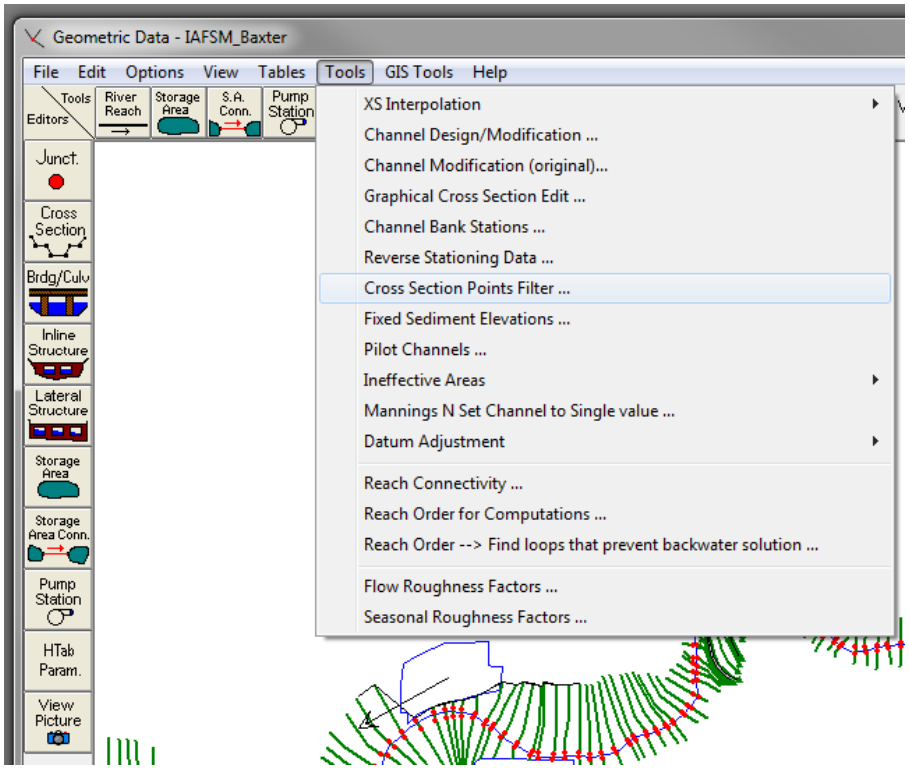
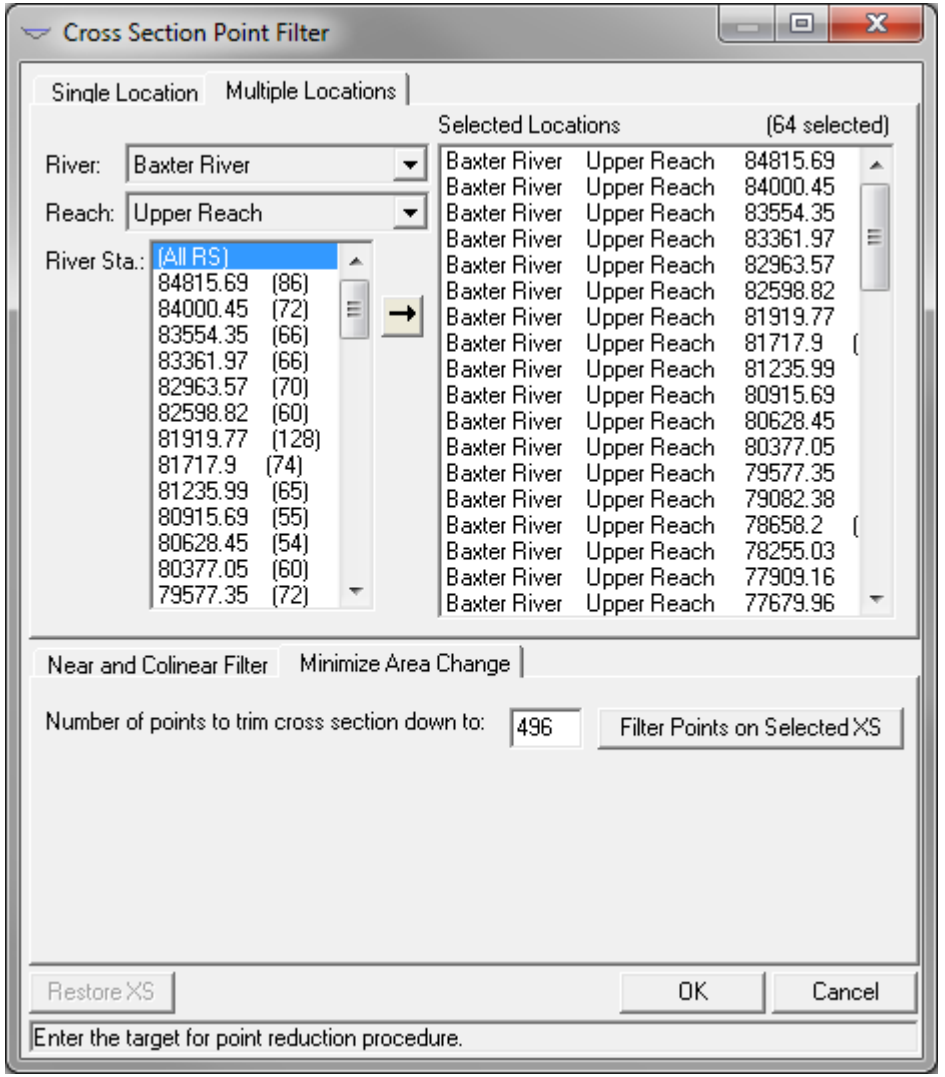
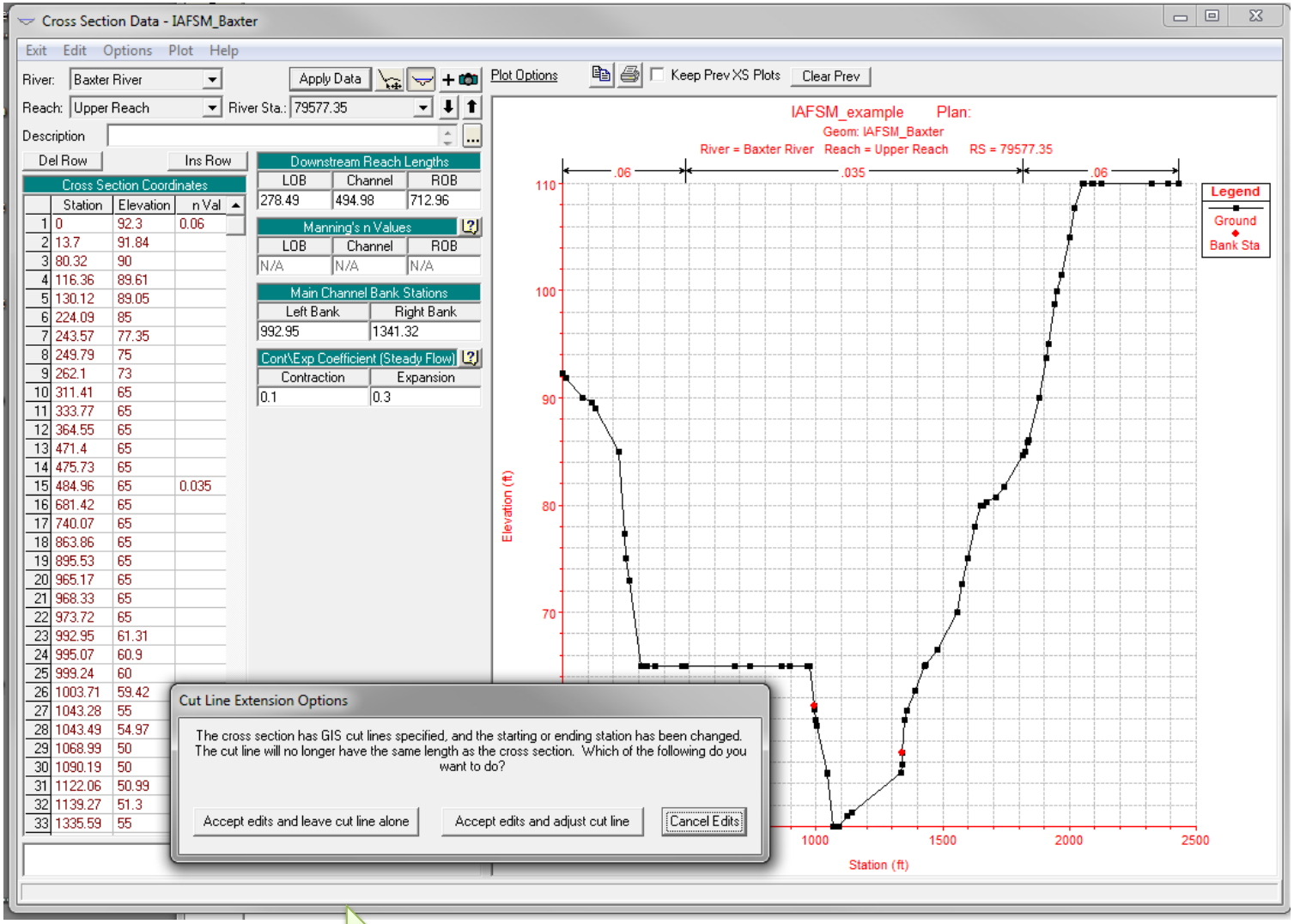
Cross Section Points Filter





Modifying Cross Section Extents



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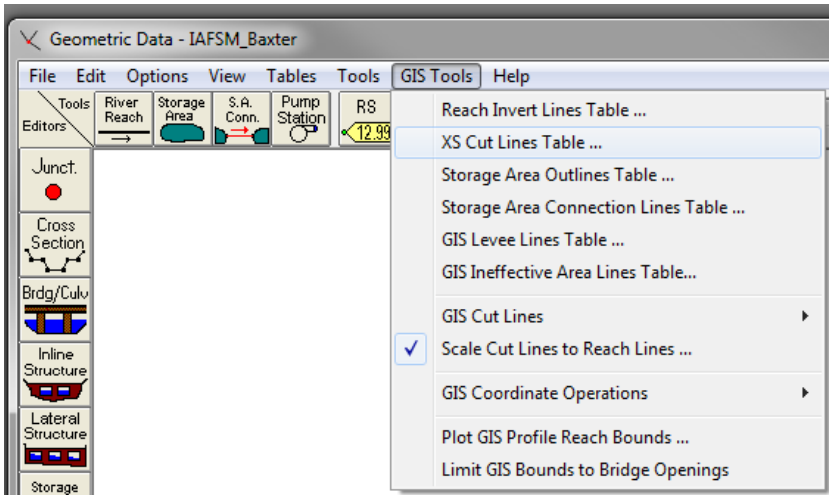
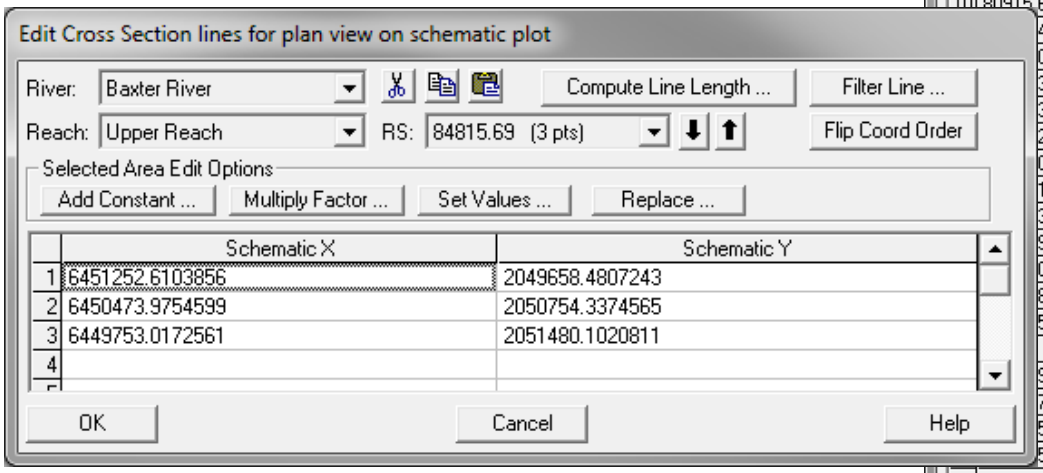
Tip

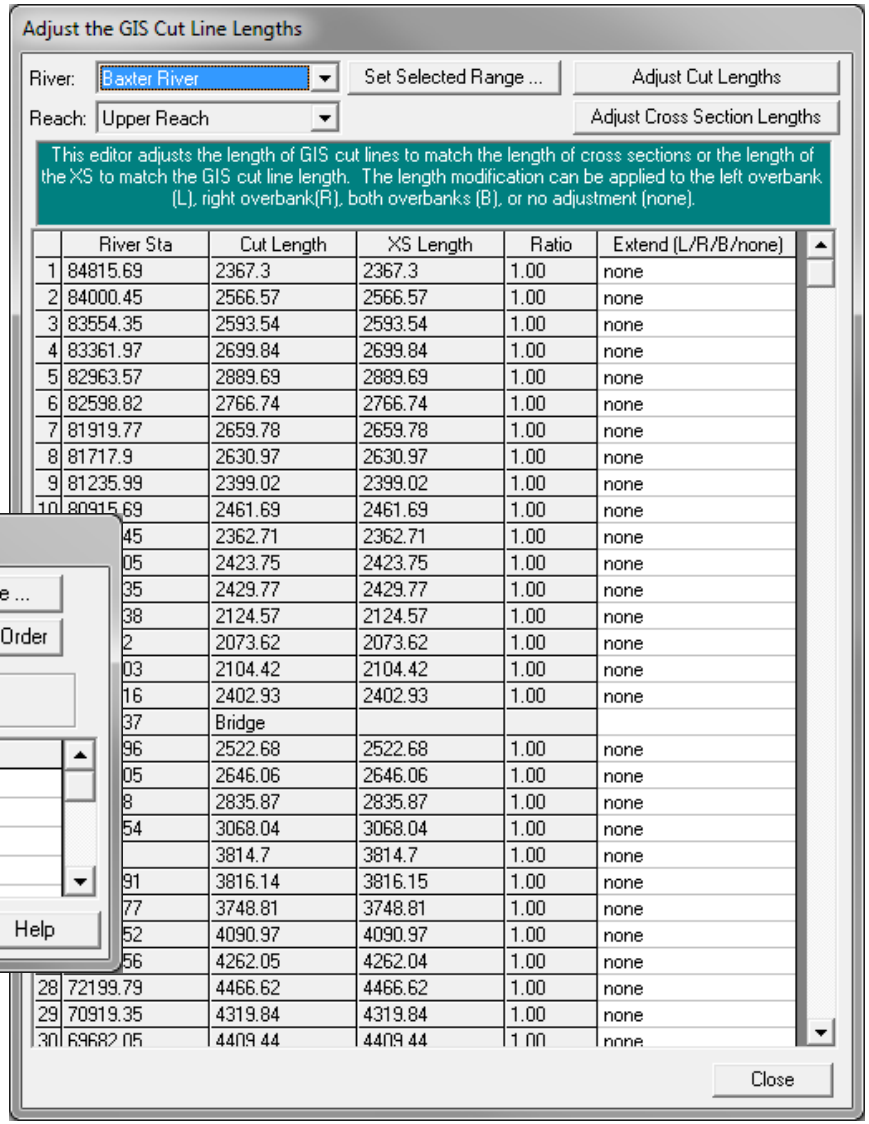
Very important for proper floodway mapping

Modifying Cross Section Extents

(If you choose 'Accept edits and leave cut line alone')







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From Import to Running Model

What still needs to be added?

- Data purposefully omitted from Geo-RAS
- Hydraulic structure data
  - Opening geometry, connections
- Additional levee, ineffective flow, block obstructions data
  - Opening geometry, revised elevations, etc.
- Detailed channel geometry
- Flow data (with boundary conditions)

Reminder:

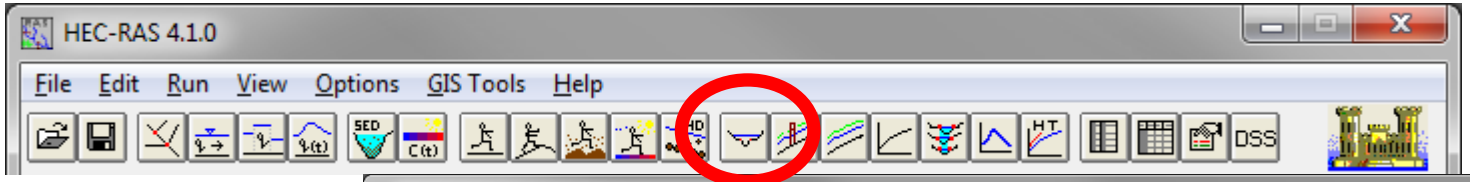
"Importing data generated from GIS layers will not create a complete river hydraulics model"

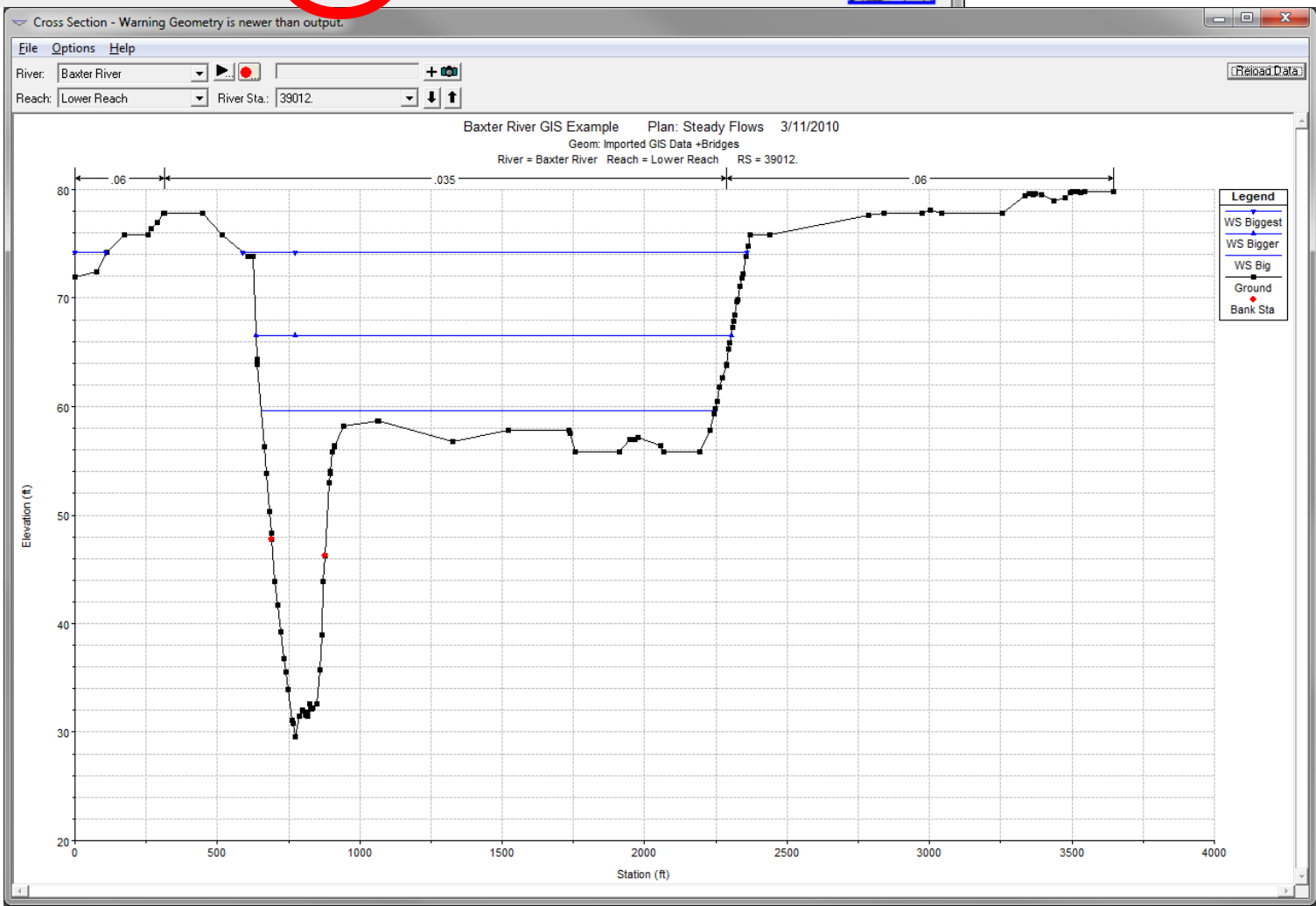
Initial Review of Results

Compute the Steady or Unsteady Flow Analysis

- Review the results and adjust your model as necessary
  - Check especially for
    - Cross sections that cannot contain the range of flows
    - Consistent levee overtopping
    - Ineffective areas around bridges / natural floodplain constrictions
- Tools for review
  - View Cross Sections
  - View Profiles
  - View 3D Multiple Cross Section Plot
    - Set Azimuth Angle to 90

View Cross Sections





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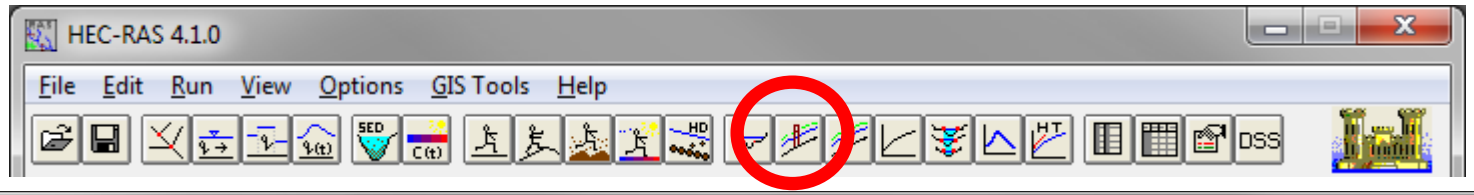
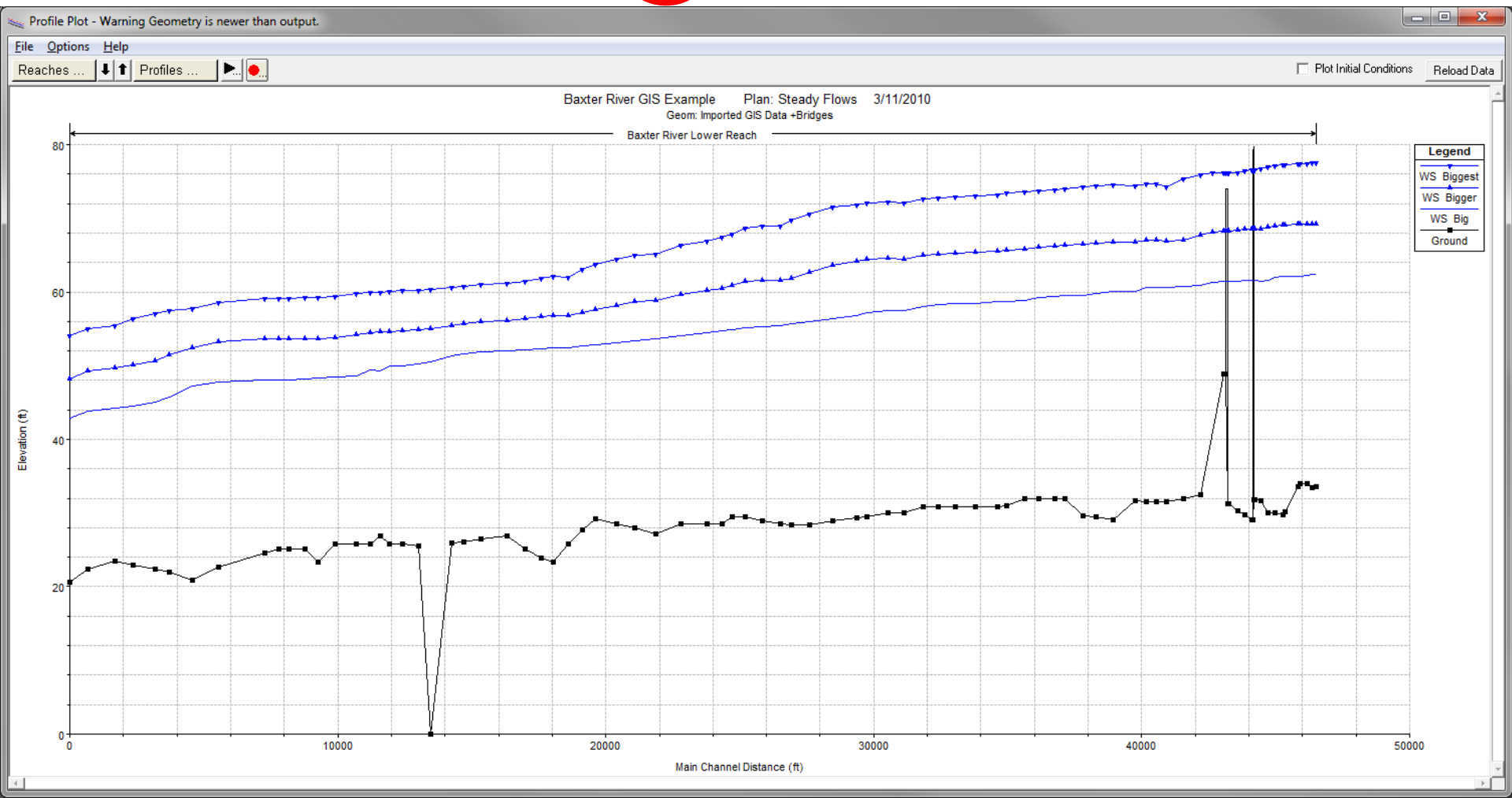
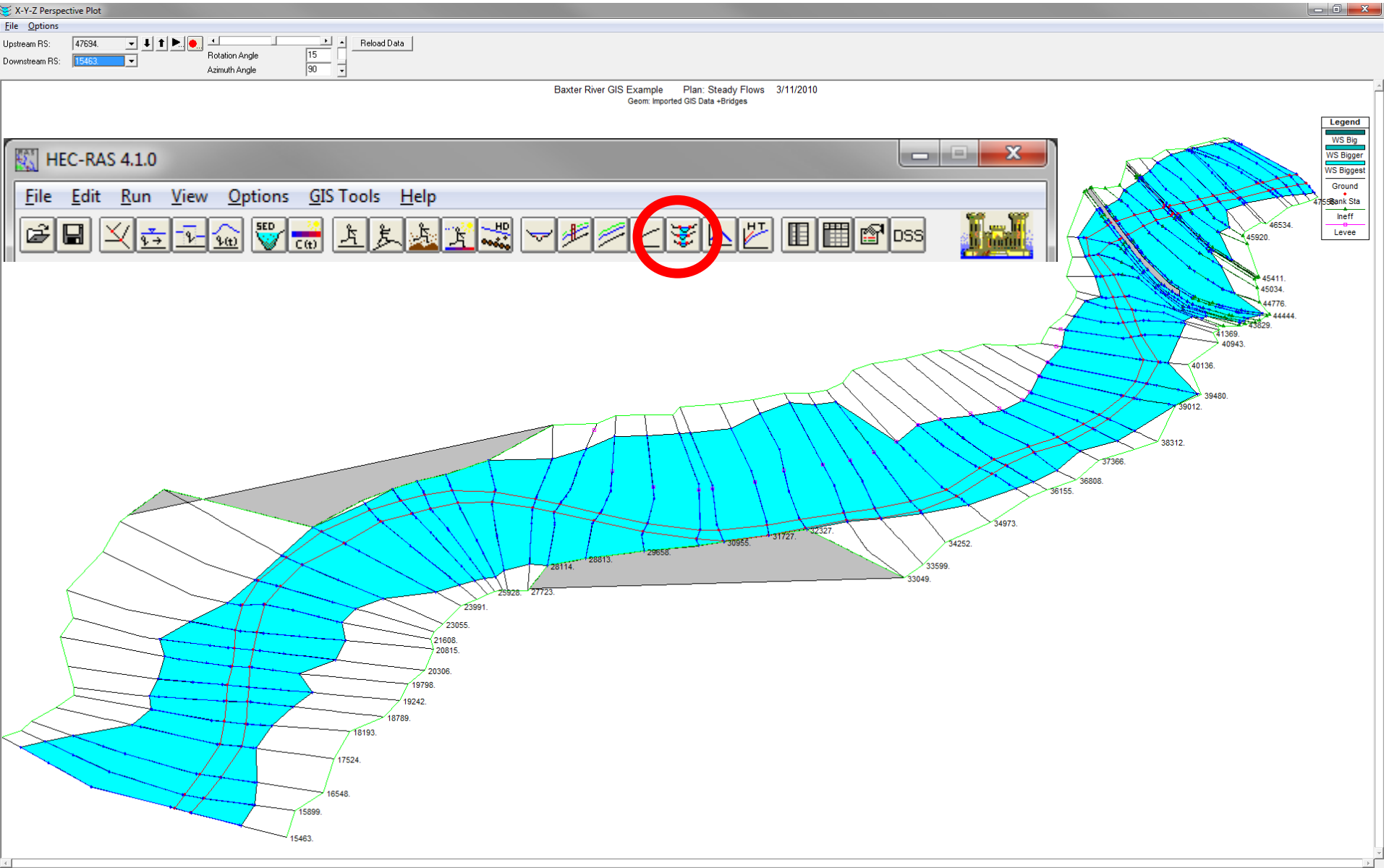
View Profiles

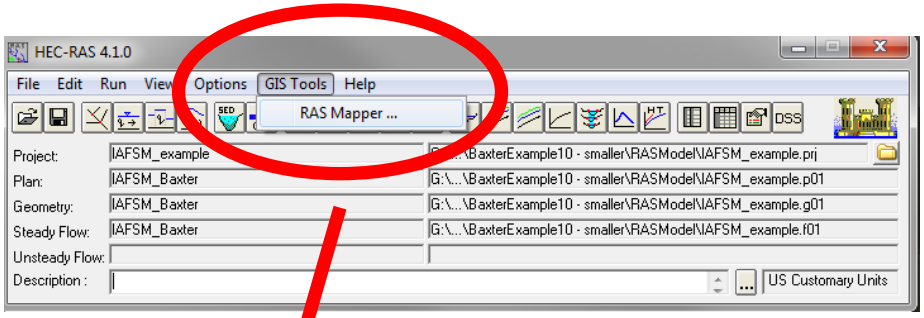


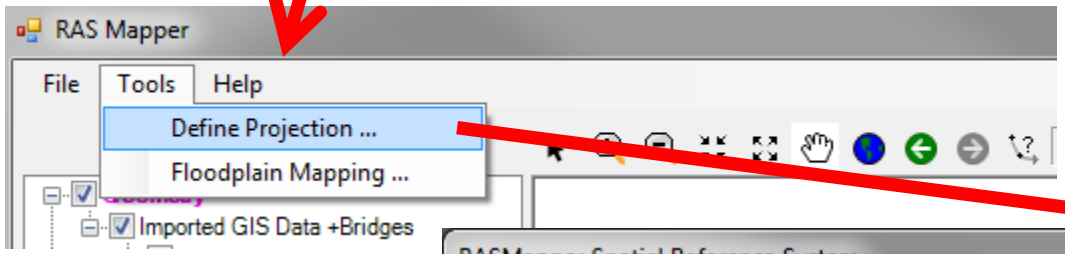


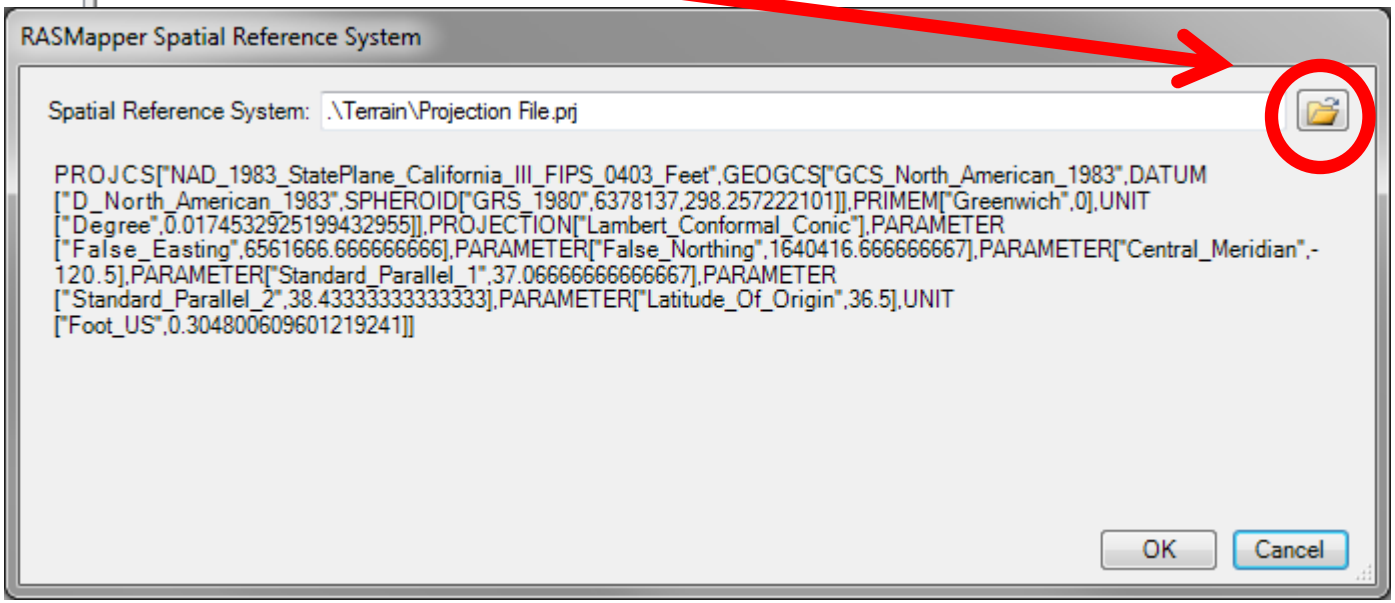
View 3D Multiple Cross Section Plot



RAS Mapper



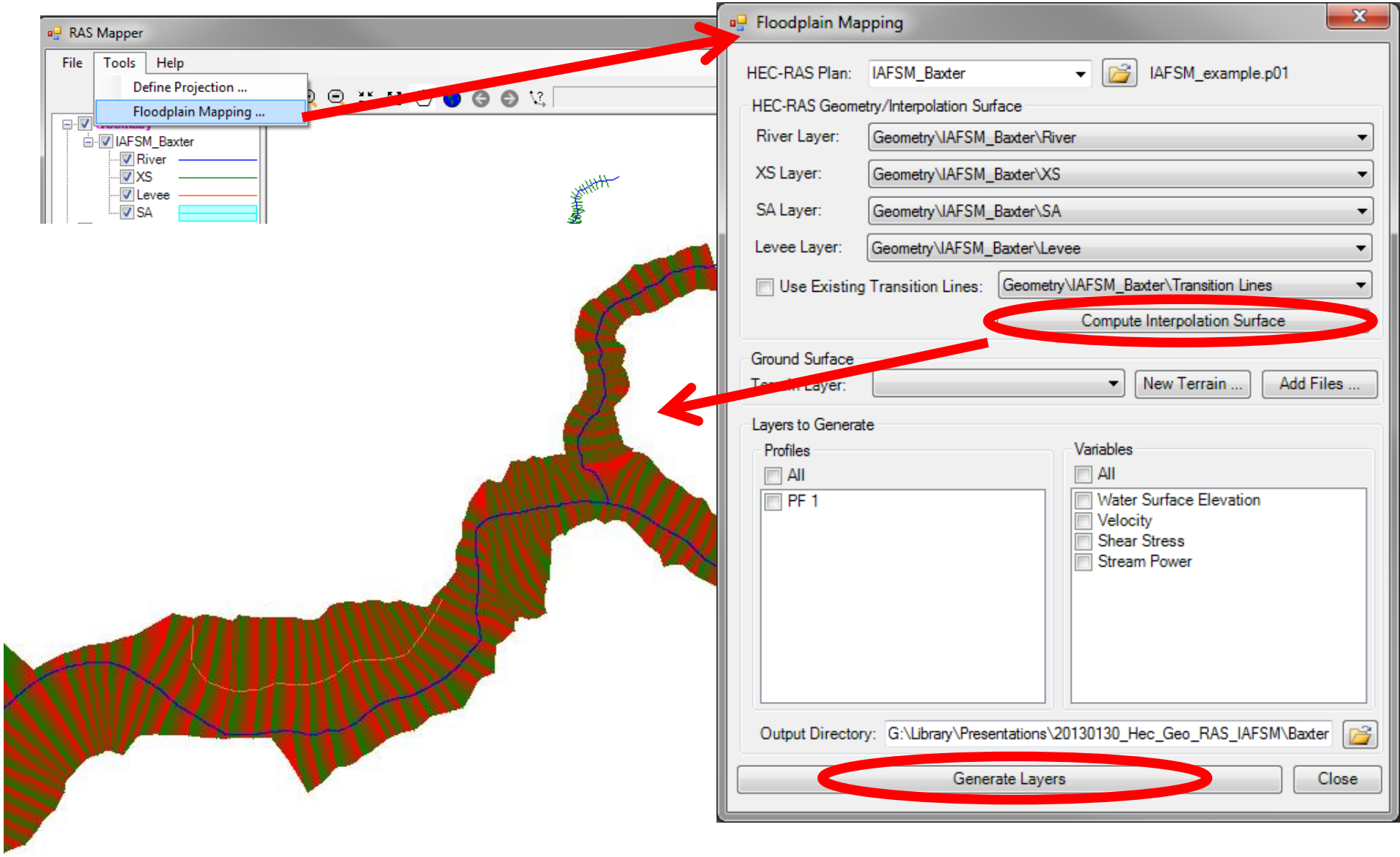




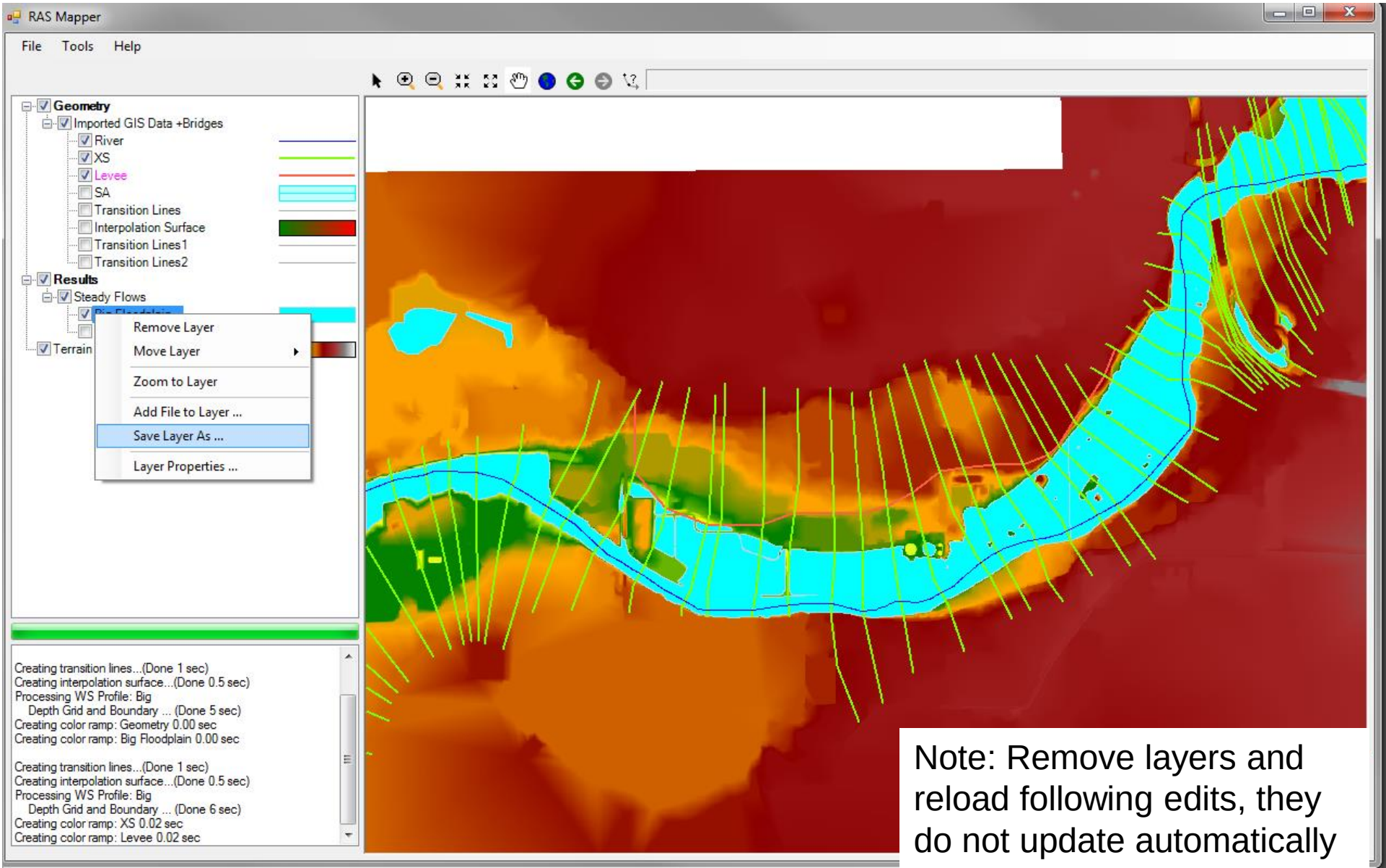
Note: Need DTM in float (.flt) format

To convert a DEM, use “Raster to Float (Conversion)” tool in ArcMap

RAS Mapper


RAS Mapper
File
Tools
Help
Define Projection ...
Floodplain Mapping ...
IAFSM_Baxter
River
XS
Levee
SA
Floodplain Mapping
HEC-RAS Plan:
IAFSM_Baxter
IAFSM_example.p01
HEC-RAS Geometry/Interpolation Surface
River Layer:
Geometry\IAFSM_Baxter\River
XS Layer:
Geometry\IAFSM_Baxter\XS
SA Layer:
Geometry\IAFSM_Baxter\SA
Levee Layer:
Geometry\IAFSM_Baxter\Levee
Use Existing Transition Lines:
Geometry\IAFSM_Baxter\Transition Lines
Compute Interpolation Surface
Ground Surface
New Terrain ...
Add Files ...
Layers to Generate
Profiles
All
PF 1
Variables
All
Water Surface Elevation
Velocity
Shear Stress
Stream Power
Output Directory:
G:\Library\Presentations\20130130_Hec_Geo_RAS_IAFSM\Baxter
Generate Layers
Close

RAS Mapper



Note: Remove layers and reload following edits, they do not update automatically

Processing HEC-RAS Results

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(217) 244-6627

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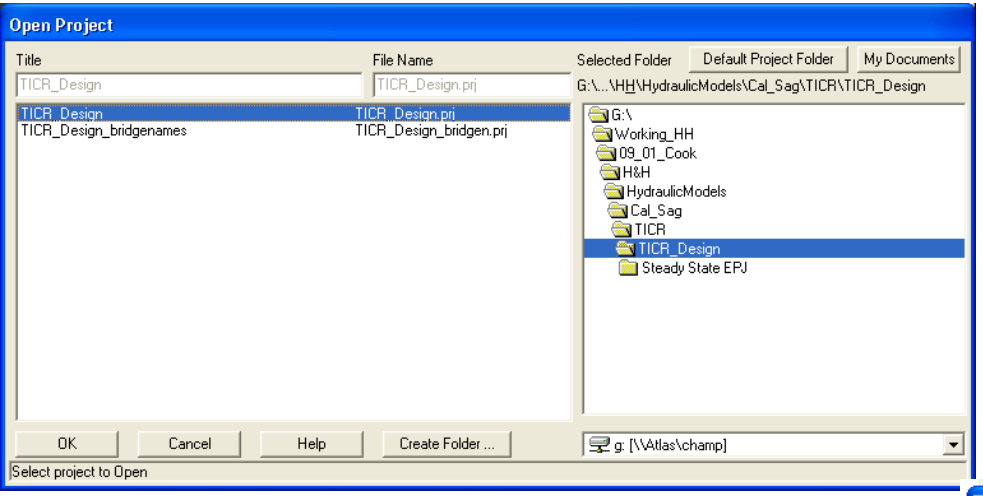
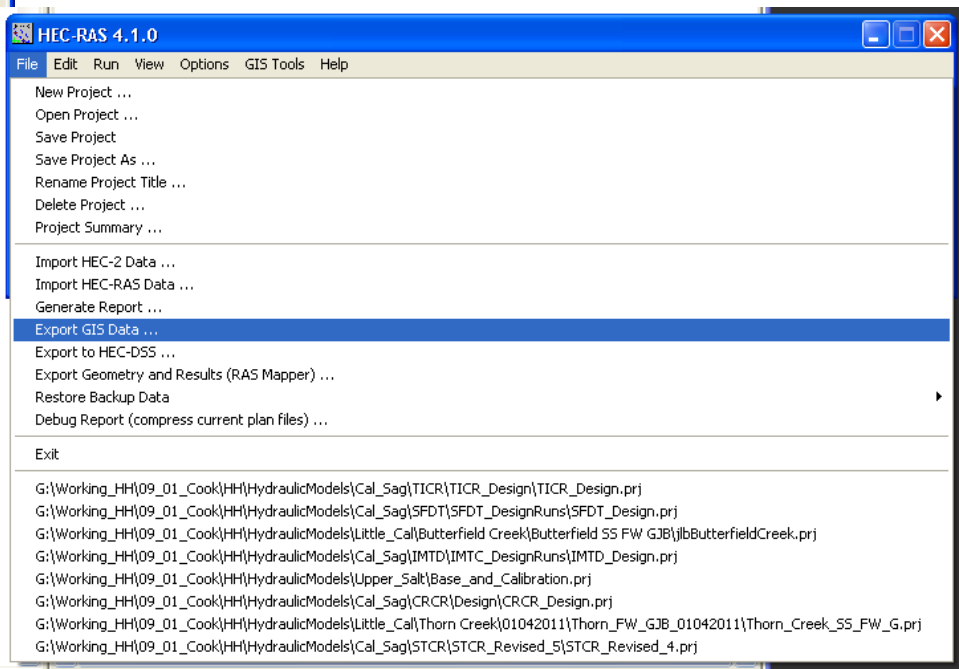
Export GIS Files from HEC-RAS

1.) Open HEC-RAS Model

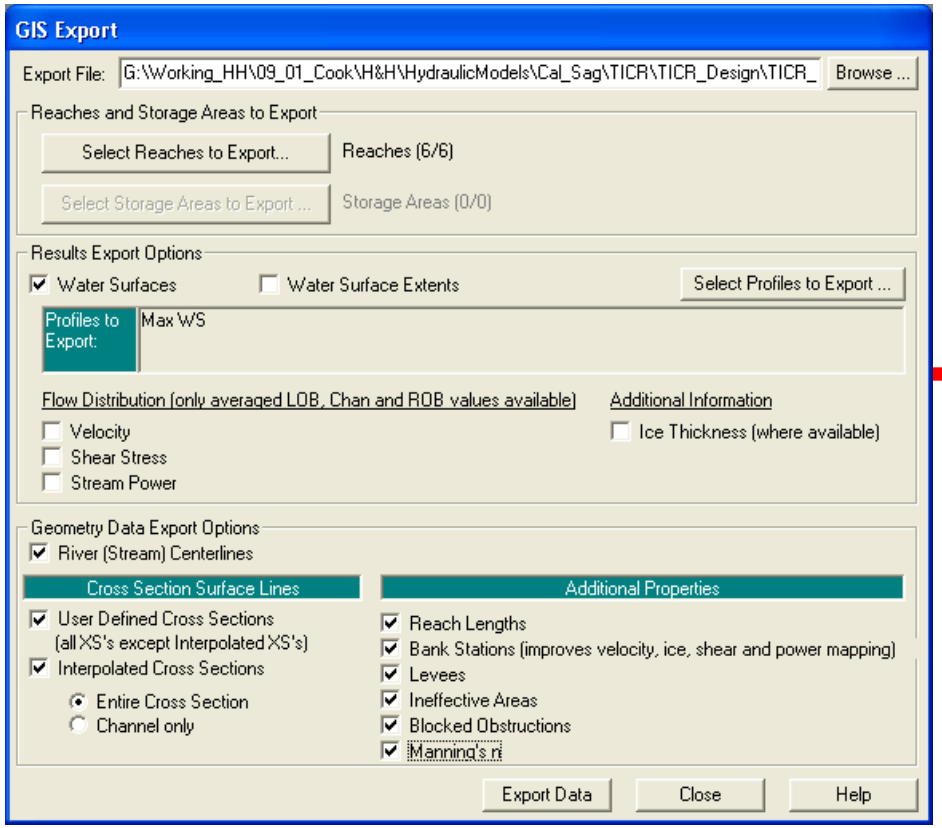


2.) File\Export GIS Data…



Export GIS Files from HEC-RAS

3.) GIS Export (complete fields)



4.) Turn On HEC-GeoRAS Toolbar in ArcMap 10

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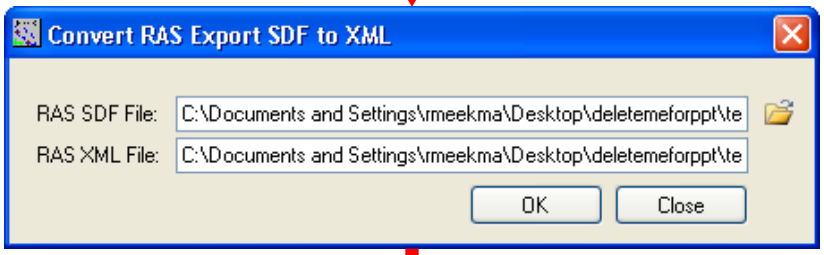
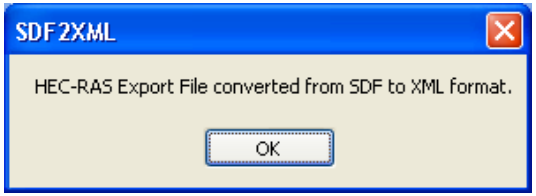
Export GIS Files from HEC-RAS

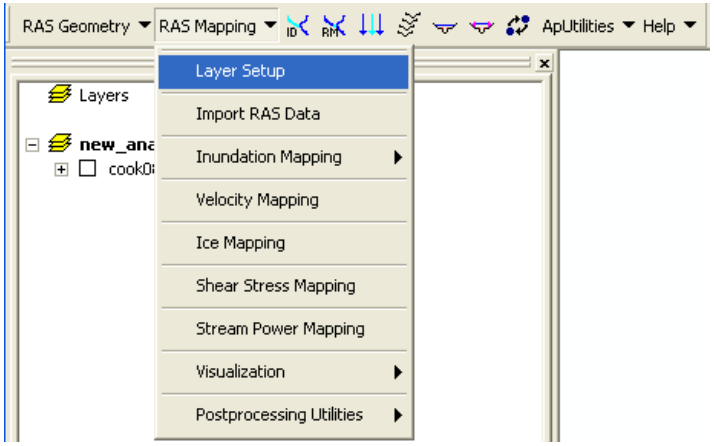
Extract GIS Data from Hec-RAS using the Geo-RAS Tool in GIS

5.) Importing the RAS GIS Export file \ SDF Conversion to XML





6.) Save MXD \ RAS Mapping \ Layer Setup



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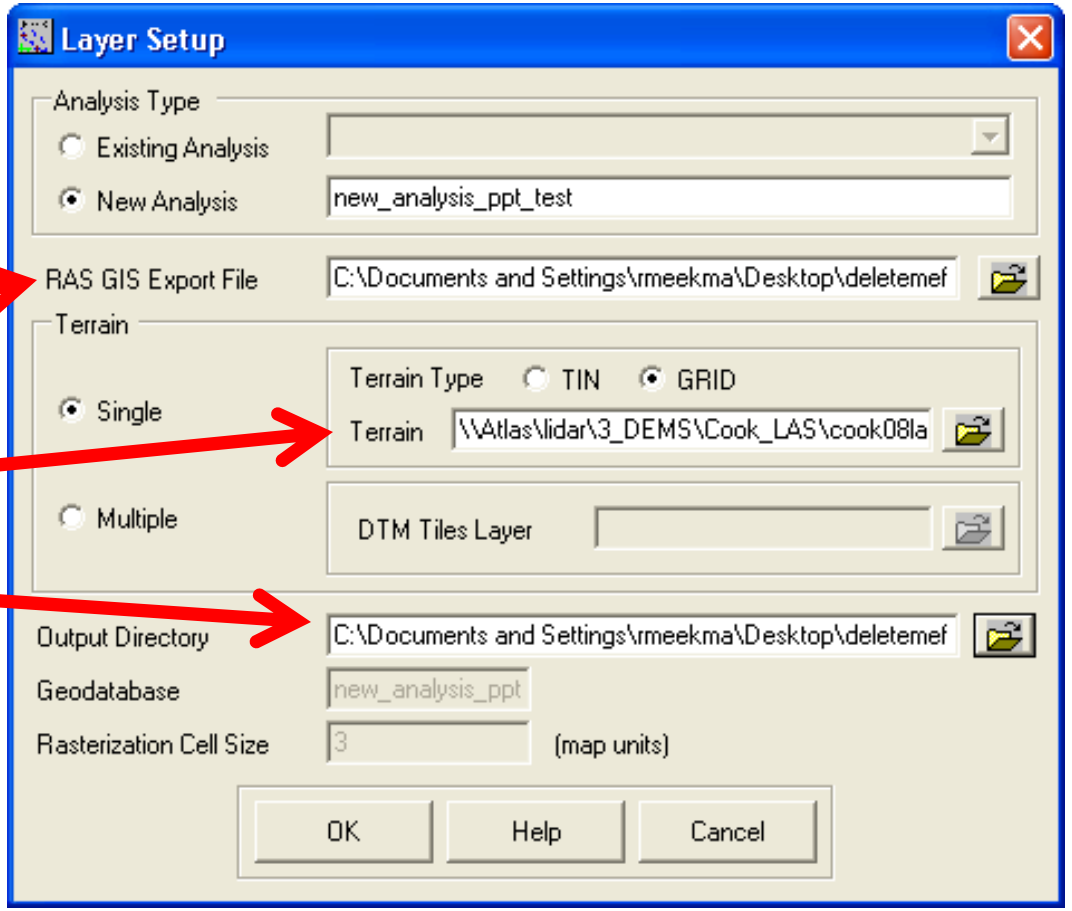
Export GIS Files from HEC-RAS

Extract GIS Data from Hec-RAS using the Geo-RAS Tool in GIS

7.) Complete Dialog Box

- Point to RAS GIS Export File
- Set file path to DTM
- Set Output Directory



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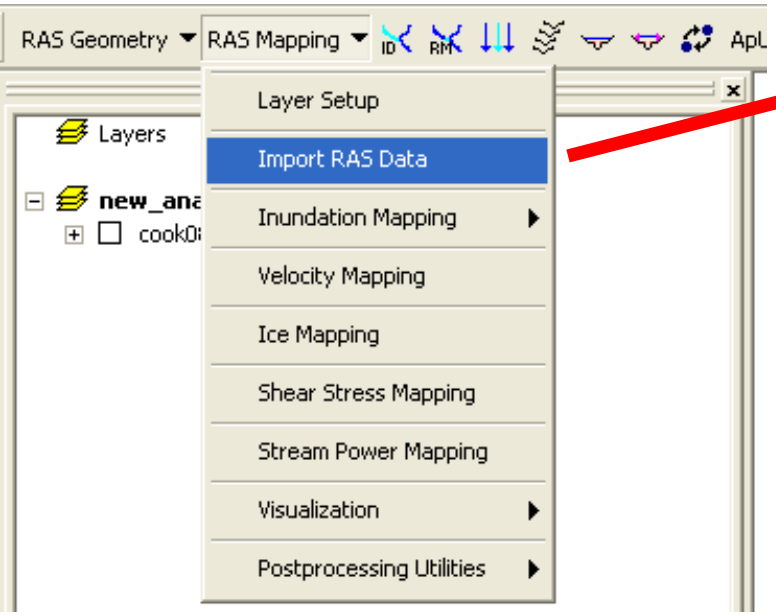
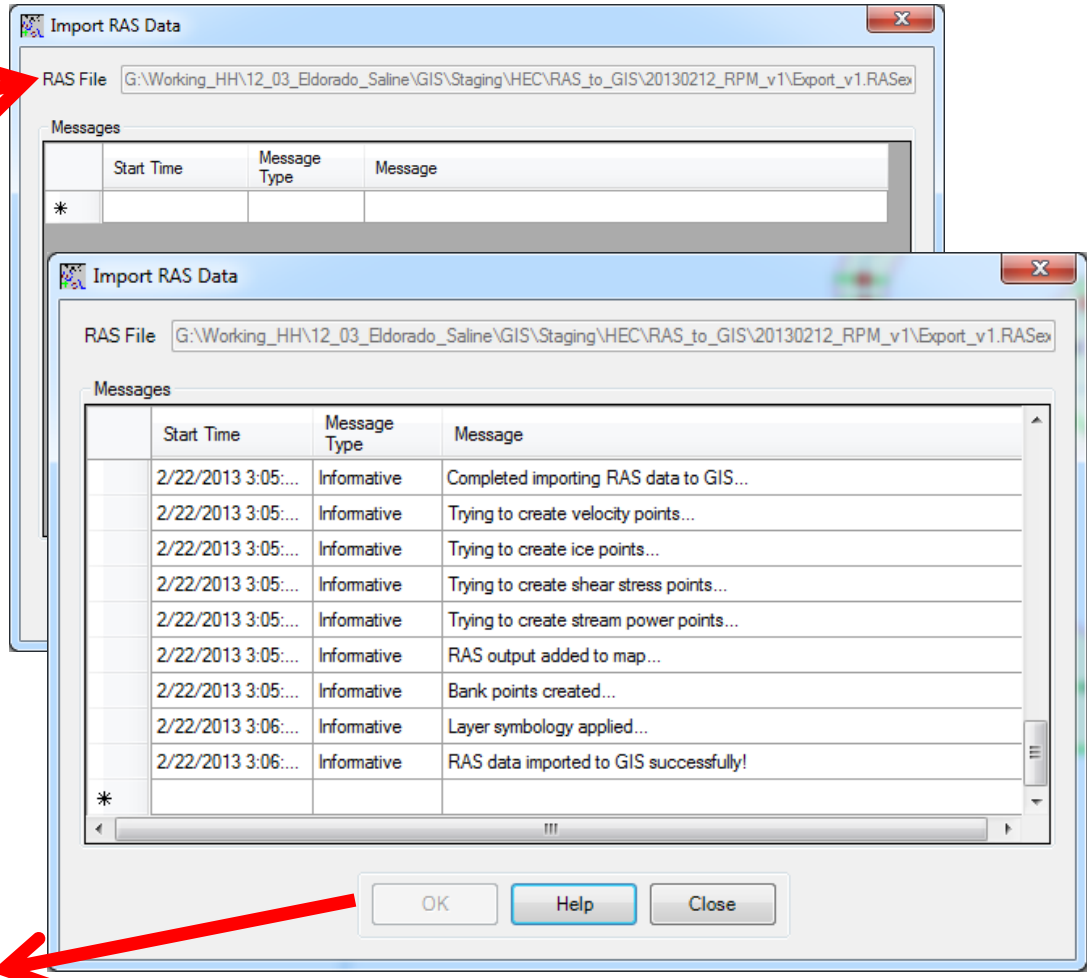
Export GIS Files from HEC-RAS

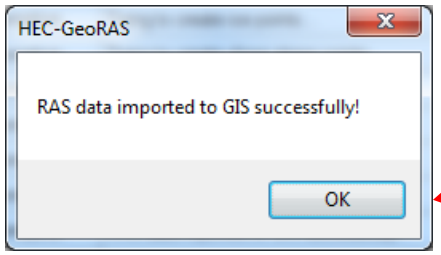
Extract GIS Data from Hec-RAS using the Geo-RAS Tool in GIS

8.) RAS Mapping Toolbar



9.) Watch Magic





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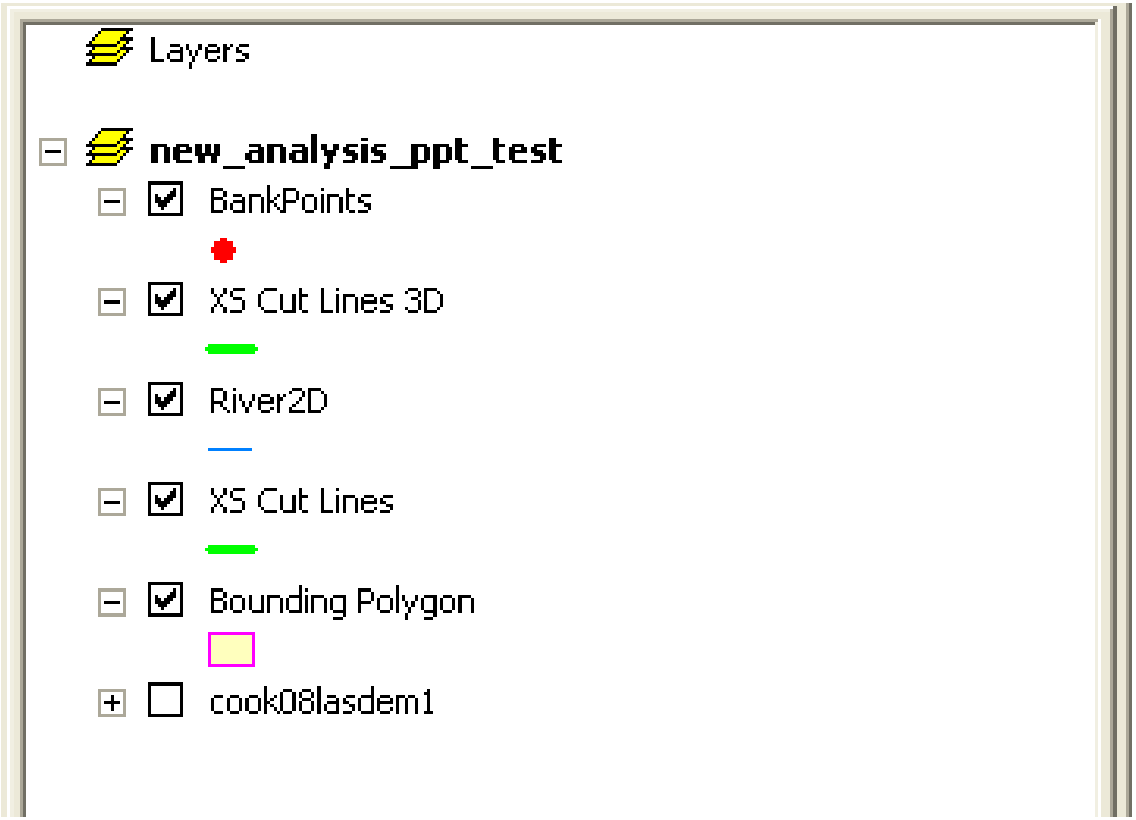
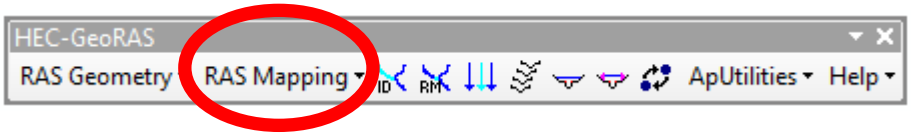
Export GIS Files from HEC-RAS

Extract GIS Data from Hec-RAS using the Geo-RAS Tool in GIS

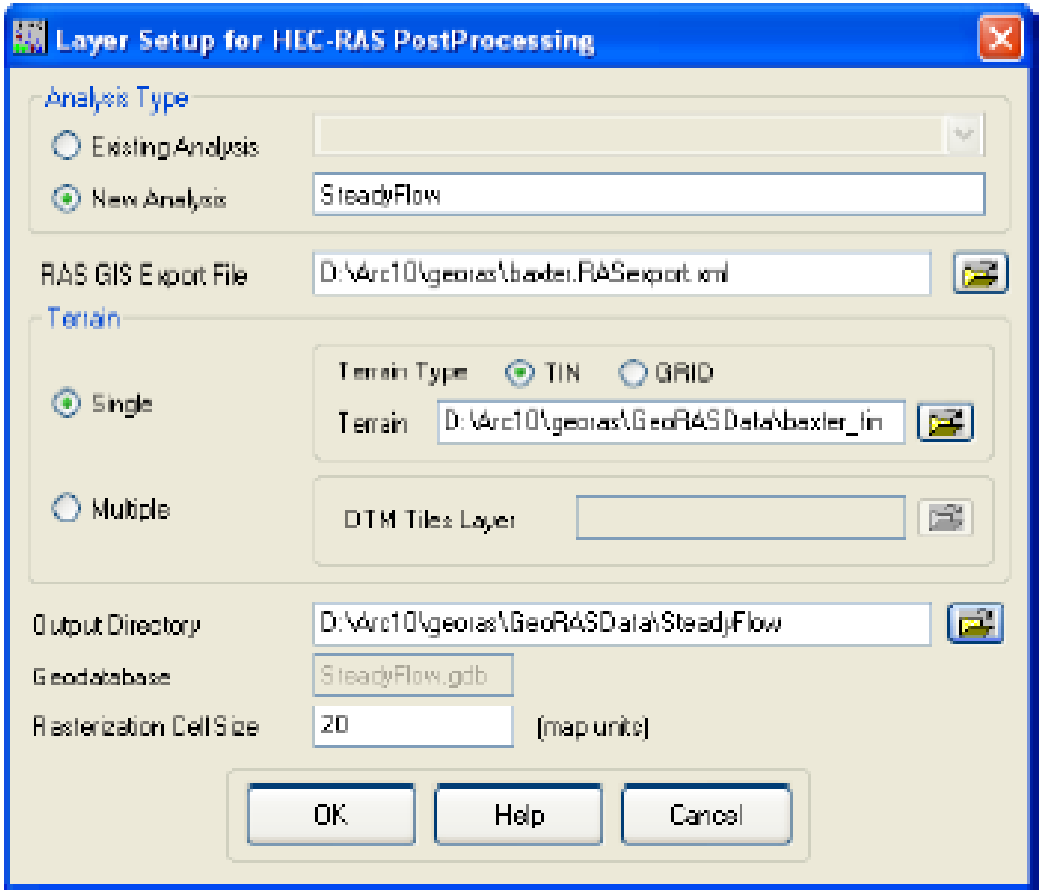
9.) Data Processing Completed



Inundation Mapping Using GeoRAS



- To begin click
  - RAS Mapping
  - Layer Setup
    - Populate post processing layer menu



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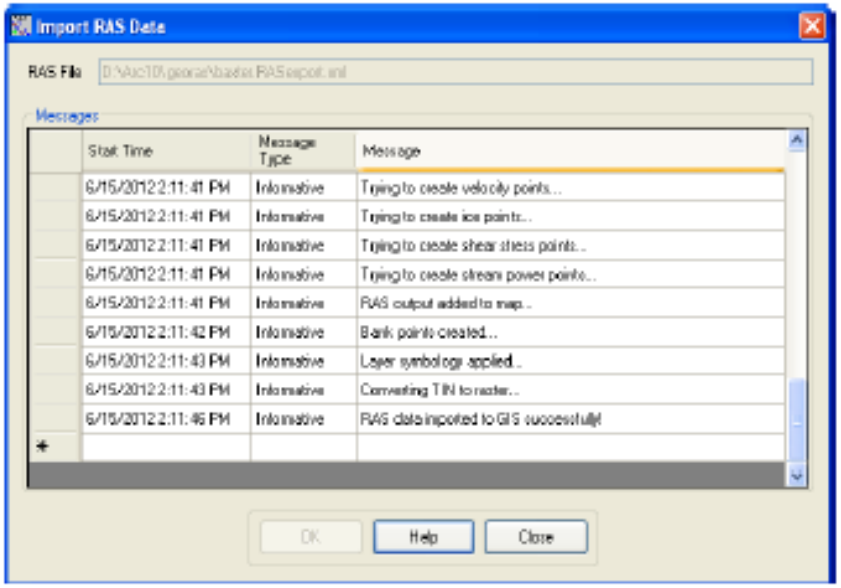
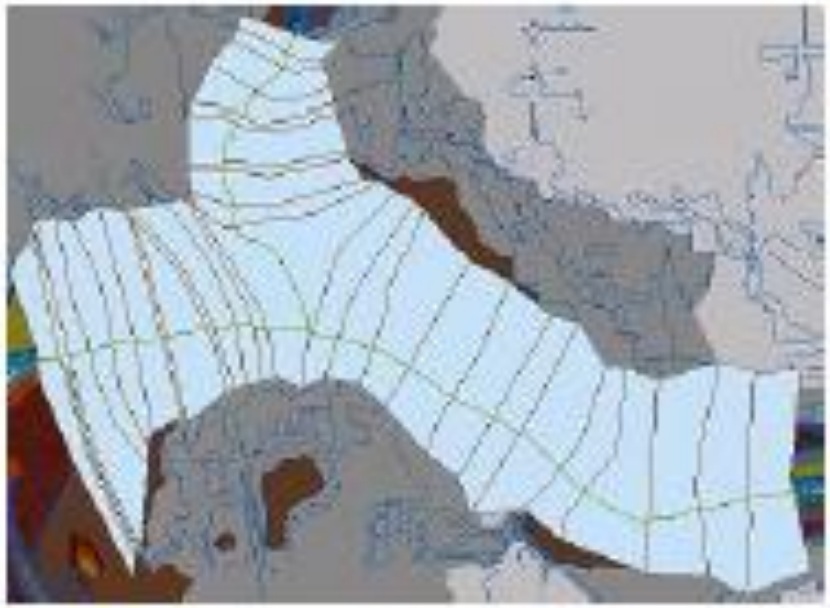
Inundation Mapping Using GeoRAS

- Next Step
  - RAS Mapping
  - Import RAS Data



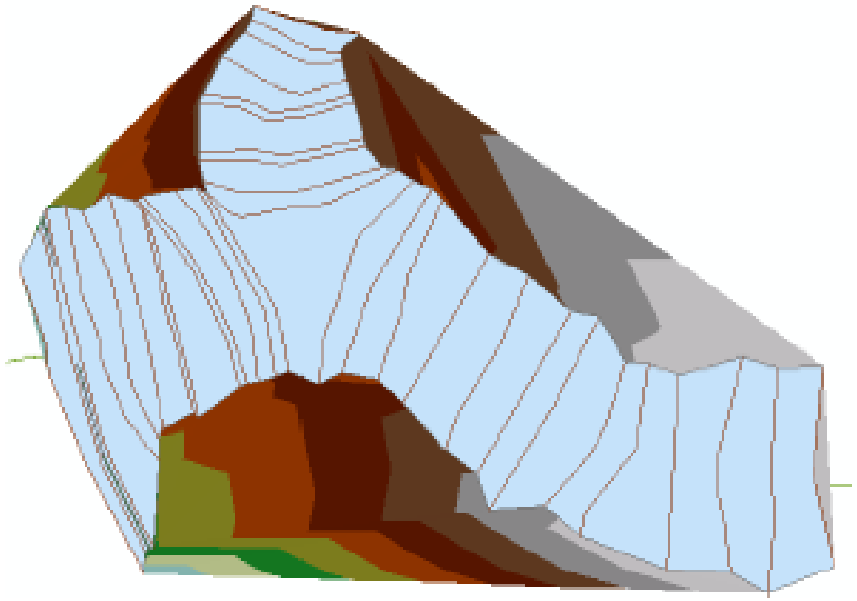
Inundation Mapping Using GeoRAS

- Bounding Polygon Created
- Defines analysis extent for inundation mapping



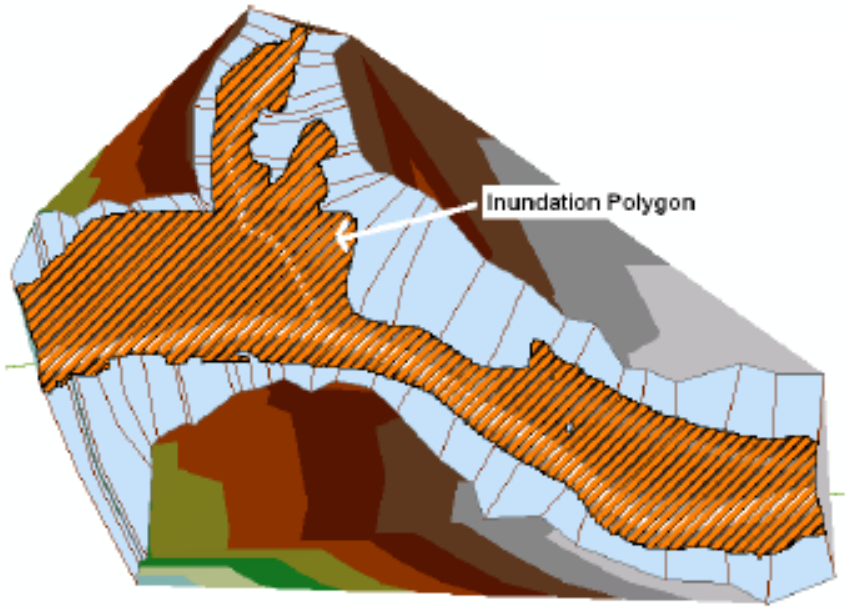
Inundation Mapping Using GeoRAS

- RAS Mapping
  - Inundation Mapping
    - Water Surface Generation
      - Pick a profile



Inundation Mapping Using GeoRAS

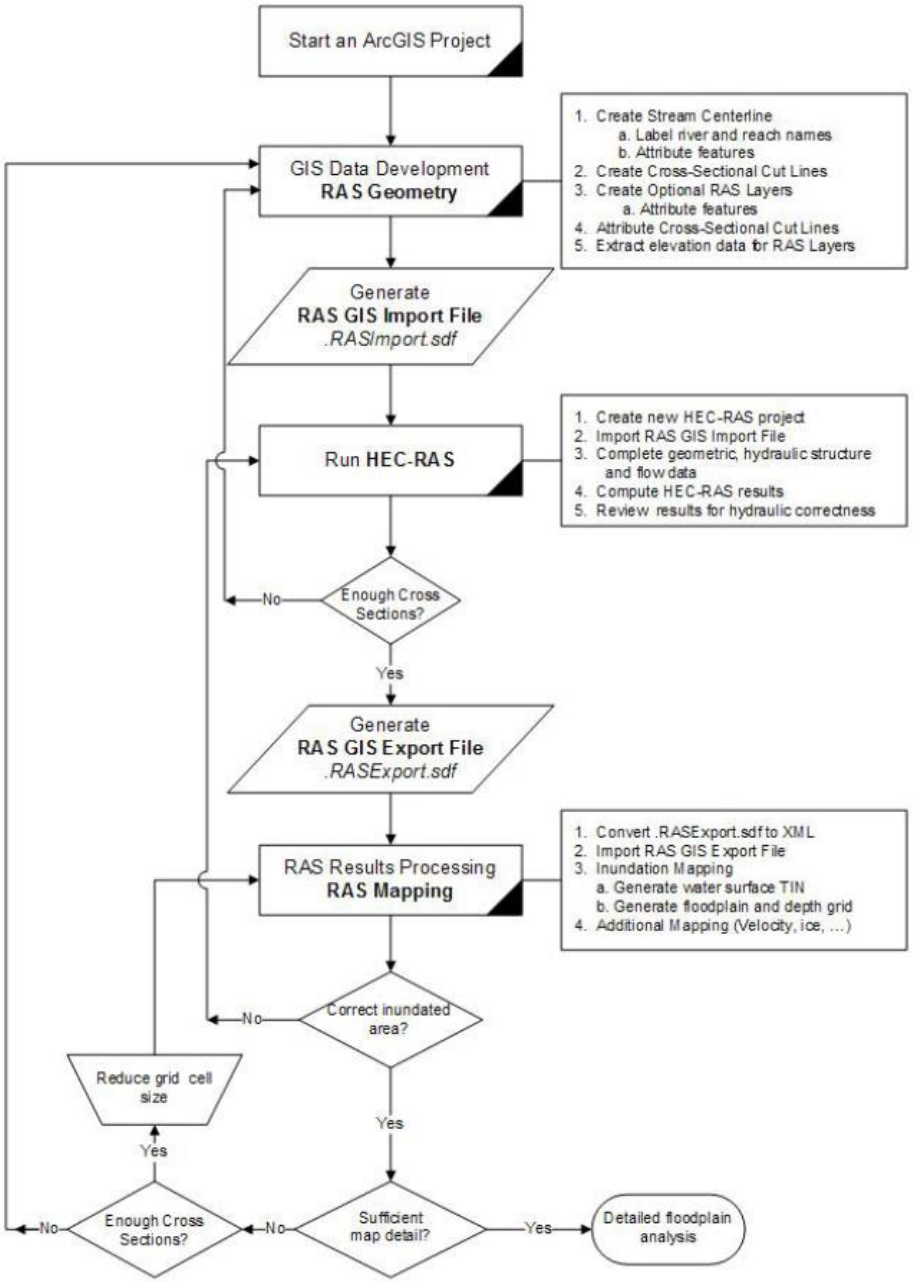
- RAS Mapping
  - Inundation Mapping
    - Floodplain Delineation using Rasters
      - Pick a profile
- DTMGRID – Water Surface
  - Positive Numbers
    - Water surface is higher than terrain (flooding)
  - Negative Numbers
    - Results are dry



Inundation Mapping Using GeoRAS

- WARNING: refinement of flood inundation results is not covered in Geo-RAS!
- The ability to judge quality of terrain and flood inundation polygons comes with the knowledge of study area and experience.
- Smoothing floodplains does not count as creating hydraulically correct output.
  - It induces error

GIS to RAS, RAS to GIS



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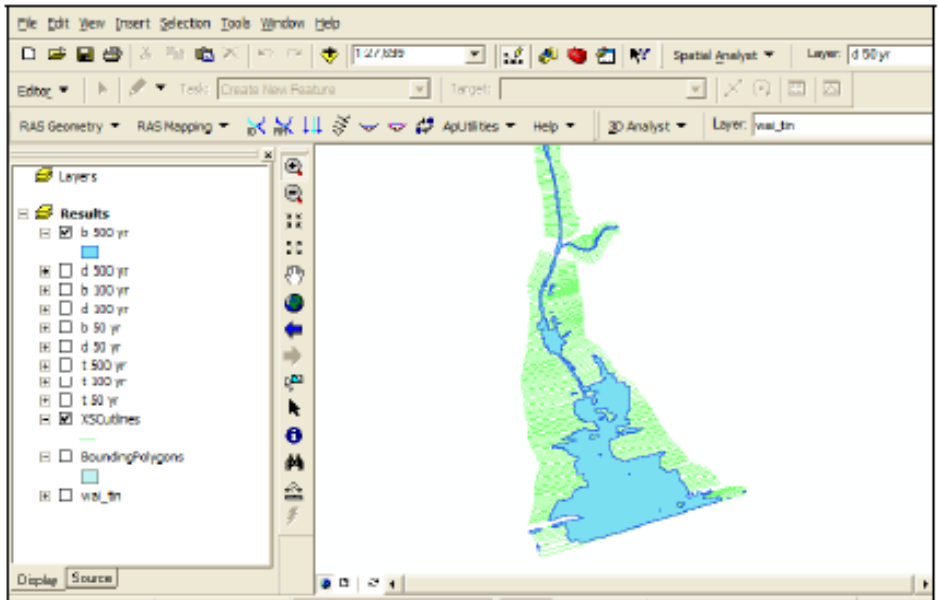
GIS Approach to Mapping Floodplains

Using "3D Analyst" and "Spatial Analyst" Extensions in ArcMap

- Extending Cross sections (Manually editing a copy of layer)
- Creating a TIN from extended Cross Sections
- Convert a TIN to Raster = WSEL Raster
- WSEL – Land Surface = floodplain
- Reclassify raster results
- Convert raster to feature
- Clean up the features
- Create Topology Rules
- Attribute Flood Hazard Lines



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Update Elevations

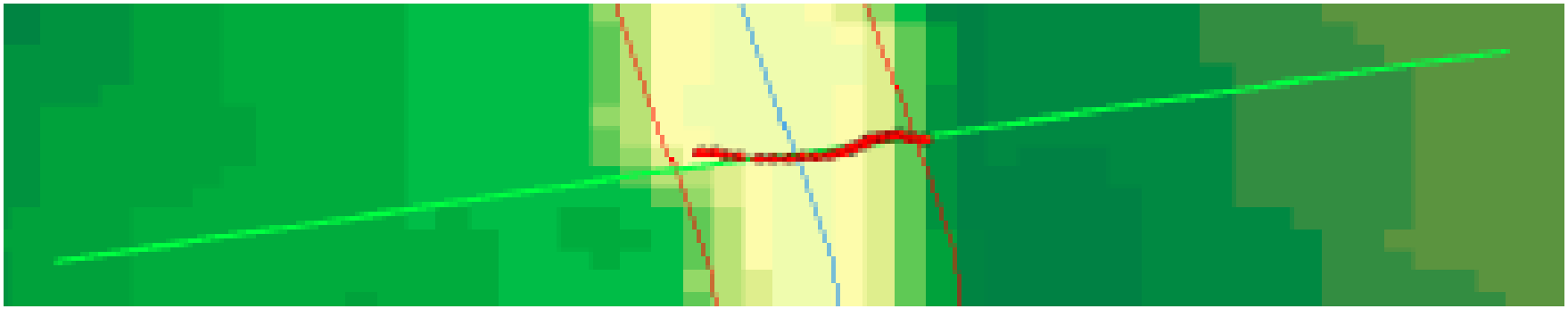
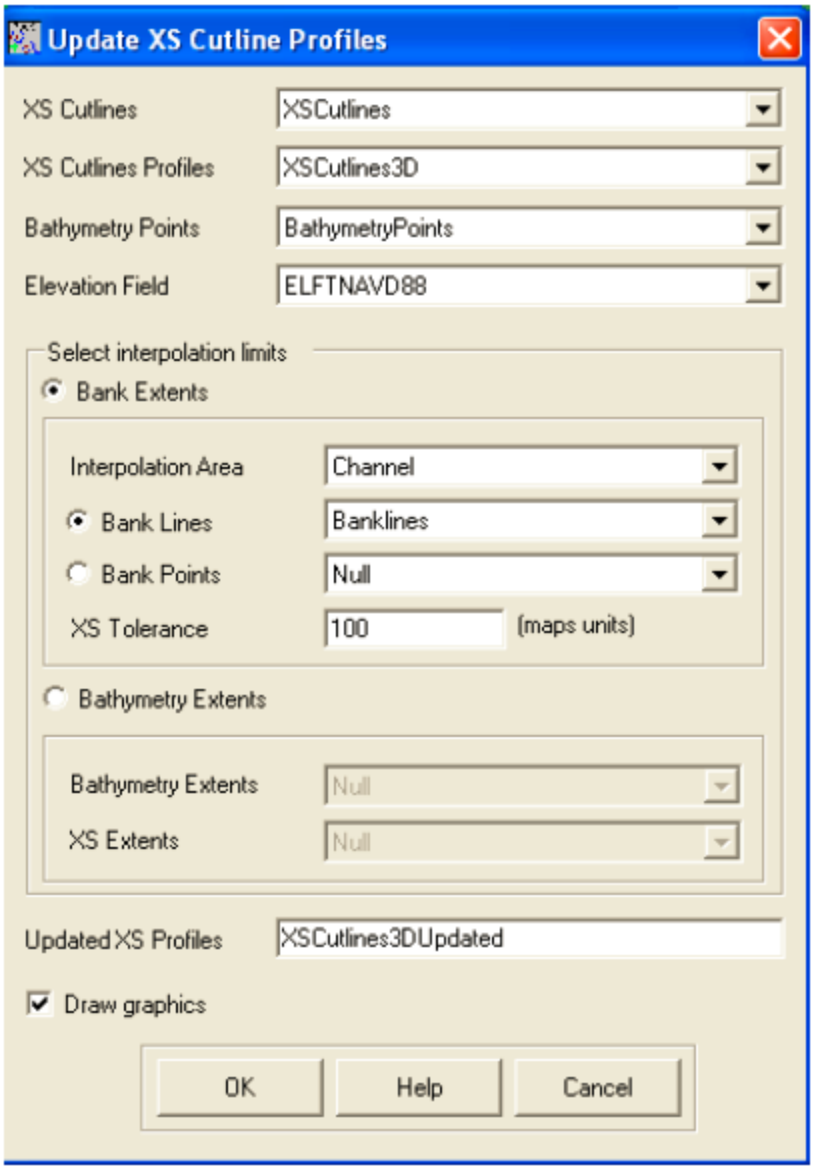


Figure 4-10. Bank lines define the limit of elevation replacement by point data on a cross section.

- Incorporate Survey Points into 3D XS feature class
- XS must have previously extracted elevation from the land surface (DTM or DEM, TIN)

Update Elevations

- Elevation Update Tool
  - Requires:
    - Point feature class
    - Field of elevation values



Update Elevations

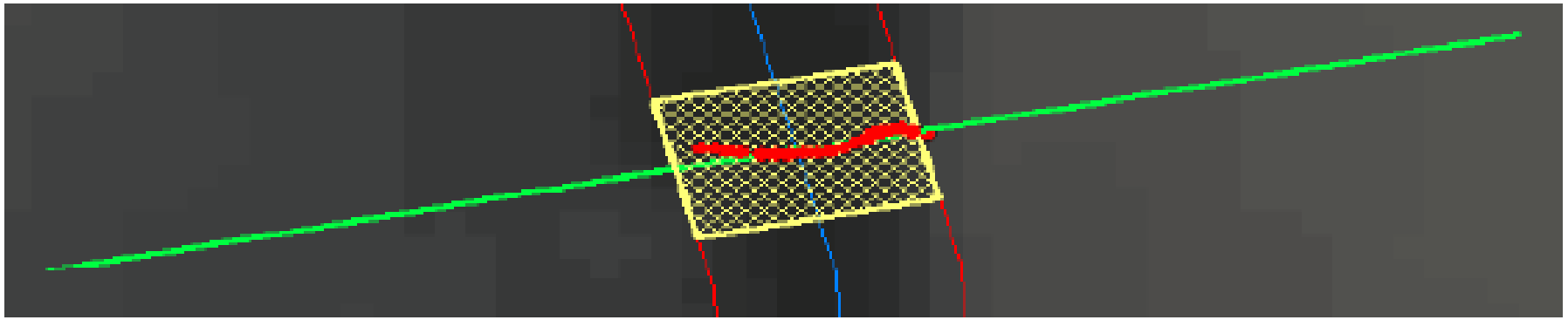


Figure 4-12. Elevation points used in the update process are highlighted along with the extents used for point inclusion.

- XSCutlines3D feature class
- Elevation Points
- “ElevUpdate” field is added and includes a “1” if point is used

Update Elevations

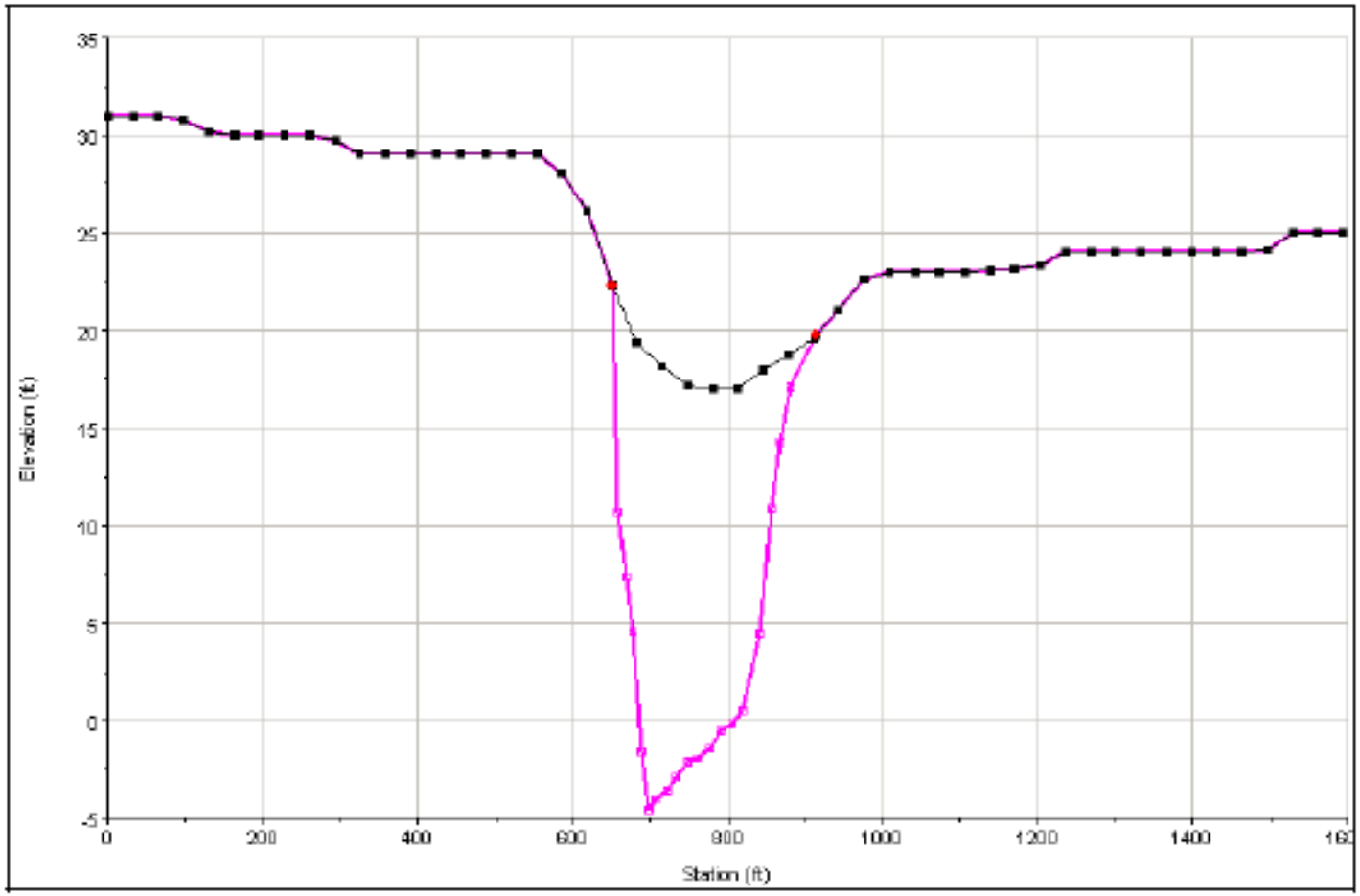
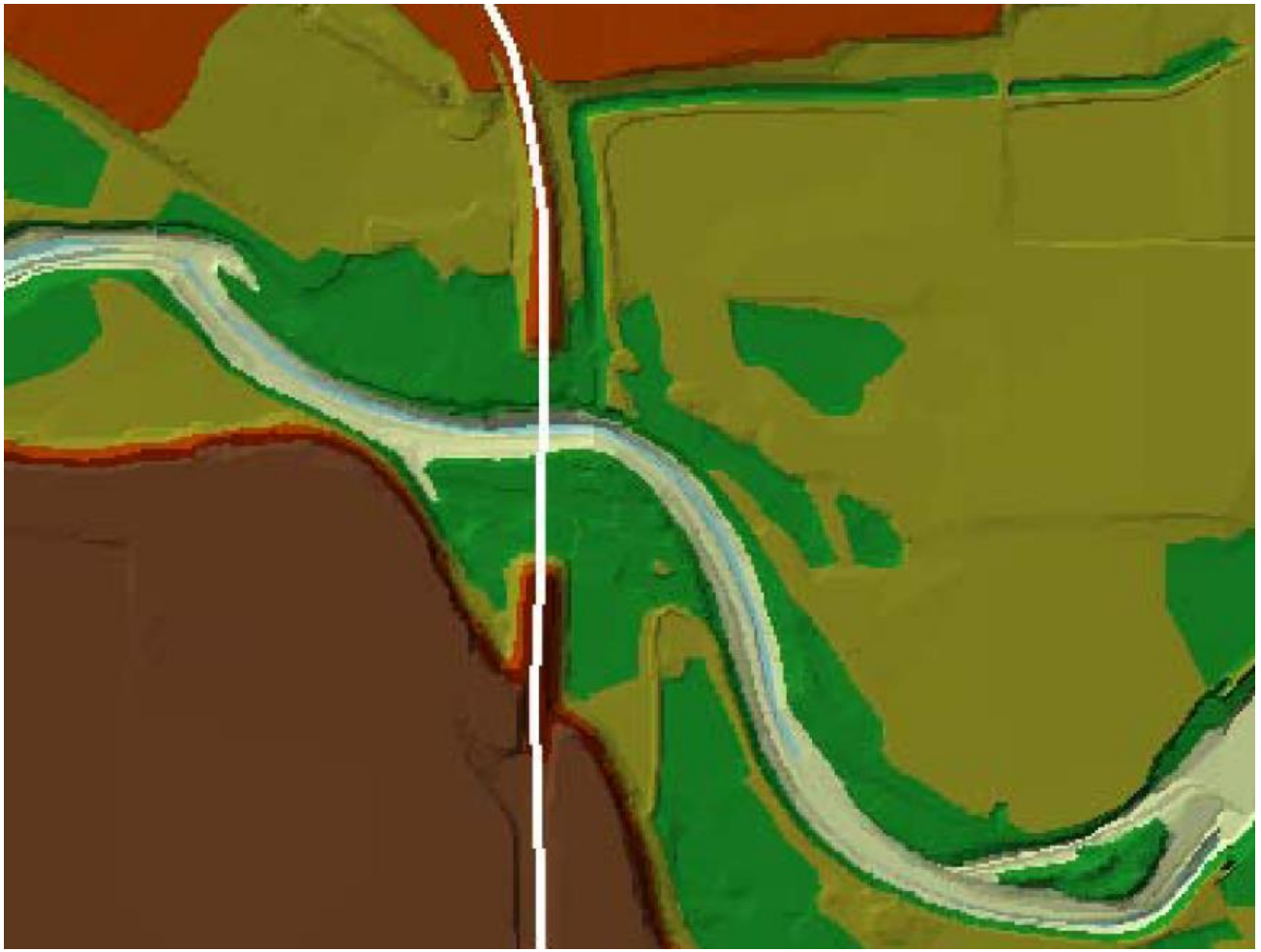


Figure 4-13. Comparison of original cross section with updated profile with channel data.

Developing Bridge \ Culvert Data

(optional) Same method for Inline Structures



RAS Geometry | Bridges / Culverts| River/Reach Names
Stationing
Elevations

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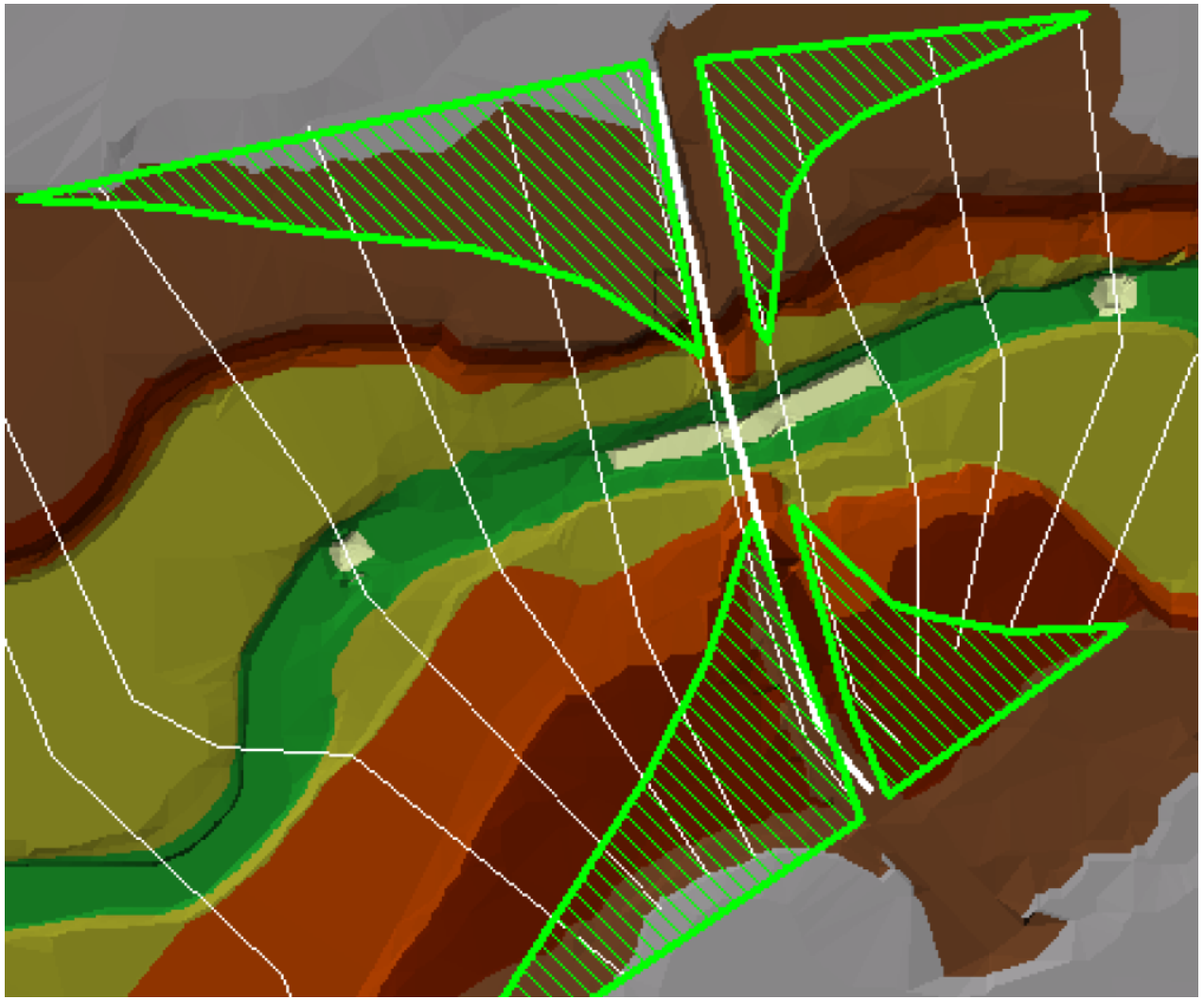
Developing Ineffective Flow Areas

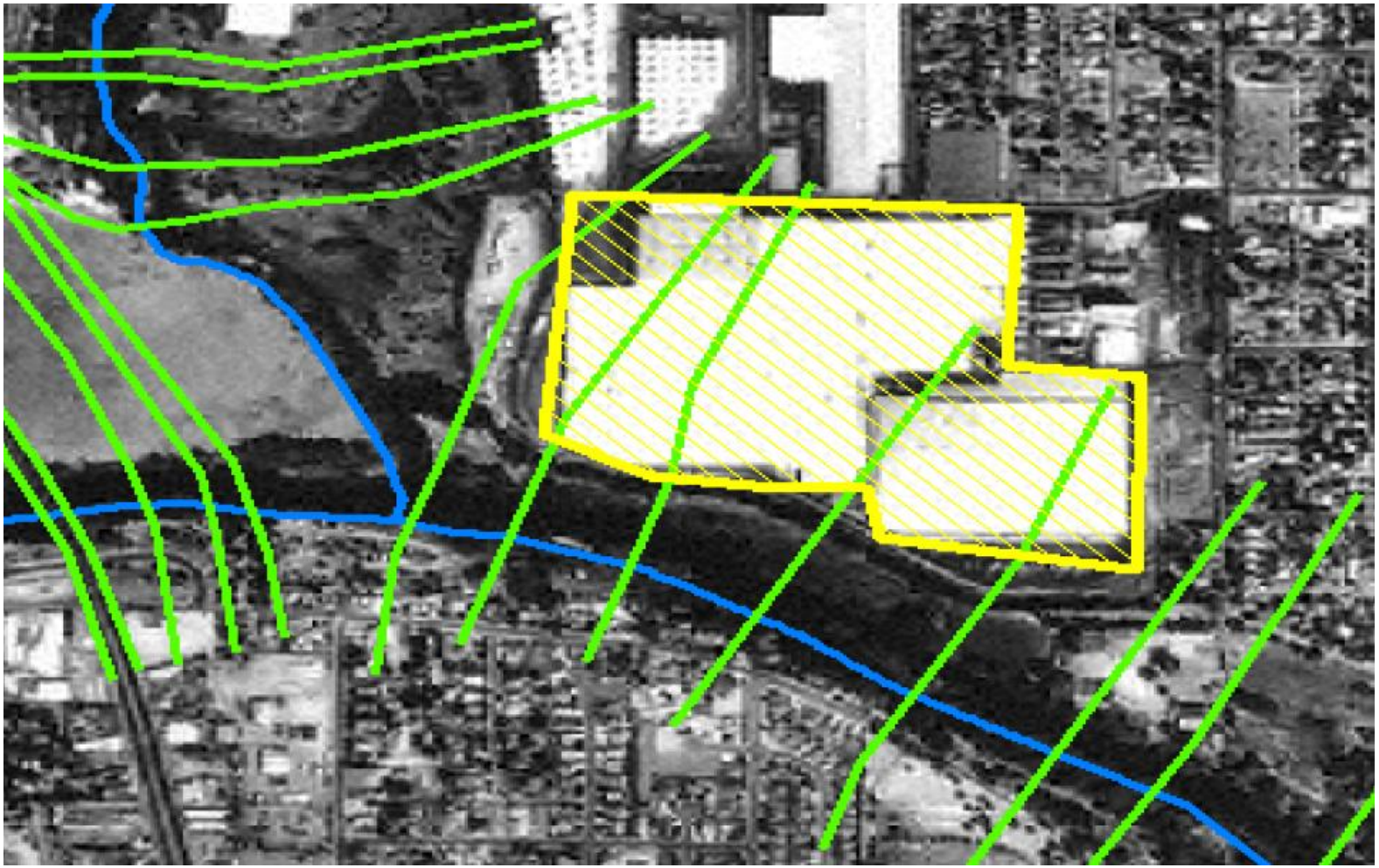
(optional)



RAS Geometry | Ineffective Flow Areas | Positions

Developing Blocked Obstructions

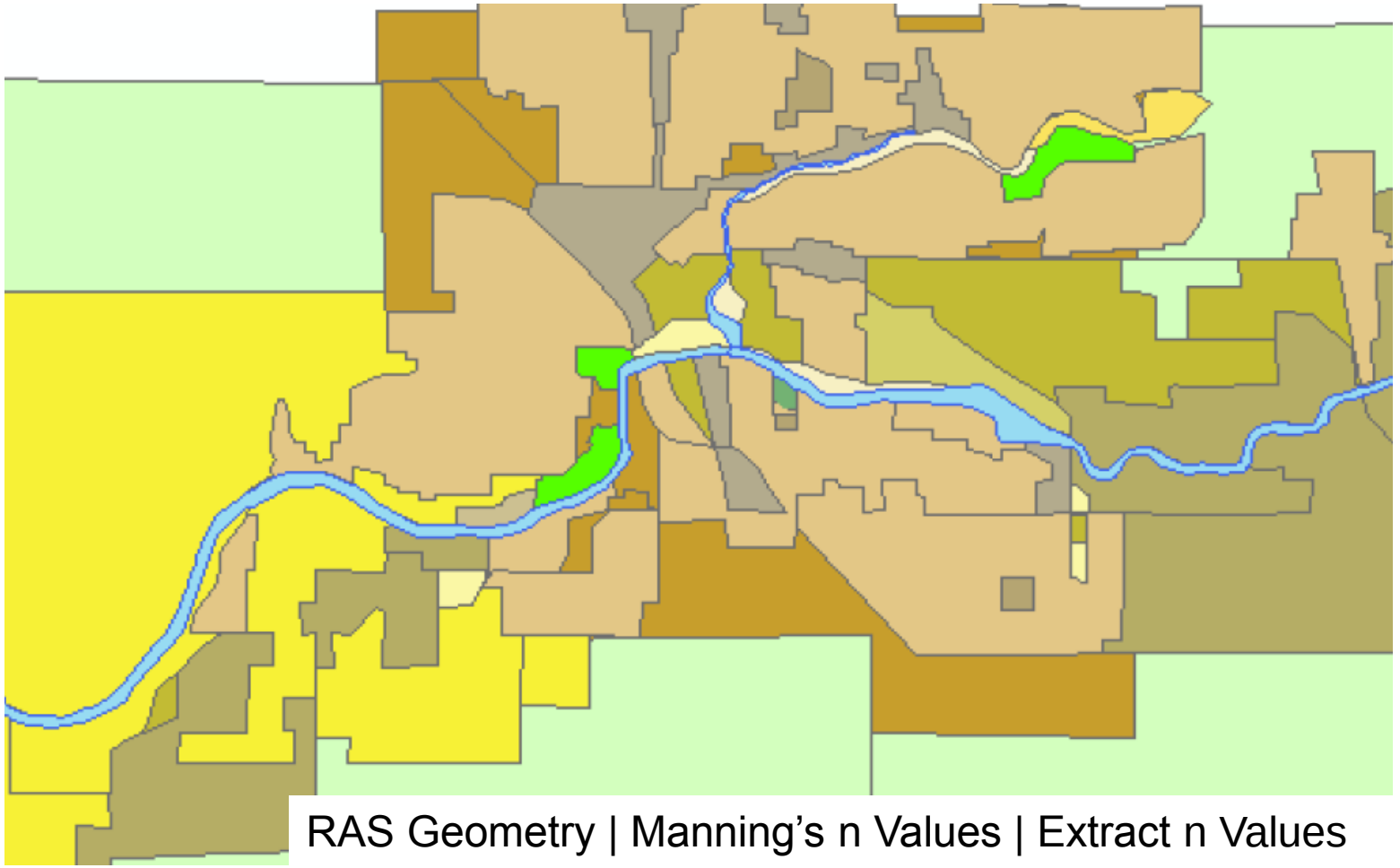
(optional)



RAS Geometry | Blocked Obstructions | Positions

Developing Manning's 'n' from Land Use Data

(optional)



RAS Geometry | Manning's n Values | Extract n Values

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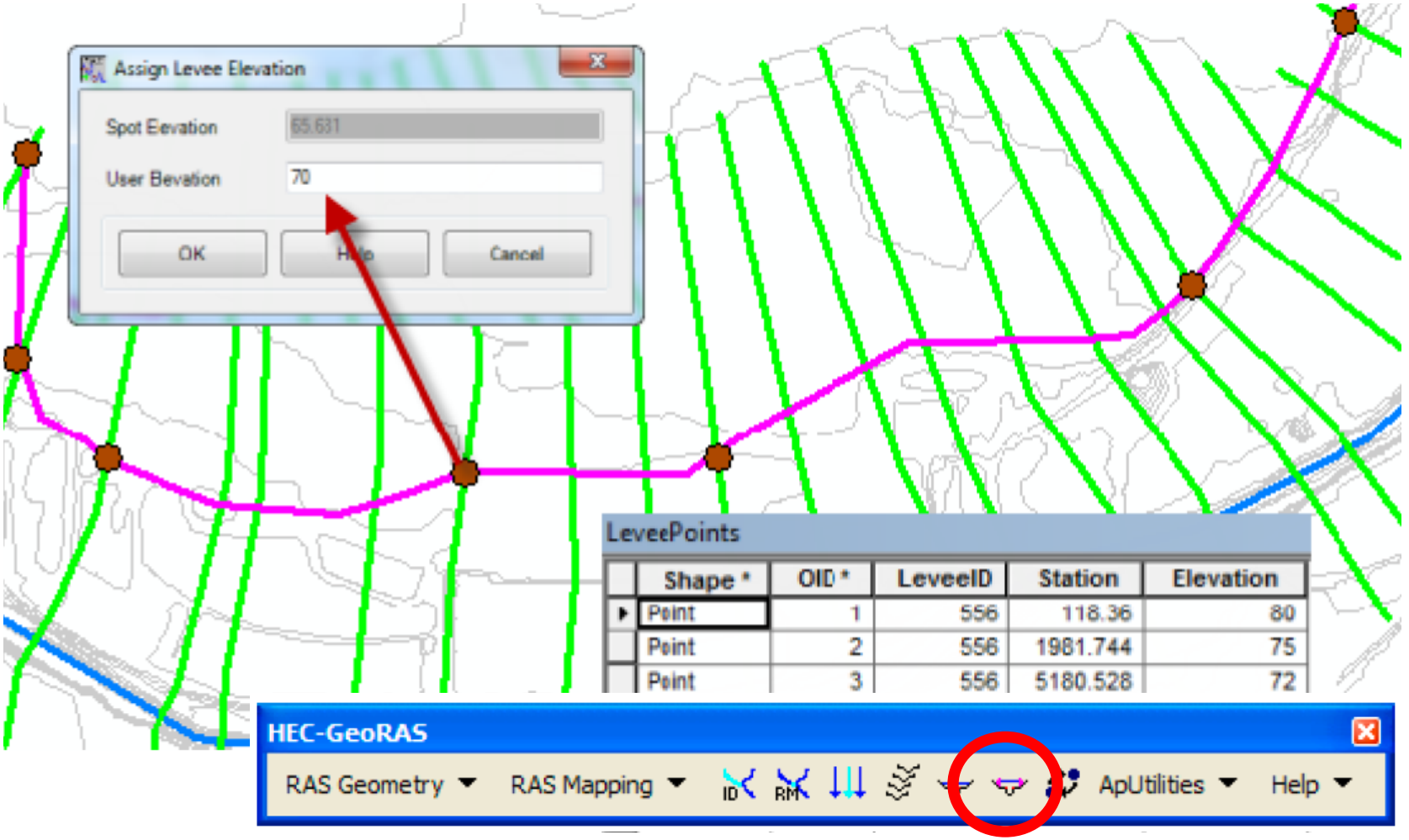
Developing Levee Data

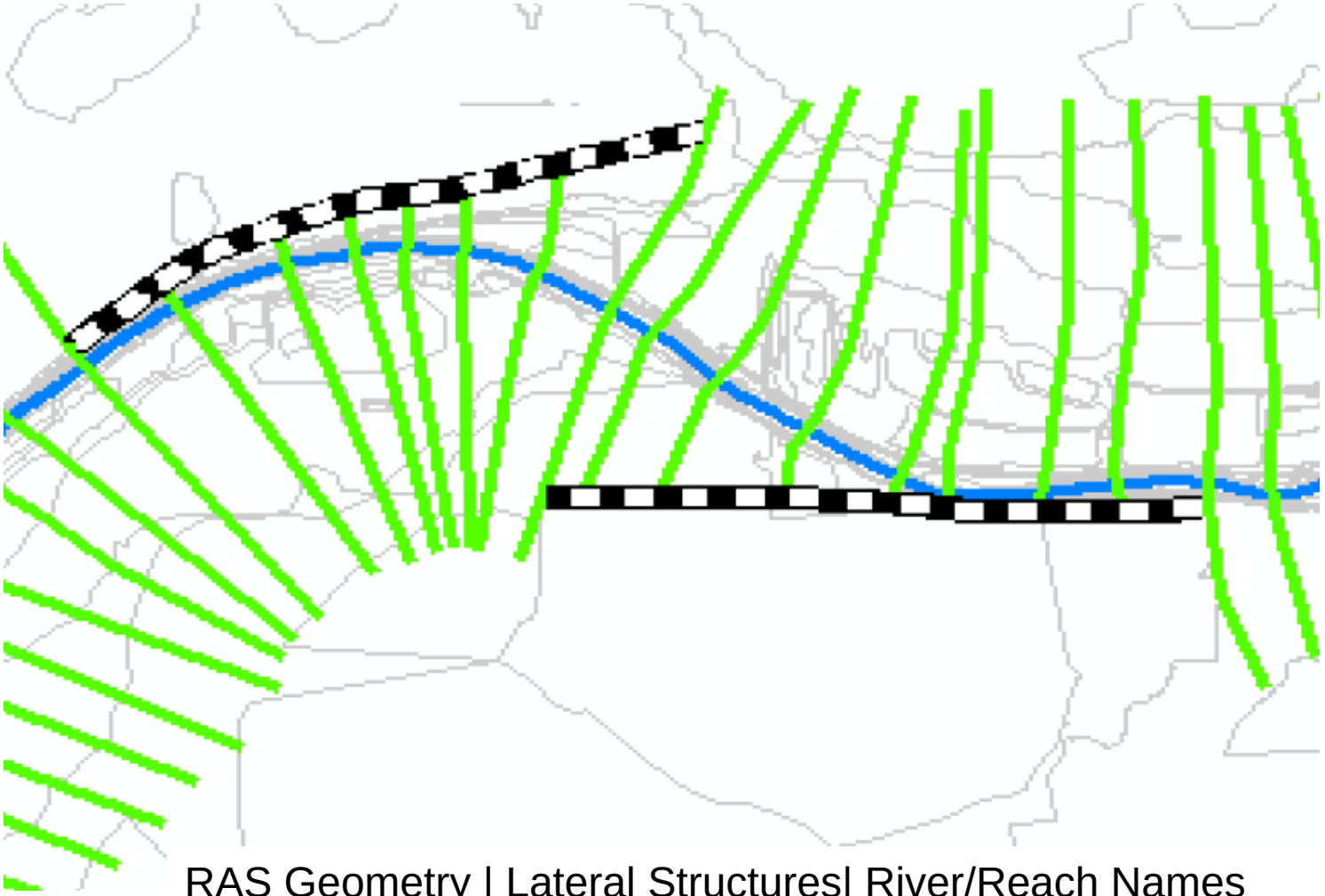
(optional)



RAS Geometry | Levee | Profile Completion Positions

Developing Lateral Structures

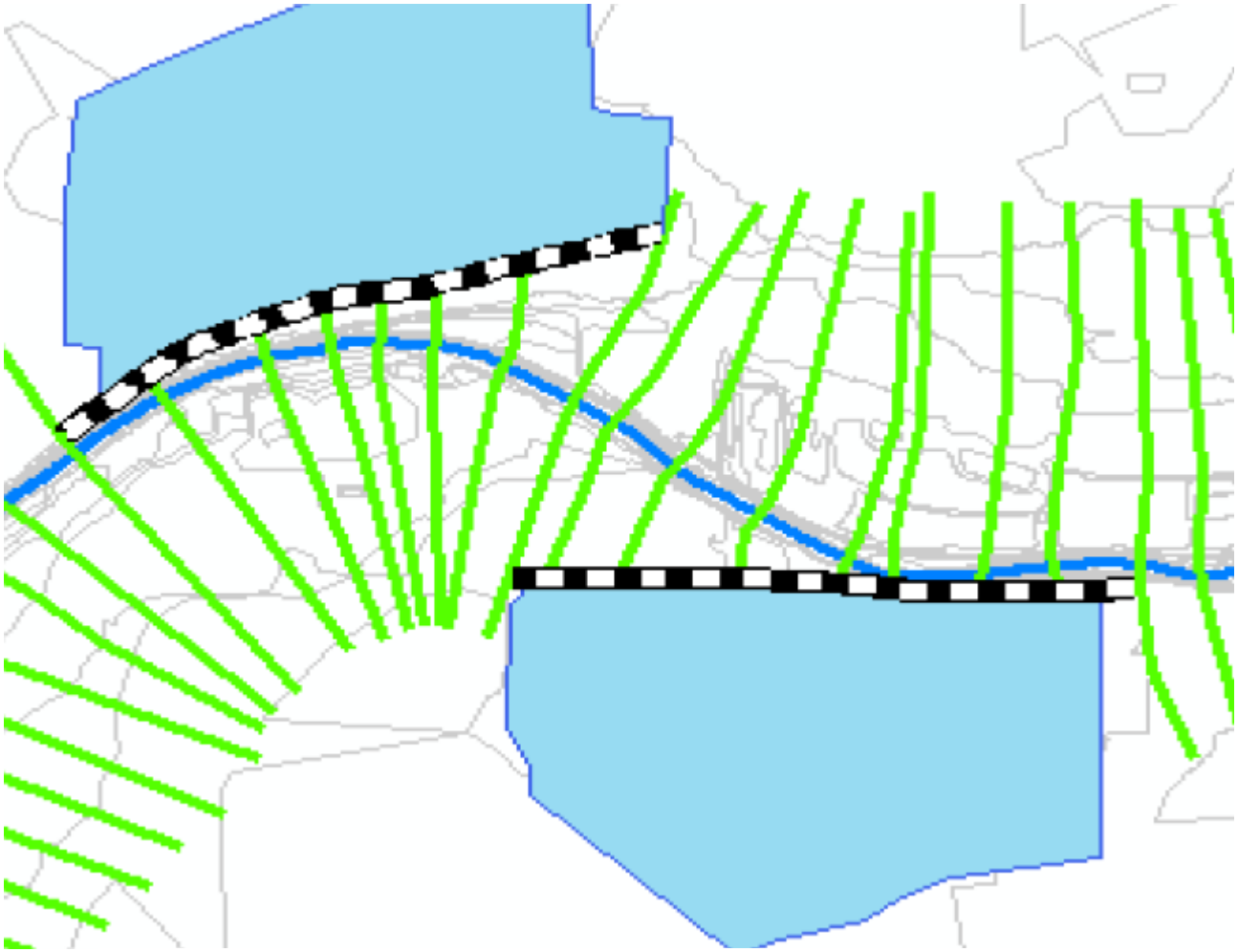
(optional)



RAS Geometry | Lateral Structures| River/Reach Names
Stationing
Elevations

Developing Storage Areas

(optional)



RAS Geometry | Storage Areas | Elevation Range
Elevation-Volume Data

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Developing Tiled Terrain Data

(optional)

- Need a terrain tiles feature class to serve as a look up table
- Each RAS layer feature must be contained within one terrain tile polygon feature
- DTMs should overlap to properly represent the terrain at the edges when using TIN models
- DTMs should break at straight river reaches and not confluences
- All of Chapter 9 of the GeoRAS Users Manual is devoted to this topic

Additional Reference Materials

- http://www.hec.usace.army.mil/
- HEC-GeoRAS User's Manual v10
- HEC-GeoRAS 10 Example Data Sets
- HEC-RAS 4.1 User's Manual, Applications Guide, and Hydraulic Reference Manual
- *Tutorial on using HEC-GeoRAS with ArcGIS 10 and HEC RAS Modeling* by Venkatesh Merwade, Purdue University

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