

Speakers



Michael Kanellos Senior Analyst OSIsoft



Sri Kamojjala, P.E., D.WRESr. Engineer at Las Vegas Valley Water District



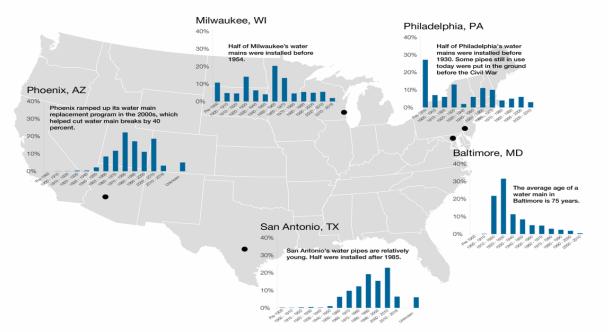
Bill Turner
Sr. Engineering Technician
at Las Vegas Valley Water District

Apr

Water Infrastructure: Old, All Over and Underground

The Age of U.S. Water Pipes

From pre-Civil War to Civil Rights era, U.S. water systems reflect a range of ages.



Each year about 240,000 water main breaks result in lost water and disruptions to daily life. (U.S. Environmental Protection Agency)

America's municipal water systems are responsible for more than 1.2 million miles of water mains. (Utah State University)

Repairing and replacing old water pipes could cost more than **\$US 1 trillion** over the next two decades.

(American Water Works Association)



Pipe age data requested by Circle of Blue from Baltimore Department of Public Works, Milwaukee Water Works, Philadelphia Water, Phoenix Water Services Department, and San Antonio Water System.



The PI System: A Data Infrastructure for Water



Barrick Gold
Digital Mine \$700
gold
Improving water
quality

Veolia Water
Found 7% more
leaks and reduced
energy by 6%

cut water and power by \$10 million in semiconductor fab

Thames Water cut 10% energy and saved millions in fines



Optimizing Utility Functions with Real-time Data and Hydraulic Models

Presenters



Acknowledgements

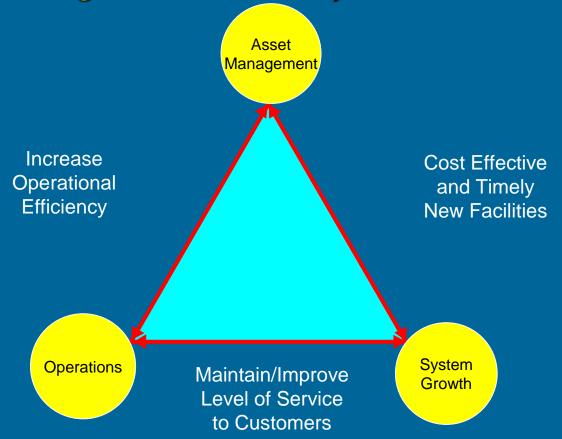
- Suzanne Lawrence, Civil Engineer P.E.
- Chris Krizmanic, Civil Engineer P.E.
- LVVWD Operations Department



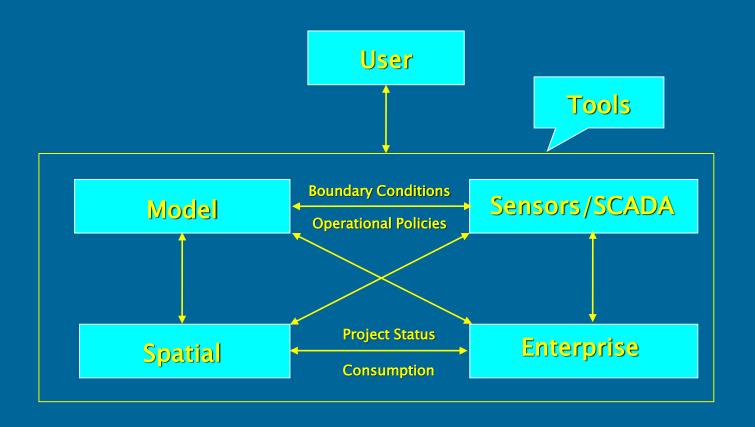
Learning Objectives

- Modeling Technology
 - Applications and Use of Sensors
- Data Integration
- Field Installation

Integration of Utility Functions



Integration of Data Sources

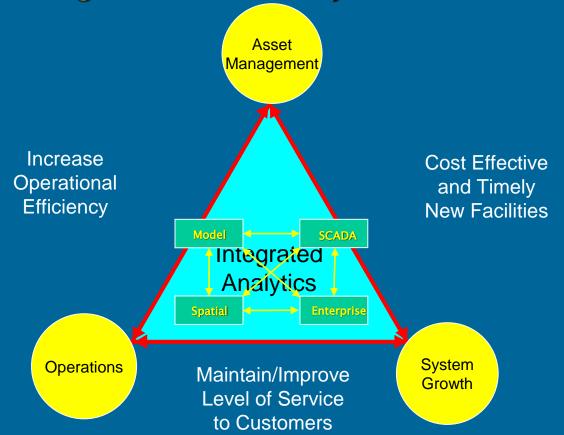


Integration Tools

- Streamline and Automate Data Processes
- Enhance Data Accuracy
- Reduce Data Redundancy
- Improve User Efficiency



Integration of Utility Functions



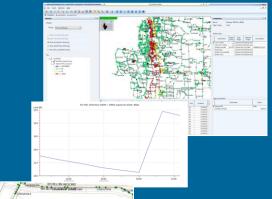
Hydraulic Models and Data Integration

- Real-time
- All-Pipes/Full System
- Transient
- Intended Use
 - Master Planning
 - Asset Management
 - Development Review
 - Water Quality
 - Operations
 - Emergency Response

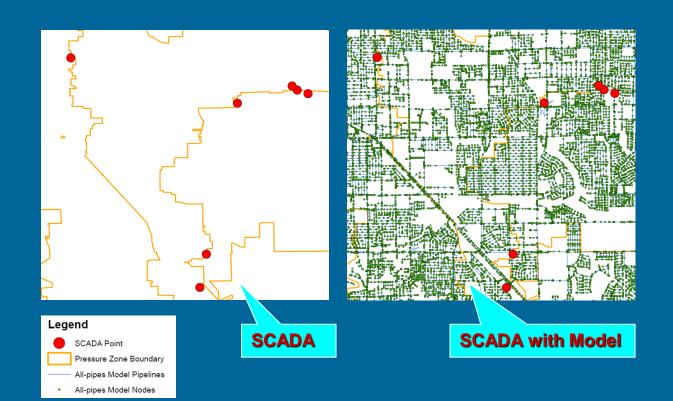
Real-time Models Integration of SCADA/Sensors with Models

- Get Current System Conditions from SCADA/Sensors
- Interpolate Between SCADA Locations
- Project System Operation
- Compare Model Prediction with Sensor/SCADA Data

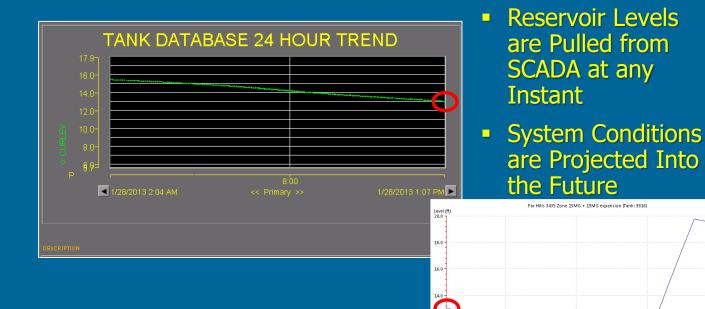




System Monitoring: SCADA vs. Model



Projecting System Operation



Real-time Models

Integration of Models with Sensors/SCADA Benefits

- Gain Understanding of Network Operations in Real Time
 - Simulate the current system performance, future scenarios and past system performance - forensic analysis
- Monitor System for Abnormal Conditions
 - Comparison of planned versus actual
- Emergency Response
 - Develop incident and response runs to determine best action during emergency response
- Develop Operational Plans
- Calibration
- Asset Protection/Management

Benefits of Wireless Sensors

- Mobility and Convenience
 - Where and When
- Quick Installation and Lower Cost
- Identification and Notification of Distribution
 System Conditions
 - Identification of Field Issues
- Confirm SCADA Measurements and Model Results

Benefits of Wireless Sensors

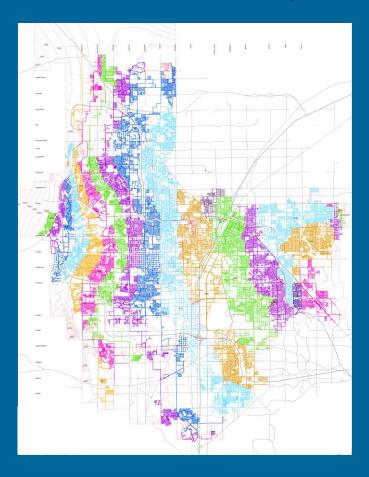
- Mobility and Convenience
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Ideal for Operational Troubleshooting, Asset Protection and Emergency Response

Hydraulic Models and Data Integration

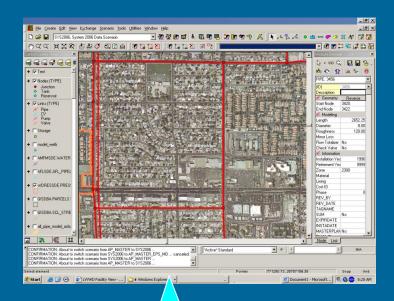
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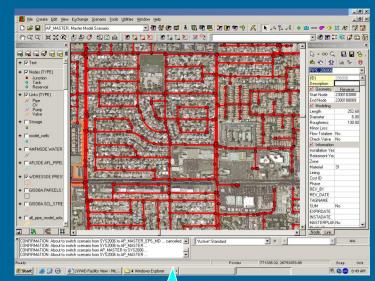
LVVWD All-Pipes Hydraulic Model



- "All Pipes"
- 202,000 Pipes (Without Laterals)
- 193,000 Nodes
- One-to-One with GIS
- Yearly Calibration
- Model is used to generate daily pumping schedule
 - Daily calibration

Skeleton vs. All-Pipes Model

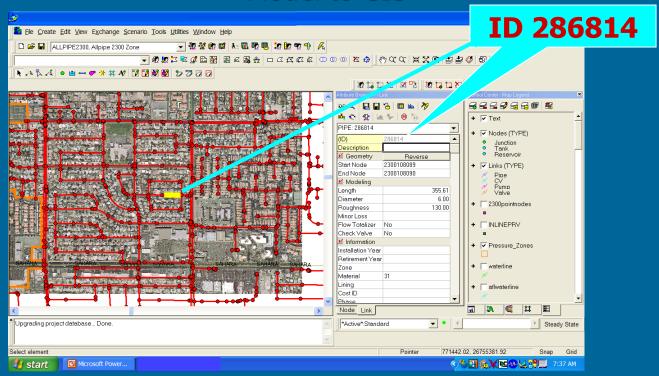




Skeletonized

All-pipes

One-to-One with Spatial Data Model to GIS



Same IDs as spatial data

Hydraulic Models and Data Integration

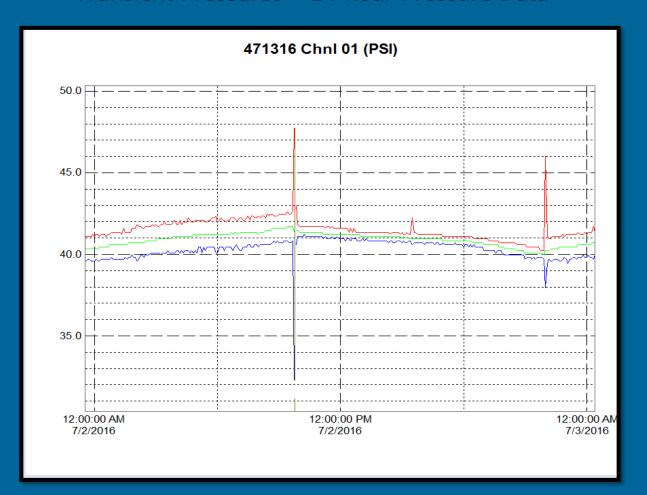
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Hydraulic Models and Data Integration Transient Models/Data

Pressure Transients

- Pressure surges that travel at velocity of sound due to sudden changes in fluid flow rates
- Important for System Operations and Asset Protection

Transient Pressures – 24-hour Pressure Data



Hydraulic Models and Data Integration

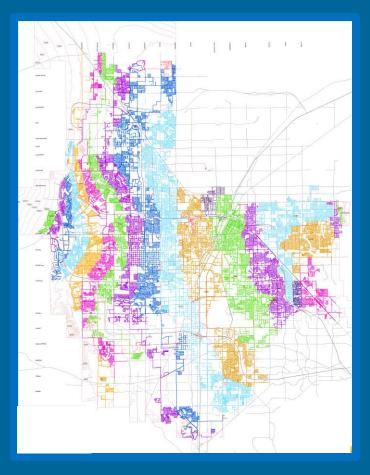
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Hydraulic Models and Data Integration Intended Use

- Initial Applications
 - Master planning
 - Development review
 - Water quality
- Current/Emerging Applications
 - Real-time operations/energy planning
 - Emergency response
 - Shutdown analysis
 - Asset management

Real-time Operational Planning Developing Daily Pumping Plans

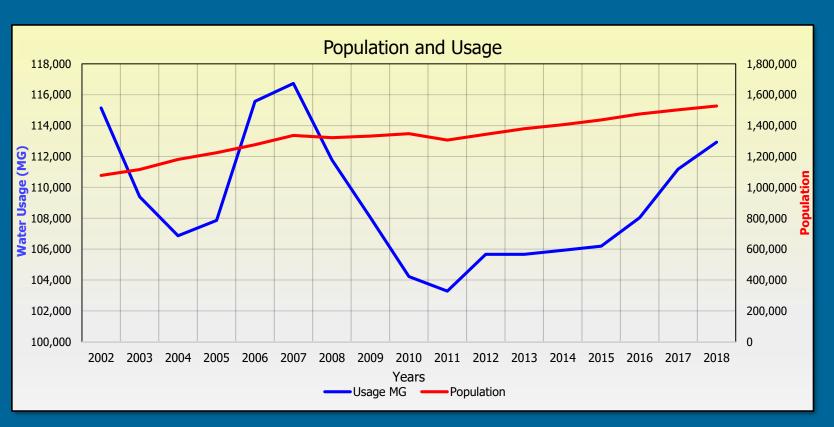
LVVWD Distribution System



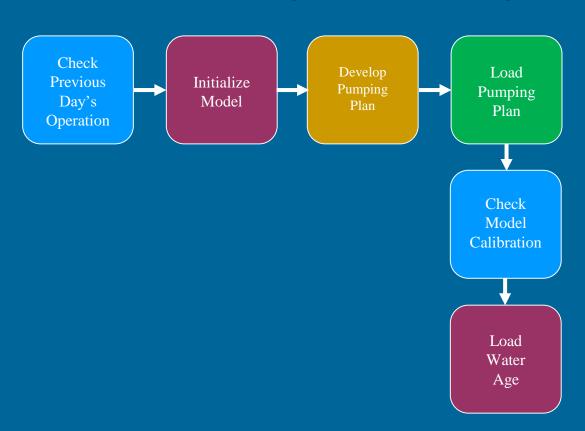
- 1.5 Million Service Area Population
- More Than 5,000 Miles of Pipeline
- 24 Active Pressure Zones
- 42 Distribution Reservoirs
- 10 Supply Turnouts
- 68 Groundwater Production Wells
- 53 Pumping Stations
 - 262 Pumping units

Las Vegas Valley Water District

Population and Usage 2002 to 2018



Tools for Daily Plan Development

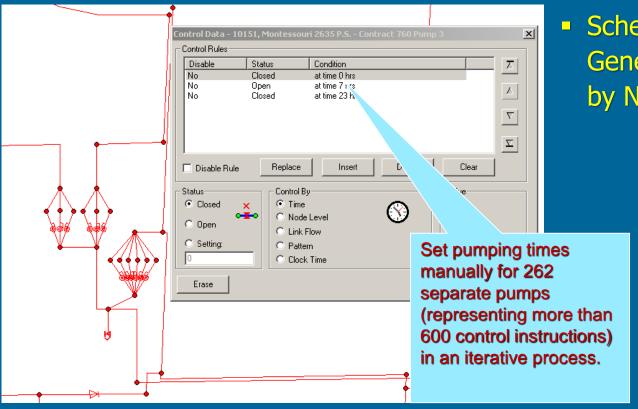


Daily Pumping Plan Modeler's Role

- Develop Optimal Pumping Schedule
 - Water quality
 - Energy cost
- Recommend Daily Water and Power Orders
- Transfer the Plan
- Identify Calibration Issues

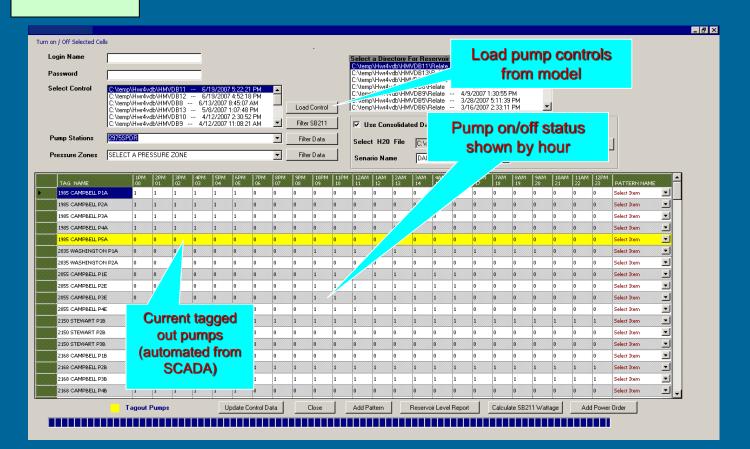


Generating Pumping Schedules (Without Tools)



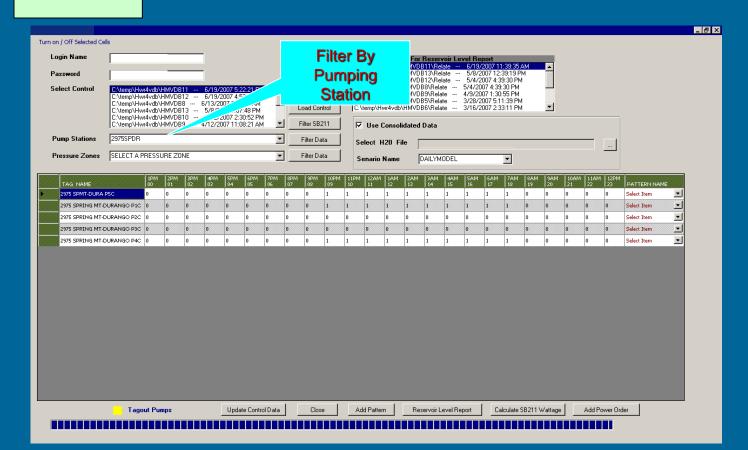
Schedules Must be Generated Daily by Noon Develop operating plan in an EPS Hydraulic Model

Pumping Plan Tool



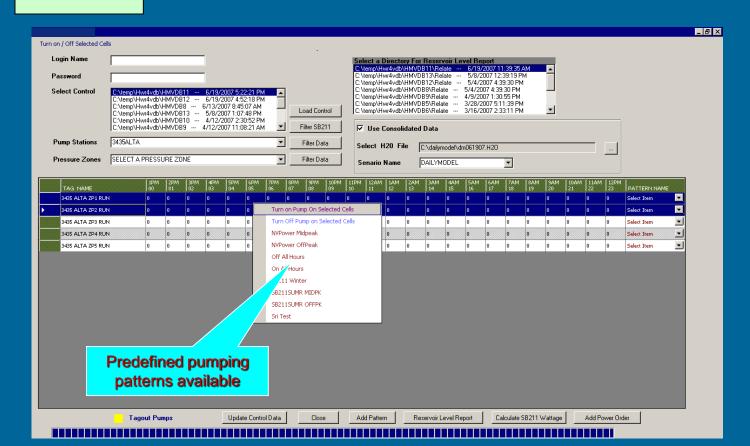
Develop operating plan in an EPS Hydraulic Model

Pumping Plan Tool



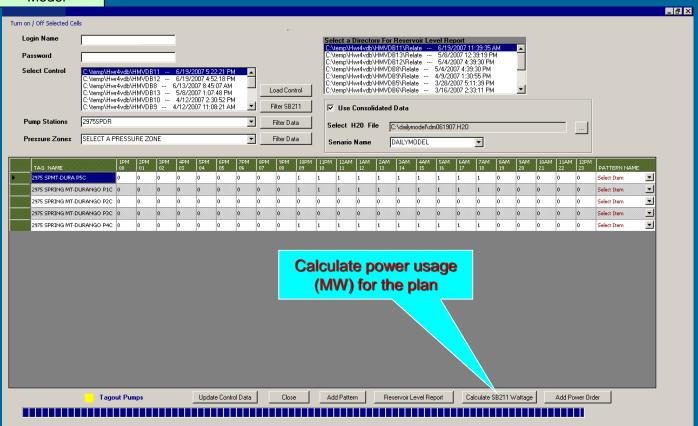
Develop operating plan in an EPS Hydraulic Model

Pumping Plan Tool



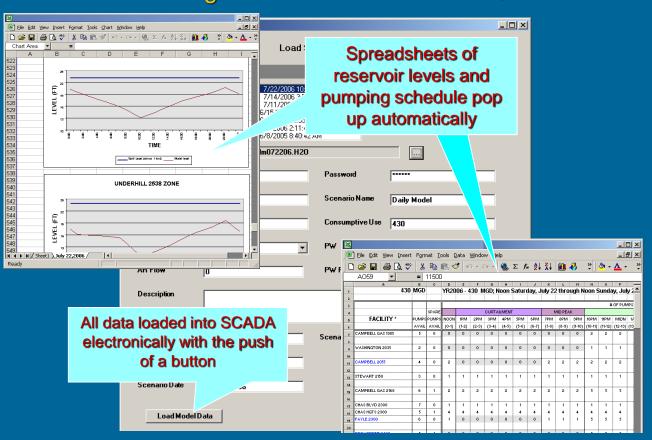
Develop operating plan in an EPS Hydraulic Model

Pumping Plan Tool

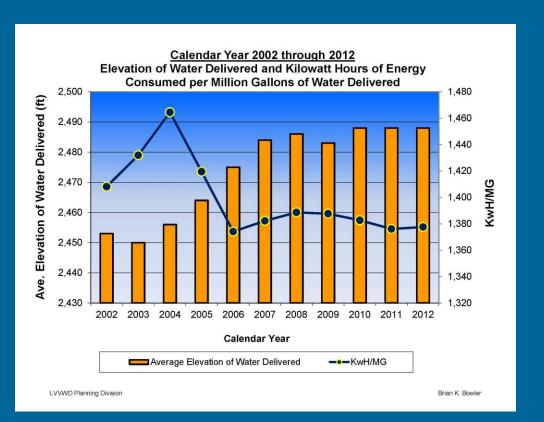


Load pumping plan and generate charts

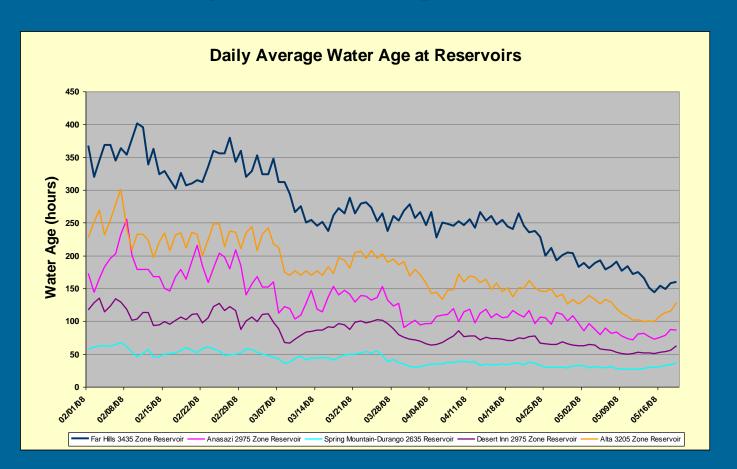
Load Simulation Data Loading Simulation Data into EWQMS



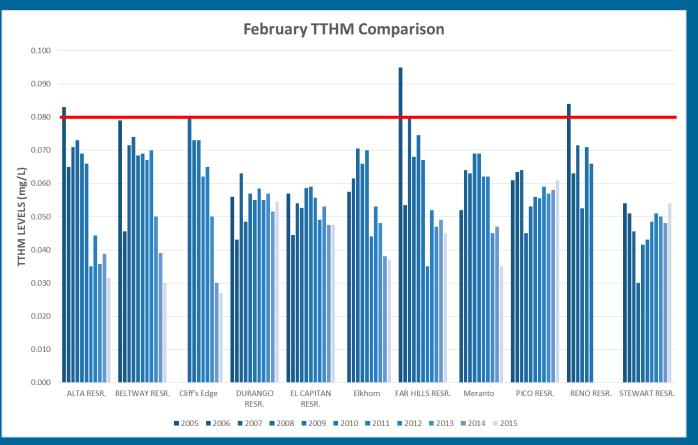
Energy Usage Comparison



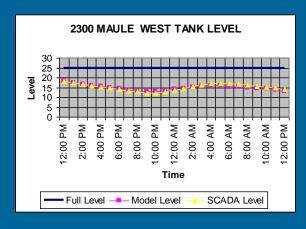
Daily Water Age Report

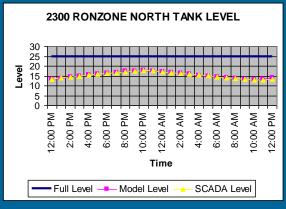


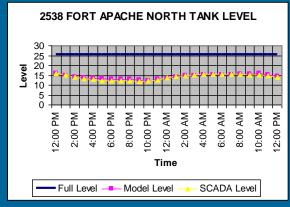
Water Quality Comparison

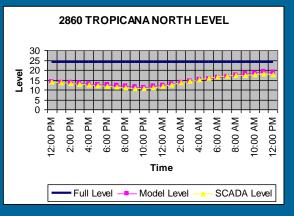


Model Calibration Reservoir Level Comparison

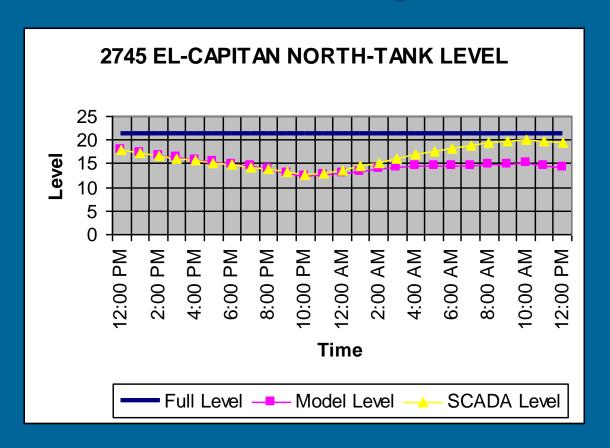




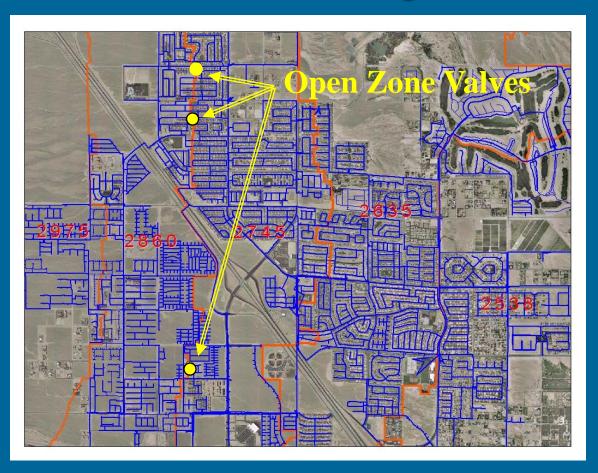




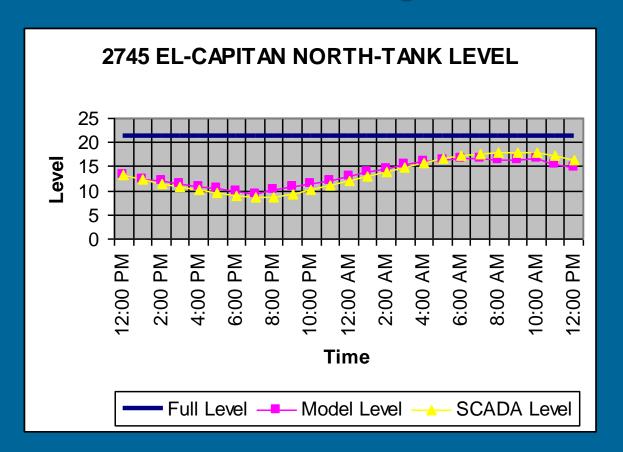
Reservoir Tracking Issue



Reservoir Tracking Issue



Reservoir Tracking Issue









Emergency Response







Failure Consequences

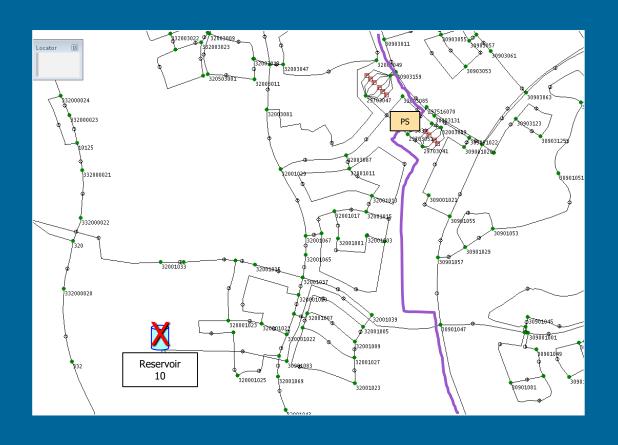
- Loss of service to critical customers
- Contamination of the distribution system
- Reduction or loss of fire protection
- Flooding and private property damage



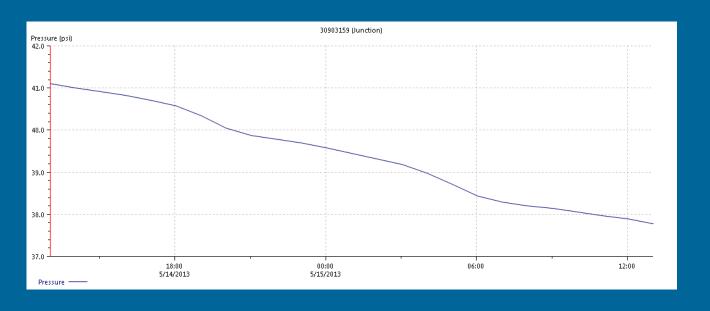




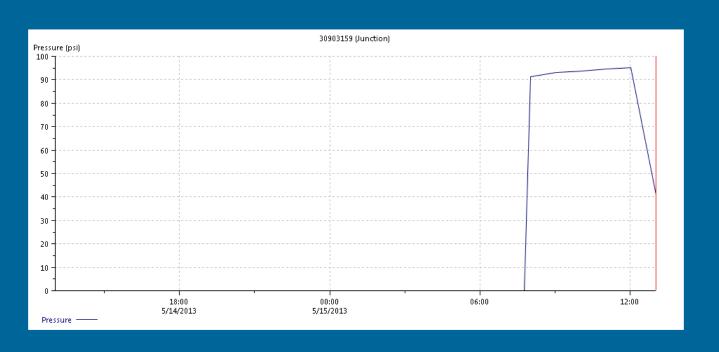




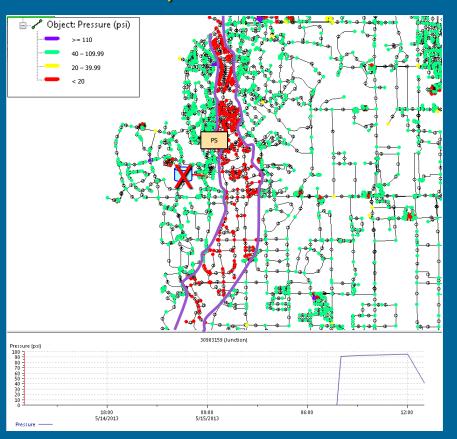
Reservoir 10: Before Outage PS Discharge Pressure



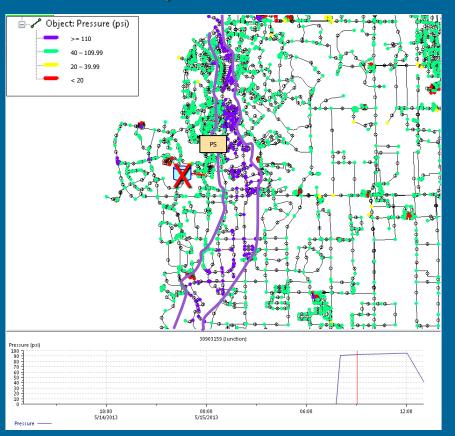
Projected Operation
6 Pumps from 8 AM to 1 PM
PS Discharge Pressure



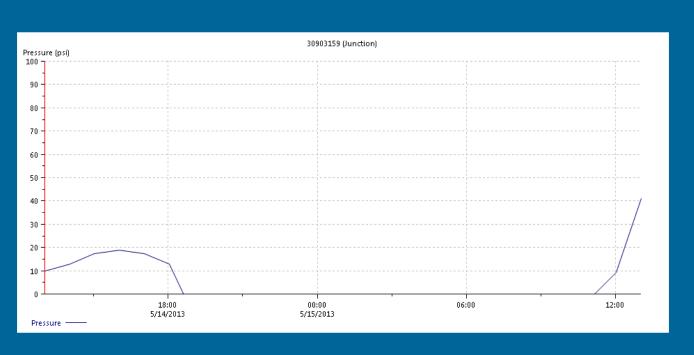
Projected Operation: 6 Pumps from 8 AM to 1 PM Distribution System Pressures at 1 PM



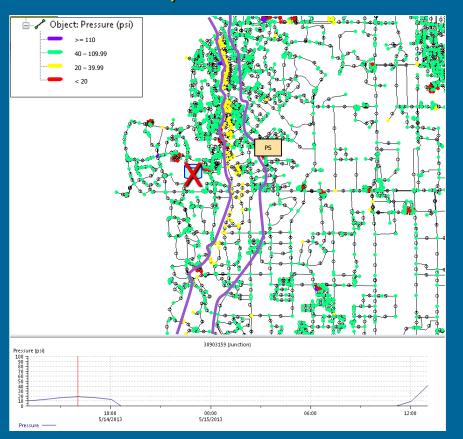
Projected Operation: 6 Pumps from 8 AM to 1 PM Distribution System Pressures at 9 AM



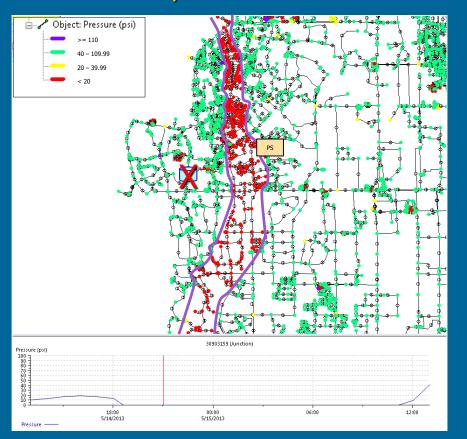
Reservoir 10 Outage
Emergency Response: 1 Pump on 24 Hours **PS Discharge Pressure**



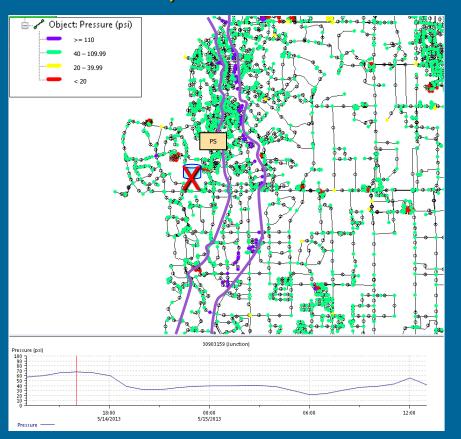
Emergency Response: 1 Pump on 24 Hours Distribution System Pressures at 4 PM



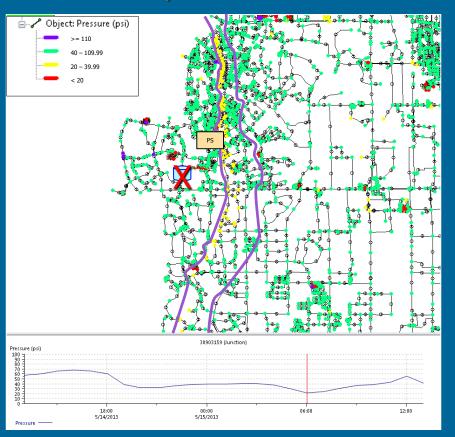
Emergency Response: 1 Pump on 24 Hours Distribution System Pressures at 9 PM



Emergency Response: 3 Pumps on 24 Hours Distribution System Pressures at 4 PM



Emergency Response: 3 Pumps on 24 Hours Distribution System Pressures at 6 AM



Advantages of a Real-time Model in Emergency Response

- Hydraulic model contains current operating conditions and pumping schedules
 - Minimal setup time
 - Multiple scenarios can be created quickly
 - Fewer modeling errors
 - Facilitates organized response





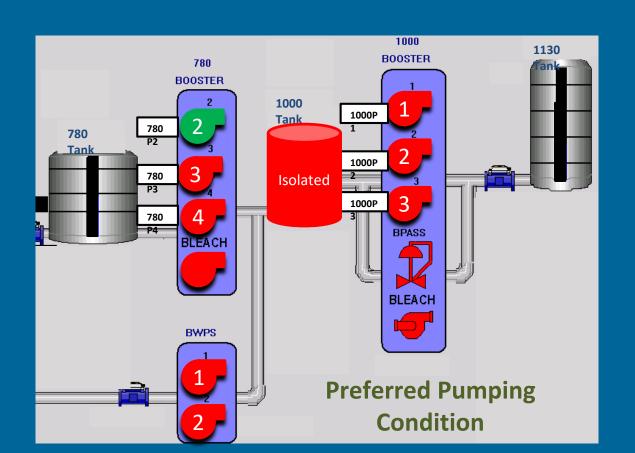


Shutdown Planning











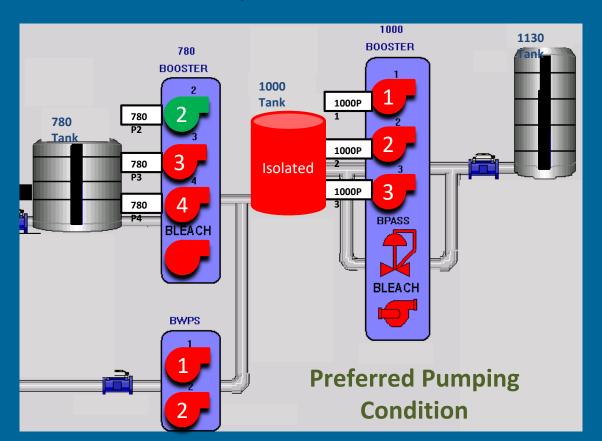
- 60-Day Shutdown
- Pumping to Closed Zone
- Monitoring Pressures in the Distribution System
- Validate SCADA and Model
 - Low and high pressure alarms

Location of Pressure Recorders in the Distribution System

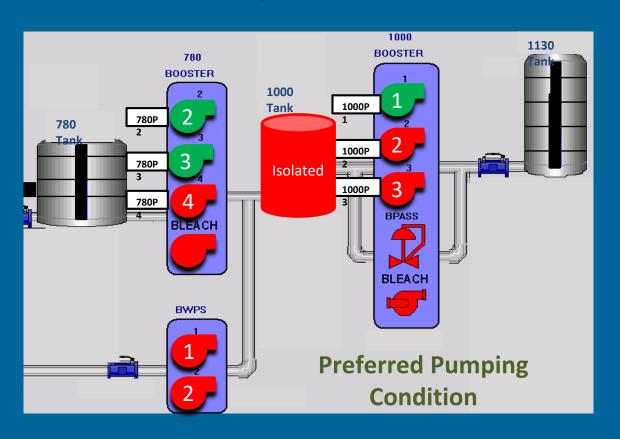




Preferred Operational Scenarios



Preferred Operational Scenarios



Summary

- Real-time Data Integration with Models Provides Powerful Tools for Infrastructure Planning, Engineering and Management
- Real-time Data is essential for Daily Operational Planning, System Troubleshooting, Asset Protection and Emergency Response
- Data Integration is Key for Realizing Full Benefits
- Look Beyond the Current State of the Technology

Sensor Field Installation

















- In 2000 the Las Vegas Valley Water District Began With 6 Direct Connect HPRs
- Today We Have 31 Direct Connect and 18 Wireless HPRs



Monitoring Pumping Station Inlet & Outlet Pressures





Monitoring Upstream\Downstream of Pressure Reducing Valves





Monitoring Flow Control Station Downstream Pressures



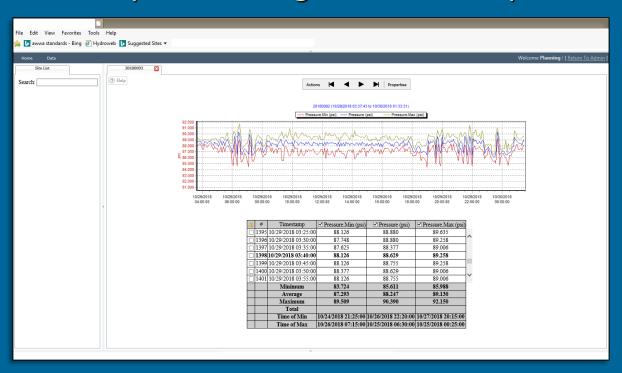
Pumping Station Surge Analysis Pressure Monitoring



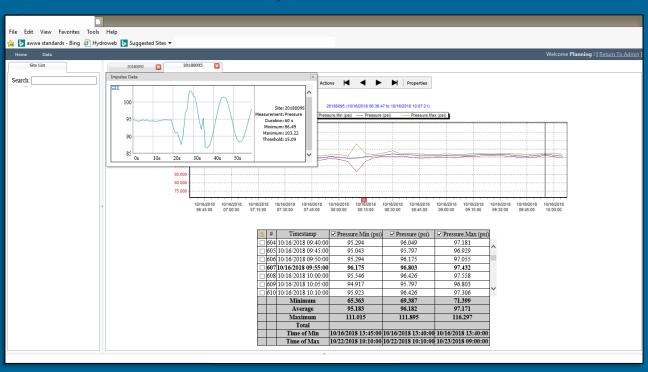
Transmission/Distribution System Pressure Monitoring



HPR Data Acquisition Using Vendor's Enterprise Software



HPR Transient Data Acquisition

















THANK YOU

