# Specifying Meteorological Data in HEC-RAS

Workshop

#### 1 Objective

This workshop will help students learn how to specify meteorological data including precipitation, evapotranspiration, and wind. In addition, the workshop also includes how to setup infiltration. This work was developed with HEC-RAS Version 6.2. However, the same steps should work for Versions 6.0 and 6.1.

#### 2 Base Plan

The terrain data (and a depth map) that was used in the HEC-RAS model for Bald Eagle Creek is show below. Evaluate the existing plan

- 1. **Open** HEC-RAS and the "BaldEagleDamBrk.prj" project
- 2. **Run** the "Single 2D Area" plan
- 3. Animate the results in RAS Mapper

Note the model setup including the geometry, dam, computational options and tolerances, and boundary conditions. Note where water is spilling into the town. The base plan is setup as a single 2D area with the dam modeled as an SA/2D Connection. The reservoir has a single inflow hydrograph. The dam as a Time-Series Controlled Gate Openings. The downstream boundary is a Normal Depth boundary condition.

## 3 Gridded Precipitation

This task will add gridded precipitation to the base model plan. The gridded precipitation DSS file has already been created.

- 4. Create a new Unsteady Flow Data file and call it "Gridded Precip".
- 5. Within the **Meteorological Data** tab of the **Unsteady Flow Data** editor, click on the drop-down menu next to **Precipitation/Evapotranspiration** and select **Enable**.

上 Unsteady Flow Data - Gridded Precip
File Options Help
Description:
Boundary Conditions Initial Conditions Meteorological Data Observed Data
Precipitation/Evapotranspiration: Enable  Vind: No Wind Forces Finable
Meteorological Stations (red <mark>Disable of the series data)</mark>
Create/Edit Stations Rasterization Parameters (Optional) Plot S

The **Precipitation** and **Evapotranspiration** fields will be enabled under **Meterological Variables**.

6. In the section called **Precipitation**, there is a **Mode** drop-down menu. Click on the drop-down menu and select

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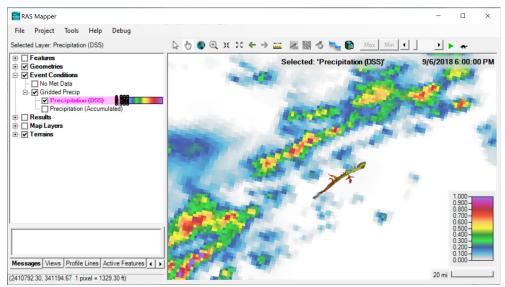
- 7. Make sure the **Source** drop-down menu is set to DSS.
- 8. In the section **DSS Data** click on the open icon if and select the DSS file called "precip.2018.09.dss" located in the **Precipitation** folder of the project folder. The **HEC-RAS DSS Viewer** will open. Set th path Parts as shown in the figure below. Then double click on any of the the rows to set the path and click on the **OK** button.

- 1								Time Wi	ndow			
	FileName						FileDate					•
3 2	C:\HEC\HEC-RAS\								ne			-
	C:\HEC\HEC-RAS\	Classes\202	2\HEC-RAS 2	D (3 Day Me	emphis)\	Workshops\2.7-W	8/25/2022 3:24:0	<b>v</b>				
General I	Filter					Ar	ply					
	1											
ast App	lied Filter:					Path	n Count: 720 / 5	138				
	File Name	Туре	Part A	Part B	Part C	Part D	Part E	Part F	Data Type	Data Units		ī
Row #	<b>•</b>	Grid	SHG -	MAR	-	<b>•</b>	<b>_</b>	NEXRAD -	-	<b>_</b>	x,y,z	
1	precip.2018.09	Grid	SHG	MARFC	PRECIP	01SEP2018:0000	01SEP2018-0100	-	PER CUM	mm		ł
2	precip.2018.09	Grid	SHG	MARFC					PER CUM	mm		
3	precip.2018.09	Grid	SHG	MARFC					PER CUM	mm		
4	precip.2018.09	Grid	SHG	MARFC	PRECIP	01SEP2018:0300	01SEP2018:0400	NEXRAD	PER_CUM	mm		
5	precip.2018.09	Grid	SHG	MARFC	PRECIP	01SEP2018:0400	01SEP2018:0500	NEXRAD	PER_CUM	mm		
6	precip.2018.09	Grid	SHG	MARFC	PRECIP	01SEP2018:0500	01SEP2018:0600	NEXRAD	PER_CUM	mm		
7	precip.2018.09	Grid	SHG	MARFC	PRECIP	01SEP2018:0600	01SEP2018:0700	NEXRAD	PER_CUM	mm		
9	precip.2018.09	Grid	SHG	MARFC	PRECIP	01SEP2018:0700	01SEP2018:0800	NEXRAD	PER_CUM	mm		
10	precip.2018.09	Grid	SHG	MARFC	PRECIP	01SEP2018:0800	01SEP2018:0900	NEXRAD	PER_CUM	mm		
11	precip.2018.09	Grid	SHG	MARFC	PRECIP	01SEP2018:0900	01SEP2018:1000	NEXRAD	PER_CUM	mm		
12	precip.2018.09	Grid	SHG	MARFC	PRECIP	01SEP2018:1000	01SEP2018:1100	NEXRAD	PER_CUM	mm		
13	precip.2018.09	Grid	SHG	MARFC	PRECIP	01SEP2018:1100	01SEP2018:1200	NEXRAD	PER_CUM	mm		
14	precip.2018.09	Grid	SHG	MARFC	PRECIP	01SEP2018:1200	01SEP2018:1300	NEXRAD	PER_CUM	mm		

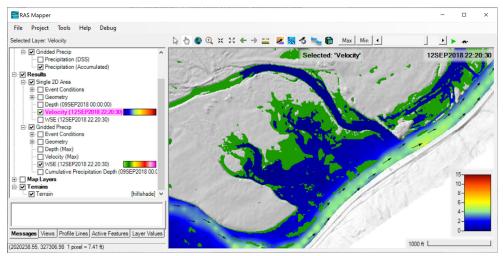
The editor should look something like the figure below.

上 Unsteady Flow Data - Gridded Precip	_		×
File Options Help			
Description:	÷	Apply	Data
Boundary Conditions Initial Conditions Meteorological Data Observed Data			
Precipitation/Evapotranspiration: Enable 💌 Wind: No Wind Forces 💌			
Meteorological Stations (required for point time series data)		-1	
Create/Edit Stations Rasterization Parameters (Optional) Plot Sta	ations		
Meteorological Variables			
Precipitation			
Mode: Gridded 💌 Ratio (Optional): Gridded Data - DSS			•
Gridded Data			
Source: DSS			
DSS Data Filename: orkshops\2.7-W-Meteorological Data\Solution\Precipitation\precip.2	019.00 d	¥ 🛋	
Path: //SHG/MARFC/PRECIP/01SEP2018:0000/01SEP2018:0100/NEXRAD/		- 8	
Evapotranspiration			
Mode: None			

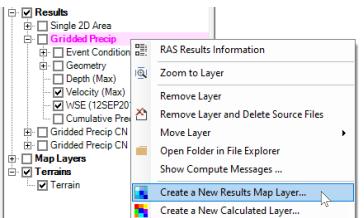
- 9. Save and close the Unsteady Flow Data editor.
- 10. Create a new plan called "Gridded Precip" with the new Unsteady Flow Data and run it.
- 11. Before inspecting the results, inspect the gridded precipitation in RAS Mapper. Open RAS Mapper and select the Gridded Precip layer under the Event Conditions layer. For the precipitation to display properly it will be necessary to adjust the surface colormap. Animate the precipitation. The gridded precipitation should look something like the figure below.



12. Inspect the HEC-RAS results and compare to the plans with and without precipitation. Use a different colormap for the water surface elevations highlight the differences or compare the extents of the water surface and velocity layers. See the example below.



13. Add the **Cumulative Precipitation** result in **RAS Mapper** by right-clicking on the "Gridded Precip" plan and selecting **Create a New Results Map Layer...** from the menu.



- 14. Adjust the colormap and inspect the spatial distribution of the precipitation.
- 15. Compare the results with and without precipitation by plotting time-series and spatial maps in **RAS Mapper**.

## 4 Infiltration

The SCS Curve Number method can be parameterized using a combination of both Land Cover and Hydrologic Soils data or only one of those datasets. In this workshop both the Land Cover and Hydrologic Soils data are utilized. First, a **Soils Layer** is created based on the USDA gSSURGO database

(<u>https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/geo/?cid=nrcs142p2</u> \_053628). Then, an **SCS Curve Number Infiltration Layer** is created based on both the **Soils Layer** and the **Land Cover** classification layers.

16. Create a **Soils Layer** by right-clicking on **Map Layers** and selecting **Create a New RAS Layer**.

🚼 RAS Mapper									
File Project	Tools	Help							
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Terrain	٠	Create a New R	AS Layer		•	Land Cover	Layer		
	٢	Create an Empt	y RAS Layer		•	Soils Layer	N		
	*	Add an Existing	RAS Layer		•	Sediment B	ed Material L	ayer	
	×	Manage Geom	try Associatio	ons			ayer From La ayer From Sł	and Cover / S hapefile	oils Layers
				1		Elevation Po Calculated I	-		

17. In the Browse for Land Classification Files window, select GSSURGO (\*.\*) as the file type and select the gdb file in the folder gSSURGO\_PA.gdb folder in the Soils Data folder in the main project directory.

> • 🛧 📙 «	Solution > Soils Data > gSSURGO_PA.gdb	Q 0 v	Search gSSURGO_PA.	gdb
Organize 🔻 🛛 New fo	older			. ?
Soils Data	Name	Date modified	Туре	Size
💻 This PC	a00000059.col_index.atx	10/22/2019 9:03 AM	ATX File	
3D Objects	a00000059.gdbindexes	10/22/2019 8:53 AM	GDBINDEXES File	
-	a00000059.gdbtable	10/22/2019 9:03 AM	GDBTABLE File	196
Desktop	a00000059.gdbtablx	10/22/2019 9:11 AM	GDBTABLX File	
🔮 Documents	a00000059.row_index.atx	10/22/2019 9:03 AM	ATX File	
👆 Downloads	📋 gdb	10/21/2019 4:25 PM	File	
👌 Music	📄 timestamps	10/22/2019 9:04 AM	File	
Pictures	v <			>
File	e name: gdb	~ GSS	SURGO (*.*)	~

18. In the Create a **New Soils Layer** editor, click on the add button as shown in the figure below and select the file in the **Soils Data** folder in the main project directory.

					×
Input Files					
		_		1	
Import Extents: Te	rains	-	(None) 💌	<b>*</b>	
+ Filename	Projection	Info	Naming Std.	Name Field	
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Unique Classification Na	mes for Selected File —		Output File		
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i			Filename: C:\\Solution\	Soils Data\Soils.hdf	6
			,		
				Create	Cancel
🔚 Create a New Soils L	ayer				×
Import Extents: Te	maine	<b>•</b>			
		_	,,	Hydrologic Grou	
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<b>_</b>					
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Unique Classification Na	mes for Selected File				
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			RAS Classification NoData	ID 0	
Name Field	Classification				
Name Field B A	Classification B A		NoData B	0	
Name Field B A B/D	Classification B A B/D		NoData B A	0 1 2	
Name Field B A B/D D	Classification B A B/D D		NoData B A B/D	0 1 2 3	
Name Field B A B/D D C	Classification B A B/D D C		NoData B A B/D D	0 1 2 3 4	
Name Field B A B/D D C C C/D	Classification B A B/D D C C C/D		NoData B A B/D D C	0 1 2 3 4 5	
Name Field B A B/D D C C/D (none)	Classification B A B/D D C C C/D (none)		NoData B A B/D D C C/D	0 1 2 3 4 5 6	
Name Field B A B/D D C C C/D	Classification B A B/D D C C C/D		NoData B A B/D D C C/D (rone)	0 1 2 3 4 5 6 7	
Name Field B A B/D D C C/D (none)	Classification B A B/D D C C C/D (none)		NoData B A B/D D C C/D	0 1 2 3 4 5 6	
Name Field B A B/D D C C/D (none)	Classification B A B/D D C C C/D (none)		NoData B A B/D D C C/D (none) A/D	0 1 2 3 4 5 6 7 7 8	
Name Field B A B/D D C C/D (none)	Classification B A B/D D C C C/D (none)		NoData B A B/D D C C/D (none) A/D Output ID Standards: [N	0 1 2 3 4 5 6 7 8 8	
Name Field B A B/D D C C/D (none)	Classification B A B/D D C C C/D (none)		NoData B A B/D D C C/D (none) A/D Output ID Standards: [N Cell Size: 10 feet	0 1 2 3 4 5 6 7 8 0 none) V Expected Output	t Size: ~1 MB
Name Field B A B/D D C C/D (none)	Classification B A B/D D C C C/D (none)		NoData B A B/D D C C/D (none) A/D Output ID Standards: [N	0 1 2 3 4 5 6 7 8 0 none) V Expected Output	t Size: ~1 MB

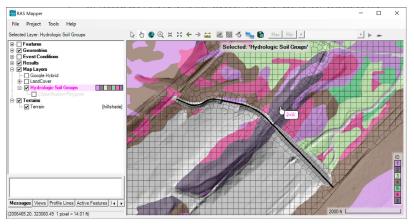
19. Replace "/" with "-" and "(none)" with "NoData" in the Classifications to dashes as shown in the figure below.

Create a New Soils	s Layer				
Import Extents:	Terrains	•	(None)	Hydrologic Grou 💌	
Filename	Projection	Info	Naming Std.	Name Field	
	(None)	13686 of 1368	36 Po (None)	Hydrologic Group	
+   Flename gdb ↓ ↓	Names for Selected File		0.4.4.5%		
Name Field	Classification		Output File	ID	
A	A		NoData	0	
B/D	B-D		в	1	
D	D		A	2	
с	С		B-D	3	
C/D	C-D		D	4	
(none)	NoData		с	5	
A/D	A-D		C-D	6	
		-	A-D	8	
	Invalid Name(s) ( / c	or \ not allowed)	Output ID Standards:	(None) 💌	
i			Cell Size: 10 feet Filename: C:\\Soils		
				Create	Cancel

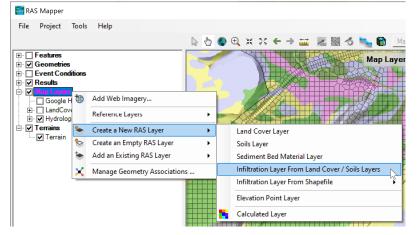
- 20. Click on the **Open Folder** icon and save the **Filename** as "Hydrologic Soil Groups.hdf" in the **Soils Data** folder in the main project directory.
- 21. In the **Create a New Soils Layer** window shown above, click **Create** and then **Close** in the **Compute Window** below.

Gompute Window - Creating Mannings n Layer 'Hydrologic Soil Groups.hdf'		×
Computation Task	hh:mm:ss	^
PREPROCESSING: Ensuring rasters are in the correct projection gdb is a vector file. Projection will be done on-the-fly if necessary. Preprocessing complete.	0	
creating output file Hydrologic Soil Groups.tif Adding Overlays	5	
creating Hydrologic Soil Groups.hdf Land cover Layer complete!	<b>0</b> 8	
		$\sim$
	C	lose

22. Inspect the Soils Layer in RAS Mapper. The layer should look something like the figure below.



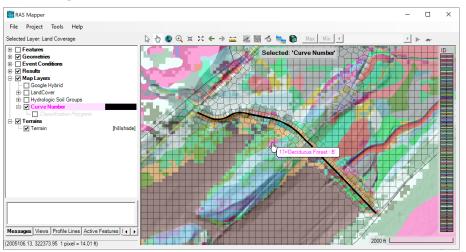
23. Create an Infiltration Layer by right-clicking on the Map Layer and selecting Create a New RAS Layer | Infiltration Layer From Land Cover / Soils Layers as shown in the figure below.



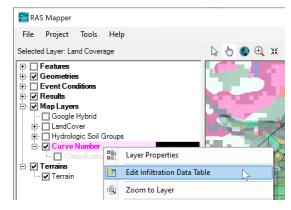
24. In the **Infiltration Layer** window, set the options as shown in the figure below and click **Create**. As mentioned previously, it is not necessary to utility both the Land Cover and Soils Layers for the SCS Curve Number method, but more accurate to do so.

Infiltration Layer					_		×
Infiltration Method:	SCS Curve Number	<b>T</b>					
Land Cover Layer:	LandCover	•	Soils Layer:		Hydrologic So	il Groups	•
Time between rainfall e	events to reestablish initi	al loss and	soil moisture (hrs):	48			
Infiltration Layer Name	: C:\\Workshops\2.7-V	V-Meteorolo	ogical Data\Solution\li	nfiltration\Curv	ve Number.hdf		
					Create	Cano	el

25. Inspect the Infiltration Layer in RAS Mapper. The layer should look something like the figure below.



26. Right-click on the SCS Curve Number Infiltration Layer and select Edit Infiltration Data Table.



27. The **Classification Parameters** window will appear. The table contains all of the land classifications which need to be assigned SCS Curve Number infiltration parameters.

	d Area Edits		P	arameter: All Paran	neters
ID	Name	Curve Number	Abstraction Ratio	Minimum Infiltration Rate (in/hr)	
124	Barren Land Rock-Sand-Clay				
125	Barren Land Rock-Sand-Clay				
126	Barren Land Rock-Sand-Clay				
127	Barren Land Rock-Sand-Clay				
128	Main Channel : NoData				
129	Main Channel : B				
130	Main Channel : A				
131	Main Channel : B-D				
132	Main Channel : D				
133	Main Channel : C				
134	Main Channel : C-D				
135	Main Channel : A-D				

28. For the purposes of the workshop, an Excel spreadsheet has been provided with the SCS Curve Number parameters. Open the spreadsheet called "Curve Number.xlsx" located in the **Infiltration** folder of the main project directory and copy the values to the **Classification Parameters** window. Then Click **OK** to accept the values in the table.

9	• : × ✓ fx				~	Classificat	ion Parameters			
		С	D	E	F A	Selecte	d Area Edits	_	Parameter: All Pa	arameters
	ID Name	Curve Number	Abstraction Ratio	Minimum Infiltration Rate (in/hr)			3 <b>+</b> × ₪ 🛱	.00 →.0	1	Minimum
2	0 NoData	75				ID	Name	Curve Number	Abstraction Ratio	Infiltration Rate
	1 NoData : B	75								(in/hr)
	2 NoData : A	75				0	NoData	75	0.1	0.12
	3 NoData : B-D	75				1	NoData : B	75	0.1	0.12
	4 NoData : D	75				2	NoData ; A	75	0.1	0.12
	5 NoData : C	75				Z	NoData : A			0.12
	6 NoData : C-D 7 NoData : A-D	75				3	NoData : B-D	75	0.1	0.12
)	8 Mixed Forest : NoData	73				4	NoData ; D	75	0.1	0.12
1	9 Mixed Forest : B	60						75	0.1	
	10 Mixed Forest : A	36					NoData : C			0.12
	11 Mixed Forest : B-D	65				_ /	NoData : C-D	75	0.1	0.12
4	12 Mixed Forest : D	79	0.2	0.12			NoData : A-D	75	0.1	0.12
5	13 Mixed Forest : C	73	0.2	0.12						0.40
5	14 Mixed Forest : C-D	78	0.2	0.12		8	Mixed Forest : NoData	79	0.2	0.12
7	15 Mixed Forest : A-D	40	0.2	0.12		9	Mixed Forest : B	60	0.2	0.12
3	16 Deciduous Forest : NoData	70	0.2	0.12		10	Mixed Forest : A	36	0.2	0.12
	17 Deciduous Forest : B	66							-	-
	18 Deciduous Forest : A	45				11	Mixed Forest : B-D	65	0.2	0.12
1	19 Deciduous Forest : B-D	70	0.2	0.12		12	Mixed Forest : D	79	0.2	0.12

29. To utilize the infiltration parameters, the **Infiltration Layer** needs to be "associated" with a geometry. Preserve the existing geometry without infiltration calculation, and create a new one by right-clicking on the geometry and selecting **Save Geometry As...** 

🚟 RAS Mapper						
File Project Tools Help						
Selected Layer: Single 2D Area - No Infiltrat	1	6	۹	ж	56	
⊕		RAS Ge	ometry Pr	operties		
	0	Edit Ge	ometry			
	Q	Validate Geometry				
Im Terrain	Г	Save Ge	eometry A	s		
	$\mathbf{\Sigma}$	Delete (	Geometry	N2.		
		View Ge	eometry ir	n 3D		

30. In the **Save Data As** window, save the new Geometry as "Single 2D Area – Curve Number".

with the second		×
Enter a unique Name for the new Geometry:		
Single 2D Area - Curve Number		
	OK	Canad
	ОК	Cancel

31. Right-click on the root **Geometry** node in **RAS Mapper** and select **Manage Geometry Associations** or go click on the menu **Project** | **Manage Layer Associations...** as shown below.

🚟 RAS Mapper			🔚 RAS Ma	apper			
File Project Tools	Help		File Pro	oject 1	Tools	Help	
		De 🖑 🍕	٢	Set Pro	ojection		
				Add W	Veb Ima	gery	
	Add New Geometry	,		Add R	eference	e Layer	
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🗄 🔲 Event Conditi	Manage Geometry	Associations		Create	e New RA	AS Terrain	
🖶 🗖 Results				Create	e New G	eometry	
			🗄 🖃 💽 🍉	Create	e a New	RAS Layer	•
			II 🗙	Manag	ge Layer	Associations	
				Manag	ge Resul	ts Maps	62

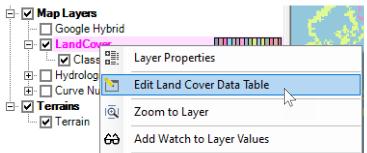
32. Set the **Infiltration** layer to **Curve Number** for the corresponding **Geometry** as shown in the figure below.

Туре	RAS Geometry Layers	Terrain	Manning's n	Infiltration	% Impervious	Sediment Bed Material Layer
Geometry	Single 2D Area - No Infiltration	Terrain 💌	LandCover 💌	(None) 🔹	(None) 💌	(None)
Geometry	Single 2D Area - Curve Number	Terrain 💌	LandCover 💌	Curve Number 💌	(None) 💌	(None)
Results	Single 2D Area	Terrain 💌	LandCover	(None)	(None)	(None)
Results	Gridded Precip	Terrain 💌	LandCover	(None)	(None)	(None)

33. Set the **% Impervious Layer** to **Land Cover** for the corresponding Geometry as shown in the figure below and click **Close**.

Туре	RAS Geometry Layers	Terrain	Manning's n	Infiltration	% Impervious	Sediment Bed Material Layer
Geometry	Single 2D Area - No Infiltration	Terrain 💌	LandCover 💌	(None) 💌	(None) 💌	(None)
Geometry	Single 2D Area - Curve Number	Terrain 💌	LandCover 💌	Curve Number 💌	LandCover 💌	(None)
	Circle 2D Area	Tamaia and		(Marea)	(NI)	(1))

34. Right-click on the Land Cover layer and select Edit Land Cover Data Table.



35. The **% Impervious** values have already been filled. Inspect the values.

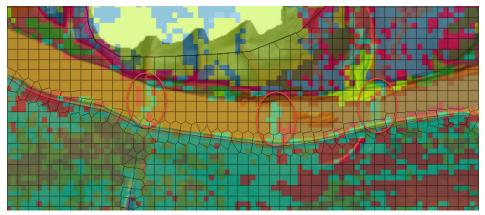
Classificati	ion Parameters		×
	d Area Edits	Parameter: A	I Parameters 👤
ID	Name	ManningsN	Percent  Impervious
0	NoData	0.035	0
43	Mixed Forest	0.12	0
41	Deciduous Forest	0.1	0
21	Developed, Open Space	0.035	0
42	Evergreen Forest	0.15	0
11	Open Water	0.035	100
52	Shrub-Scrub	0.05	0
81	Pasture-Hay	0.045	0
71	Grassland-Herbaceous	0.04	0
	0.15 1.10	0.05	•
			OK Cancel

Question: Why are the impervious values set to 100 for open water?

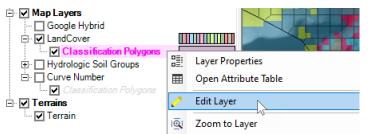
36. Inspect the **Land Cover** layer by setting the opacity/transparency to 50% and overlaying the layer the Terrain. Do this by right-clicking on the layer and selecting **Layer Properties**. Then close the Layer Properties window.

Google Hybrid     Google Hybrid     Classification     Hvdrolonic Soil G     G     LandCover     Layer Properties     -
Classification  Classification  Layer Properties  Layer Properties  -
E CandCover - Layer Properties - X
E CandCover - Layer Properties - X
Visualization and Information Source Files
Vector
Point: Line: Fill:
Label Features with Attribute Column(s)
Surface
Plot Surface 🔲 Update Legend with View
ID Edit
Opacity: 50%
Contours / Hillshade
Plot Contours Interval: 5 Color:
Plot Hillshade Z Factor: Edit
Copy Symbology Paste Symbology Reset Symbology

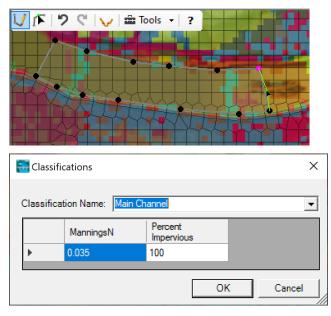
37. Find areas in the channels that do not correspond to Open Water (see examples in figure below).



38. Practice fixing areas like this using **Classification Polygons**. Right-click on **Classification Polygons** and select **Edit Layer**. Then click on the **Add New Feature** tool **U**.



39. Draw polygons over the areas which need to corrected. After each polygon is drawn, an editor will appear to select the **Classification** for each polygon. Select the **Main Channel** classification and clock **OK**.



40. After creating a few polygons, right-click again on the **Classification Polygons** layer, and select **Stop Editing**.

Map Layers     Google Hybrid     LandCover	m	
Classification Polygons	<u>_</u> _	
Hydrologic Soil Groups		Layer Properties
Curve Number		Open Attribute Table
		Stop Editing
V Terrain	١Ō	Zoom to Laver

41. The window below will appear. Click on **Yes** to save the edits.

Save Edits (Classification Polygons)	×
Do you want to Save Edits for 'Classification Polygons'?	
Yes No Cancel	

42. Create a new plan called "Gridded Precip CN" with the new **Geometry** called "Single 2D Area – Curve Number" and run it.

Plan: Gridded Precip CN Short ID: Gridded Precip CN
Geometry File: Single 2D Area - Curve Number
Unsteady Flow File: Gridded Precip
Programs to Run Plan Description
Geometry Preprocessor
Unsteady Flow Simulation
Post Processor

43. Inspect the results and compare to the previous plans using profile and timeseries plots in **RAS Mapper**.

<u>*Questions:*</u> How do the water level time-series compare between the three plans? Which water levels are higher and where the largest differences?

<u>*Questions:*</u> Why is there no infiltration in the channels?

<u>*Questions</u></u>: Animate the Cumulative Infiltration Depth. Why does it reset to zero at some point during the simulation?*</u>

### 5 Potential Evapotranspiration

In this section, a time-series of potential evapotranspiration is added. The timeseries is specified at a single meteorological station.

44. Create a new **Unsteady Flow Data** file called "Gridded Precip Evap".

ی ا	Jnsteady Flow Data - Gridded Precip
File	Options Help
	New Unsteady Flow Data
	Open Unsteady Flow Data
	Save Unsteady Flow Data
	Save Unsteady Flow Data As
	Rename Unsteady Flow Title
	Delete Unsteady Flow File

45. Next, create a **Meteorological Station**, by clicking on the button labeled **Create/Edit Stations...** 

Lunsteady Flow Data - Gridded Precip Wind	_		
<u>File Options H</u> elp			
Description:	÷	Apply Data	1
Boundary Conditions Initial Conditions Meteorological Data Observed Data			
Precipitation/Evapotranspiration: Enable 💌 Wind: Speed/Direction 💌			
Meteorological Stations (required for point time series data)			
Create/Edit Stations Rasterization Parameters (Optional) Plot Stat	ions		

46. In the **Meteorological Stations** editor, click on the new button, call it Sayers Dam, and enter either the WGS84 or projected coordinates shown below.

Meteorological Stations	
Detailed   Table	1
Point Name: Sayers Dam 💽 📕 🕇 🛄 🔛	
Gauge Height [required for wind] (m): 10.	
GIS Coordinates (enter coordinates one way)	
WGS84 Projected (set SRS in RAS Mapp	er)
Latitude (-S, +N): 41.05 or X: 2007114.58	2
Longitude (-W, +E): -77.61 Y: 321872.32	
Plot Point Locations Sort Points By Name	OK Cancel

47. Click on the **Plot Stations** button.

L Unsteady Flow Data - Gridded Precip Wind	_		Х
<u>File Options</u> <u>H</u> elp			
Description:	÷	Apply	Data
	<u> </u>		
Boundary Conditions Initial Conditions Meteorological Data Observed Data			
Precipitation/Evapotranspiration: Enable 💌 Wind: Speed/Direction 💌			
Meteorological Stations (required for point time series data)			
Create/Edit Stations Rasterization Parameters (Optional)	ions	1	
► – □	×		
(Plot.) Table			
Meteorological Stations	<u>^</u>		
380000 Legend			
SA/2D	-		
360000 Meteorological Statio	ns		
340000-			
320000			
300000			
1960000 1980000 2000000 2020000 2040000 2060000 2080000 2100000			
(ft)			

48. In the **Evapotranspiration** section, set the **Mode** is set to **Point**, and click on the .... button to expand the section as shown below.

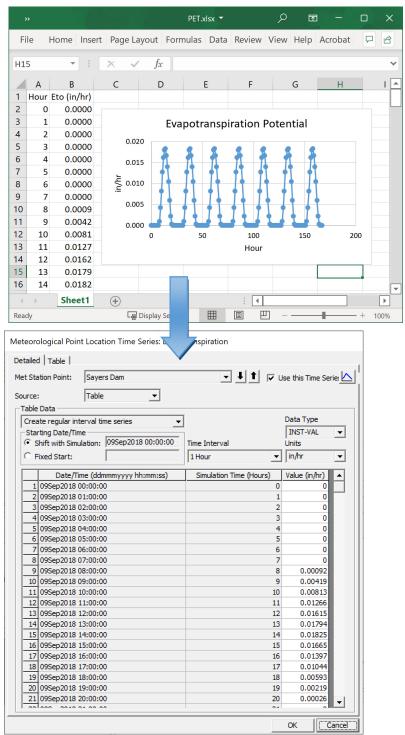
eteorological Variables - Precipitation	
Moder Cridded Tel Gridded Data - DSS	
Evapotranspiration	
	<b></b> )

49. Click on the **Edit** button shown below.

Meteorological Variables	
Precipitation	
Mode: Gridded 💌 Gridd	ed Data - DSS
- Evapotranspiration	
Mode: Point 💌 Ratio (	Optional): Point Time Series Mode (Nearest)
Point Time Series Data	
Interpolation Method: Nearest	👻 Edit 🖄
Station Name	Summary Edit
1 Sayers Dam	Table Data: data range = 0.0000 to 0.0183 (in/hr)

Notes: In Version 6.2, the time-series plots of Meterological Variables does not work. In addition the **Ratio** option does not work. Both of these issues have been fixed in Version 6.3.

50. In the **Meteorological Point Location Time Series** window, enter the hourly potential evapotranspiration data for **Sayers Dam** as shown in the figure below. The data has been provided in an Excel spreadsheet called "PET.xlsx" located in the **Potential Evapotranspiration** folder of the main project directory. Once all the data is entered click on the **OK** button.



51. Open the **Unsteady Flow Analysis** editor and create a new **Plan** called "Gridded Precip CN Evap".

汽 Unsteady Flow Analysis				×
File Options Help				
Plan: Gridded Precip CN Evap		Short ID:	Gridded Precip CN Evap	
Geometry File:	Single 2D Area - Curve	Number		-
Unsteady Flow File:	Gridded Precip Evap			-
Programs to Run Geometry Preprocessor Unsteady Flow Simulation	Plan Description			^

- 52. **Save** the plan and run it.
- 53. Compare the results with the previous plans in **RAS Mapper**. Specifically, plot the **Cumulative Evapotranspiration Depth** at various points.

<u>*Questions</u></u>: How do the water level time-series compare between the plans with and without evapotranspiration?*</u>