

# Boundary and Initial Conditions for 2D Modeling

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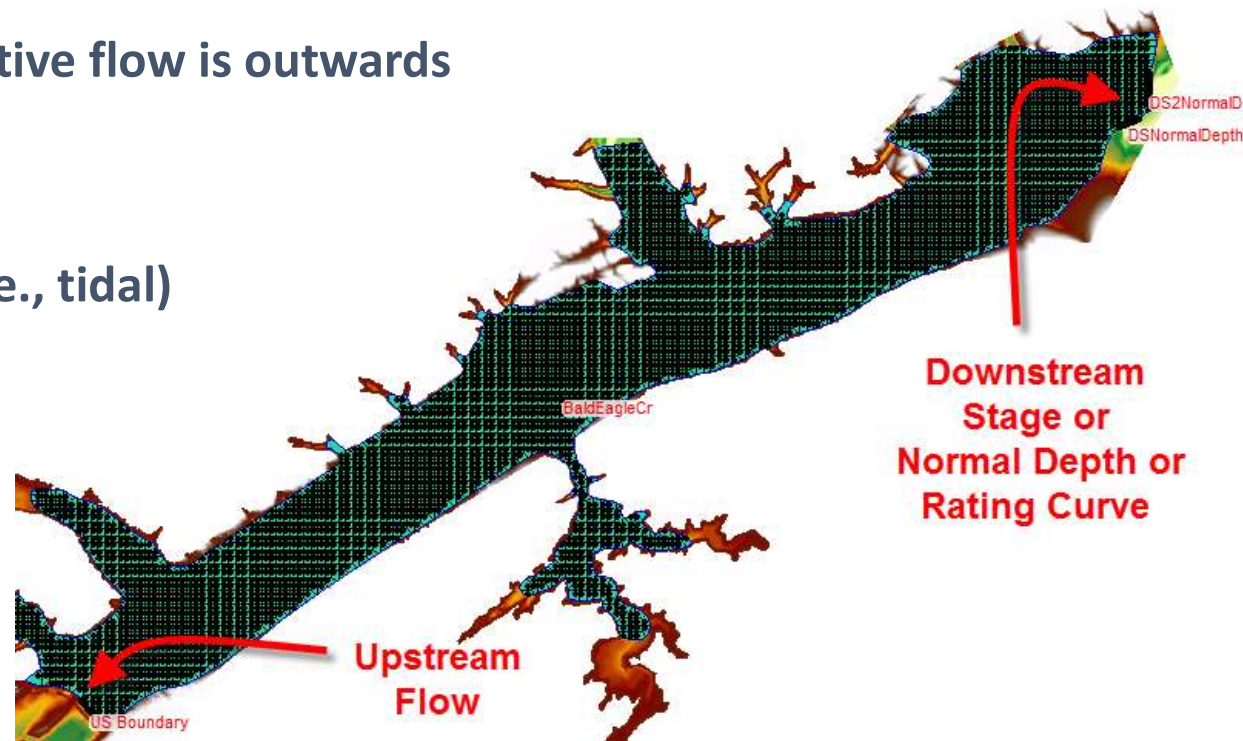
# Overview

- Boundary Conditions (BC)
  - External
  - Internal
  - Global
- Initial Conditions (IC)
  - User-Specified
  - Ramp Up and Warm Up Periods
  - Restart File
  - Interpolate from Previous Results



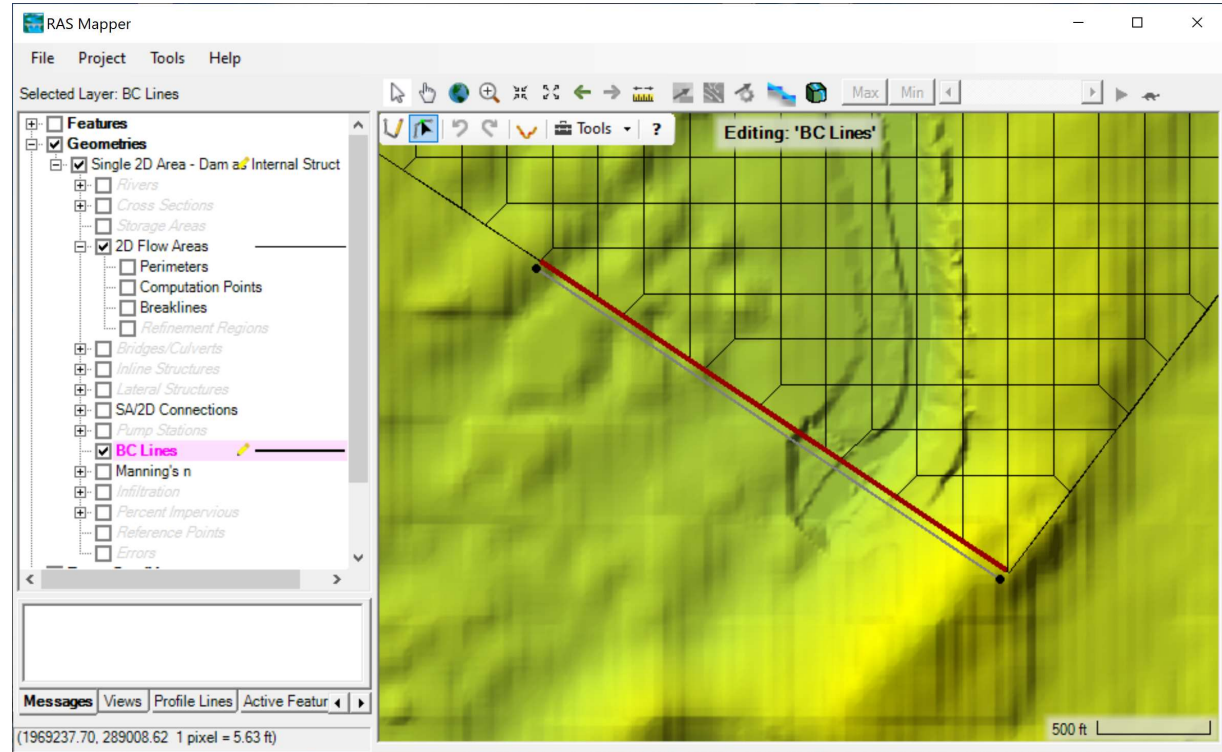
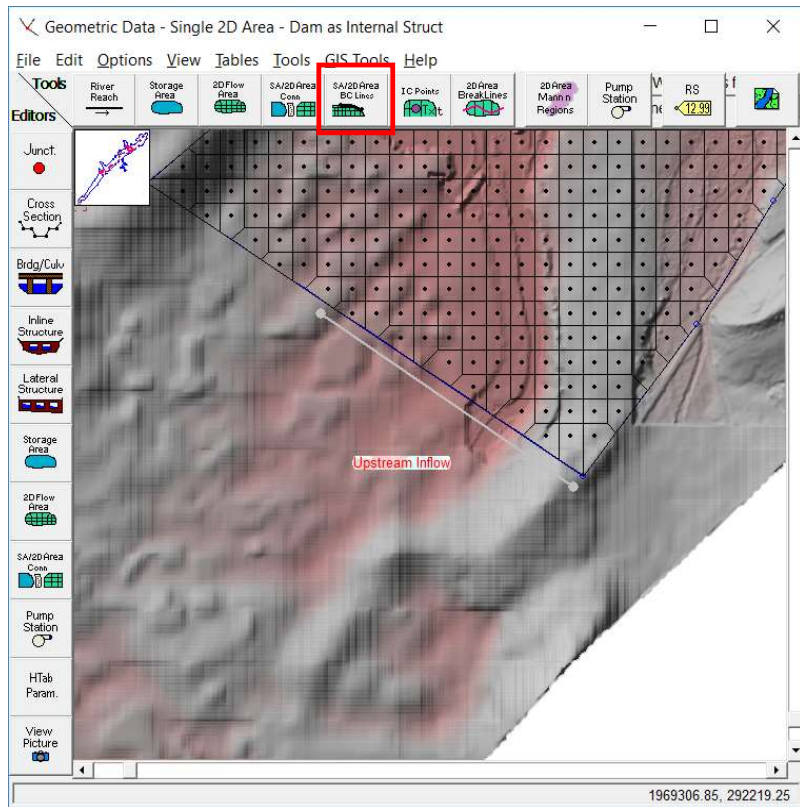
# External Boundary Conditions

- Flow Hydrograph
  - Usually for inflow (upstream/lateral)
  - Can also be used for outflow
  - Positive flow is inwards; Negative flow is outwards
- Stage Hydrograph
  - Usually for outflow
  - Can also be used for inflow (i.e., tidal)
- Normal Depth (outflow only)
- Rating Curve (outflow only)



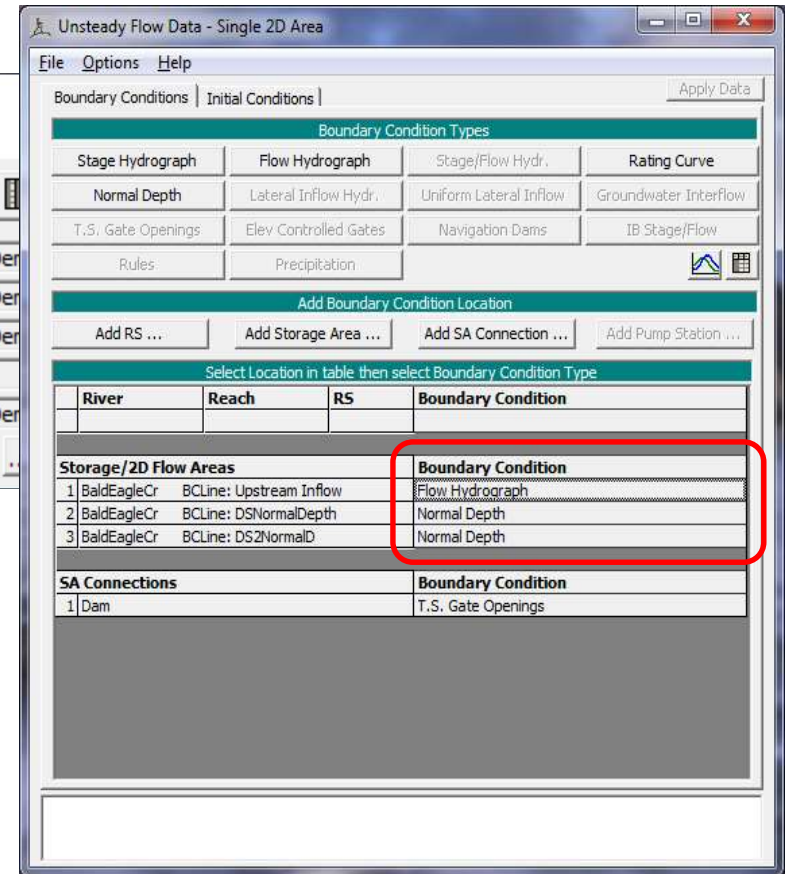
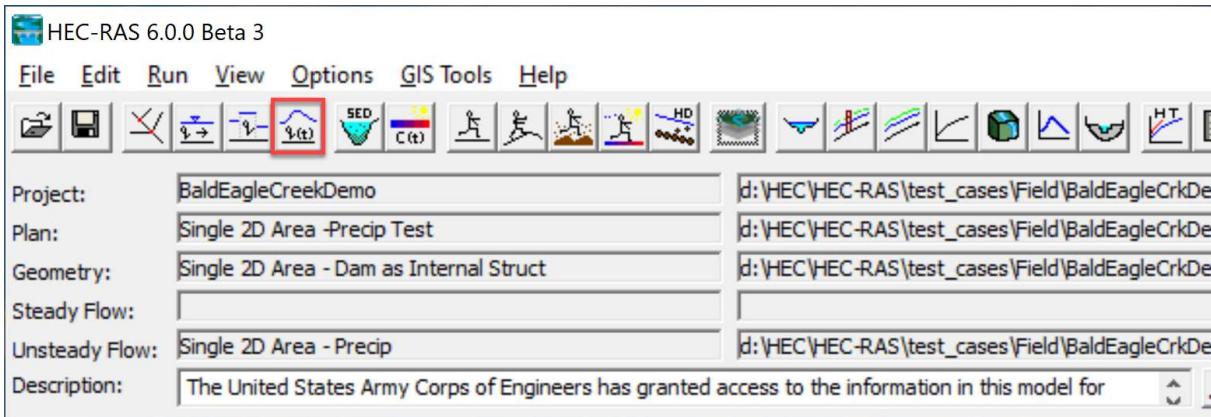


# Creating External Boundary Condition Lines





# External Boundary Condition Data



- Open Unsteady Flow Data editor
- Required BC's appear automatically



# Flow Hydrograph & EG Slope

Flow Hydrograph

SA: 2D Area BCLine: BC Upstream (Upstream name)

Read from DSS before simulation Select DSS file and Path

File:

Path:

Enter Table Data time interval: 1 Minute

Select/Enter the Data's Starting Time Reference

Use Simulation Time: Date: 01JAN1999 Time: 1200

Fixed Start Time: Date:  Time:

No. Ordinates Interpolate Missing Values Del Row Ins Row

Hydrograph Data			
	Date	Simulation Time (hours)	Flow (cfs)
1	01Jan1999 1200	00:00	400
2	01Jan1999 1201	00:01	416.67
3	01Jan1999 1202	00:02	833.33
4	01Jan1999 1203	00:03	1250

Time Step Adjustment Options ("Critical" boundary conditions)

Monitor this hydrograph for adjustments to computational time step

Max Change in Flow (without changing time step):

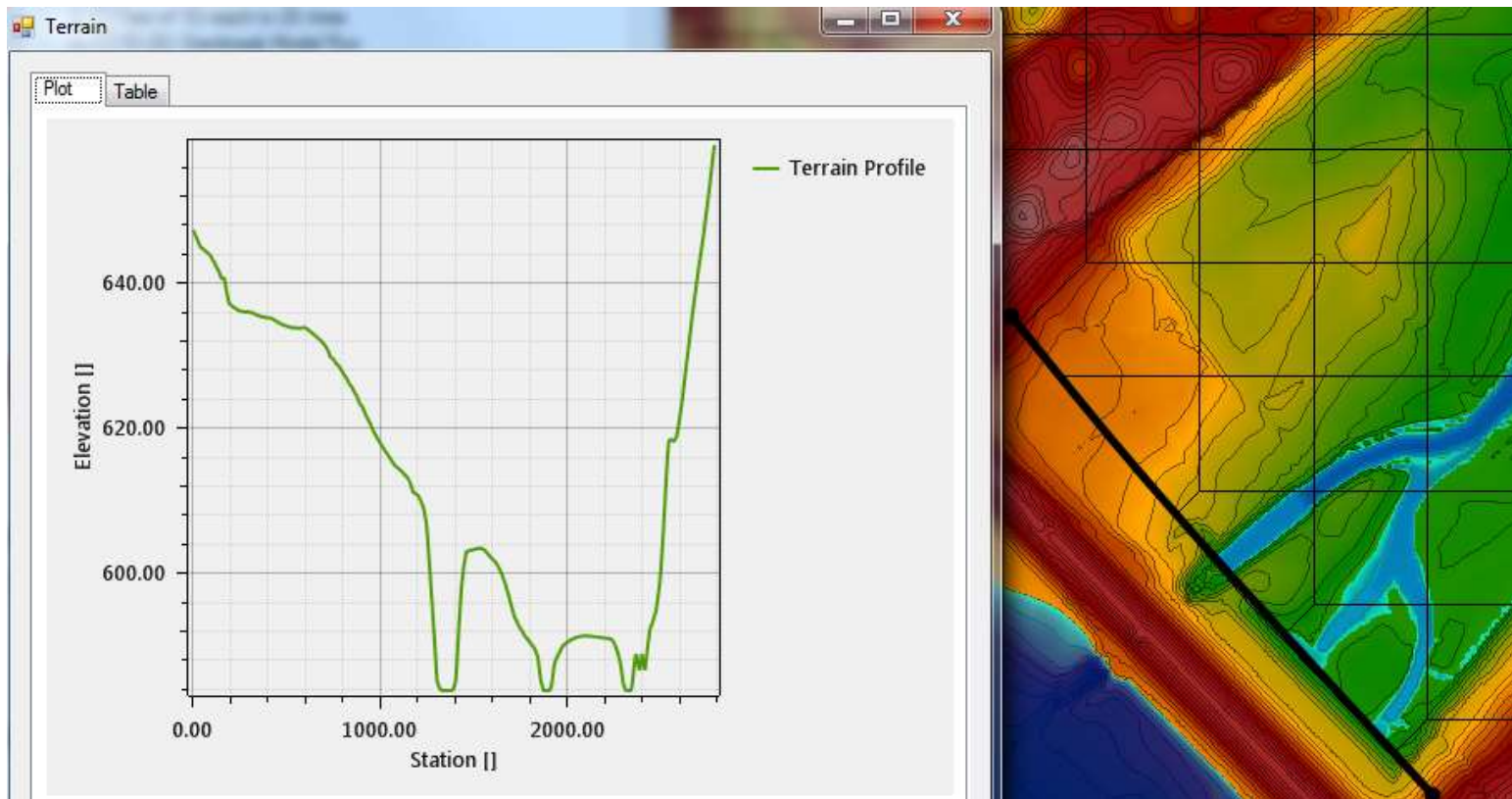
Min Flow:  Multiplier:  EG Slope for distributing flow along BC Line: 0.1  TW Check

Plot Data OK Cancel

- Time series can specified from DSS file or entered as a table
- **EG Slope** required to compute normal depth
- Flow distributed along boundary based on conveyance
- **TW Check** option uses higher of TW and normal depth
- Face velocities computed for shallow water equations



# Flow Distribution along Boundary



- Flow is distributed to the appropriate cells based on EG Slope Conveyance or actual water surface

# Stage Hydrograph

- DSS or Table
- **Use Initial Stage** option applies a horizontal water level from the boundary inwards
- All wet faces at the boundary assigned the same value
- Stage specified at boundary faces

Unsteady Flow Data - 2D Lower

Boundary Condition Types

Stage Hydrograph

SA: BaldEagleCr BCLine: DS Stage

Read from DSS before simulation

File:  Path:

Enter Table

Select/Enter the Data's Starting Time Reference

Use Simulation Time: Date: 01JAN1999 Time: 1200

Fixed Start Time: Date:  Time:

No. Ordinates

Hydrograph Data			
	Date	Simulation Time (hours)	Stage (ft)
1	01Jan1999 1200	00:00	536.13
2	01Jan1999 1300	01:00	537.07
3	01Jan1999 1400	02:00	536.86
4	01Jan1999 1500	03:00	537.53
5	01Jan1999 1600	04:00	538.18
6	01Jan1999 1700	05:00	539.73
7	01Jan1999 1800	06:00	540.38
8	01Jan1999 1900	07:00	540.77

Use Initial Stage (recommended)

Boundary Condition Location

Boundary Condition

DS Stage

DS Stage 2





# Normal Depth



- Only for outflow
- Friction slope constant for entire boundary
- Manning's Eq. used to compute flow per face
- Boundary stage can vary
- Should be reserved for situations where no other data is available
- Placed away from project area

Unsteady Flow Data - 2D Lower

File Options Help

Boundary Conditions | Initial Conditions | Apply Data

Boundary Condition Types

Stage Hydrograph	Flow Hydrograph	Stage/Flow Hydr.	Rating Curve
Normal Depth	Lateral Inflow Hydr.	Uniform Lateral Inflow	Groundwater Interf
T.S. Gate Openings	Elev Controlled Gates	Navigation Dams	IB Stage/Flow
Rules			

Add Boundary Condition Location

Add RS ... Add Storage Area ... Add SA Connection

Select Location in table then select Boundary Condition

River	Reach	RS	Boundary Condition

Storage/2D Flow Areas

	Boundary Condition
1 BaldEagleCr BCLine: US Boundary	Flow Hydrograph
2 BaldEagleCr BCLine: DS2NormalD	Normal Depth
3 BaldEagleCr BCLine: DSNormalDepth	Normal Depth

Normal Depth Downstream Boundary

SA: BaldEagleCr BCLine: DS2NormalD

Friction Slope: 0.0003

OK Cancel

DS2NormalD

DSNormalDepth



# Rating Curve



Unsteady Flow Data - 2D Lower

File Options Help

Boundary Conditions | Initial Conditions |

Boundary Condition Types			
Stage Hydrograph	Flow Hydrograph	Stage/Flow Hydr.	Rating Curve
Normal Depth	Lateral Inflow Hydr.	Uniform Lateral Inflow	Groundwater
T.S. Gate Openings	Elev. Controlled Gates	Navigation Dams	IB Sta

Rules

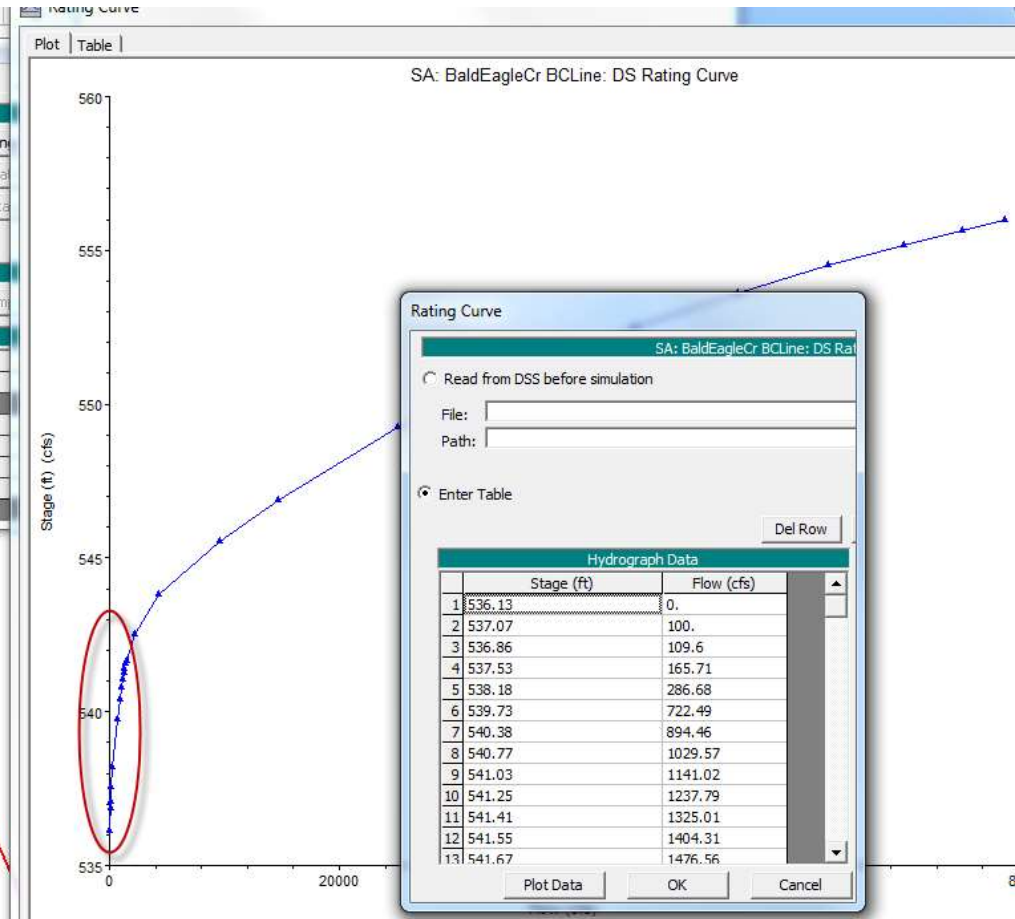
Add Boundary Condition Location

Add RS ... Add Storage Area ... Add SA Connection ... Add Pump

Select Location in table then select Boundary Condition Type

River	Reach	RS	Boundary Condition

Storage/2D Flow Areas		Boundary Condition
1	BaldEagleCr BCLine: US Boundary	Flow Hydrograph
2	BaldEagleCr BCLine: DS Rating Curve	Rating Curve
3	BaldEagleCr BCLine: DSNormalDepth	Normal Depth





# Rating Curve Considerations

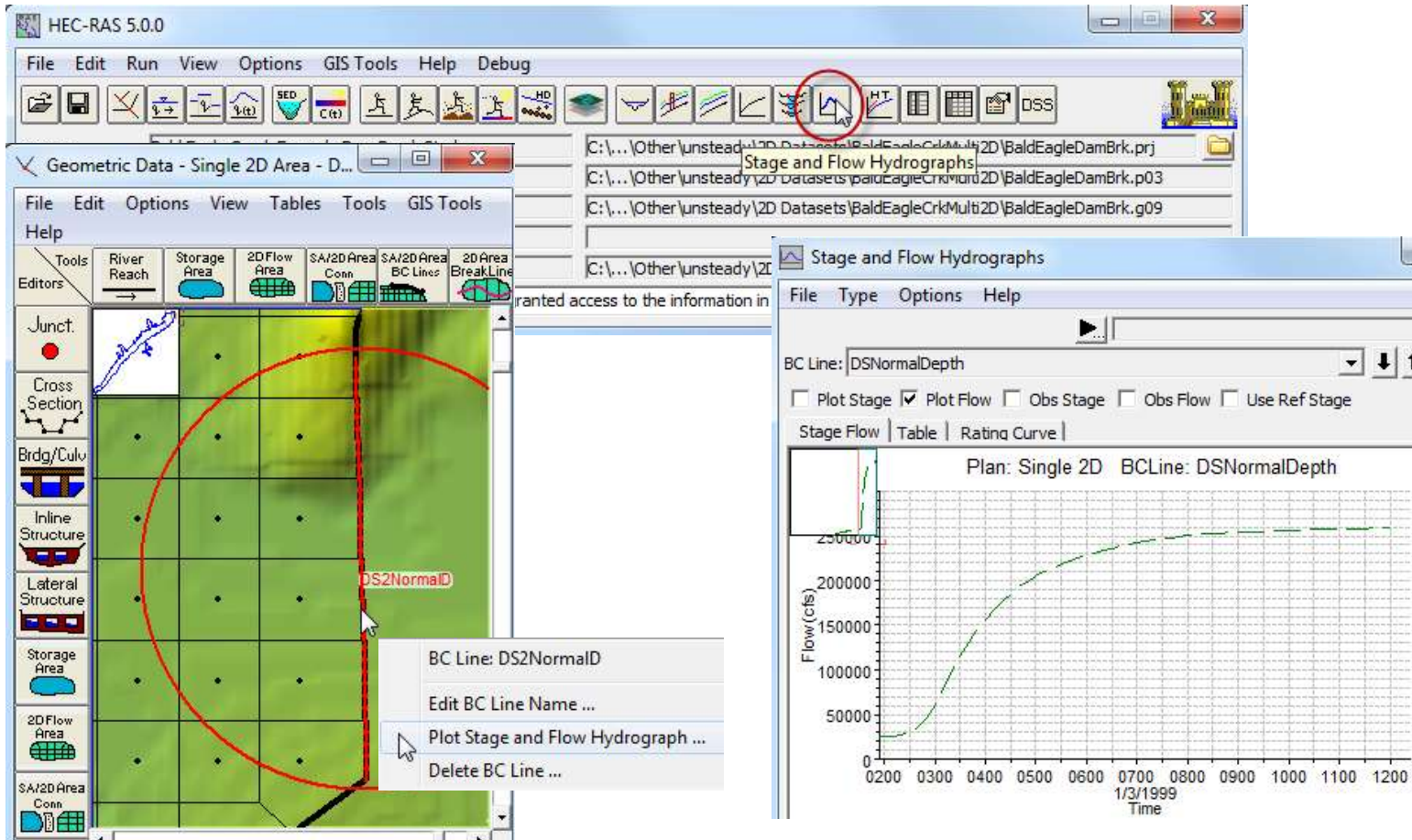
- Flow based on conveyance-averaged WSE
- Flow distribution based on conveyance
- Watch out for a steeply sloped curve and/or sharp transitions in the curve
- Watch out for “bad” low flow curve
- Zero flow point on Rating Curve does **NOT** have to be at invert (could be higher)
- Can have initialization problems  
(when RC is not consistent with cold-start conditions)



# External Boundary Locations

- Extend boundary condition locations away from study area of interest
  - **Normal Depth is an approximate boundary**
  - **Stage creates a horizontal WSE along the boundary cells (place normal to flow)**
  - **Rating curve does not take into for changes in flow for rising and falling-limbs of hydrograph**

# Boundary Output



A small red icon of a castle with three towers, located in the top left corner of the slide.

# Internal Boundary Conditions

- Flow Hydrographs
  - Must be completely inside of the 2D Flow Area
  - Can have positive and/or negative flows
  - No flow direction; Flow is only in Continuity Equation and not Momentum Equations
  - Flow is allocated to each cell based on length of line in cells
- Precipitation
  - Time-series applied to individual 2D areas
  - Precipitation rates constant for every cell
  - Specified as period cumulative depths



# Internal Flow Boundary Condition

The screenshot displays the HEC-RAS Mapper interface. The main window shows a topographic map with a grid overlay. A red line, representing an internal flow boundary condition, is drawn across the grid. The text "Internal BC" is visible near this line. The "RAS Mapper" window is open, showing a list of features and geometries. The "Selected Layer: BC Lines" is indicated. The "Features" list includes:

- Features
- Geometries
  - Single 2D Area - Dam as Internal Struct
  - Rivers
  - Cross Sections
  - Storage Areas
  - 2D Flow Areas
  - Bridges/Culverts
  - Inline Structures
  - Lateral Structures
  - SA/2D Connections
  - Pump Stations
  - BC Lines
  - Manning's n
  - Infiltration
  - Percent Impervious
  - Reference Points
  - Errors
- Bald Eagle Multi 2D Areas
- 1D-2D Dam Break Model Refined Grid
- U.S 2D - D.S 1D No Dam
- 2D to 2D Connection

The "RAS Mapper" window also shows a map view with a red line labeled "Internal Flow" and a red box highlighting a section of the grid. The "Upstream Inflow" is labeled on the left side of the map. The status bar at the bottom indicates the coordinates (1969051.59, 289409.89) and a scale of 1 pixel = 8.58 ft.



# Internal Flow Boundary Condition

HEC-RAS 6.0.0 Beta 3

File Edit Run View Options GIS

Project: BaldEagleCreekDe  
Plan: Single 2D Area - Test  
Geometry: Single 2D Area - D  
Steady Flow:  
Unsteady Flow: Single 2D Area - Precip  
Description: The United States Army Co

Unsteady Flow Data - Single 2D Area - Precip

Boundary Conditions Initial Conditions Meteorological Data Observed Data

Boundary Condition Types

Stage Hydrograph	Flow Hydrograph	Stage/Flow Hydr.	Rating Curve
Normal Depth	Lateral Inflow Hydr.	Uniform Lateral Inflow	Groundwater Interflow
T.S. Gate Openings	Elev Controlled Gates	Navigation Dams	IB Stage/Flow
Rules	Precipitation		

Add Boundary Condition Location

Add RS ... Add SA/2D Flow Area ... Add SA/2D Area Conn ... Add Pump Station ...

Select Location in table then select Boundary Condition Type

River	Reach	RS	Boundary Condition
<b>Storage/2D Flow Areas</b>			
1	BaldEagleCr	BCLine: Internal Flow	Flow Hydrograph
2	BaldEagleCr	BCLine: Upstream Inflow	Flow Hydrograph
3	BaldEagleCr	BCLine: DSNormalDepth	Normal Depth
4	BaldEagleCr	BCLine: DS2NormalD	Normal Depth
5	BaldEagleCr		Precipitation
<b>SA/2D Area Conns</b>			
1	Dam		T.S. Gate Openings

Flow Hydrograph

SA: BaldEagleCr BCLine: Internal Flow

Read from DSS before simulation

File: Path:

Enter Table Data time interval: 1 Hour

Select/Enter the Data's Starting Time Reference

Use Simulation Time: Date: 09SEP2018 Time: 0000

Fixed Start Time: Date: Time:

No. Ordinates Interpolate Missing Values Del Row Ins Row

	Date	Simulation Time (hours)	Flow (cfs)
1	08Sep2018 2400	00:00	
2	09Sep2018 0100	01:00	
3	09Sep2018 0200	02:00	
4	09Sep2018 0300	03:00	
5	09Sep2018 0400	04:00	
6	09Sep2018 0500	05:00	
7	09Sep2018 0600	06:00	
8	09Sep2018 0700	07:00	
9	09Sep2018 0800	08:00	
10	09Sep2018 0900	09:00	
11	09Sep2018 1000	10:00	
12	09Sep2018 1100	11:00	
13	09Sep2018 1200	12:00	
14	09Sep2018 1300	13:00	
15	09Sep2018 1400	14:00	

Time Step Adjustment Options ("Critical" boundary conditions)

Monitor this hydrograph for adjustments to computational time step

Max Change in Flow (without changing time step):

Min Flow: Multiplier: EG Slope for distributing flow along BC Line: TW Check

Plot Data OK Cancel





# Internal (2D Area) Precipitation BC

HEC-RAS 6.0.0 Beta 3

File Edit Run View Options GIS Tools

Project: BaldEagleCreek  
Plan: Single 2D Area - Precipitation  
Geometry: Single 2D Area - Dam  
Steady Flow:  
Unsteady Flow: Single 2D Area - Precipitation  
Description: The United States Army Corps of Engineers

Unsteady Flow Data - Single 2D Area - Precipitation

File Options Help

Description: [ ] [Apply Data]

Boundary Conditions | Initial Conditions | Meteorological Data | Observed Data

Boundary Condition Types

Stage Hydrograph	Flow Hydrograph	Stage/Flow Hydr.	Rating Curve
Normal Depth	Lateral Inflow Hydr.	Uniform Lateral Inflow	Groundwater Interflow
T.S. Gate Openings	Elev Controlled Gates	Navigation Dams	IB Stage/Flow
Rules	Precipitation		

Add Boundary Condition Location

Add RS ... Add SA/2D Flow Area ... Add SA/2D Area Conn ... Add Pump Station ...

Select Location in table then select Boundary Condition Type

River	Reach	RS	Boundary Condition
<b>Storage/2D Flow Areas</b>			
1	BaldEagleCr		Precipitation
2	BaldEagleCr	BCLine: Upstream Inflow	Flow Hydrograph
3	BaldEagleCr	BCLine: DSNormalDepth	Normal Depth
4	BaldEagleCr	BCLine: DS2NormalD	Normal Depth
<b>SA/2D Area Conns</b>			
1	Dam		T.S. Gate Openings

Precipitation Hydrograph

SA: BaldEagleCr

Read from DSS before simulation [Select DSS file and Path]

File: [ ]  
Path: [ ]

Enter Table

Select/Enter the Data's Starting Time Reference

Use Simulation Time: Date: 09SEP2018 Time: 0000  
 Fixed Start Time: Date: [ ] Time: [ ]

Data time interval: 1 Hour

No. Ordinates Interpolate Missing Values Del Row Ins Row

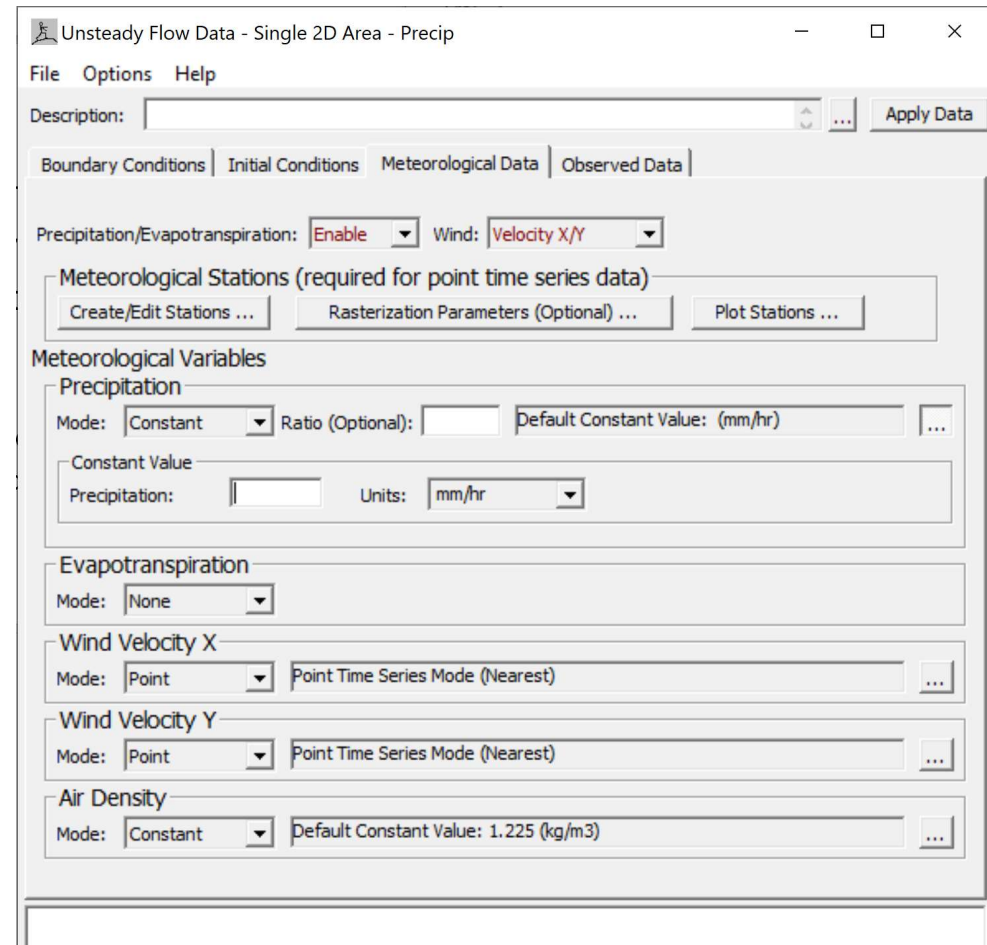
	Date	Simulation Time (hours)	Precipitation (in)
1	08Sep2018 2400	00:00	
2	09Sep2018 0100	01:00	
3	09Sep2018 0200	02:00	
4	09Sep2018 0300	03:00	
5	09Sep2018 0400	04:00	
6	09Sep2018 0500	05:00	
7	09Sep2018 0600	06:00	
8	09Sep2018 0700	07:00	
9	09Sep2018 0800	08:00	
10	09Sep2018 0900	09:00	
11	09Sep2018 1000	10:00	
12	09Sep2018 1100	11:00	
13	09Sep2018 1200	12:00	
14	09Sep2018 1300	13:00	
15	09Sep2018 1400	14:00	
16	09Sep2018 1500	15:00	
17	09Sep2018 1600	16:00	
18	09Sep2018 1700	17:00	
19	09Sep2018 1800	18:00	
20	09Sep2018 1900	19:00	

Plot Data OK Cancel



# Global Boundary Conditions

- Applied to the entire project
- Specified in **Meteorologic Data** tab of **Unsteady Flow Data** editor
- Types of Boundaries:
  1. Precipitation
  2. Evapotranspiration Potential
  3. Wind
  4. Air Density
- Types of Data
  1. Point
  2. Constant
  3. Gridded



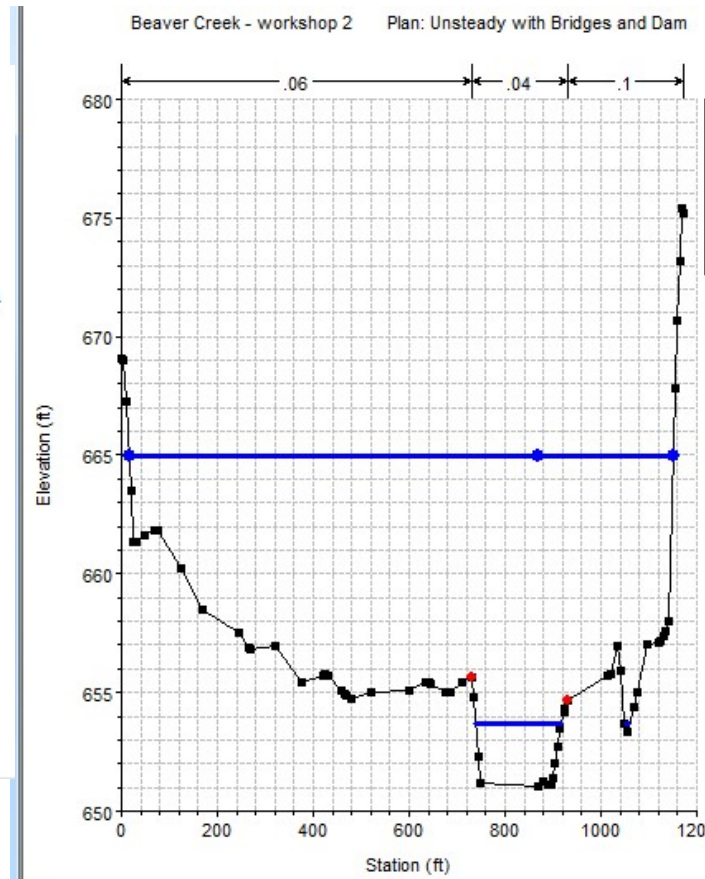
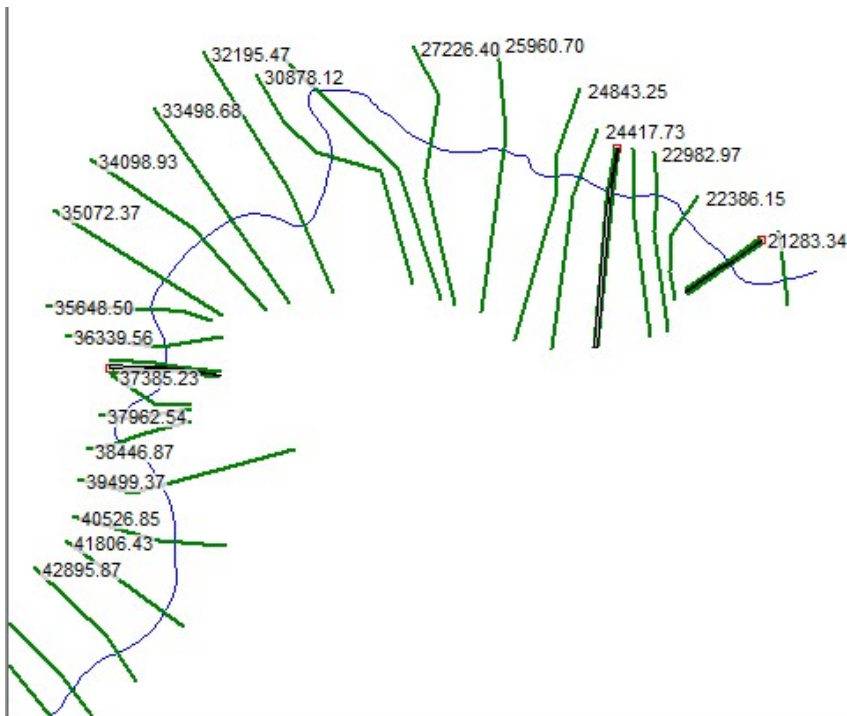
A small red icon of a castle or fortress with three towers, located in the top left corner of the slide.

# 2D Initial Conditions Overview

- User Specified Initial Conditions
  - Dry Initial Conditions
  - Single Horizontal WSE
  - Option to apply initial stage boundary values horizontally into domain
  - **2D Initial Condition Time** (Optional)
    - **Allows each 2D area to compute an initial profile**
    - **Somewhat similar to 1D initial backwater**
  - Optional entire model **Warm Up** period to settle simulation
- Use **Restart File**
  - Restart File created by previous run
- Interpolate from Previous Results
  - Interpolates wse, velocity, and flows for 1D and 2D
  - Geometries do not have to be the same

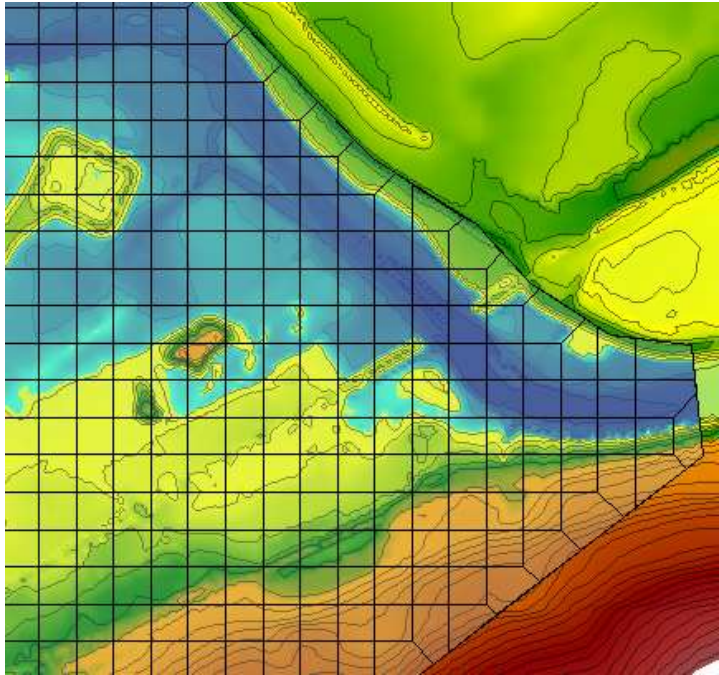
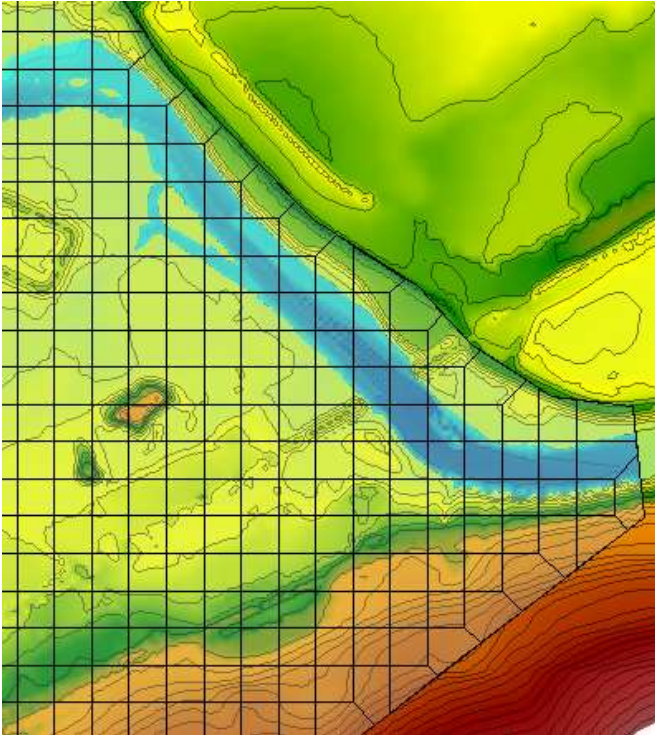


# 1D Finite-Difference Stays Wet





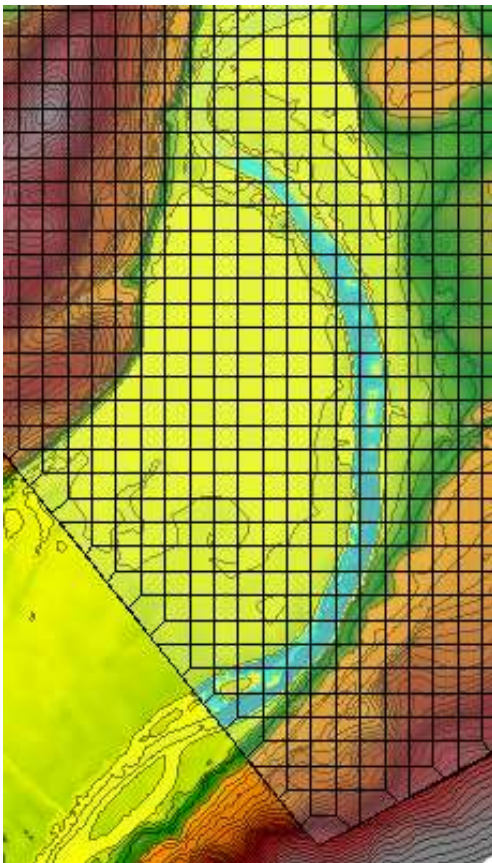
# 2D Wetting/Drying





# Filling 2D Channel

- Use Initial Conditions Time to fill channel



- Upstream flow will eventually fill channel
- May take a long time to fill, especially reservoirs
- Initial [horizontal] WSE can be used to speed things up
- A Restart File can save time



# Initial Conditions Ramp Up

- Ramp Up Period run before Warm Up Period
- Specified for each 2D area
- Ramp Up Fraction determines the period over which flow and stage are ramped up from the initial condition and then held constant

HEC-RAS Unsteady Computation Options and Tolerances

General | 2D Flow Options | 1D/2D Options | Advanced Time Step Control | 1D Mixed Flow Options

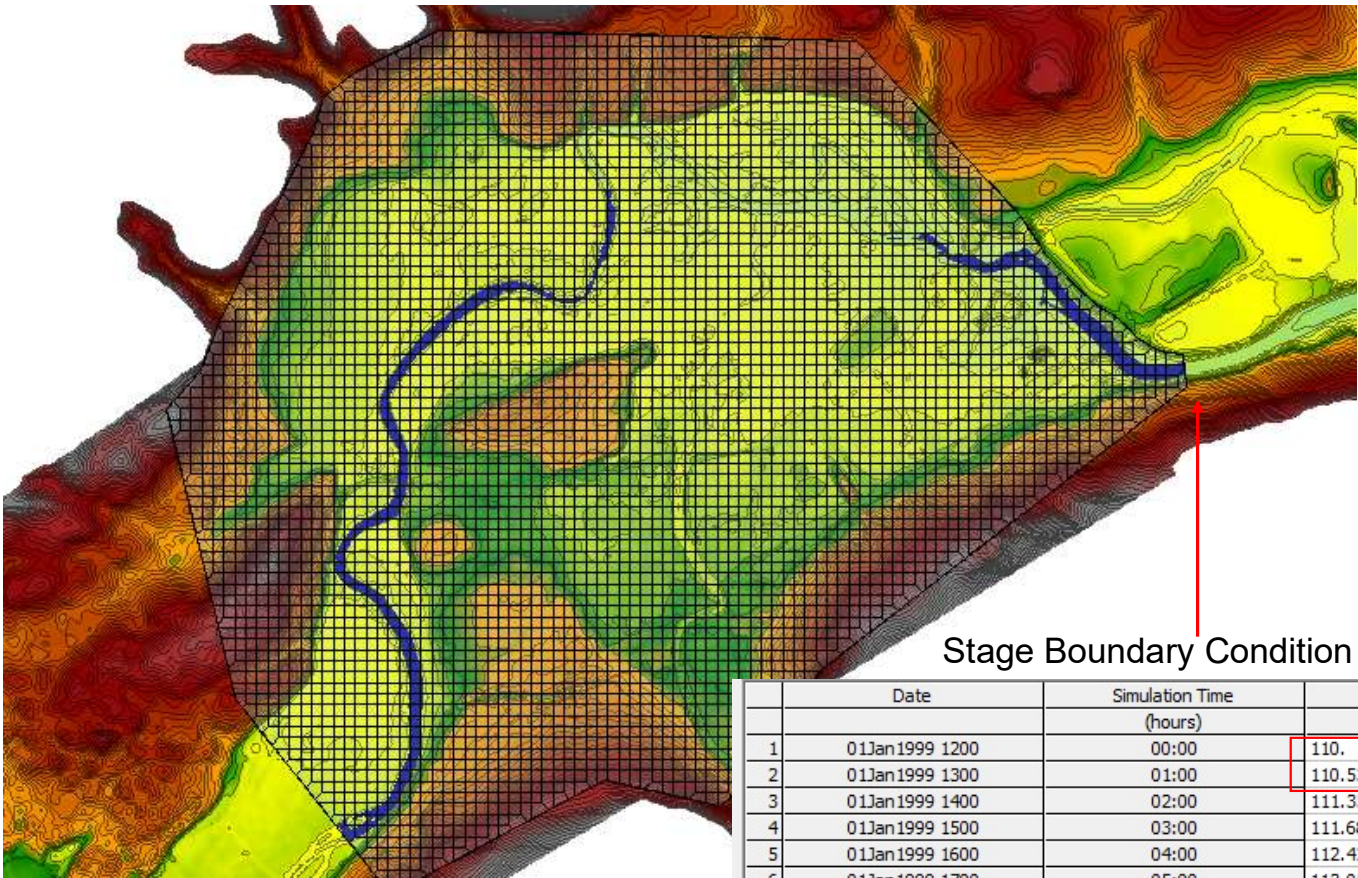
Use Coriolis Effects (not used with Diffusion Wave equation)

Parameter	(Default)	BaldEagleCr
1 Theta (0.6-1.0)		1
2 Theta Warmup (0.6-1.0)	1	1
3 Water Surface Tolerance [max=0.2](ft)	0.01	0.01
4 Volume Tolerance (ft)	0.01	0.01
5 Maximum Iterations	20	20
6 Equation Set	Diffusion Wave	Diffusion Wave
7 Initial Conditions Time (hrs)		
8 Initial Conditions Ramp Up Fraction (0-1)	0.5	0.5
9 Number of Time Slices (Integer Value)	1	1
10 Turbulence Model	None	None
11 Longitudinal Mixing Coefficient	0.3	0.3
12 Transverse Mixing Coefficient	0.1	0.1
13 Smagorinsky Coefficient	0.05	0.05
14 Boundary Condition Volume Check	<input type="checkbox"/>	<input type="checkbox"/>
15 Latitude for Coriolis (-90 to 90)		
16 Solver Cores	All Available	12 Cores
17 Matrix Solver	Pardiso (Direct)	Pardiso (Direct)
18 Convergence Tolerance		
19 Minimum Iterations	0	0
20 Maximum Iterations	0	0
21 Restart Iteration	10	10
22 Relaxation Factor	1.3	1.3
23 SOR Preconditioner Iterations	10	10

OK Cancel Defaults ...



# 2D Initial Conditions Warm Up in Progress



Stage Boundary Condition

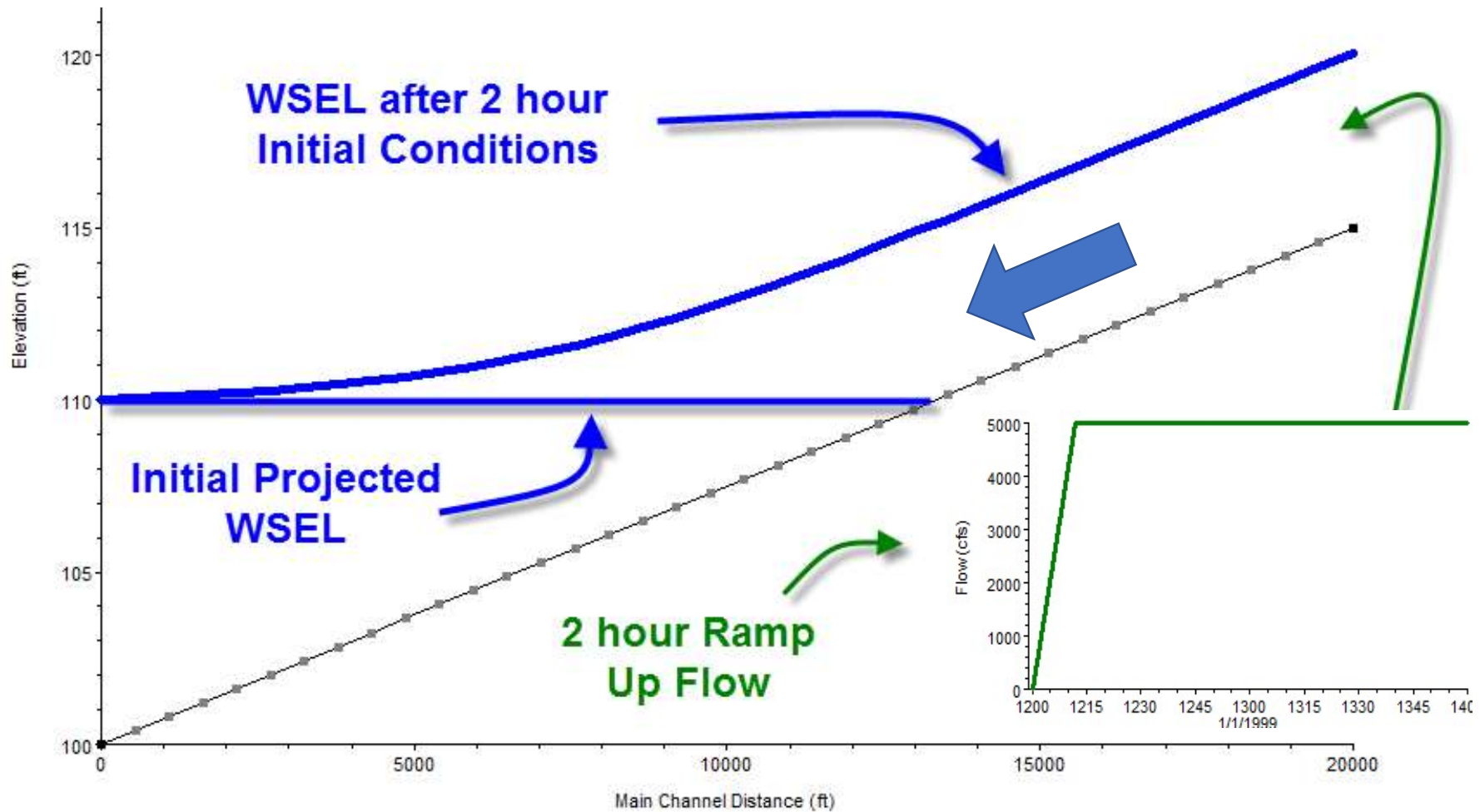
	Date	Simulation Time (hours)	
1	01Jan1999 1200	00:00	110.
2	01Jan1999 1300	01:00	110.53
3	01Jan1999 1400	02:00	111.35
4	01Jan1999 1500	03:00	111.68
5	01Jan1999 1600	04:00	112.42
6	01Jan1999 1700	05:00	113.05

Use Initial Stage (recommended)    [?] t Data    OK

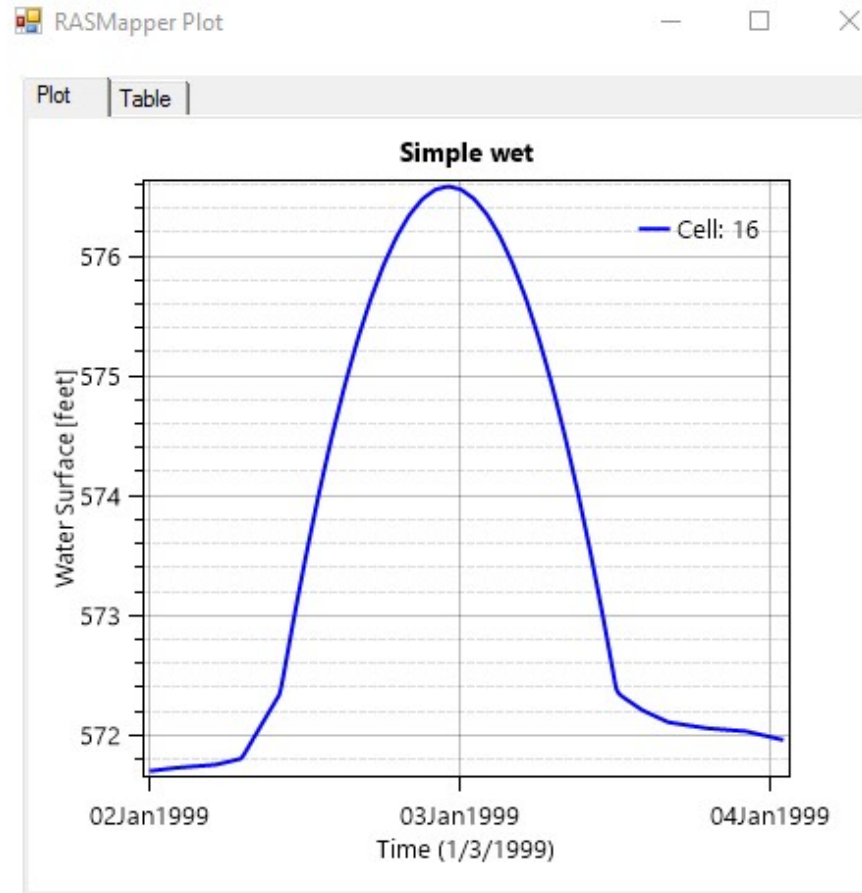
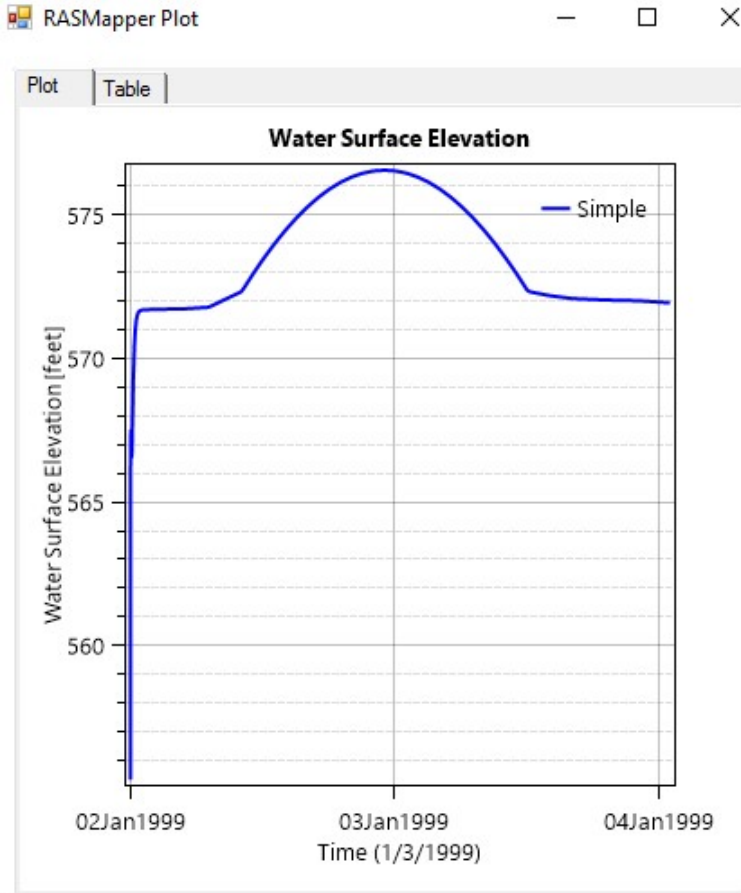




# 2D Initial Conditions Profile



# Dry vs Wet Start





# Initial Conditions Warm Up Period

- Run after Initial Conditions Period
- Length specified as number of time steps
- Time step is optional
- Hold all the BC's constant and allows the model to stabilize

HEC-RAS Unsteady Computation Options and Tolerances

General | 2D Flow Options | 1D/2D Options | Advanced Time Step Control | 1D Mixed Flow Options

1D Unsteady Flow Options

Theta [implicit weighting factor] (0.6-1.0): 1.

Theta for warm up [implicit weighting factor] (0.6-1.0): 1.

Water surface calculation tolerance [max=0.2](ft): 0.02

Storage Area elevation tolerance [max=0.2](ft): 0.02

Flow calculation tolerance [optional] (cfs):

Max error in water surface solution (Abort Tolerance)(ft): 100.

Maximum number of iterations (0-40): 20

Maximum iterations without improvement (0-40):

1D/2D Unsteady Flow Options

Number of warm up time steps (0 - 100,000): 20

Time step during warm up period (hrs): 0

Minimum time step for time slicing (hrs): 0

Maximum number of time slices: 20

Lateral Structure flow stability factor (1.0-3.0): 2.

Inline Structure flow stability factor (1.0-3.0): 1.

Weir flow submergence decay exponent (1.0-3.0): 1.

Gate flow submergence decay exponent (1.0-3.0): 1.

Gravity (ft/s<sup>2</sup>): 32.174

Wind Forces

Reference Frame: Eulerian

Drag Formulation: Hsu (1988)

1D Numerical Solution

Finite Difference (classic HEC-RAS methodology)

Finite Difference Matrix Solver

Skyline/Gaussian (Default: faster for dendritic systems)

Pardiso (Optional: may be faster for large interconnected systems)

Finite Volume (new approach)

Number of cores to use with Pardiso solver: All Available

Geometry Preprocessor Options

Family of Rating Curves for Internal Boundaries

Use existing internal boundary tables when possible.

Recompute at all internal boundaries

OK Cancel Defaults ...

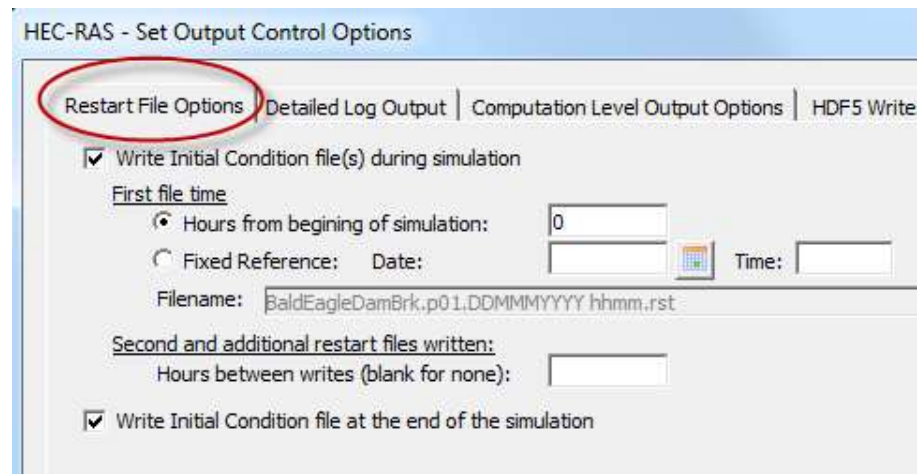
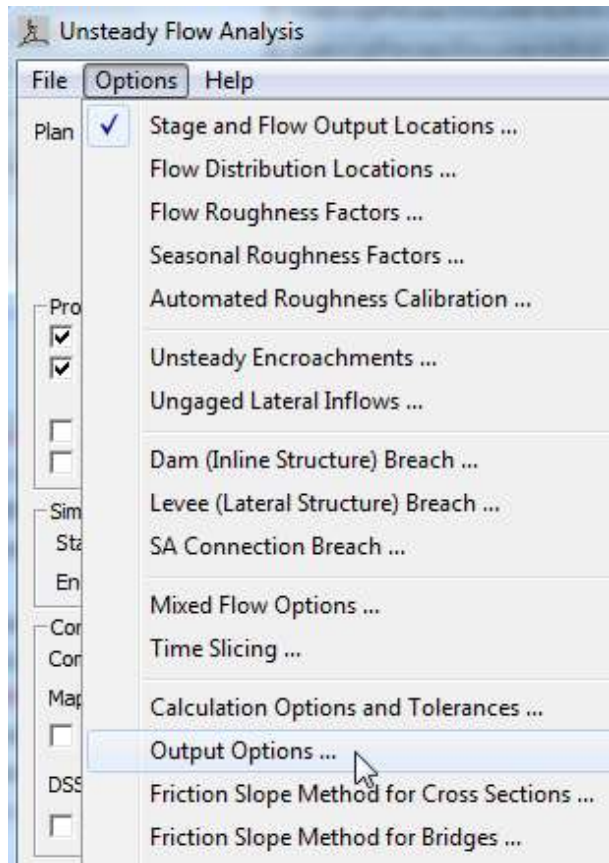
A small red icon of a castle or fortress with three towers, enclosed in a red square border.

# Using a Restart File

1. Write **Initial Condition File** out
2. Create a new **Unsteady Flow Plan** (“Save As...”)
3. Select **Use a Restart File** option in  
**Unsteady Flow Initial Conditions Tab**
4. Adjust starting date, and any hydrographs, if needed  
(if you start model later than previous run).



# Write Initial Condition File





# Select Restart

The image shows two overlapping dialog boxes from the HEC-RAS software. The background dialog is titled "Unsteady Flow Data - Unsteady flow data" and has tabs for "Boundary Conditions" and "Initial Conditions". Under "Initial Conditions", the "Initial Flow Distribution Method" is set to "Use a Restart File". The "Filename" field contains the path: `(Documents)\RAS Data\Beaver.p03.10FEB1990.1200.rst`. Below this is a table titled "Locations of Flow Data Changes (specify the flow or optional)".

River	Reach	RS	Initial F
1 Beaver Creek	Kentwood	5.99	

The foreground dialog is titled "Unsteady Flow Analysis" and has tabs for "File", "Options", and "Help". It shows the following settings:

- Plan : Unsteady 100 yr
- Short ID : 100 yr
- Geometry File : Beaver Cr. - bridge
- Unsteady Flow File : Unsteady flow data
- Plan Description :
- Programs to Run:
  - Geometry Preprocessor
  - Unsteady Flow Simulation
    - Sediment
  - Post Processor
  - Floodplain Mapping
- Simulation Time Window:
  - Starting Date : 10FEB1990
  - Starting Time : 1200
  - Ending Date : 12FEB1990
  - Ending Time : 2400

A red arrow points from the filename field in the "Unsteady Flow Data" dialog to the "Starting Date" field in the "Unsteady Flow Analysis" dialog. A red oval highlights the "Starting Date" and "Starting Time" fields in the "Unsteady Flow Analysis" dialog.



# Hydrograph Starting Time

Flow Hydrograph

River: Bald Eagle Reach: Loc Hav RS: 138154.4

Read from DSS before simulation

File:   
Path:

Enter Table Data time in

Select/Enter the Data's Starting Time Reference

Use Simulation Time: Date: 10FEB1990 Time: 1200

Fixed Start Time: Date:  Time:

No. Ordinates | Interpolate Missing Values | Del Row | Ins Row

Hydrograph Data			
	Date	Simulation Time	Flow
		(hours)	(cfs)
1	10Feb 1990 1200	00:00	1075.53
2	10Feb 1990 1300	01:00	1301.64
3	10Feb 1990 1400	02:00	1676.94
4	10Feb 1990 1500	03:00	2199.12
5	10Feb 1990 1600	04:00	2864.95
6	10Feb 1990 1700	05:00	3670.34
7	10Feb 1990 1800	06:00	4610.32
8	10Feb 1990 1900	07:00	5679.08
9	10Feb 1990 2000	08:00	6870.05

Time Step Adjustment Options ("Critical" boundary conditions)  
in Flow: this hydrograph for adjustments to computational time step  
Max Change in Flow (without changing time step):

Min Flow:  Multiplier:

Plot Data | OK | Cancel

Flow Hydrograph

River: Bald Eagle Reach: Loc Hav RS: 138154.4

Read from DSS before simulation

File:   
Path:

Enter Table Data time in

Select/Enter the Data's Starting Time Reference

Use Simulation Time: Date: 10FEB1990 Time: 1200

Fixed Start Time: Date: 01Jan1990 Time: 0000

No. Ordinates | Interpolate Missing Values | Del Row | Ins Row

Hydrograph Data			
	Date	Simulation Time	Flow
		(hours)	(cfs)
1	31Dec1989 2400	00:00	1075.53
2	01Jan1990 0100	01:00	1301.64
3	01Jan1990 0200	02:00	1676.94
4	01Jan1990 0300	03:00	2199.12
5	01Jan1990 0400	04:00	2864.95
6	01Jan1990 0500	05:00	3670.34
7	01Jan1990 0600	06:00	4610.32
8	01Jan1990 0700	07:00	5679.08
9	01Jan1990 0800	08:00	6870.05

Time Step Adjustment Options ("Critical" boundary conditions)  
in Flow: this hydrograph for adjustments to computational time step  
Max Change in Flow (without changing time step):

Min Flow:  Multiplier:

Plot Data | OK | Cancel

A small red icon of a castle or fortress with three towers, enclosed in a red square border.

# Restart File Notes

- Geometry must be the same
- Can switch 2D equation if desired
  - **Use to run DWE to create Restart for SWE**
- Can change the time step
- Can change the output interval
- Can (generally) change flow and plan data





# Interpolate From Previous Results

- New for Version 6.0
- User selects a previous plan results file (ProjectName.p###.hdf)
- Geometry does not have to be the same
- Interpolates water levels, velocities, and flows
- Works for 1D and 2D

Unsteady Flow Data - Interpolated Initial Conditions

File Options Help

Description:

Boundary Conditions Initial Conditions Meteorological Data

Initial Flow Distribution Method

Restart Filename:

Results Filename:  Results Profile:

Enter Initial flow distribution (Optional - leave blank to use boundary conditions)

User specified fixed flows (Optional)

	River	Reach	RS	Initial Flow
1				

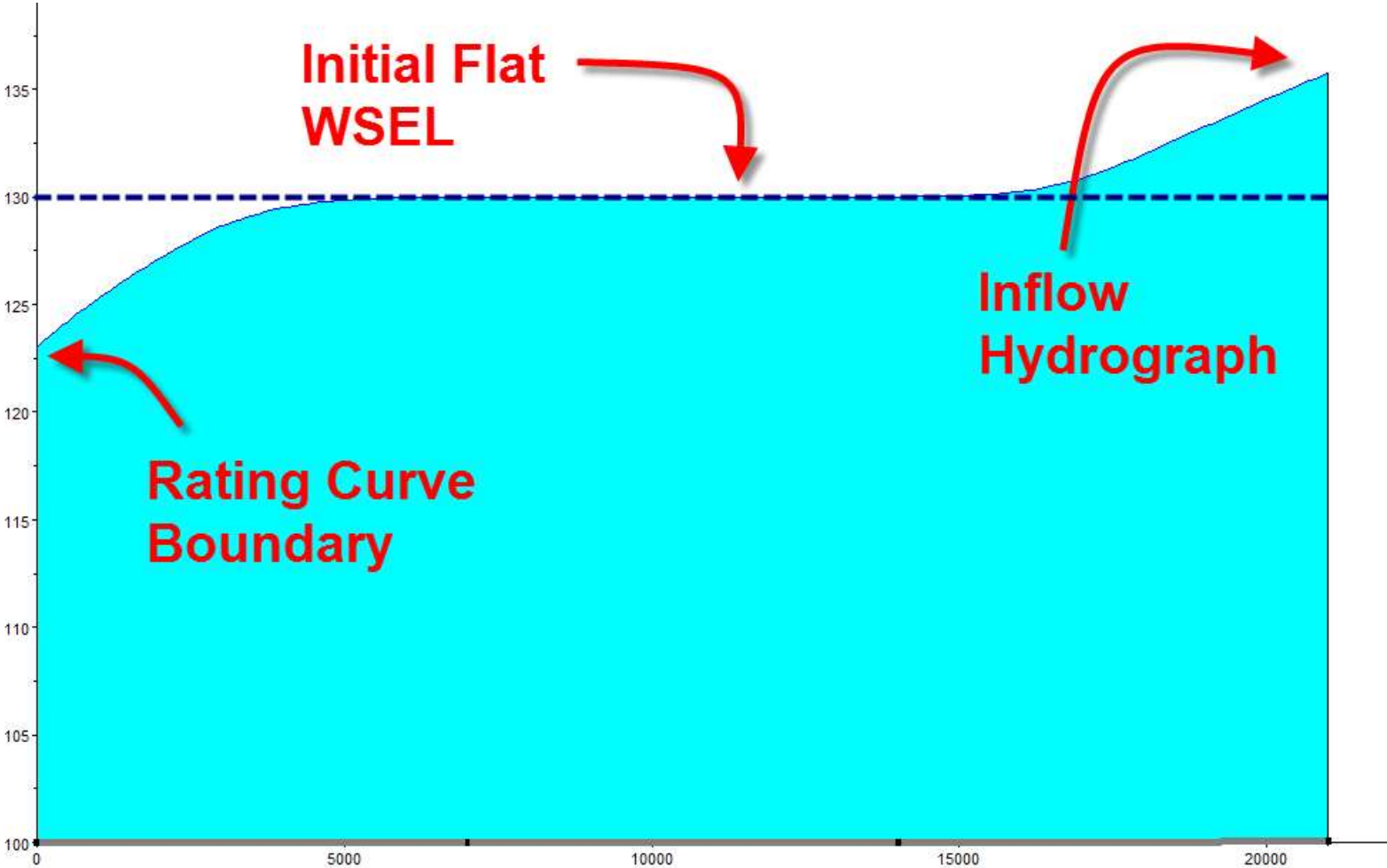
Initial Elevation of Storage Areas/2D Flow Areas (Optional)

Keep initial elevations constant during warmup

	Storage Area/2D Flow Area	Initial Elevation
1	2D: BaldEagleCr	



# Flat WSEL vs Momentum



# Questions?

