Advanced Hydraulic Modeling
Sizing/Design Tools and Dual Drainage
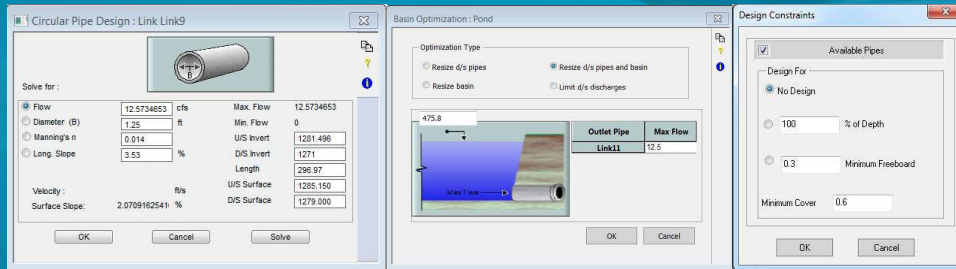
1
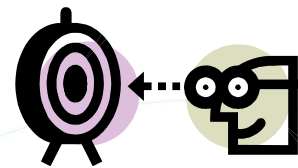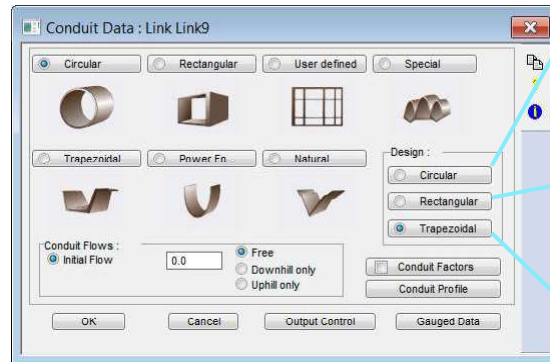
Workshop No. 11 Objectives

- Automated Conduit Sizing
- Modify Elevations
- Ponding Options
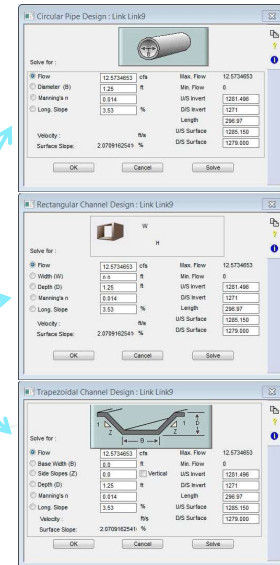- Dual Drainage
- Drainage Inlets
- Pond Optimization

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Conduit Sizing/Design

- Manning's Equation for Full Flow

3

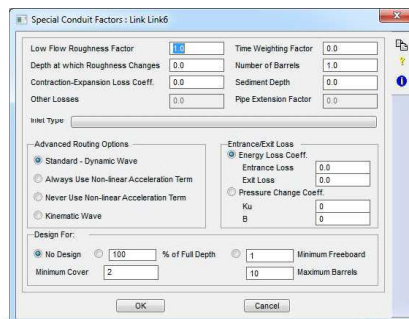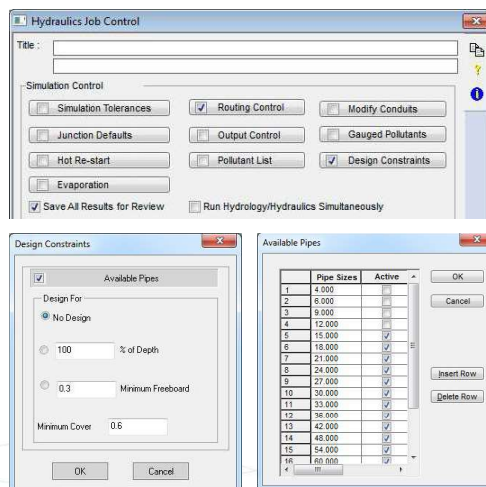# Automated Conduit Design

■ Job Control: All Conduits

■ Conduit Factors : Individual Conduit(s)

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Automated Conduit Design

Overview of Algorithm

1. Identify undersized pipes
2. Increase pipe size
   i. Increase by one nominal size
   ii. If already at maximum, (no cover) then increase number of barrels by one
3. Restart Simulation
4. Repeat until all pipes meet design constraints

Note: Step 3 can be disabled with Configuration Parameter DESIGN_RESTART=OFF

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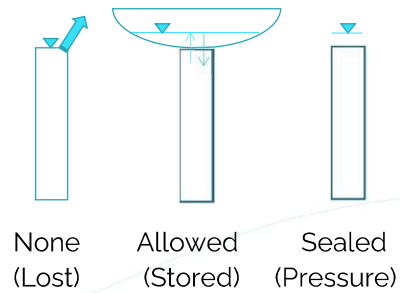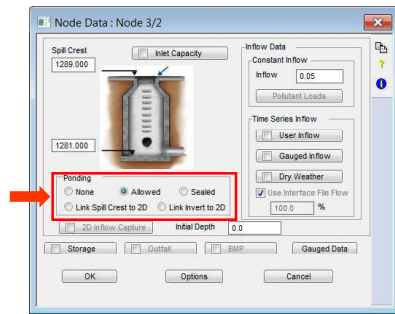
Modify Elevations

- For selected objects:
  - Raise or lower inverts
  - Generate intermediate inverts
  - Drop Inverts from ground
  - Raise or lower ground elevations
  - Read inverts from TIN files
  - Set node level to lowest link invert
  - Match Crowns
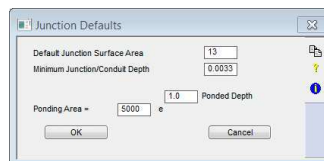 - Match Inverts
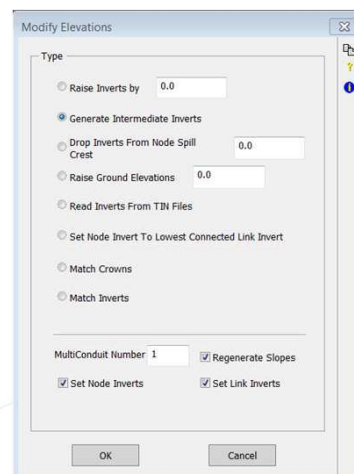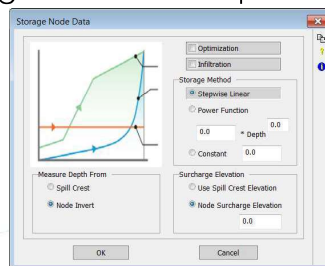

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Node Ponding Options

None   Allowed   Sealed
(Lost)   (Stored)   (Pressure)

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Ponding Allowed

1. Global Equation in HDR Job Control

2. Local Storage Curve from Spillcrest
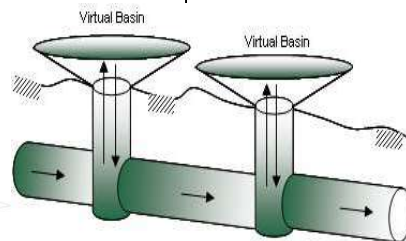

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Traditional Surcharge Approach

Ponding Allowed in Flooded Node
- Overflowed water can be stored in virtual basin
- Returns back into the system when 1D system regains capacity.

Limitations:
- How to define the basin dimension
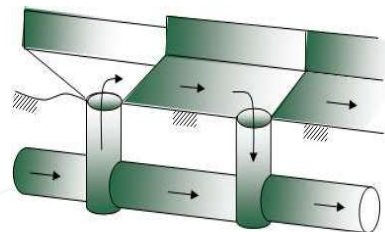- No overland flow path

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Dual Drainage

- Overflowed water can be routed through the predefined street channels (up to defined street cross-section)
- Capture to closed system can simulated with inlet capacity

Limitations:
- Extra effort is necessary
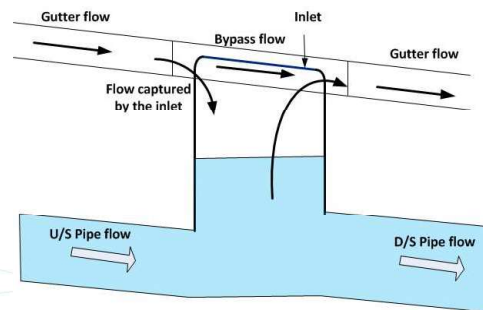- No flood extents beyond the defined street geometry

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Dual Drainage

- Gutter flow and pipe flow can be simulated together
- Multilink can be used for modelling
- Gutter flow modeled using natural or trapezoidal shape
- Inlet Capacity should be specified at the nodes

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Drainage Inlets

- Inlet Capture
  - Maximum capacity
  - Rates by approach flow or depth
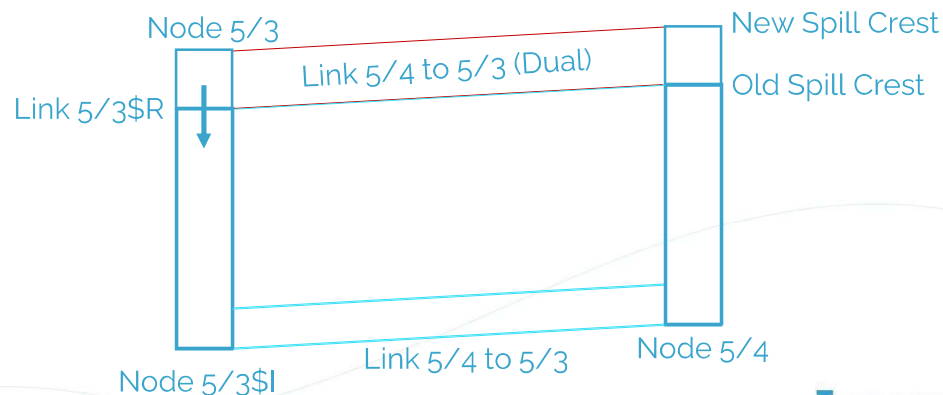 - HEC-12/22
- Gutter flow, spread, and velocity

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Inlet Capacity – Internal Nodes and Links

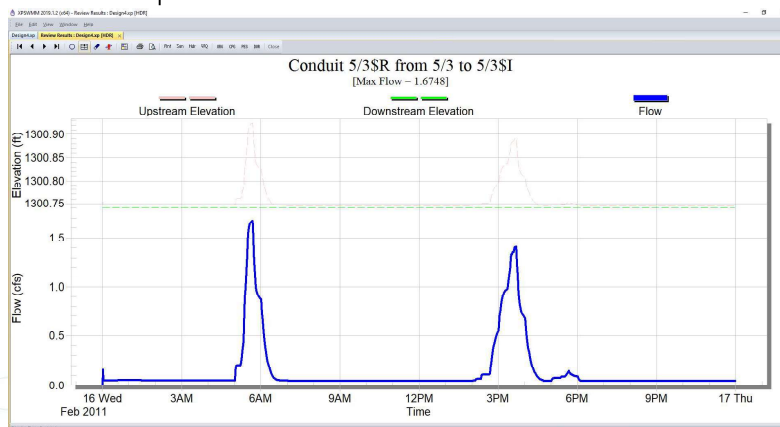- When using inlet capacity an internal (computational) node and link are created at each node

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Review Results: Inlet Capacity

- Troubleshoot Inlet Flows, Inlet time series include:
  - Inlet Flows (+/– flow direction)
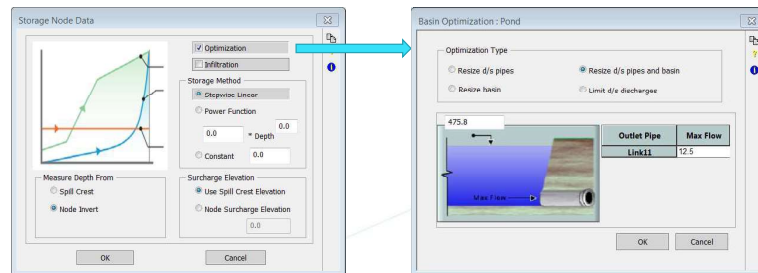 - Upstream and Downstream HGL

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Pond Optimization

1. Resize downstream pipes [Max HGL]
2. Resize basin [Max HGL]
3. Resize downstream pipes & basin [Max HGL | Max Flow]
4. Limit downstream discharges [Max Flow]

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Workshop Example Preview

- Conduit Sizing
- Storage
  - Pond Storage
  - Ponding Allowed
- Dual Drainage and Inlet Capacity
- Pond Design
  - Restrict downstream discharges
  - Restrict downstream discharges and maximum water surface

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