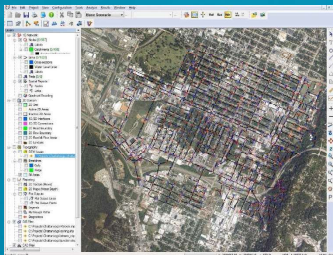


Stormwater and Sanitary Modeling

xpswmm & xpstorm



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Empowering water experts

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Introductions

- Where are you from?
- Do you have experience using xpswmm/xpstorm?
- Experience with other water resources software?
- What do you expect to learn?
- Something interesting about yourself!

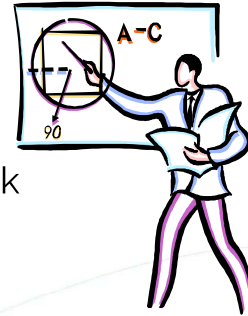


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Workshop Format

- PowerPoint Lecture
- Software Demonstration
- Independent and Guided Work
- Review Questions/Discussion



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Storm/Sewer/Flood Family

Rank	Question*	InfoWorks ICM	xpswmm	xpstorm	InfoSWMM®	InfoSewer®
1	What is the primary problem you are trying to understand?	Urban Sewers & Urban/River Flooding	Integrated 1D/2D Urban Sewer/River Modeling	Integrated 1D/2D Urban Flood Modeling	Sewer systems (storm & sanitary)	Sewer
2	How large is the problem?	City & Watershed (200,000 nodes)	Medium Scale (32,000 nodes)	Medium Scale (32,000 nodes)	City Scale (100,000 nodes)	City Scale (100,000 nodes)
3	What is your preferred level of GIS integration?	Standalone CAD & GIS	Standalone CAD & GIS	Standalone CAD & GIS	Full GIS Integration (ArcMap)	Full GIS Integration (ArcMap)
4	Are you looking to support a workgroup?	Team Shareable Simultaneous Users	Single User	Single User	Single User	Single User
5	Does the solution need to support FEMA Flood Studies or Letter of Map Amendments (LOMRs)?	Regional FEMA approved	National FEMA Approved	National FEMA Approved	via SWMM5	None
6	Do you support casual or new modelers?	Expert guidance	Yes Visual UI	Yes Visual UI	Yes, GIS background helpful	Yes, GIS background helpful
7	Do you need green infrastructure?	CS-SUDS, SWMM5 LIDs 2D SUDS	Catchment, BMP, 2D	Catchment, BMP, 2D	SWMM5 LIDs SUSTAIN	None

*Always consider local regulations or unique situations that might drive the selection of a specific model.

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Storm/Sewer/Flood Family

	InfoWorks ICM	xpswmm	xpstorm	InfoSWMM®	InfoSewer®
Key features	<ul style="list-style-type: none"> Powerful Modeling & Advanced RTC Controls Data Flagging Unstructured Mesh 3D Viewer GPU & Multicore processing 	<ul style="list-style-type: none"> Design to Model Visual UI Global Storms & Statistical Analysis Emergency Route Planning GPU & Multicore processing Steps for 2D cell counts 	<ul style="list-style-type: none"> Design to Model Visual UI Global Storms & Statistical Analysis Emergency Route Planning GPU & Multicore processing Steps for 2D cell counts 	<ul style="list-style-type: none"> Scenario Management Suite Modules like: <ul style="list-style-type: none"> RDI Analyst Subcatchment Manager Calibrator DWF Allocator Sustain Multicore processing Unlimited 2D elements 	<ul style="list-style-type: none"> Scenario Management Steady State Peaking Factors DWF Design tool Fast solution Load Allocator HS2
Key Hydrology Methods	17 methods <ul style="list-style-type: none"> EPA SWMM 5 SCS Hydrology UH (Clark, Snyder) UK Methods (Variable PR, Wallingford, ReFH) Japanese Methods (Res, Desbordes, Sprin) Prob. Density Model Rain on Mesh 	23 methods <ul style="list-style-type: none"> EPA SWMM SCS Hydrology Unit Hydrographs (Clark, SBUH, Snyder, Nash, T-A) UK Methods (Variable PR, Wallingford, ReFH, FEH, FSR) Rain on Grid 	23 methods <ul style="list-style-type: none"> EPA SWMM SCS Hydrology Unit Hydrographs (Clark, SBUH, Snyder, Nash, T-A) UK Methods (Variable PR, Wallingford, ReFH, FEH, FSR) Rain on Grid 	13 methods <ul style="list-style-type: none"> EPA SWMM 5 SCS Hydrology Unit Hydrographs (Clark, SBUH, Snyder, Espey, CUHP, Delmarva) Modified Rational German Runoff Rain on Mesh 	Requires Pro Version: <ul style="list-style-type: none"> Rational for Steady State Unit Hydrograph For EPS (User defined, SCS, CUHP)

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Online Storm and Flood Agenda

Day 1 – Morning session

- Module 1 – Introduction/User Interface Skills
- Module 2 – Hydrologic Analysis

Day 1 – Afternoon session

- Module 3 – Hydraulic Analysis
- Module 11 – Advanced Modeling Tools

Day 2 – Morning session

- Module 10 – 1D River Modeling and Mapping
- Module 12 – 1D/2D River Modeling

Day 2 – Afternoon session

- Module 13 – Integrated 1D/2D Urban Modeling

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Workshop Storm and Flood Agenda

Day 1 – Morning session

- Module 1 – Interface and Hydrologic Analysis
- Module 3 – Hydraulic Analysis

Day 1 – Afternoon session

- Module 6 – Low Impact Development
- Module 11 – Advanced Modeling Tools

Day 2 – Morning session

- Module 10 – 1D River Modeling and Mapping
- Module 12 – 1D/2D River Modeling

Day 2 – Afternoon session

- Module 13 – Integrated 1D/2D Urban Modeling
- Module 14 – Levee Failure and 2D Scenarios

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Workshop Storm and Sanitary Agenda

Day 1 – Morning session

- Module 1 – Interface and Hydrologic Analysis
- Module 3 – Hydraulic Analysis

Day 1 – Afternoon session

- Module 6 – Low Impact Development
- Module 11 – Advanced Modeling Tools

Day 2 – Morning session

- Module 10 – 1D River Modeling and Mapping
- Module 4 – Sanitary Sewer Modeling

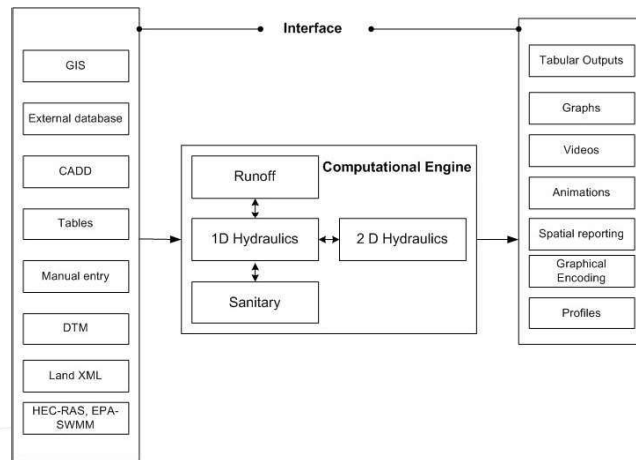
Day 2 – Afternoon session

- Module 7&8 – RTC; Pumps and Force Mains
- Module 13 – Integrated 1D/2D Urban Modeling

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Model Structure



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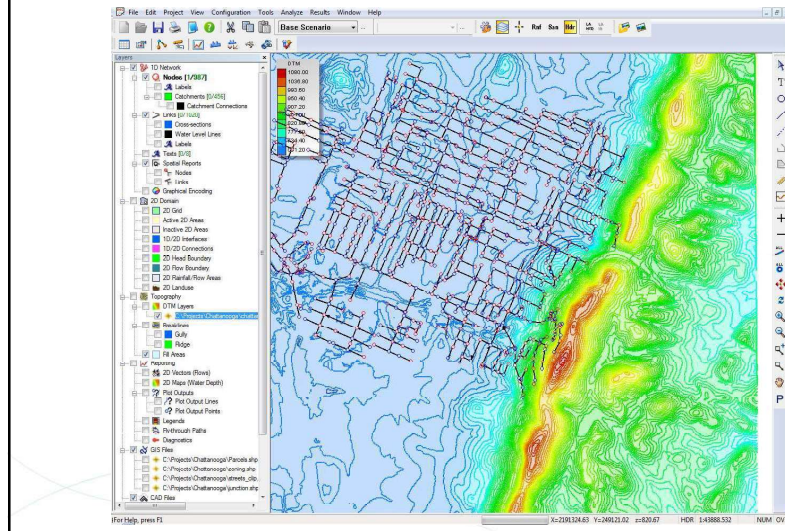
1D Modeling Components

- Backdrop (Optional)
 - ~ CAD, GIS, Aerial Photos
- Catchments
 - ~ Optionally visualized as polygons
 - ~ Imported from GIS, CAD, Databases etc.
- Nodes
 - ~ Catchment Outlet in Runoff
 - ~ Manhole/Inlet/Junction in Hydraulics
- Links
 - ~ Open and Closed Conduits (Dual Drainage)
 - ~ Pumps, Orifices, Weirs, Rating Curves...

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Backdrops

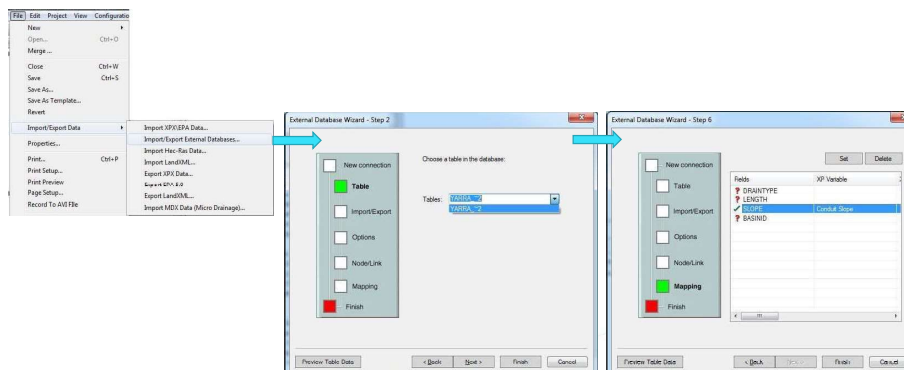


1. ESRI Shape Files
2. Geo-referenced Images
3. CAD Files
4. DTM Model

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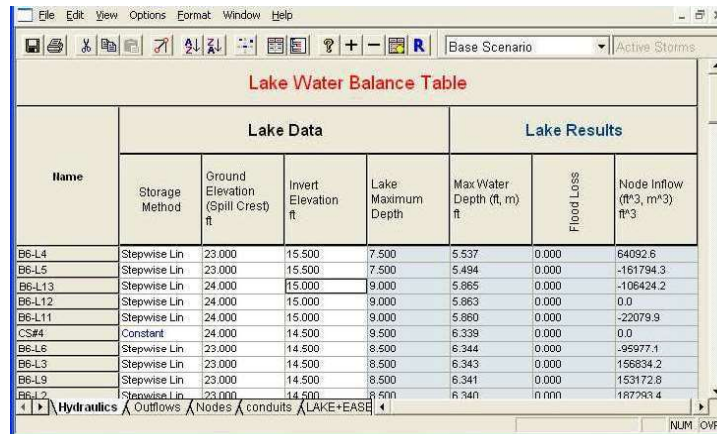
Model Build – External Database Links



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XPTABLES: Tabular Reports



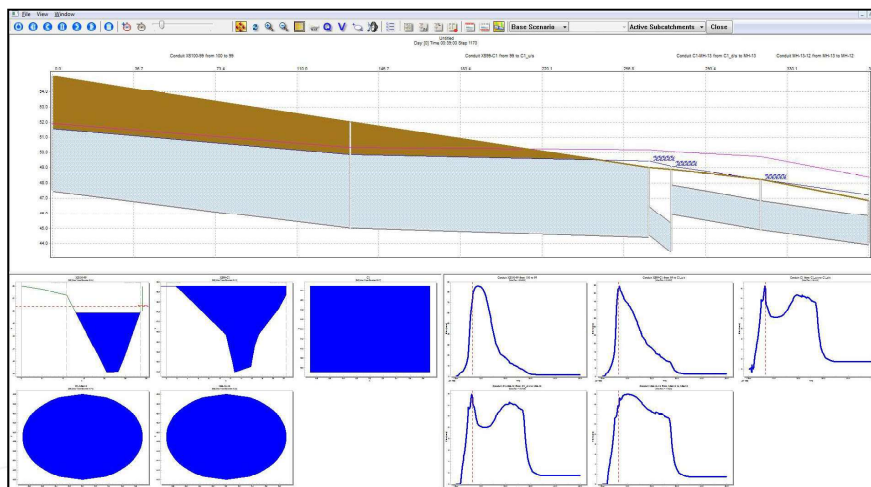
The screenshot shows the 'Lake Water Balance Table' within the XPTABLES software. The table is organized into three main sections: 'Name', 'Lake Data', and 'Lake Results'. The 'Lake Data' section includes 'Storage Method', 'Ground Elevation (Spill Crest) ft', 'Invert Elevation ft', and 'Lake Maximum Depth'. The 'Lake Results' section includes 'Max Water Depth (ft, m)', 'Flood Loss', and 'Node Inflow (ft³, m³)'. The table lists data for various nodes, including B6-L4, B6-L5, B6-L13, B6-L12, B6-L11, CS#4, B6-L8, B6-L3, B6-L9, and B6-L2.

Name	Lake Data				Lake Results		
	Storage Method	Ground Elevation (Spill Crest) ft	Invert Elevation ft	Lake Maximum Depth	Max Water Depth (ft, m)	Flood Loss	Node Inflow (ft³, m³)
B6-L4	Stepwise Lin	23,000	15,500	7,500	5,537	0.000	64092.6
B6-L5	Stepwise Lin	23,000	15,500	7,500	5,494	0.000	-161794.3
B6-L13	Stepwise Lin	24,000	15,000	9,000	5,865	0.000	-106424.2
B6-L12	Stepwise Lin	24,000	15,000	9,000	5,863	0.000	0.0
B6-L11	Stepwise Lin	24,000	15,000	9,000	5,860	0.000	-22079.9
CS#4	Constant	24,000	14,500	9,500	6,339	0.000	0.0
B6-L8	Stepwise Lin	23,000	14,500	8,500	6,344	0.000	-95977.1
B6-L3	Stepwise Lin	23,000	14,500	8,500	6,343	0.000	156834.2
B6-L9	Stepwise Lin	23,000	14,500	8,500	6,341	0.000	153172.8
B6-L2	Stepwise Lin	23,000	14,500	8,500	6,340	0.000	187793.4

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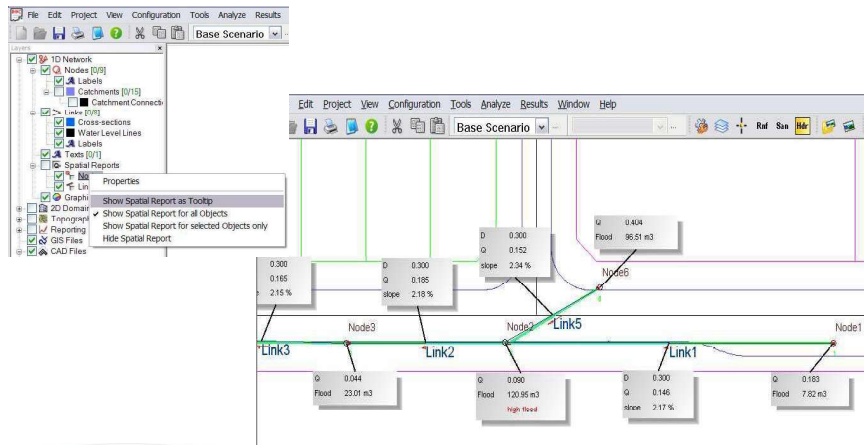
Dynamic Section Views: Animate HGL



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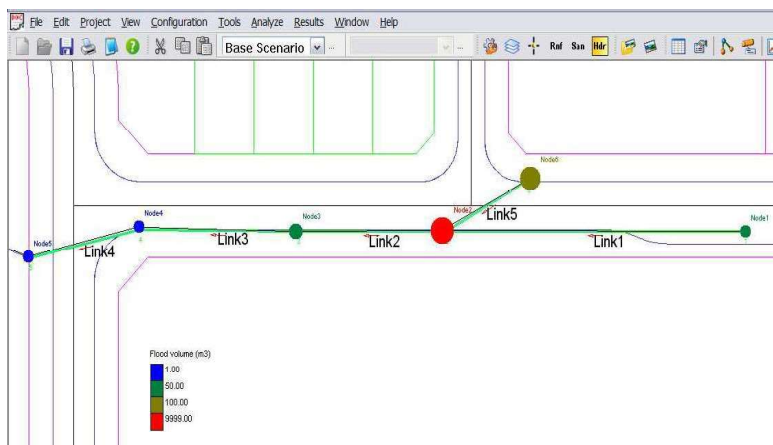
Graphical Reporting: Spatial Reports



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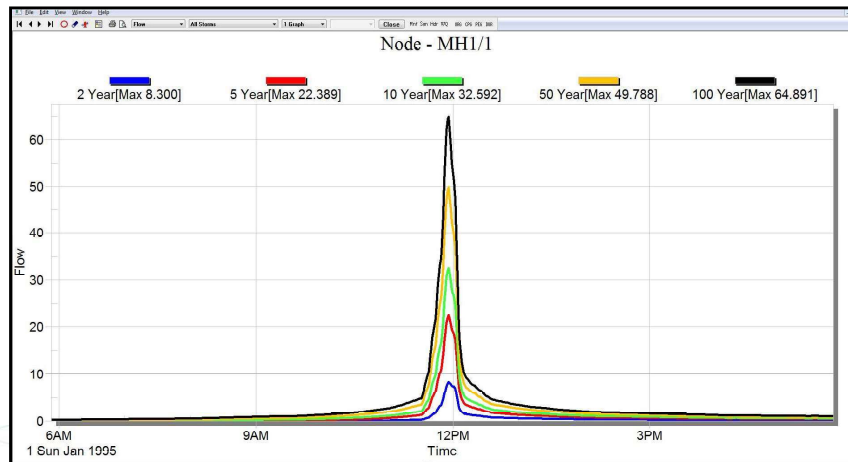
Graphical Reporting: Graphical Encoding



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Review Results: Time Series Graphing

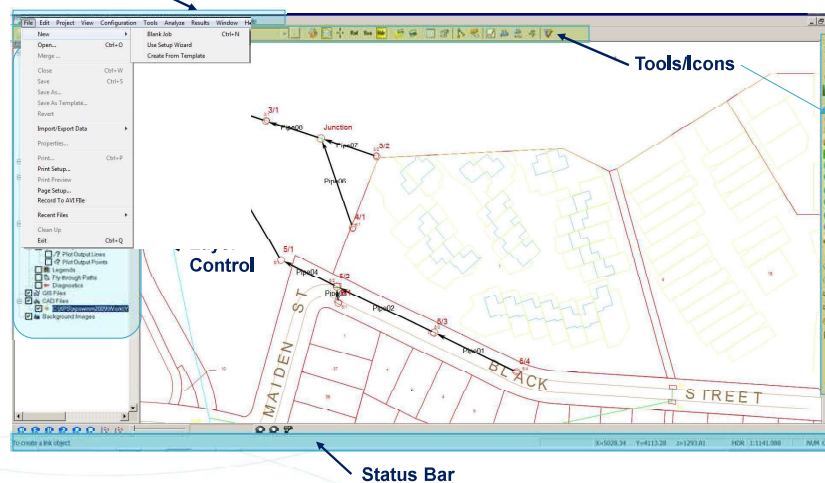


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The XP User Interface

Pull down Menu

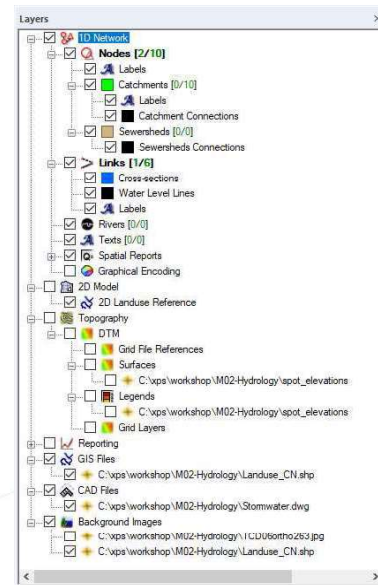


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Layer Control Panel

- Display check box
 - On
 - Off
- Nodes
 - Lock
 - Unlock
 - Properties
 - Selected/Count **1/5**
- Links
 - Lock
 - Unlock
 - Properties
 - Selected/Count **0/4**



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Runoff Mode Highlights

- [Continuous Simulation \(Some methods\)](#)
- Runoff Method is Deterministic: Rainfall, Snowmelt, Infiltration, Evaporation, and Groundwater are simulated
- Surface Hydrology using 23 methods: Runoff, SCS, Kinematic Wave, and many Unit Hydrograph Methods
- Infiltration by Horton, Green-Ampt, Initial, Proportional and Continuing Losses, SCS Loss Method
- [RDII using RTK method of 3 unit hydrographs](#)
- 2 Compartment Groundwater Module (Mounding)
- Water Quality (nonpoint source pollutographs)
- [LID \(WSUD\)](#)
 - Redirect Surface Flows
 - BMP modeling in Runoff at node or catchment
- [Global Storms](#)

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