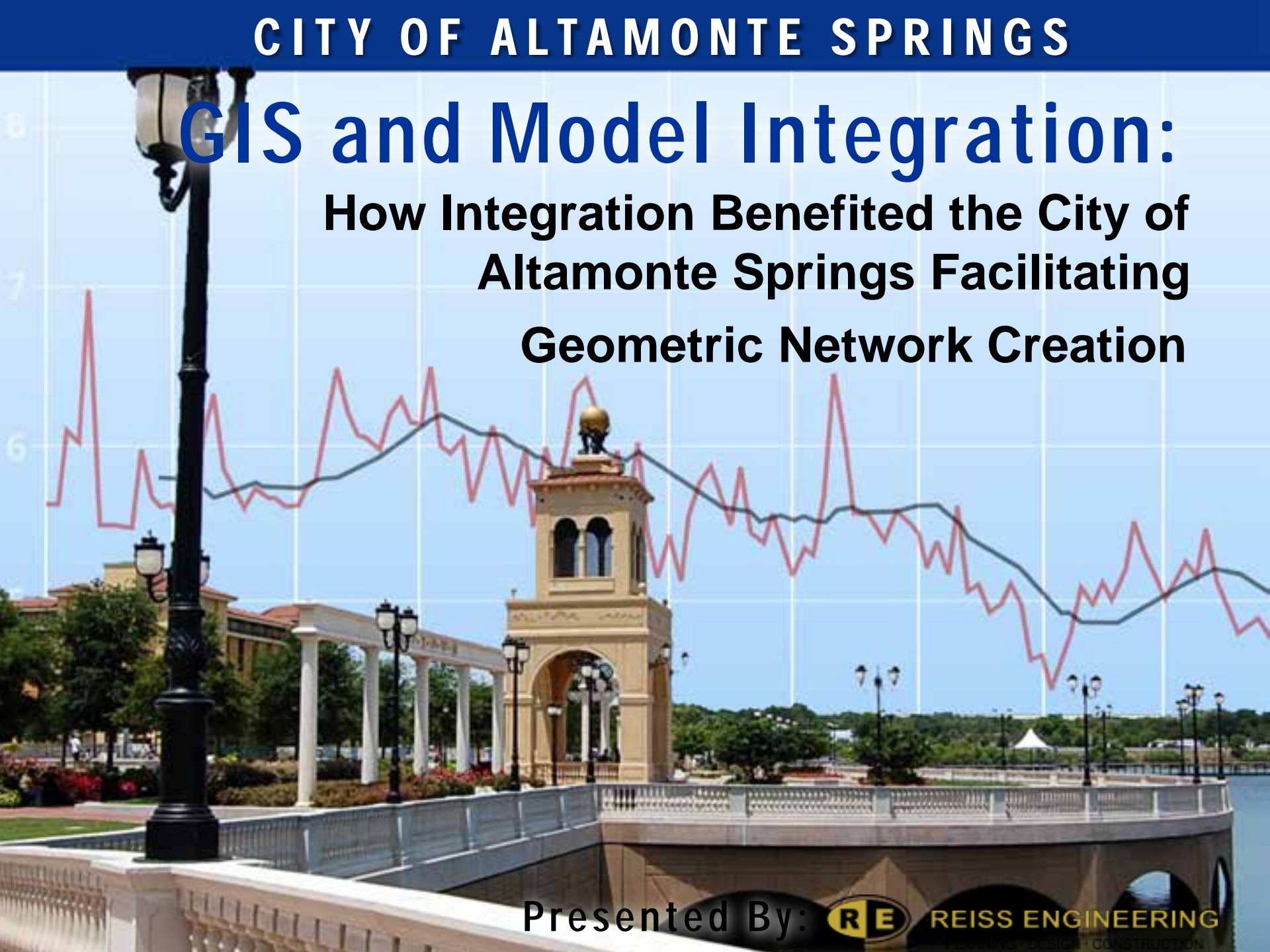


GIS and Model Integration:

How Integration Benefited the City of
Altamonte Springs Facilitating
Geometric Network Creation



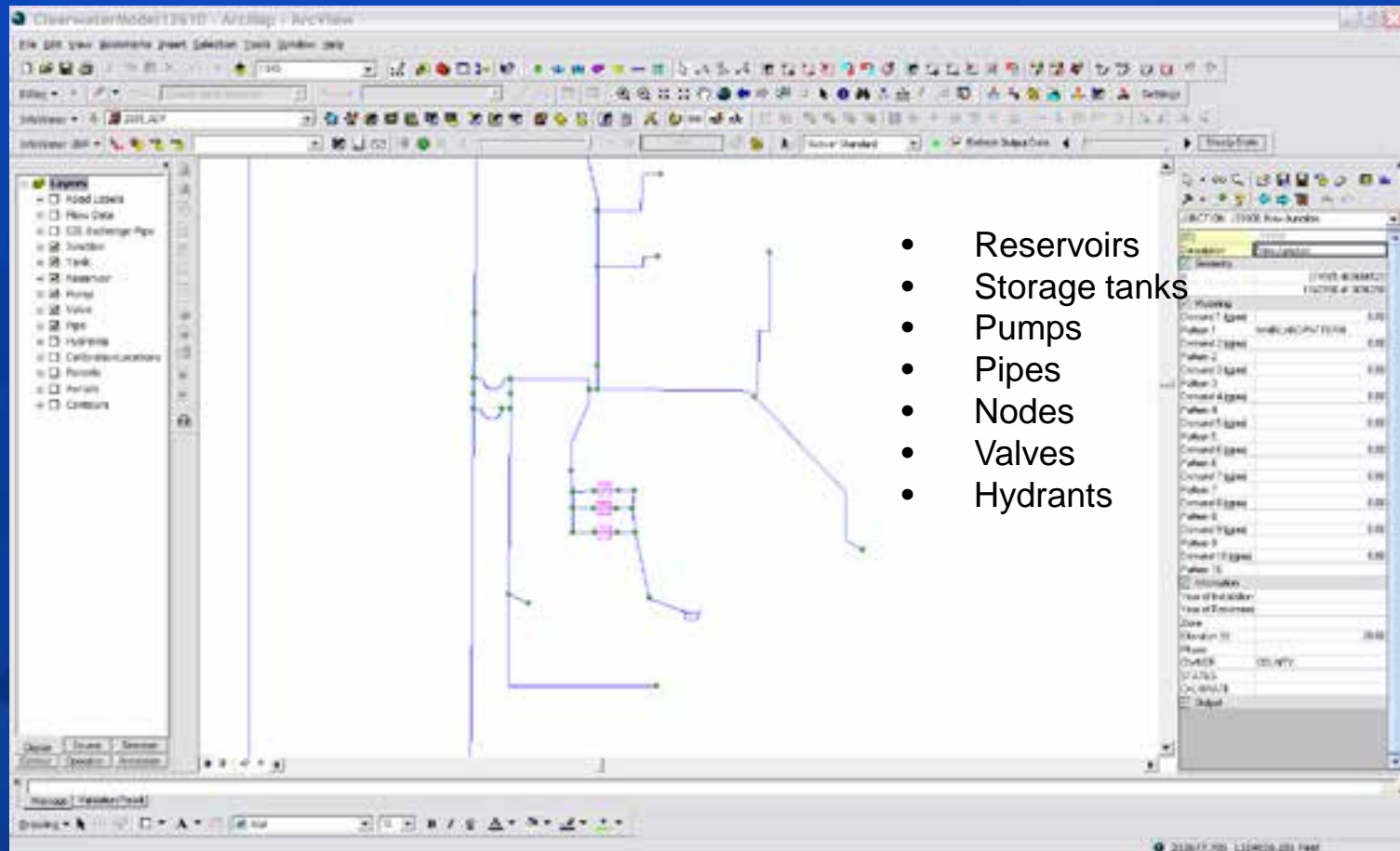
Presentation Agenda

1. What is Model Integration?
2. Why Model Integration?
3. Steps Taken
4. Results
5. Challenges
6. Summary



What is Hydraulic Model Integration?

Computer Simulation

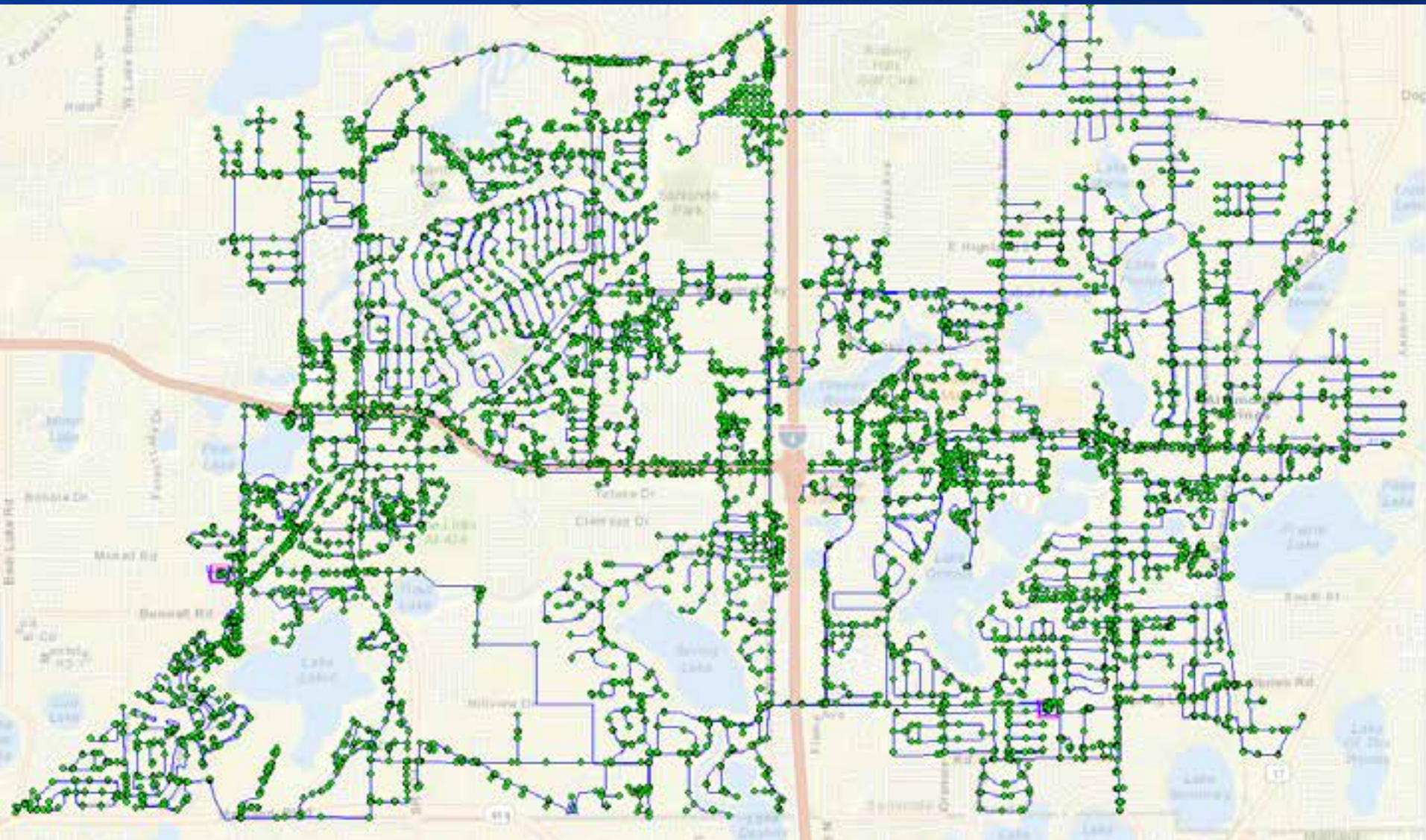


The screenshot displays a hydraulic modeling software interface. The central workspace shows a network diagram with blue lines representing pipes and various components like pumps and valves. On the left, a tree view lists elements such as Reservoirs, Storage tanks, Pumps, Pipes, Nodes, Valves, and Hydrants. On the right, a data table lists various components and their properties.

Component	Value
Reservoir 1	1000
Reservoir 2	1000
Reservoir 3	1000
Reservoir 4	1000
Reservoir 5	1000
Reservoir 6	1000
Reservoir 7	1000
Reservoir 8	1000
Reservoir 9	1000
Reservoir 10	1000
Reservoir 11	1000
Reservoir 12	1000
Reservoir 13	1000
Reservoir 14	1000
Reservoir 15	1000
Reservoir 16	1000
Reservoir 17	1000
Reservoir 18	1000
Reservoir 19	1000
Reservoir 20	1000
Reservoir 21	1000
Reservoir 22	1000
Reservoir 23	1000
Reservoir 24	1000
Reservoir 25	1000
Reservoir 26	1000
Reservoir 27	1000
Reservoir 28	1000
Reservoir 29	1000
Reservoir 30	1000
Reservoir 31	1000
Reservoir 32	1000
Reservoir 33	1000
Reservoir 34	1000
Reservoir 35	1000
Reservoir 36	1000
Reservoir 37	1000
Reservoir 38	1000
Reservoir 39	1000
Reservoir 40	1000
Reservoir 41	1000
Reservoir 42	1000
Reservoir 43	1000
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Reservoir 45	1000
Reservoir 46	1000
Reservoir 47	1000
Reservoir 48	1000
Reservoir 49	1000
Reservoir 50	1000

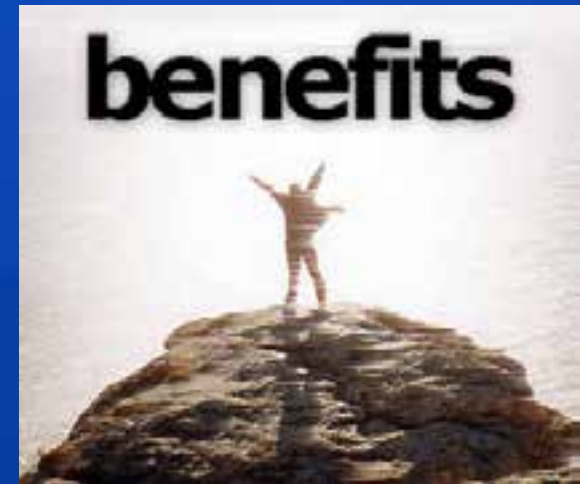
- Reservoirs
- Storage tanks
- Pumps
- Pipes
- Nodes
- Valves
- Hydrants

Model Construction: Pipe and Junctions



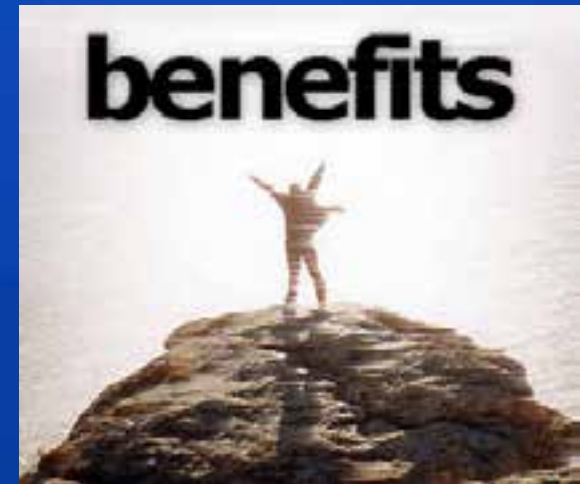
Why Modeling Integration?

- § Facilitated Geometric Network Creation
- § More Reliable Information
 - Planning and Operations
- § Reduced Response Time
- § Better Accessibility Model Inputs/Outputs to:
 - GIS Tools
 - GIS Model Functionality
- § Map Accuracy



Why Modeling

- § Pressure and Velocity Optimization
- § Water Quality Predictions
- § Fire Hydrant Flow
- § Water Age
- § Operational What Ifs
- § Auto Flushing Flows & Locations
- § Source Identification
- § Pump/Tank Operations Optimization
- § Pipe Sizing



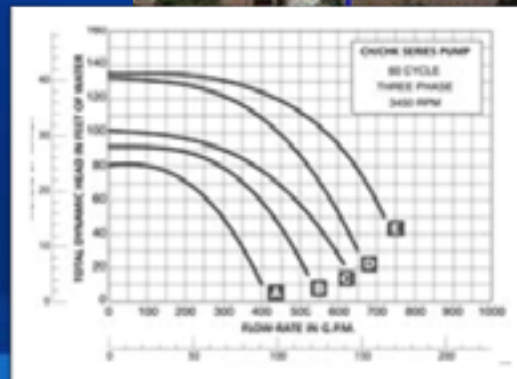
Steps Taken For Model Integration

- § GIS Data Collection
- § GIS Integration
- § Pre / Post Processing
- § Water Demand Allocation
- § Scenario Development
- § Model to GIS Data Adoption



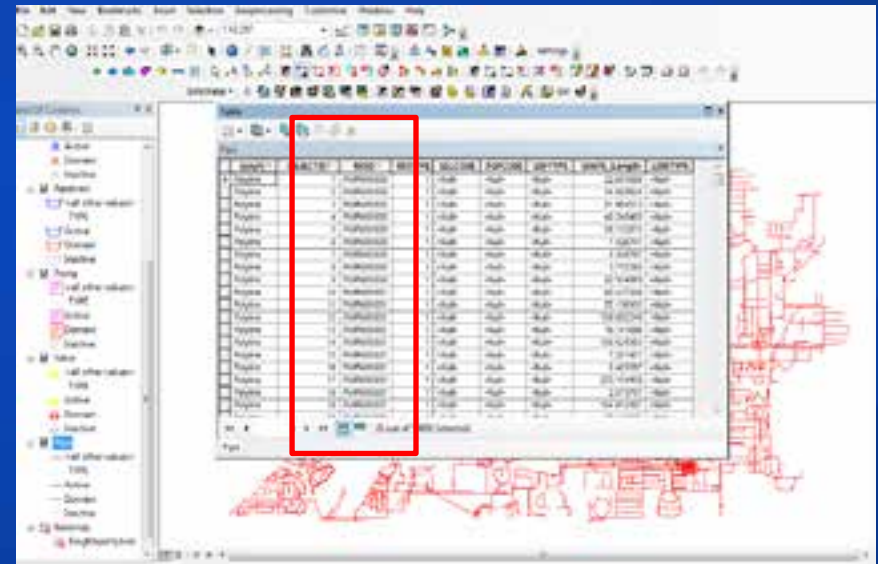
Data Collection

- § City's GIS data is used as a basis
- § As-built drawings
- § Pump data
- § Digital elevation data
- § City Staff input



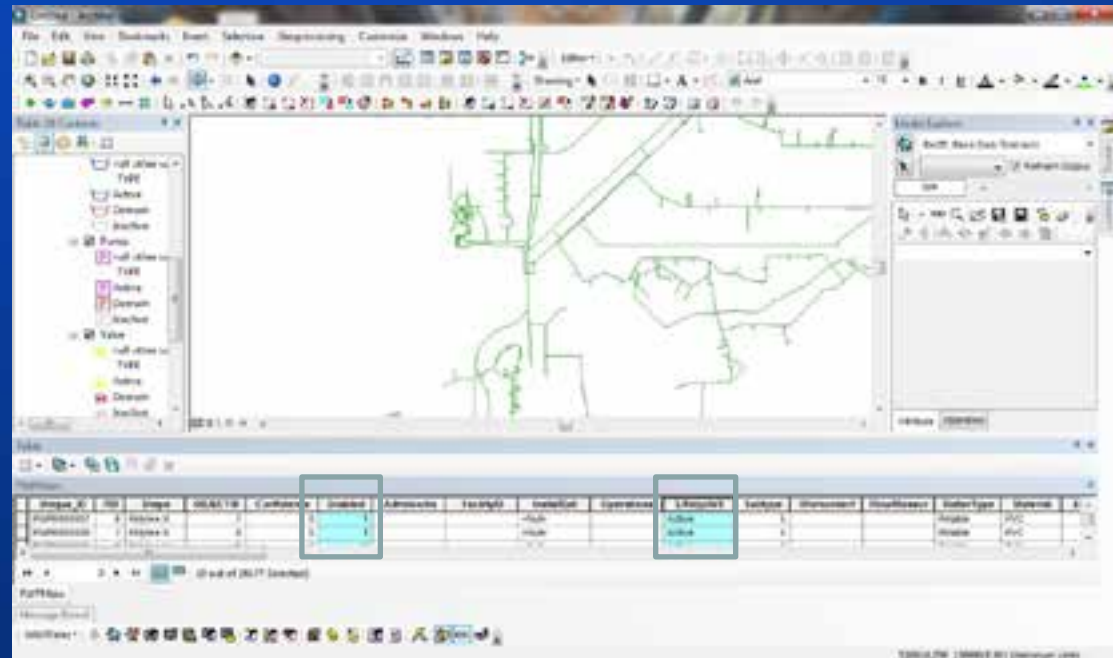
Pre-Processing

- § Unique IDs for all GIS elements are created
 - § No overlaps will occur
 - § Allows GIS data and model elements to be linked
- § Tools used to generate unique IDs:
 - § Counter
 - § Field Calculator



Pre-Processing

- § Active elements designation for use in simulations:
 - § Enabled field
 - § Lifecycle Status



Example: An element being added from/to GIS

The image shows two overlapping dialog boxes from a GIS application. The top dialog is titled "GIS Exchange Cluster" and contains several sections: "GIS Data Source" (with a text box and a minus button), "Feature Class\Table" (with a text box), "WHERE Clause" (with a text box), "InfoWater Data Source" (with a "Type" dropdown set to "Junction Tables" and an "ID" dropdown), "Exchange Options" (with radio buttons for "Relate Type" set to "Tabular Join", "Update Direction" set to "Bi-Direction", and checkboxes for "Create New Records", "Update Existing Records", "Delete Not Existing Records", "Support Batch Exchange", "Create Unique IDs", and "Update Geometry Data"), and "Tabular Join" (with a "GIS ID Mapping Field" dropdown). The bottom dialog is titled "Add Data" and shows a "Look in" dropdown set to "Connection to Pas3-Seraph.sde". It has three tabs: "Tabular Join", "Spatial Join", and "Field Mapping". The "Field Mapping" tab is active, showing a list of "GIS Data Fields" on the left (including AV_ADD, AV_CITY, AV_SIDE, AV_STATE, AV_STATUS, AV_ZIP, CITY, FALL_MEMBE) and a list of "InfoWater/GIS Data Field Mapping" on the right (including NODE->X (Selected), NODE->Y (Symbol), NODE->Z (Symbol Size), NODE->SELECTED (Handle), NODE->SYMBOL (Annotation Handle), NODE->SYMSIZE (X), NODE->HANDLE (Y)).

GIS Exchange Cluster

GIS Data Source: []

Feature Class\Table: [] WHERE Clause: []

InfoWater Data Source

Type: Junction Tables

ID: []

Apply on Domain

Apply on Active Network

Exchange Options

Relate Type: Tabular Join Spatial Join

Update Direction: 0: Bi-Direction

Support Batch Exchange

Create New Records Create Unique IDs

Update Existing Records Update Geometry Data

Delete Not Existing Records

Tabular Join

GIS ID Mapping Field: []

Add Data

Look in: Connection to Pas3-Seraph.sde

Field Mapping

GIS Data Field: << >>

InfoWater/GIS Data Field Mapping

InfoWater Fields

GIS Fields

AV_ADD

AV_CITY

AV_SIDE

AV_STATE

AV_STATUS

AV_ZIP

CITY

FALL_MEMBE

NODE->X (Selected)

NODE->Y (Symbol)

NODE->Z (Symbol Size)

NODE->SELECTED (Handle)

NODE->SYMBOL (Annotation Handle)

NODE->SYMSIZE (X)

NODE->HANDLE (Y)

Name: [] Add

Show of type: Datasets and Layers (*.lyr) Cancel

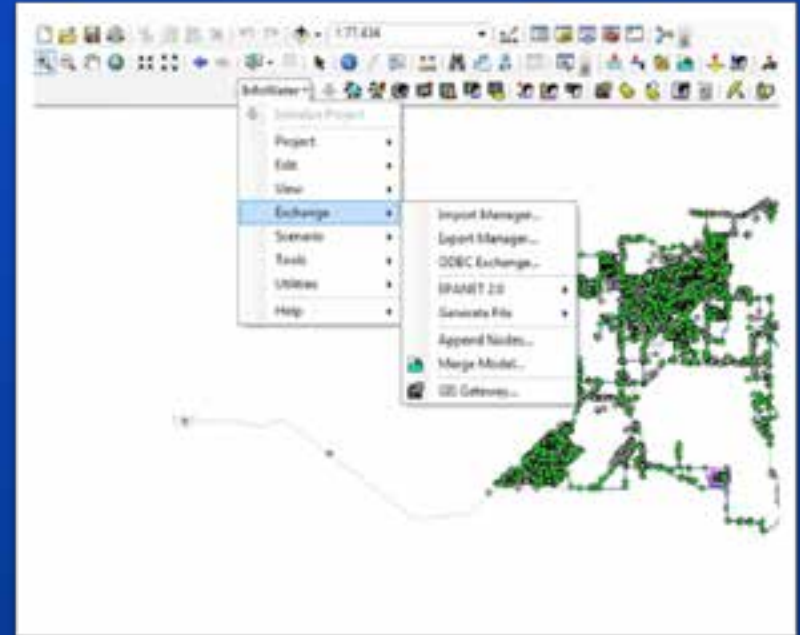
A new GIS exchange cluster definition has been created.

Use the GIS ID Mapping field to be matched with the

GIS layer will be added to the water data table.

Pre-Processing

- § GIS Exchange:
 - § Enables GIS integration by Establishing a link between the GIS data and model elements.
 - § Enables communication
 - § Allows “exchange” of Geo database information to and from the hydraulic model via tabular join.
 - § Exchange Clusters are used



Post Processing

§ Network fixes are necessary to connect info to model simulations:

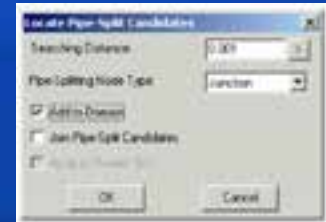
Locate/Fix Nodes in Close Proximity



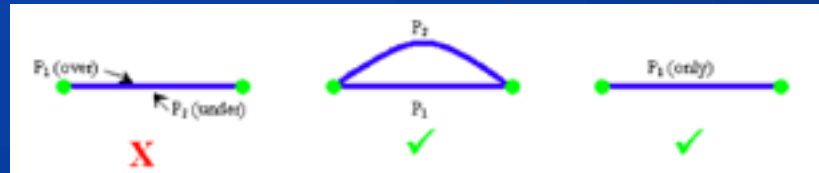
Trace Upstream/Downstream Network



Locate/Fix Pipe-Split Candidates



Locate Parallel Pipes



Merge Nodes

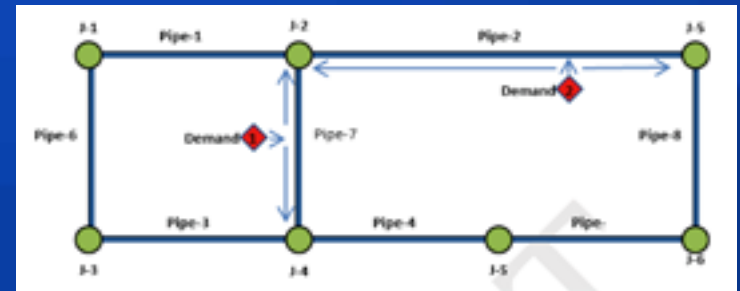


Other Steps Taken for Model Integration

- § Some Tools used to obtain missing information from Exchanged GIS elements:
 - § Elevations
 - § Info water elevation tool
 - § Digital elevation topographic data
- § Pipe Lengths
 - § GIS auto processing tools
- § WTP components
 - § Overlaying geo referenced as built drawings

Demands

- § Existing Demands:
- § If insufficient water billing data use:
- § Information address fields
- § Google Earth Pro
- § Demands are allocated
- § Spot checked for validity
- § Future Demands:
- § Based on existing demand locations
- § Adjustment factors were used



Scenario Development

- § The model was simulated in five scenarios:
 - § Average Daily Flow
 - § Maximum Daily Flow
 - § Maximum Daily Flow + Fire Flow (residential and commercial)
 - § Peak Hour Flow
 - § Extended Period Simulation
- § System Operations:
 - § Based on existing operations.



Challenges

- § Exchange from Model back to Geo database
- § Domain information being reconnected from GIS to model and vice versa.
- § Connection conflicts
- § Making sure that during pre and post processing the city GIS rules are being followed



Summary

- § GIS Exchange facilitates an effective synchronization of data between the Model and the Geometric Network
- § More Reliable Information in the Geo database
- § An effective geometrically connected network can better meet the City's piping infrastructure planning, operation and maintenance.
- § Better Accessibility Model Inputs/Outputs to:
 - § GIS Tools
 - § GIS Model Functionality
 - § Map Accuracy

THANK YOU!

Questions and Answers

Presented By: Brandon Bryant, P.E.



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