Unsteady Flow Modeling for Reservoir Analysis with HEC-RAS

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Outline

- Boundary Conditions and Computation
- Inline Structures and Gates
- Reservoir Modeling Layout Options
Boundary and Initial Conditions, and Computation Options and Tolerances
Unsteady Flow Data

- **External Boundaries required**
  - Upstream and Downstream ends of the river
  - Typically flow or stage hydrograph upstream
  - Typically rating or “normal depth” downstream

- **Internal Boundaries can be added**
  - Add flow within the river system
  - Define gate operation

- **Initial Conditions - at the start of simulation**
Unsteady Flow Data Editor

HEC-RAS 5.0.3

Project: Bald Eagle Creek Example Dam Break Study
Plan: PMF Event No Breach
Geometry: Existing GIS Data Nov 2006
Steady Flow: 
Unsteady Flow: PMF Event from HMS
Description: The United States Army Corps of Engineers has granted

Upstream Boundary Conditions

- Flow Hydrograph
- Stage Hydrograph
- Stage/Flow Hydrograph
Flow Hydrograph

- Read from DSS
  - Select DSS file
  - Select Pathname

- Enter in Table
  - Select time interval
  - Select start date/time
  - Enter flow data - or cut & paste
Flow Hydrograph

- Min Flow
- Multiplier
- Hydrograph Monitor for Time Slicing

Minimum time step for time slicing (hrs):
Maximum number of time slices:

Min Flow: [Blank] Multiplier: [Blank]
Downstream Boundary Conditions

- **Downstream Options:**
  - Normal Depth
  - Rating Curve
  - Stage Hydrograph
  - Flow Hydrograph
  - Stage & Flow Hydrograph
Computation

- Computation Time Step
- Hydrograph Output
- Detailed Output
- Mixed Flow Regime
Computation Options

- **Theta**
  - 1 = Most Stable

- **Water Surface Tolerance**

- **Stability Factors**
  - 1 = Most Accurate
  - 3 = Most Stable
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Entering Inline Structure Data
Weir and Embankment Profile

- Distance + Width < U/S XS Reach Length
- Weir include top of dam and spillway
- Weir Coef. used for both dam and spillway
Gates

- Sluice
- Radial
- Overflow
- User Defined Curves
Gate Settings

- Add the Inline Structure station as a BC location to Specify Gate Settings
Gate Boundary Conditions
Outline

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Reservoir Modeling Option

- Model Reservoir with cross sections
- Cross sections must include channel information, especially around dam both u/s and d/s
- Allows for dynamic routing of water (sloped water surface)
Initial Internal Stages

- Internal RS Initial Stages used to set initial water surface at a XS
- Stage U/S from inline structure is based on a balance of outlet size/gate opening and water surface.
Operation Rules for Gated Structures

- Unsteady Flow Editor “Rules” boundary condition
- Inline/Lateral Structures
- Storage Area Connections

Controls
  - Gates
  - Weir Coefficients
  - Min/Max Flow

- Rules are evaluated at every time step
User Defined Rules Editor for Operating Gated Structures