Developing Geometric Data with RAS Mapper

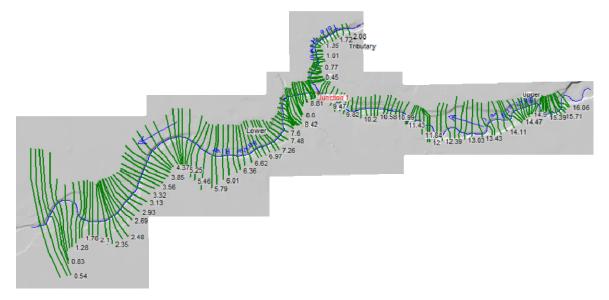
Workshop

1 Objective

In this workshop, you will use HEC-RAS to create a new RAS Terrain and RAS Layers necessary to create a 1D river hydraulics model.

2 Background

The workshop requires you to create geometry from scratch. The terrain models for the workshop are provided and you will start by importing them to a RAS Terrain. You will be working with the Baxter dataset to create a 3 reach model similar to that shown below (but you don't need so many cross sections!).



3 Geometry Development

You will be starting from scratch with a new HEC-RAS project.

3.1 Create a new HEC-RAS Project

1. Create a **NEW** HEC-RAS project and give it a Name.

New Project		
Title	File Name	Selected Folder Default Project Folder Documents
GeometryDevelopment	GeometryDevelopment	C:\Temp_2022_Steady Class\Workshops\Geometry Development
		C:\ Temp J2022_Steady Class Workshops Geometry Development GISData

- Open RAS Mapper and set the Projection for the project, using the Tools | Set Projection for Project menu item. Browse to the "GISData" folder in the workshop folder.
- 3. Select the "**projection.prj**" file

🚟 RAS Mapper Options	×
Project Settings	Coordinate Reference System
Projection *	Projection File: C:\Temp\ 2022 Steady Class\Workshops\Geometry Development\GISData\projection.prj
General	Projection Prile, C. Vremp V_2022_steady class (workshops vaeometry Development valis Data projection.pt)
Render Mode	PROJCS["NAD_1983_StatePlane_California_III_FIPS_0403_Feet",GEOGCS["GCS_North_American_1983",DATUM
Mesh Tolerances	[I"D_North_American_1983",SPHEROID['GRS_1980",6378137,298,257222101],PRIMEM['Greenwich'',0],UNIT ["Degree",0.0174532925199432955]],PROJECTION['Lamber_Conformal_Conic''],PARAMETER ["False_Easting'',5561666.66666666],PARAMETER['False_Northing', 1640416.666666667],PARAMETER
Global Settings	["Central_Meridian",-120.5).PARAMETER["Standard_Parallel_1",37.06666666666666666667].PARAMETER ["Standard_Parallel_2",38.43333333333333333].PARAMETER["Latitude_Of_Origin",36.5].UNIT
General	["Foot_US",0.304800609601219241]]

4. Press **OK** to close the Options window.

3.2 Import the Terrain Model

- 5. Create a new terrain model using the **Project | Create New RAS Terrain** menu item.
- 6. Click to + button to add the terrain files.
- 7. Navigate to the "\GISData\Terrain" folder and select the 5 terrain tiles (with the .flt file extension).

New Terrain Layer					2
Set SRS	files)				
+ Filename		Projection	Cell Size	Rounding	Info
+ Filename tile1.fit			20	(na)	i
tile2.flt			20	(na)	i
★ tile3.flt			20	(na)	i
			20	(na)	i
◆ tile5.ft			20	(na)	i
Output Terrain File – Rounding (Precision) Vertical Conversion:	Use Input File (Default)	🔽 Mer	ge Inputs to Si	ngle Raster	
Filename:	C:\Temp_2022_Steady Class\Workshops\Geometry Develop	oment\Terrain\T	errain.hdf		
				Create	Cancel

- 8. Press the **Create** button to import the terrain data.
- 9. After the data has imported, **double-click** on the Terrain layer that was just created and spend a few minutes exploring the display options. (Keep Layer Properties open.)
 - a. Check on the "Update Legend with View" option.
 - b. Turn on the "Plot Contour" option. Change the contour interval.
 - c. Check on the "Plot raster file outlines" and "Plot raster file names" options.
 - d. Toggle the "Plot Surface" option.
 - e. Set the Terrain display options to your liking, and continue on.

3.3 Create RAS Geometry File and Layers

10. In RAS Mapper, right-click on the **Geometries** node and choose **Add New Geometry**. Enter a name for the geometry and hit OK.

🧱 New Geometry Data		×
Enter a unique Name for the new Geometry:		
Existing		
	ОК	Cancel

11. **Edit** the Geometry. The pencil icon is a shortcut.

3.4 Create the River Network

- 12. Click on the **Rivers** node.
- 13. Draw the river network (as shown above) with the Baxter River and Tule River coming together.
 - a. Left-click to add a point to a line, double-click to end a line.
 - b. Right-click to re-center the map display.
 - c. Use the Shift key to Pan, use the Mouse Wheel to Zoom in and out.

14. Draw the Baxter River first. When finished drawing a river reach you will be prompted for a name.

prompted re		
Provide River an	d Reach Name	×
River Name:	Baxter River	•
Reach Name:	Main	
🗖 Rename entire	River (All other	Reaches)
	ОК	Cancel

15. <u>Draw Tule Creek and end it "on top"</u> of the Baxter River.

Provide River and	d Reach Name	×
River Name:	Tule River	•
Reach Name:	Tributary	
🗖 Rename entire	River (All other	Reaches)
	ОК	Cancel

16. A junction will be formed when you end a river reach segment on an existing river reach. Multiple dialogs will prompt you to (a) split the river reach, (b) rename the lower reach, and (c) provide a junction name.

	Create a New Junction
	Would you like to split the river 'Baxter River - Main' and create a junction?
a)	Yes No
	Reach Name
	Provide a unique name for the Lower Reach (16 char. max)
b)	Main-Lower OK
-	Junction Name
	Provide a unique name for the Junction (16 char. max)
c)	Junction 1 OK

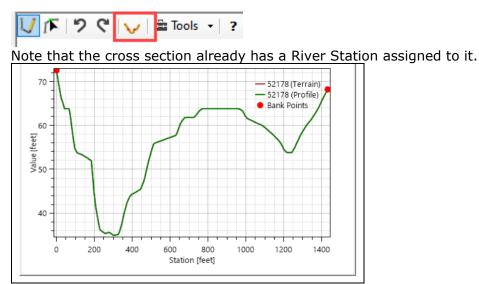
17. Note that by default the name of the river and reach is automattically drawn at the start of each river reach. Open the River Layer Properties.

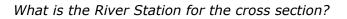
What other drawing options are available and what do they do?

3.5 Layout Cross Sections

For this workshop we are going to ignore laying out bank lines and flow path lines and skip straight to the cross sections.

- 18. Select the **Tools | Options** menu item.
- 19. Change the "XS River Stations" Units to **Miles** and press the **OK** button.
- 20. Click on the **Cross Sections** node.
- 21. Create a dozen (or so) cross sections on each river reach to resonably represent 1D river/floodplain flow. Cross sections should be created left to right when looking downstream!
- 22. After you have created a cross section, **Plot the elevation profile**.





What units are being used?

Where are the Banks Stations?

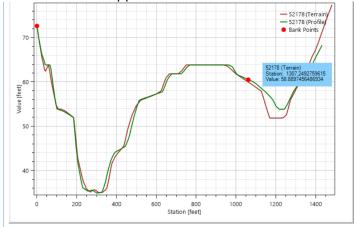
23. Create another cross section. Note that the Profile Plot automatically updates!

24. When **FINISHED** created features, select the **Geometries Node | Stop Editing** menu item. Select **Yes** to confirm the edits.

Save Edits (Existing)		×	
Do you want to Save	e Edits for 'Exist	ing'?	
Yes	No	Cancel	

3.6 Modify the Cross Section Data

- 25. Start Editing the Geometry in RAS Mapper.
- 26. Select the Cross Sections layer.
- 27. Select a cross section.
- 28. **Plot** the Elevation Profile.
- 29. **Start editing** the cross section (with a **double-click)**.
- 30. Grab one of the end points and move it to make the cross section wider and/or change how it crosses the floodplain.
- 31. Observe what happens to the Profile Plot.



Note that the Terrain no longer matches the cross section Profile. This is because the crosss section is considered an "existing cross section" and we don't RAS Mapper to unintentially overrite data.

- 32. **Double-click** to finish the cross section.
- 33. Update the cross section by right-clicking on the cross section and selecting **Compute | Elevation Profile** from Terrain.
- 34. **Plot** the cross section to see if the terrain matches the profile plot.

3.7 Auto Update Geometry

- 35. Make sure you are **Editing** the Geometry in RAS Mapper.
- 36. **Select** the Geometry layer, right-click and choose the **"Auto Update Geometry**" option.
- 37. Click the "Check All Properties" button to turn on updating for each property.

RAS Geometry Properties		×
Filename: C:\\Workshops\Geome Title: Existing Associated Layers	try Development\Geom	netryDevelopment.g01.hdf
Terrain: Terrain	Infiltration:	(None)
Manning's n: (None)	Sediment Soils:	(None)
% Impervious: (None)		Manage Associations
Summary Editor		
Automatically Update Geometric Cross Sections: ▼ River Stations ▼ Banks Stations ▼ Reach Lengths ▼ Elevations - Channel ▼ Elevations - Overbanks	Data When Editing Fea ✓ Ineffective Area ✓ Blocked Obstru ✓ Manning's n Va	as uctions
Structures:	Storage Areas:	
River Stations	Elevation-Volu	me Info Uncheck All Properties
Highlight entire hydraulic model li	mits	Close

- 38. **Plot** a cross section.
- 39. Edit a cross section by moving it around and note the behavior.

What happens to the elevation profile?

40. **Edit the stream centerline** to change the length of the river between cross sections.

What happens to the cross section's river station?

41. **Right-click** on the Geometry and choose the "**RAS Geometry Properties**" menu item.

What options are available for automatically updating the geometry?

3.8 Creak Bank Lines

42. Click on the **Bank Lines** node.

W – Geometric Data Development

43. Create a line for the Left Bank and Right Bank for each River.

3.9 Create Flow Path Lines

- 44. Click on the **Flow Path Lines** node.
- 45. Create a line for the Left Overbank and Right Overbank flow for each River.

3.10 Add Manning n value Information

- 46. Select the **Project | Create New RAS Layer | Land Cover** Layer menu item
- 47. Browse to the "GISData\LandCover" folder and select the **NLCD** data.

Import Extents: Terrains Import Extents: Terrains Projection Info Naming Std. Name Field Indd2011_5ft.td (Same as Project) Cell Size: 5 US sur NLCD 2016 N/A Unique Classification Names for Selected File Name Field Classification 0 NoData 82 Cutivated Crops 21 Developed, Open Space 23 Developed, Medium Intens 24 Developed, Medium Intenstry 23 Developed, Low Intenstry 95 Emergent Herbaceous We 11 Open Water 11 Open Water 0 Output ID Standards: NLCD 2016 Cell Size: 10 feet Expected Output Size: <1 MB Filename: C:\Land Classification.LandCover.hdf	🚟 Create a New Land Cove	r Layer									×
Hereinsen Projection Info Naming Std. Name Field Indcd2011_6h.td (Same as Project) Cell Size: 5 US sur NLCD 2016 N/A Image: Classification Names for Selected File Output File Image: Classification	Input Files										
Inde2011_5ft.tf (Same as Project) Cell Size: 5 US sur NLCD 2016 N/A Image: Classification Names for Selected File Output File Image: Classification Image: Classification </td <td>Import Extents: Terrain</td> <td>s 💌</td> <td>[</td> <td></td> <td>NLCD 2016</td> <td>•</td> <td></td> <td></td> <td>▼ Ac</td> <td>ld Field.</td> <td></td>	Import Extents: Terrain	s 💌	[NLCD 2016	•			▼ Ac	ld Field.	
Image: Classification Names for Selected File Output File Name Field Classification Name Field Classification Name Field Classification NoData 0 R2 Cultivated Crops 21 Developed, Open Space 23 Developed, Medium Intens 24 Developed, High Intensity 23 Developed, Low Intensity 24 Developed, Low Intensity 25 Emergent Herbaceous We 11 Open Water 12 Eveloped, Low Intensity 13 Classification Classification LandCover.hdf		Projection	Info		Naming Std.		Name I	Field			
Unique Classification Names for Selected File Name Field Classification 0 NoData 82 Cultivated Crops 21 Developed, Open Space 23 Developed, Medium Intens 24 Developed, Low Intensity 25 Emergent Herbaceous We 11 Open Water	× nlcd2011_5ft.tif	(Same as Project)	Cell Size: 5	US sur	NLCD 2016		N/A				
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0 NoData 82 Cuttivated Crops 21 Developed, Open Space 23 Developed, Medium Intensity 24 Developed, Low Intensity 25 Emergent Herbaceous We 11 Open Water 0 Output ID Standards: NLCD 2016 Cell Size: 10 feet Expected Output Size: <1 MB			_			n		ID			•
21 Developed, Open Space 23 Developed, Medium Intens 24 Developed, High Intensity 25 Emergent Herbaceous We 11 Open Water 11 Open Water 11 Output ID Standards: NLCD 2016 Cell Size: 10 feet Expected Output Size: <1 MB											
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24 Developed, High Intensity 22 Developed, Low Intensity 95 Emergent Herbaceous We 11 Open Water 0utput ID Standards: NLCD 2016 Cell Size: 10 feet Expected Output Size: <1 MB	21	Developed, Open Space	e	De	veloped, Open	Space		21			
22 Developed, Low Intensity 95 Emergent Herbaceous We 11 Open Water 12 Output ID Standards: NLCD 2016 Cell Size: 10 feet Expected Output Size: <1 MB	23	Developed, Medium Inte	ins	De	veloped, Mediu	um Inter	nsity	23			
95 Emergent Herbaceous We 11 Open Water 11 Open Water 11 Output ID Standards: NLCD 2016 Cell Size: 10 feet Expected Output Size: <1 MB	24	Developed, High Intensi	ty	De	veloped, High	Intensity	/	24			- 1
11 Open Water 11 Output ID Standards: NLCD 2016 Cell Size: 10 feet Expected Output Size: <1 MB	22	Developed, Low Intensi	y	De	veloped, Low I	ntensity	r	22			
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Cell Size: 10 feet Expected Output Size: <1 MB	11	Open Water		Op	en Water			11			
Cell Size: 10 feet Expected Output Size: <1 MB	••			-				•••	1	_	•
i Filename: C:\\Land Classification\LandCover.hdf				Out	put ID Standar	ds: N	LCD 201	16 💌			
				Cell	Size: 10	feet		Ð	pected Ou	tput Siz	e: <1 MB
	i			File	name: C:\)	Land C	lassificat	ion\Lan	dCover.hd		2
Create Cancel									Create	1	Cancel

- 48. Press Create.
- 49. Right-click on the **LandCover** layer and select the **Edit Land Cover Data Table** menu item
- 50. Provide Manning's n value data in the table provided.
- 51. Verify the LandCover layer is associated with the Geometry using the **Project** | Manage Geometry Associations menu item.

Manage Layer Associations

Туре	RAS Geometry Layers	Terrain	Manning's n	
Geometry	Existing	Terrain	✓ LandCover	-

3.11 Extract Manning's n Values

- 52. Start Editing the Geometry
- 53. Update the Manning's n values using the **Update Cross Sections** | **Manning's n Values** menu item <u>on the Cross Section Layer</u>.

	Layer Properties			
	Open Attribute Table			
0 0	Stop Editing			
4	Update Cross Sections (173 of 173)	•	4	All XS Attributes (Except Terrain)
	River Stations Table		5.9	River Stations
uc	Generate Layers	•	~	Bank Stations
	Zoom to Layer		¢	Reach Lengths
tic	Remove Layer		4,8	Ineffective Flow Areas
r C nd	Move Layer		Q.	Blocked Obstructions
e	wove cayer		♥	Manning's n Values

54. Stop Editing.

4 Geometry Evaluation

- 55. Close RAS Mapper
- 56. Open the Geometric Data Editor
- 57. Open the Geometry file you just created.
- 58. Investigate each cross section.

5 Geometry Improvement

- 59. As time allows, improve your geometry. You can do this cross section by cross section from the Geometric Data Editor or from RAS Mapper.
- 60. Suggestions include:
 - a. Improved Manning's n Values
 - b. Ineffective Flow Area