SENSUS
Managing Infrastructure with AMI

TRAVIS SMITH
Sr. Product Mgr

SENSUS

Content

- Customer Needs and Issues
- Competitors
- Sensus Solutions and Differentiators
- Threats
- Needs

Customer Needs and Benefits

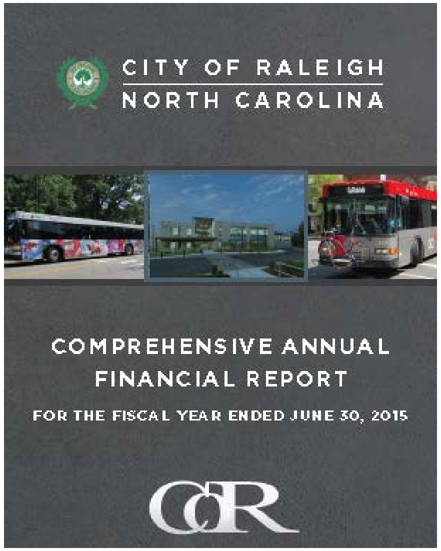
Utility Director Perspective

Goals

- **Supply Water for Fire Service**
- **Supply Clean Water**
- **Manage the Sustainability of the Water Supply**
- **Maintain Fiscal Goals of the City**
- **Keep the Politicians, Lawyers, and Accountants Away**

- **Water Utilities Finances**
  - ⟶Magnitude of Water on a City
- **Issues/Opportunity**
  - ⟶ Asset Management
  - ⟶ Non Revenue Water
  - ⟶ Costs
  - ⟶ Damages
- **Smart Water Applications ?????**
  - ⟶ Lot of Data
  - ⟶ Make Sense Of It

City of Raleigh Finances - Assets



Capital Assets*

(in millions of dollars)

	Governmental Activities		Business-type Activities		Total Activities	
	2014	2015	2014	2015	2014	2015
Land	$149.5	$149.8	$81.2	$81.2	$230.7	$231.0
Construction in progress	259.3	347.2	296.4	316.1	555.7	663.3
Watershed protection rights	-	-	4.7	4.7	4.7	4.7
Buildings and machinery	60.3	57.6	311.1	301.3	371.4	358.9
Water and sewer systems	-	-	810.0	823.6	810.0	823.6
Streets and sidewalks	289.4	272.5	0.9	0.8	290.3	273.3
Parking decks	-	-	110.4	106.8	110.4	106.8
Buses	-	-	8.3	14.8	8.3	14.8
Equipment	20.2	25.4	21.5	23.2	41.7	48.6
Furniture and fixtures	0.1	0.1	-	-	0.1	0.1
Improvements	99.9	114.6	104.9	112.3	204.8	226.9
Enterprise-wide software	33.6	31.7	-	-	33.6	31.7
Total	**$912.3**	**$998.9**	**$1,749.4**	**$1,784.8**	**$2,661.7**	**$2,783.7**

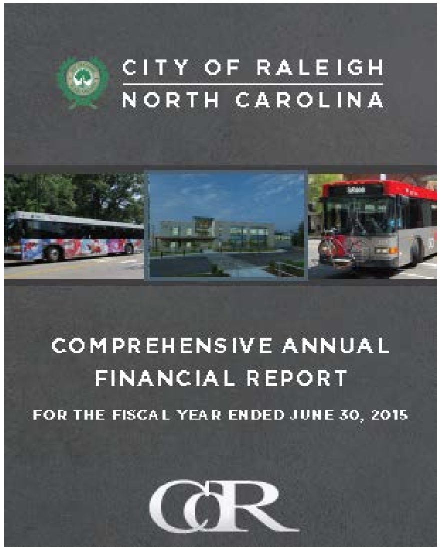
* Amounts shown net of accumulated depreciation

- 30% of City total assets
- Largest Single Line Item
- $800 M of assets

City of Raleigh Finances - Revenue

Net Cost of Business-Type Activities
(in millions of dollars)

	Total Cost of Services 2014	Total Cost of Services 2015	Net (Cost) Revenue of Services 2014	Net (Cost) Revenue of Services 2015
Water and sewer	$145.0	$146.9	$55.9	$71.0
Convention center	33.9	33.9	(20.9)	(20.6)
Mass transit	35.4	37.9	(22.7)	(14.0)
Parking facilities	11.8	11.5	0.5	2.0
Stormwater management	10.4	12.2	6.7	6.9
Solid waste services	30.5	28.4	(8.1)	(4.3)
Total	**$267.0**	**$270.8**	**$11.4**	**$41.0**



- 173% of Revenue
- Largest Single Line Item
- $147 M of Costs
- $218 M of Revenue

City of Raleigh NC Comprehensive Annual Financial Report June 2015

Damage Control

Friction in the Pipes

Figure 2.10: Cast Iron Pipe Sections Replaced

City of Fort Myers Water Master Plan

Malcolm Pirnie, Inc.

Table 10.1: Existing Utility Maintenance CIP Items

CIP Project Description	Year Scheduled for Completion	Total Cost
Citywide Water Meter Replacement Program	2011	$ 2,070,934
Replace Water Mains and Service Lines Citywide	2014	$ 821,578
Total Budgeted Costs for Utility Maintenance CIP Items		**$ 2,892,512**

Capital Costs

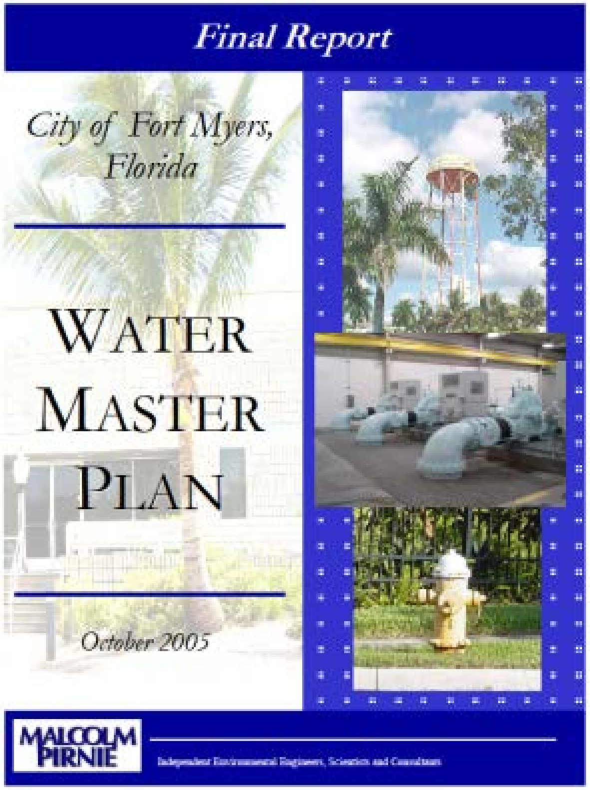
Table 11.3: Summary of Additional Capital Improvement Costs

Proposed Project	FY 04-05	FY 05-06	FY 06-07	FY 07-08	FY 08-09	FY 09-10 through FY 13-14	FY 14-15 through FY 23-24
Treatment and Operations							
Second Water Treatment Plant Feasibility Study		$ 100,000					
Second 8 mgd Water Treatment Plant and supply development					$5,000,000	$15,000,000	$20,000,000
Corrosivity Water Quality and Process Modification Study		$ 200,000					
Additional operations and maintenance staff for plant expansion and/or new plant staffing						$ 1,000,000	$ 2,000,000
Installation of arsenic removal treatment, sulfide removal and/or disinfection capability at the Winkler Pump Station to be used with the ASR well.				$1,500,000	$1,500,000		
Treatment and Operations Subtotal	**$ -**	**$ 300,000**	**$ -**	**$ 1,500,000**	**$ 6,500,000**	**$16,000,000**	**$22,000,000**
							$ 46,300,000

Value of Non Revenue Water

Water Withdrawl	Population est	Mgal/day	Mgal/yr	Price of water ($/Kgal)	Total Revenue $	20% Loss Value	10% Loss Value	Value of a 2.5 year payback based upon 10% recovery
Totals Domestic Public Supply	264,444,444.44	23,800	8,687,000	4	$ 34,748,000,000	$ 6,949,600,000	$ 3,474,800,000	$ 8,687,000,000
less PR and USVIS		23,566	8,601,710	4	$ 34,406,841,800	$ 6,881,368,360	$ 3,440,684,180	$ 8,601,710,450
23% market share		5,420	1,978,393	4	$ 7,913,573,614	$ 1,582,714,723	$ 791,357,361	$ 1,978,393,404
5 mgd	55,556	5	1825	3	$ 5,475,000	$ 1,095,000	$ 547,500	$ 1,368,750
10mgd	111,111	10	3650	3	$ 10,950,000	$ 2,190,000	$ 1,095,000	$ 2,737,500
20 mgd	222,222	20	7300	3	$ 21,900,000	$ 4,380,000	$ 2,190,000	$ 5,475,000
50 mgd	555,556	50	18250	3	$ 54,750,000	$ 10,950,000	$ 5,475,000	$ 13,687,500
100 mgd	1,111,111	100	36500	3	$ 109,500,000	$ 21,900,000	$ 10,950,000	$ 27,375,000
200 mgd	2,222,222	200	73000	3	$ 219,000,000	$ 43,800,000	$ 21,900,000	$ 54,750,000

Water Master Plans


Final Report

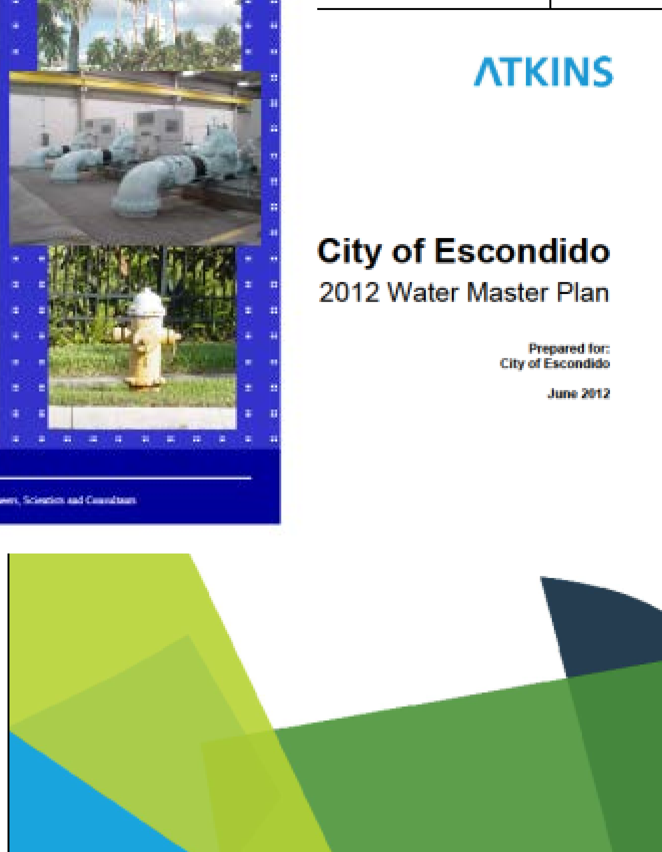
City of Fort Myers, Florida

WATER MASTER PLAN

October 2005

MALCOLM PIRNIE

Independent Environmental Engineers, Scientists and Consultants

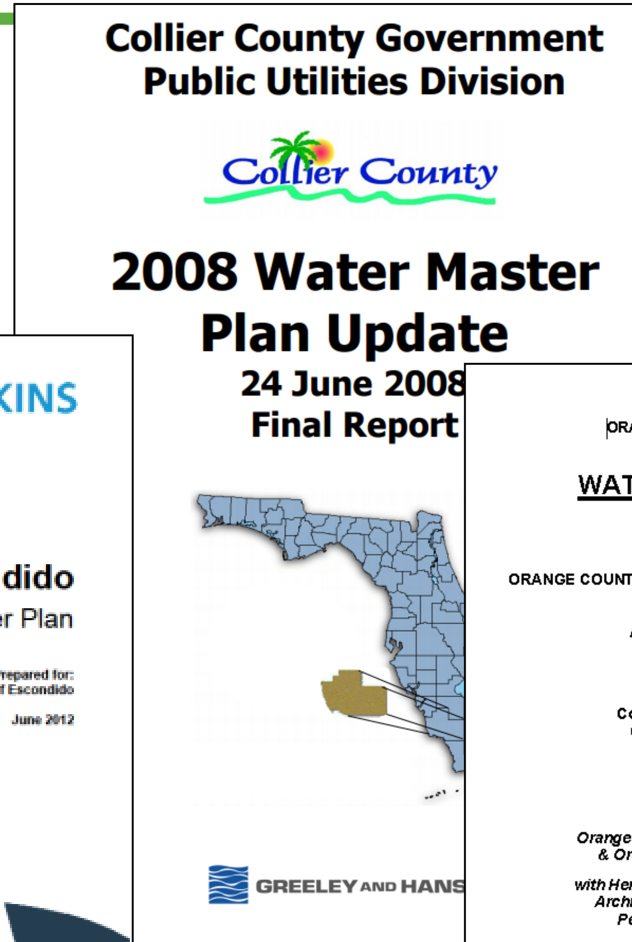

ATKINS

City of Escondido

2012 Water Master Plan

Prepared for:
City of Escondido

June 2012


Collier County Government
Public Utilities Division

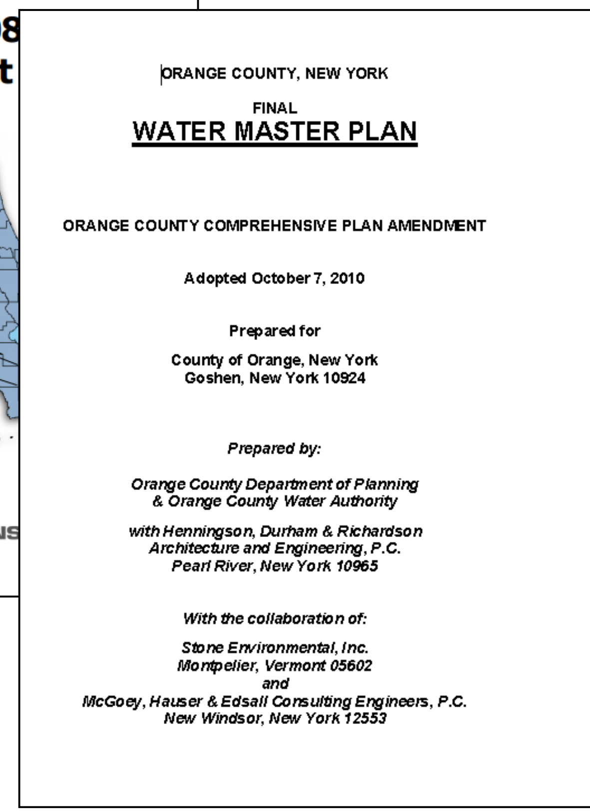
Collier County

2008 Water Master Plan Update

24 June 2008

Final Report

GREELEY AND HANS


ORANGE COUNTY, NEW YORK

FINAL

WATER MASTER PLAN

ORANGE COUNTY COMPREHENSIVE PLAN AMENDMENT

Adopted October 7, 2010

Prepared for

County of Orange, New York
Goshen, New York 10924

Prepared by:

Orange County Department of Planning
& Orange County Water Authority

with Henningson, Durham & Richardson
Architecture and Engineering, P.C.
Pearl River, New York 10965

With the collaboration of:

Stone Environmental, Inc.
Montpelier, Vermont 05602
and
McGoey, Hauser & Edsall Consulting Engineers, P.C.
New Windsor, New York 12553

City Master Plan RFQ

In addition to any qualifications your firm considers pertinent, the following areas should be addressed in the submittal:

1. Water Distribution System Master Plan program development including prioritization of health, safety, regulatory, and economic factors, level of service or minimum hydraulic performance criteria used for modeling analysis, infrastructure option evaluation criteria, and document presentation format.
2. Computer modeling of system hydraulics
3. Field investigation and evaluation of distribution systems for hydraulic and water quality parameters such as friction factors, water flow/velocities, demand patterns, pump capacities and operational controls
4. Development and calibration of hydraulic model
5. Projected growth in service area, resulting water demand, and demand reallocation
6. System capacity analysis under both normal and emergency power conditions
7. GIS Capabilities
8. Financial analysis of capital improvement program

RFQ 08292014
Water Distribution System Master Plan 7

http://charmeck.org/city/charlotte/Utilities/CustomerService/Bid%20Documents/RFQ%2008292014%20Water%20Distribution%20System%20Master%20Plan.pdf#search=water%20master%20plan

Master Plan Focus

The Rio Linda/Elverta Community Water District (District) is an independent special water district which serves the communities of Rio Linda and Elverta. This Water Master Plan (Master Plan) was developed to meet the Strategic Plan Objectives that were developed by the District in 2013. The Strategic Plan Objectives are to maintain the water system, maintain a safe work place, provide for future customers, use water efficiently, and meet financial requirements.

With these objectives in mind, the Master Plan focused on

- identifying regional and statewide programs to which the District is committed,
- updating the water system planning criteria,
- assessing the existing water system,
- evaluating the water system based on the planning criteria,
- identifying improvements required to supply new customers when the District's moratorium is lifted, and
- providing a summary of recommended capital improvements for which the District will use in developing its annual capital improvement budget

1.2 PURPOSE AND NEED

This report presents findings and recommendations relating to the Silverton municipal potable water system study. This study was commissioned by the city in an effort to determine the current state of the water system and to plan for future needs. The planning study is intended to build upon previous planning efforts.

A review of the fundamental planning elements such as population, water supply and demand, development and household densities, and fire flow requirements is presented, as well as an analysis of the system followed by a summary of recommendations and a capital improvement plan. Figures and supporting data for the information presented in this report have been included in the appendices for reference.

SENSUS

Lawrence KS Master Plan

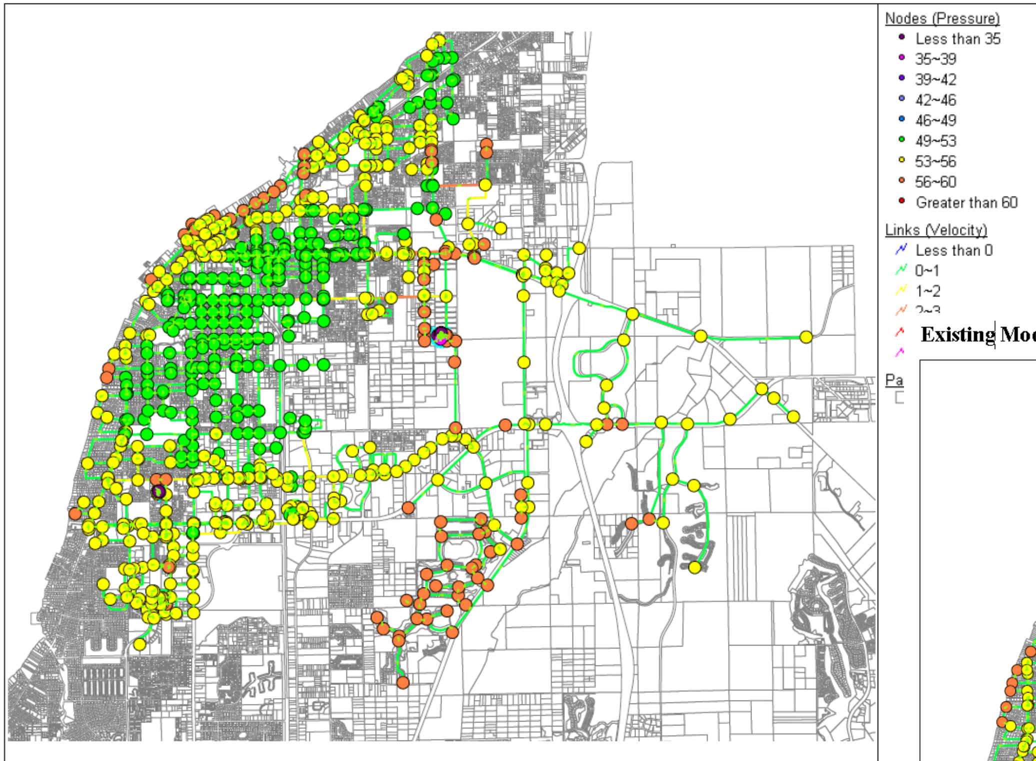
G. Distribution System Improvements

The first step determining water distribution system improvements is development of a GIS-based hydraulic model in Bentley WaterGEMS V8i. The City's GIS water system data was imported into the hydraulic model using tools available in the modeling software. The City's topologically correct geometric network of the water system was imported to construct the base model and a series of processes were executed to condense the water system by removing features not critical for hydraulic analysis. The process of condensing the system is known as skeletonization, and allows the system to be modeled accurately while reducing the number of features modeled. The model does not include dedicated fire hydrant lines, dedicated building and/or customer service lines, fire lines, private lines, abandoned lines, or dead end mains of short length with no customer consumption data.

The model is calibrated based on the results of the field testing program and is used to determine water distribution system improvements for years 2010, 2020, 2030, and buildout. SCADA information for the high service pumps, booster pumps and tanks are used to develop diurnal curves for the system and each pressure zone as well as data for the extended period simulations. The results of the diurnal evaluation provide peak hour and minimum hour demand ratios and are incorporated into model scenarios for each year. The diurnal evaluation also provides the system equalization volume and is used in the storage analysis. Fire demands for each year are also evaluated in the model.

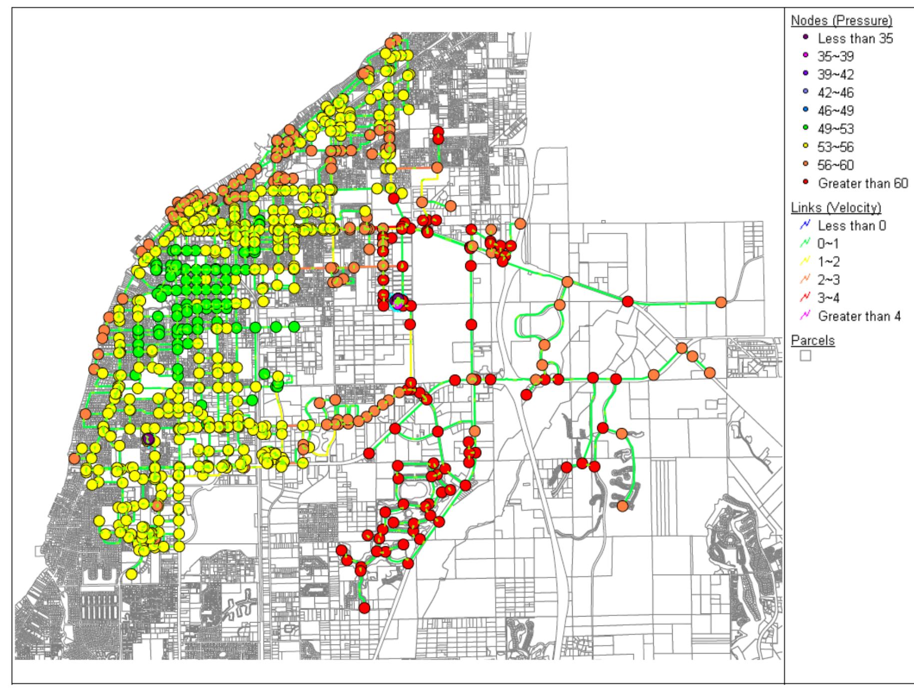
Pressure Profiles

Existing Model **9:00 PM Peak Hour Residential Demand**



Prepared By: Malcolm Pirnie, Inc. City of Fort Myers Water Master Plan

Existing Model **11:00 AM Peak Hour Commercial/Industrial Demand**



Prepared By: Malcolm Pirnie, Inc. City of Fort Myers Water Master Plan Figure 5.17

Hydraulic Models

Simulates behavior of the system using Average, Peak, and Fire Flow Conditions

5.1 DISTRIBUTION SYSTEM HYDRAULIC MODEL

Modeling of the City's potable water distribution system was completed using H2OMAP software by MWH Soft. The H2OMAP software simulates hydraulic behavior of the water system by controlling various elements based on time of day, tank water levels, system pressure, node demands, pipe size, roughness and minor losses. The software also allows for complete fire flow analysis. The GIS-based, calibrated model was used to evaluate the existing system for average and peak flow and fire flow conditions.

Basis is168 data points in a one week period.

The goal of the model construction and calibration was to develop a model that accurately represents distribution system performance under various demand conditions. The model was calibrated for 168 one-hour time steps during a one week period. The calibration was completed comparing model output to data collected from the Water Treatment Plant, the Winkler Pump Station and various pressure points throughout the distribution system.

Ft Myers Plan

term supply needs. **Table 4.4** summarized the treatment losses for the fiscal year 2003. A of treatment loss of 20% is typical for a reverse osmosis treatment process used for water from brackish wells.

Table 4.4: Summary of Treatment Losses

Fiscal Year (October – September)	2003
Total Water Supplied to the WTP (gallons)	2,972,083,000
Total Water Supplied to Distribution (gallons)	2,391,154,000
Treatment Losses (gallons)	580,929,000
% Treatment Loss	20%

The average unaccounted for water from 1997-2003 was approximately 700,000 gpd

At $4/1000 gallons this is $1,022,000/yr

Water Master Plan Ft Myers 2005 Malcom Pirnie

Table 10.2: Existing Potable Water Utility Construction CIP Items

CIP Project Description	Year Scheduled for Completion	Total Cost
Citywide Watermain Repl.Prog. PhIIIC Area 1 & 1A	2006	$ 2,430,335
Citywide Watermain Repl.Prog. PhIII Area 2	2007	$ 2,259,125
Citywide Watermain Repl.Prog. PhIII Area 3	2006	$ 1,247,832
Citywide Watermain Repl.Prog. PhIII Area 4	2009	$ 400,750
Citywide Watermain Repl.Prog. PhIII Area 5	2009	$ 802,302
Citywide Watermain Repl.Prog. PhIII Area 6	2007	$ 794,287
Citywide Watermain Repl.Prog. PhIII Area 7	2008	$ 477,465
Citywide Watermain Repl.Prog. PhIII Area 8	2009	$ 389,300
Citywide Watermain Repl.Prog. PhIV Area A	2008	$ 4,841,863
Citywide Watermain Repl.Prog. PhIV Area B	2012	$ 3,935,000
Citywide Watermain Repl.Prog. PhIV Area C	2012	$ 4,800,000
Citywide Watermain Repl.Prog. PhV	2013	$ 3,350,000
Citywide Watermain Repl.Prog. PhVI	2014	$ 4,510,000
Citywide Watermain Repl.Prog. PhVII	2014	$ 3,780,000
Citywide Watermain Repl.Prog. PhVIII	2014	$ 535,300
Citywide Watermain Repl.Prog. PhIX	2014	$ 555,500
US 41 Water Main Replacement - Vict-Winkler	2014	$ 2,432,056
Downtown Redev Water/Sewer PH I	2010	$ 51,523,896
Downtown Redev Water/Sewer PH II, III	2014	$ 2,520,000
Potable Water System Master Plan Update	2006	$ 117,370
SR739 Metro Pkwy/Winkler-Hansen Utility Relocation	2010	$ 1,407,921
Waterline Interconnect	2011	$ 2,050,000
Evans Ave Potable Water Transmission Main	2010	$ 1,484,261
Utility Replacement SR80/Fowler-Seaboard	2008	$ 6,104,000
Edison Ave Extension/Jacksonville-Ortiz Utilities	2014	$ 1,933,176
Hansen St. Extension/Metro-Buckingham Utilities	2014	$ 6,574,000
Parker Annexation Water/Sewer Transmission Line and Looping	2006	$ 1,401,330
Parker Annexation Extraordinary Utility Cost Reimb/Water Line Looping	2010	$ 1,650,422
Palomino Estates Water/Sewer Transmission Line	2006	$ 3,341,168
Palomino Estates Extraordinary Utility Cost/Provide Water/Sewer Services	2011	$ 2,409,146
WSMP Water System Piping/Distribution Impr	2014	$ 6,504,785
Brookhill Subdivision Water/Sewer Replacement	2007	$ 1,500,000
Total Budgeted Costs Utility Construction CIP Items		**$128,062,590**

Table 10.3: Existing Water Treatment Plant CIP Items

CIP Project Description	Year Scheduled for Completion	Total Cost
Rep & Maint FM Priority #3 FY04-05 Gate Repairs	2006	$ 6,000
Gasification Plant Clean Up	2006	$ 102,240
High Service Pump Drive Replacement	2006	$ 85,461
Aquifer Storage & Recovery	2007	$ 710,896
Process Modifications	2006	$ 249,256
Raw Water Meter	2006	$ 92,730
Wellfield Capacity Enhancement	2006, 2011	$ 412,606
Membrane Flush System Replacement	2006	$ 171,564
Membrane & Associated Equipment Replacement	2006, 2010, 2014	$ 2,073,780
Upgrade Computer Software MIS	2006, 2014	$ 850,000
Water Treatment Plant/Wellfield Exp (6200)	2006	$ 211,717
Water Treatment Plant/Wellfield Exp (6200)	2012	$ 4,206,400
Water Treatment Plant/Wellfield Exp (6300)	2006	$ 1,953,489
Water Treatment Plant/Wellfield Exp (6300)	2014	$ 4,375,000
Storage Tank Pump Station at Imaginarium	2006	$ 360,380
FM-Cape Coral Interconnect	2012	$ 810,000
Implementation of Security Study	2006, 2014	$ 228,975
Injection Well (Backup) subj to DEP decision	2012	$ 3,735,000
Winkler Generator	2009	$ 55,000
Winkler Pump Replacement	2007	$ 250,000
Re-roof Water Plant Administration Building	2009	$ 25,000
Re-roof Winkler Pump Station	2009	$ 25,000
Scrubber Station	2011	$ 825,000
Resurface Water Plant Roads	2011	$ 126,720
Feed Pump #3 & #4 Replacement	2011	$ 420,900
Degasifier #1 and #2 Replacement	2011	$ 486,480
Corrosion Inhibitor Bulk Storage Tank Addition	2010	$ 115,000
Clearwell Transfer Pump #4	2009	$ 95,000
Repaint Ground Storage Tanks	2009, 2014	$ 300,000
High Service Pump Rebuild	2011	$ 261,300
Wellfield and Water Plant Generator	2010	$ 500,000
Well Pump and Motor	2014	$ 280,000
Bulk and Day Storage Tank Replacement	2011	$ 75,000
Storage Tank Pump Station in SE Area	2009	$ 1,425,000
Total Budgeted Costs for Water Treatment Plant CIP Items		**$ 25,900,894**

Trade Magazine – WaterWorld

HYDRAULIC MODELING IMPROVES WATER SYSTEM RELIABILITY, EFFICIENCY

by Jack Cook

Antipolo City is located in the northern half of Rizal Province in the Philippines and is within the eastern boundary of metropolitan Manila. It is the second largest city in Rizal Province, with a rugged, mountainous topography.

The Antipolo network system comprises three stages of pumping stations and two reservoirs. From the Balara treatment plant, water is supplied to Antipolo by gravity through the Tanong Line, which serves as the suction line to Kingsville pumping station. Water is then pumped from the Kingsville pumping station to the Siruna pumping station and then into the reservoir via the primary line (see Fig. 1).

Water modeling plan

First, the hydraulic network model was calibrated in WaterGEMS V8 XM Edition, based both on field data and the existing network database. Hydraulic and transient simulations using WaterGEMS and HAMMER helped identify critical locations in the system.

The primary reliability strategy for this project was to subdivide the water distribution network into four separate pressure zones: the Unboosted Zone, the Siruna Pressure Zone, the Lucban Pressure Zone and the Lucban Pump Zone (see Fig. 3).

Since the Unboosted Zone had constraints in maximizing the output of the water system, a parallel line coming from the Siruna Pressure Zone was installed to cover some areas of the Unboosted Zone. The strategy was to minimize the area covered by the Unboosted Zone. Smaller pressure zones were then designed by creating smaller reservoirs in areas of rolling terrain to break pressure surges due to extreme differences in elevation, and to ensure water availability regardless of interruptions in pumping operations.

Trade Magazine – WaterWorld -2

Using the 5-year demand projection, Manila Water's engineers also ran steady-state and extended-period simulations to design the network for supplying the mountain communities and expansion areas of Antipolo.

The model was then reviewed in HAMMER for transient analysis. Several scenarios were created using different pump operations and different times of power failure, to identify critical areas affected by transients. Based on this, surge protection solutions were proposed, and appropriate flow control operations were identified.

Local Communities Realize Cost Benefits, Health Improvements

A total population of more than 709,000 people — which equates to more than 140,000 households — benefitted from the project. And, an additional 3,000 households will benefit upon completion of the network's expansion. The Antipolo Water System project will not only improve the water supply and pressure in the area but, more importantly, the people of Antipolo can now enjoy clean and potable water 24 hours a day, 7 days a week.

Using the modeling solution resulted in a significant time savings. Traditionally, it could take two to three months to create the model, but Manila Water was able to reduce that to less than a month with the new modeling solution.

Installing surge protections, such as PRVs and SAVs, at strategic locations as identified by the network model decreased the incidents of water interruption from pipe breakages from an average of 6 breakages per month to 0 to 2 breakages per month. This resulted in a decrease in leakages of 6.3 mld.

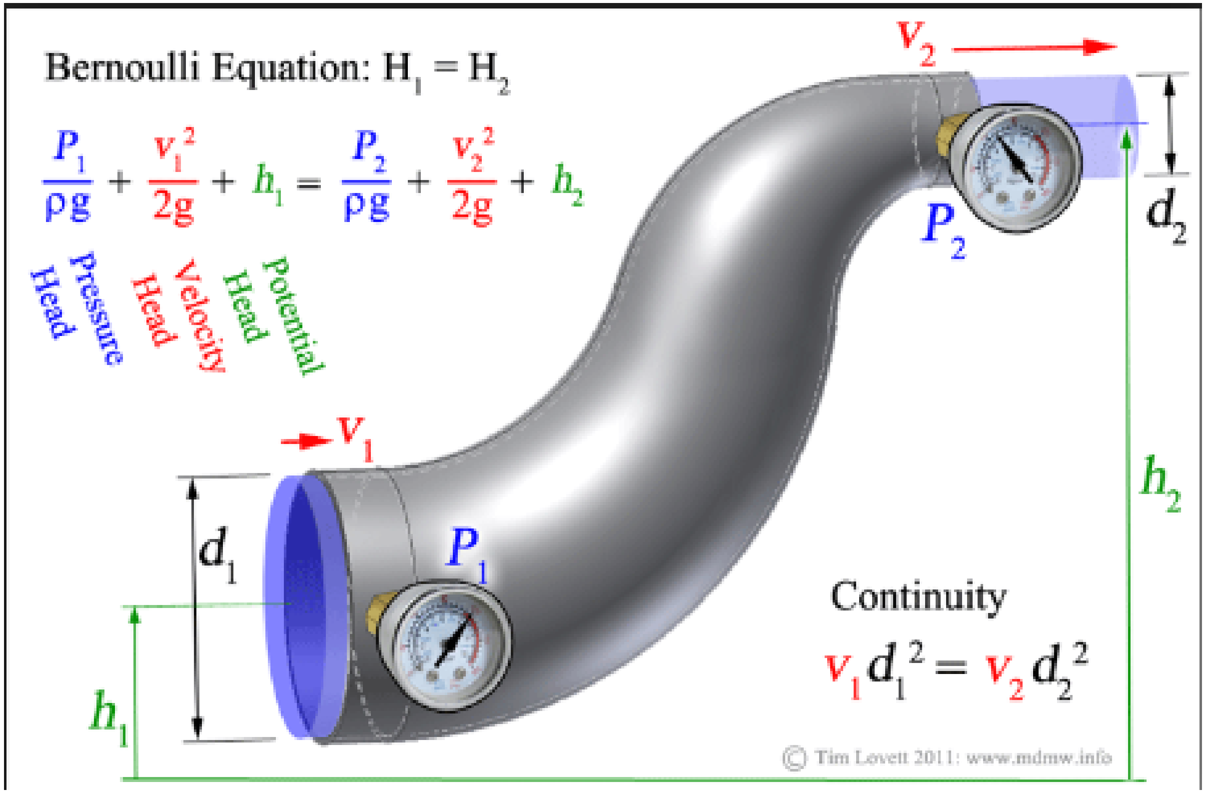
Furthermore, adjustments to the pump operation plan that were developed based on the hydraulic model and field studies, decreased the pump station operating expenditure by almost $7,000 per month.

About the Author:

Jack Cook is a Water Solution Executive at Bentley Systems, Incorporated. Bentley provides comprehensive software solutions for the infrastructure lifecycle.

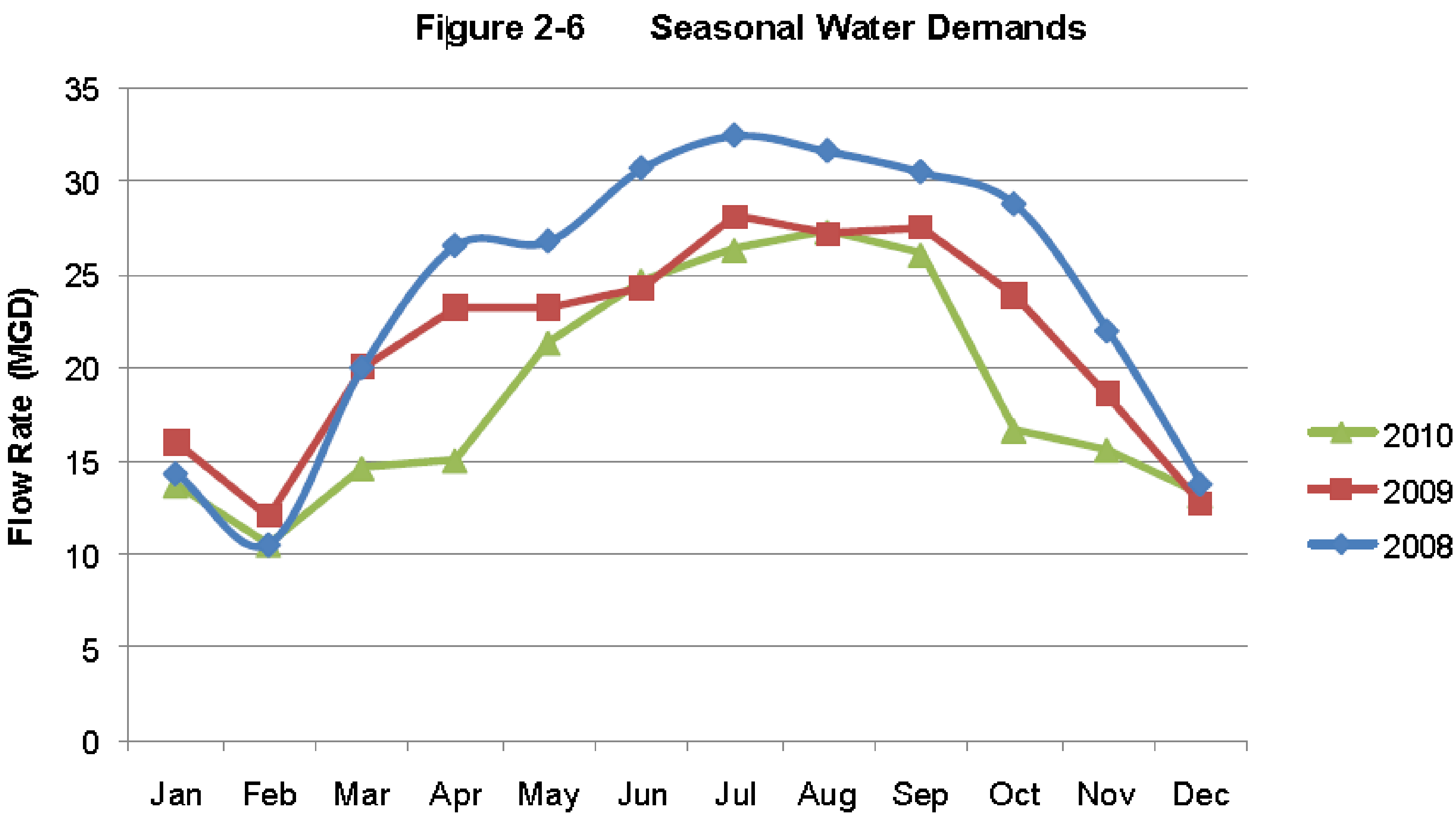
How Water Works

1. Flow
2. Pressure
3. Gravity
4. Friction
5. Map



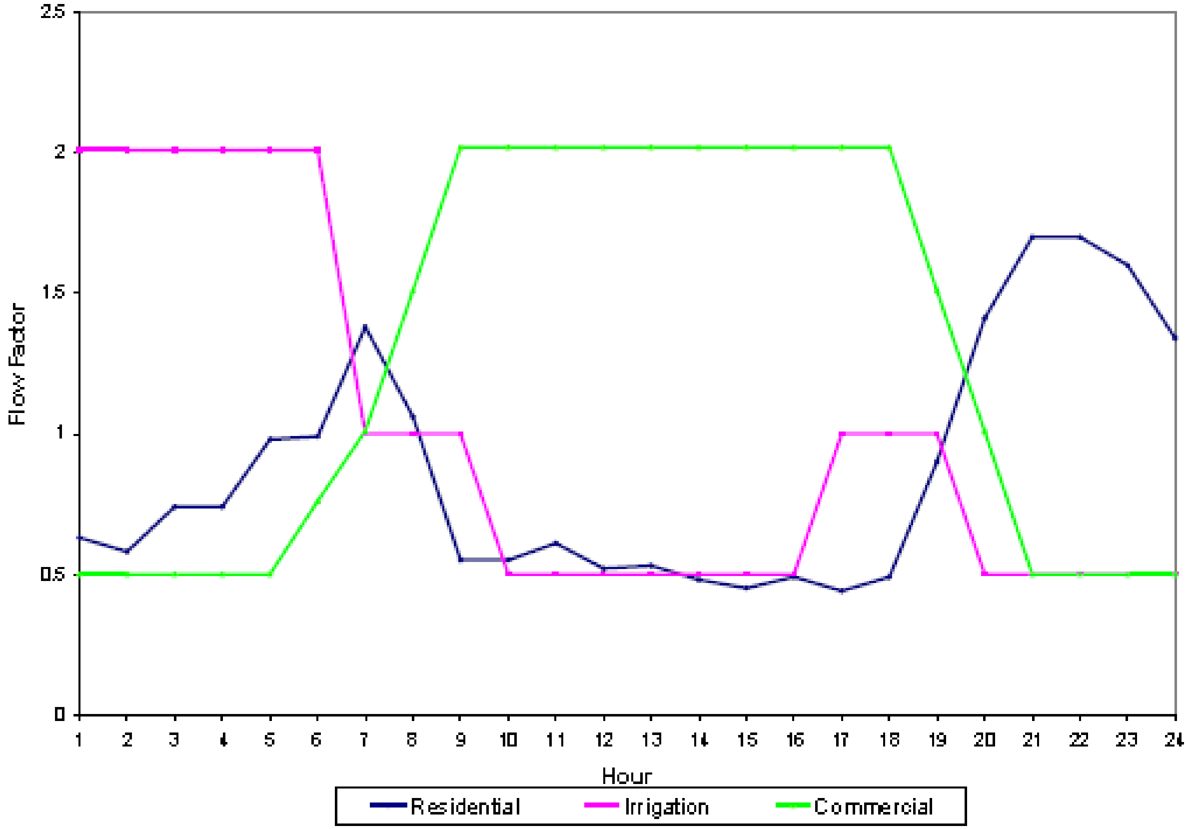
SENSUS

Flow - Why More Often



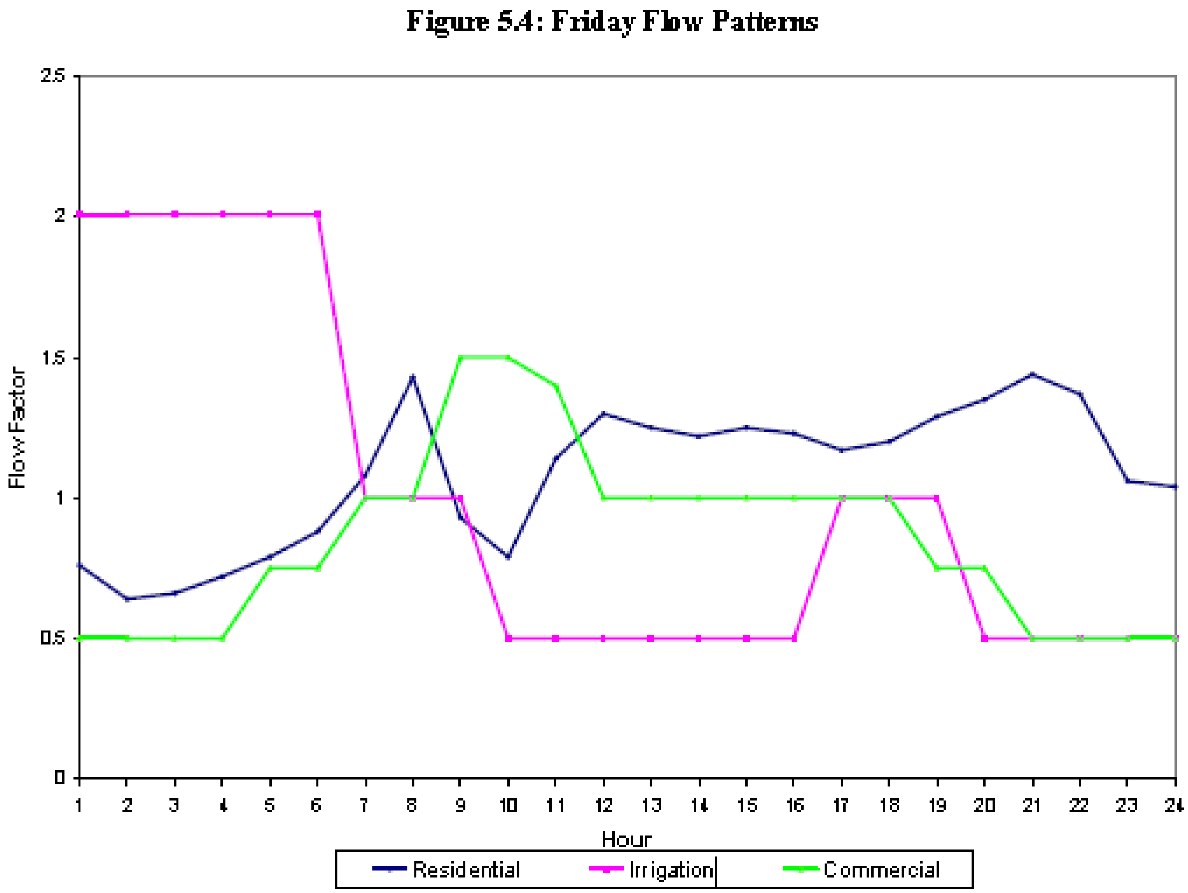
Hourly and Daily Changes

Figure 5.3: Monday – Thursday Flow Patterns



Water Master Plan Ft Myers 2005 Malcom Pirnie

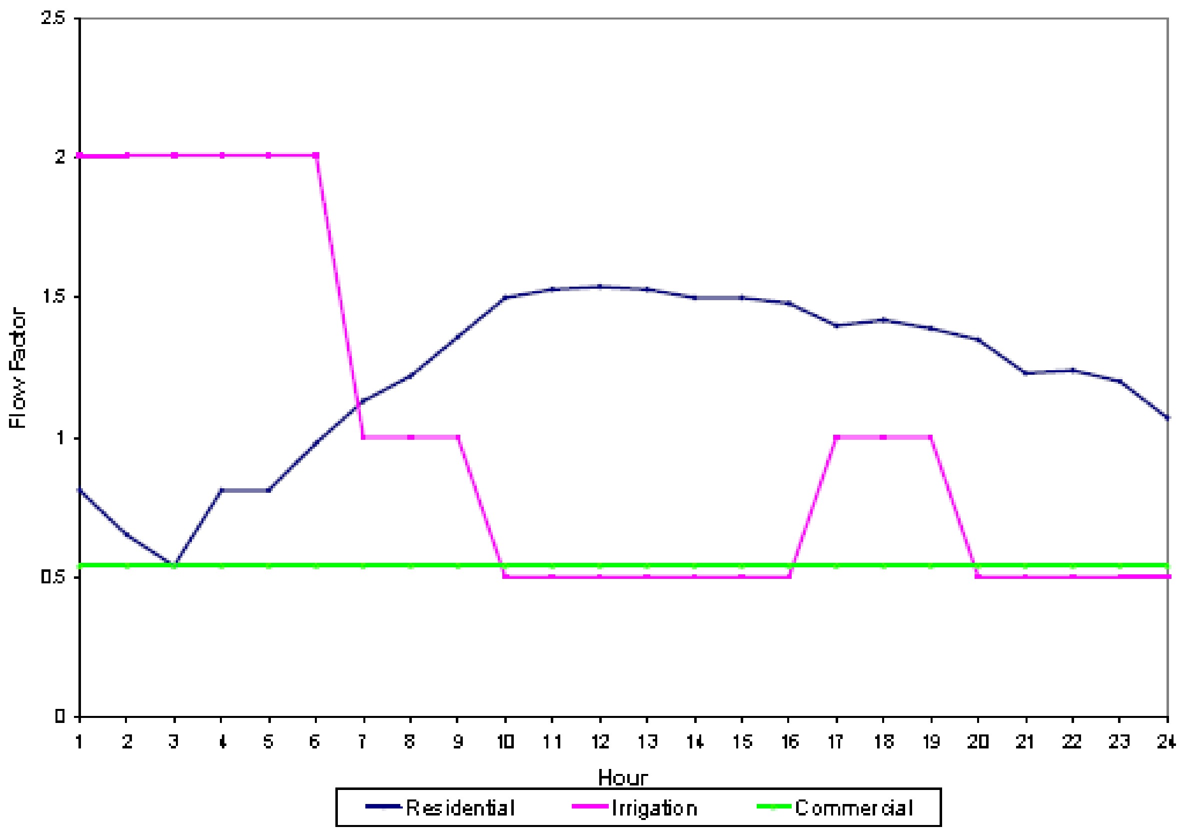
Hourly and Daily Changes 2



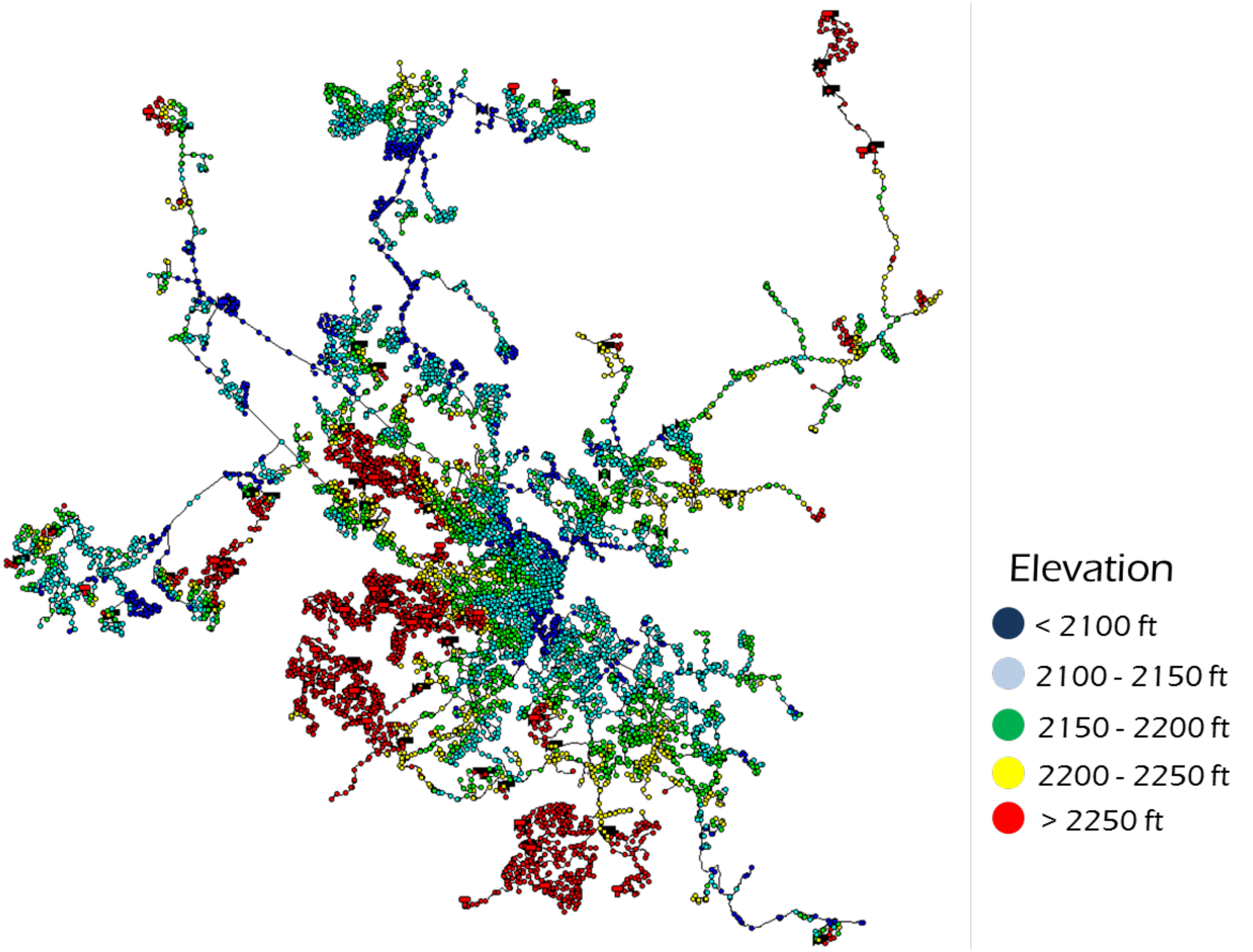
Water Master Plan Ft Myers 2005 Malcom Pirnie

Hourly and Daily Changes -3

Figure 5.2: Weekend Flow Patterns

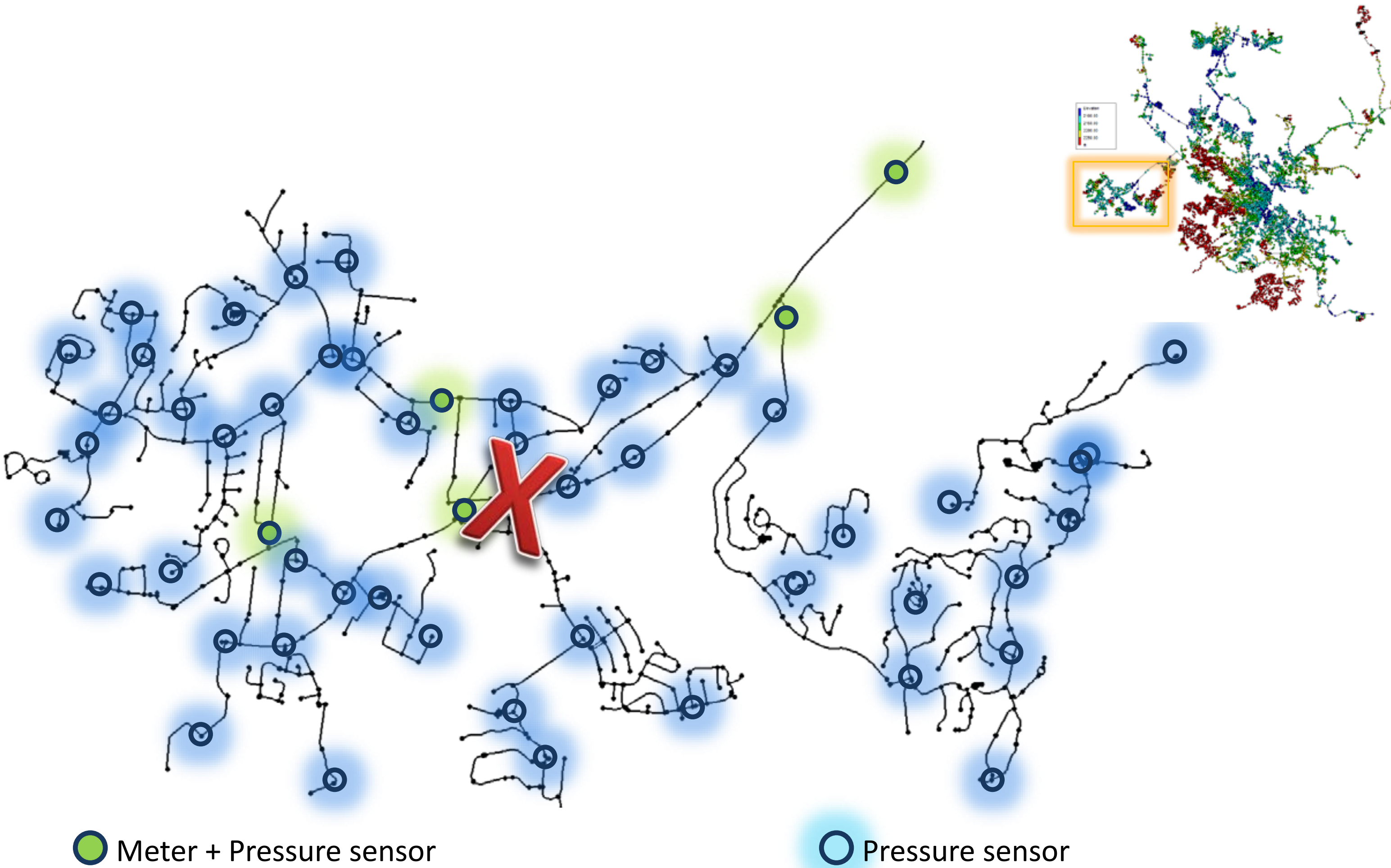


Map - EPANET Backbone

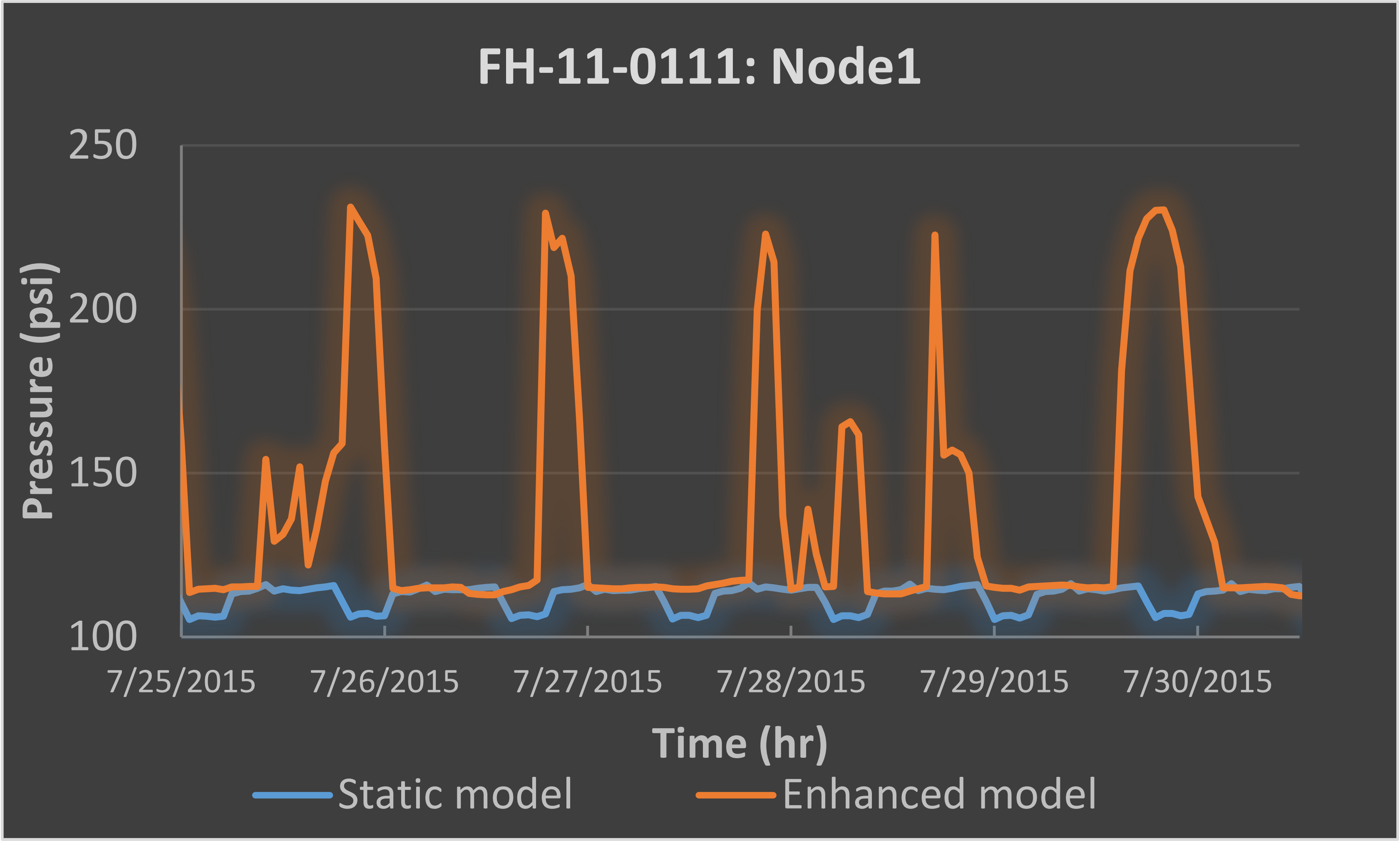


Meter & Pressure Sensors

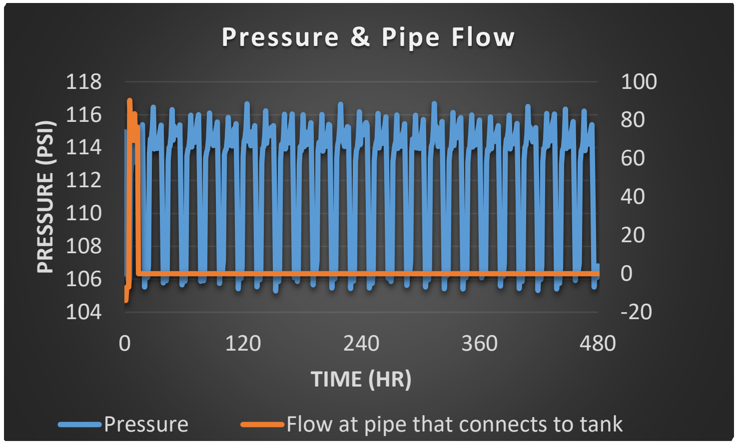
Cummings Dr.

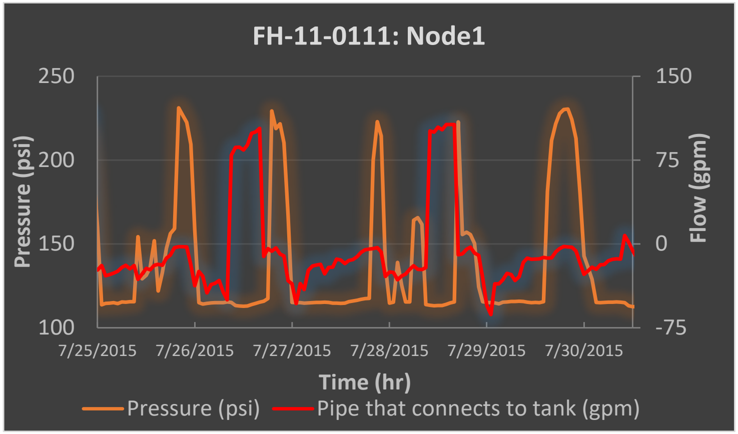


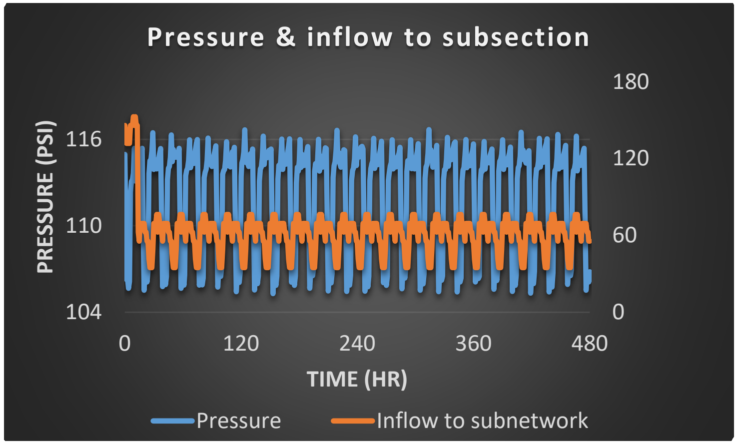
Comparison of Current with Sensus Model

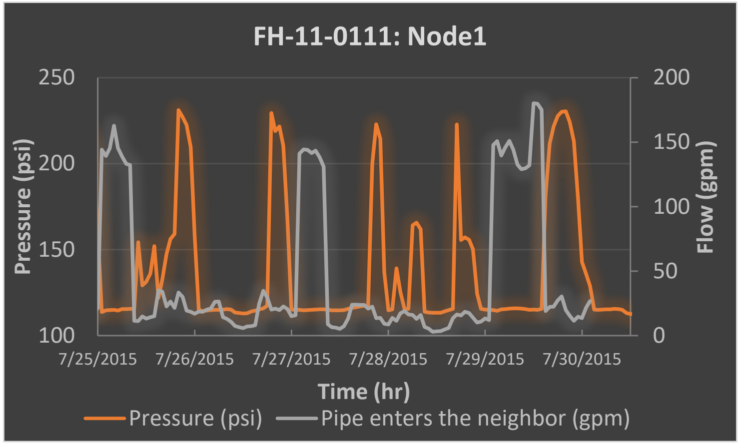


Current vs Sensus Model









Current

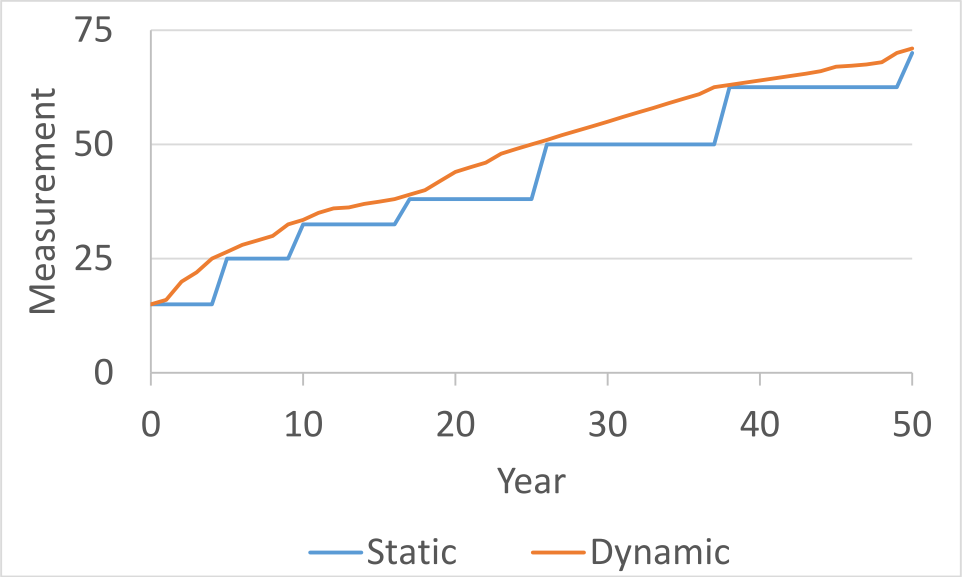
Add Other Data

Both magnitude and trend of plots are different

sensus

Dynamic vs Static Modeling

- **Dynamic model**
  - ⟶Evolve over time as demand and consumption
  - ⟶Present the status quo of network
  - ⟶Update easily
  - ⟶Find Background and New Leak Locations
  - ⟶Model water quality
- **Static model**
  - ⟶Present previous state
  - ⟶Costly maintenance
  - ⟶General performance of network, not reliable for detail

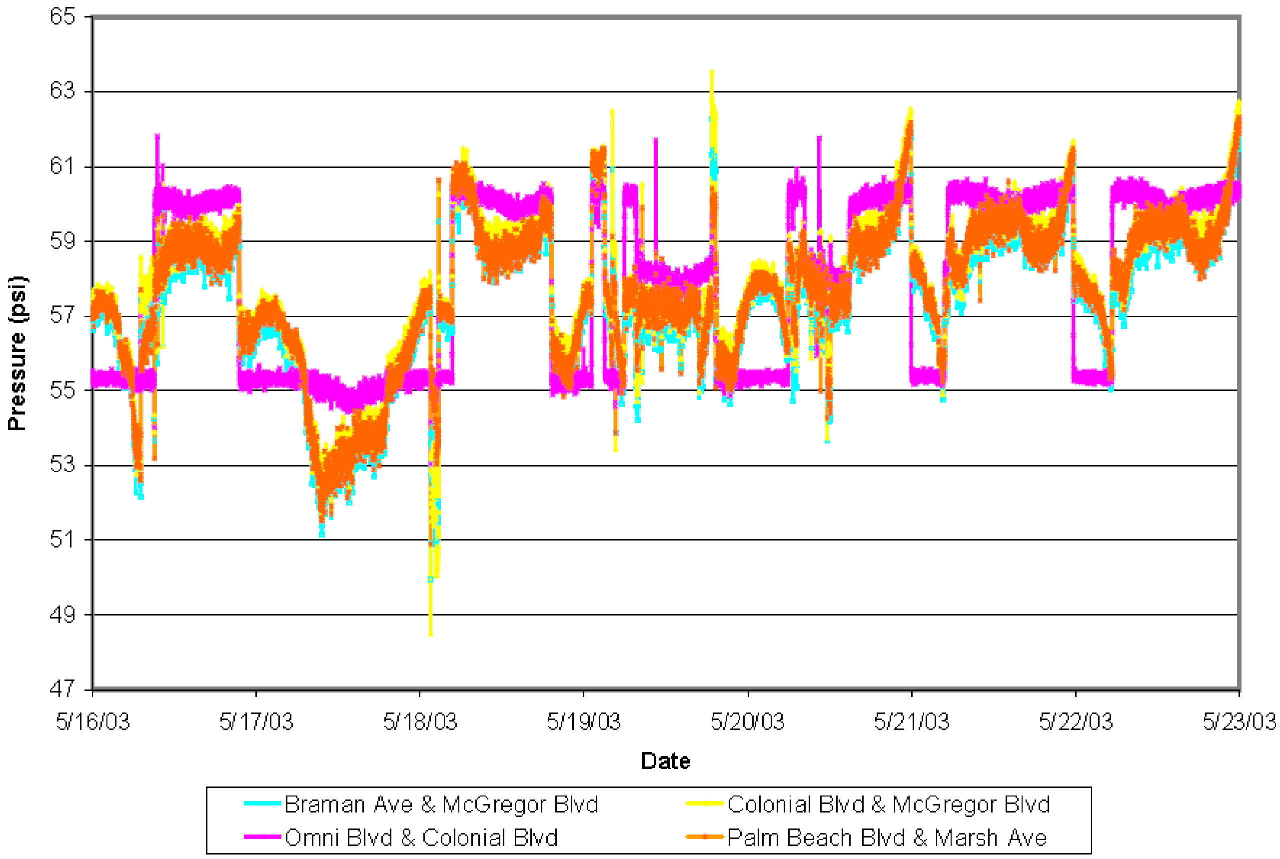


Key Differentiators

- **Better Demand Data- Hourly**
- **Pressure Instrumentation throughout the network and over time.**
- **Better hydraulic modeling algorithms**
  - ⟶Node alignment
  - ⟶Subnetwork analysis
  - ⟶Pressure indication for leaks
  - ⟶Friction Factor measurement
  - ⟶Better infrastructure
    - Greener: lower energy cost and gas emission control.
    - More resilient in water quality and maintenance: lower vulnerability.
- **Near Real Time**
- **Evergreen – adapts over time**

City Master Plan

Figure 5.6: System Pressures Recorded by the Distribution System Data Loggers During Calibration Period

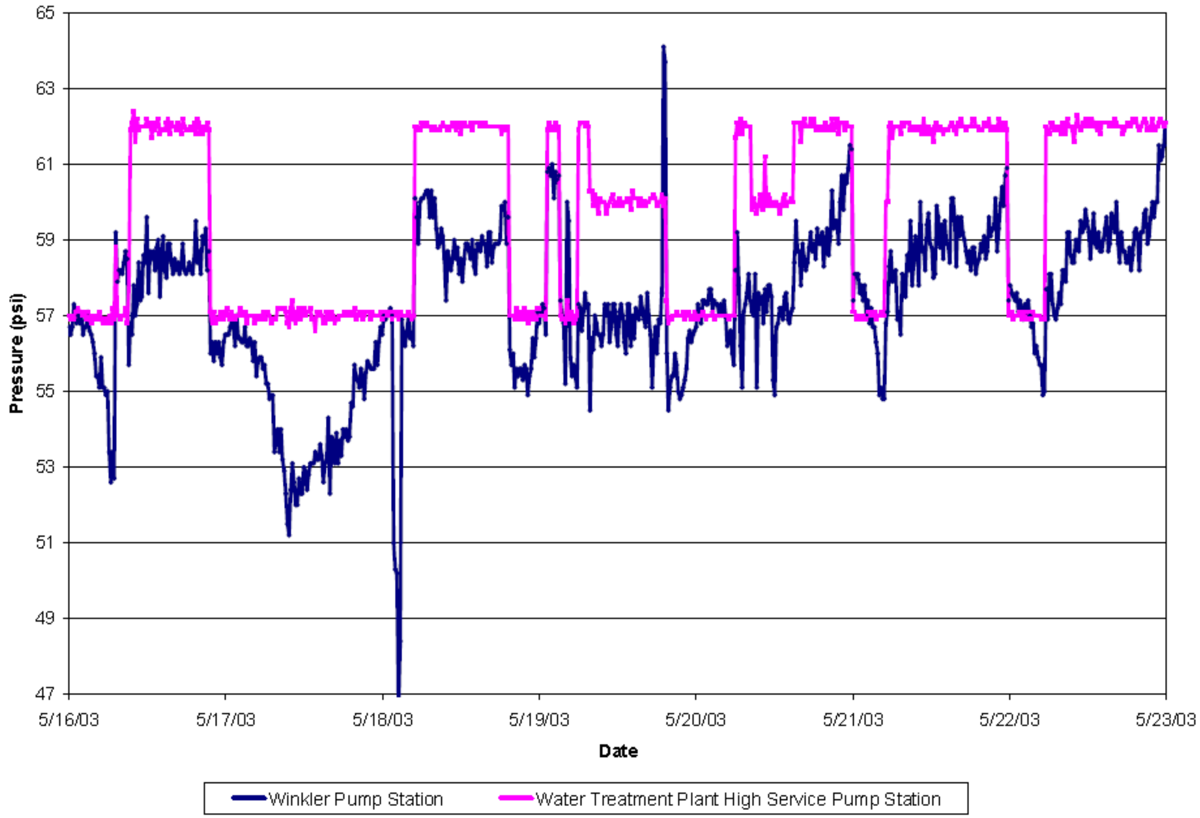


City of Fort Myers Water Master Plan
Section 5: Evaluation of Existing System

Malcolm Pirnie, Inc.
5-9

City Master Plan 2

Figure 5.7: Pressures Recorded at Pump Stations During Calibration Period



City of Fort Myers Water Master Plan
Section 5: Evaluation of Existing System

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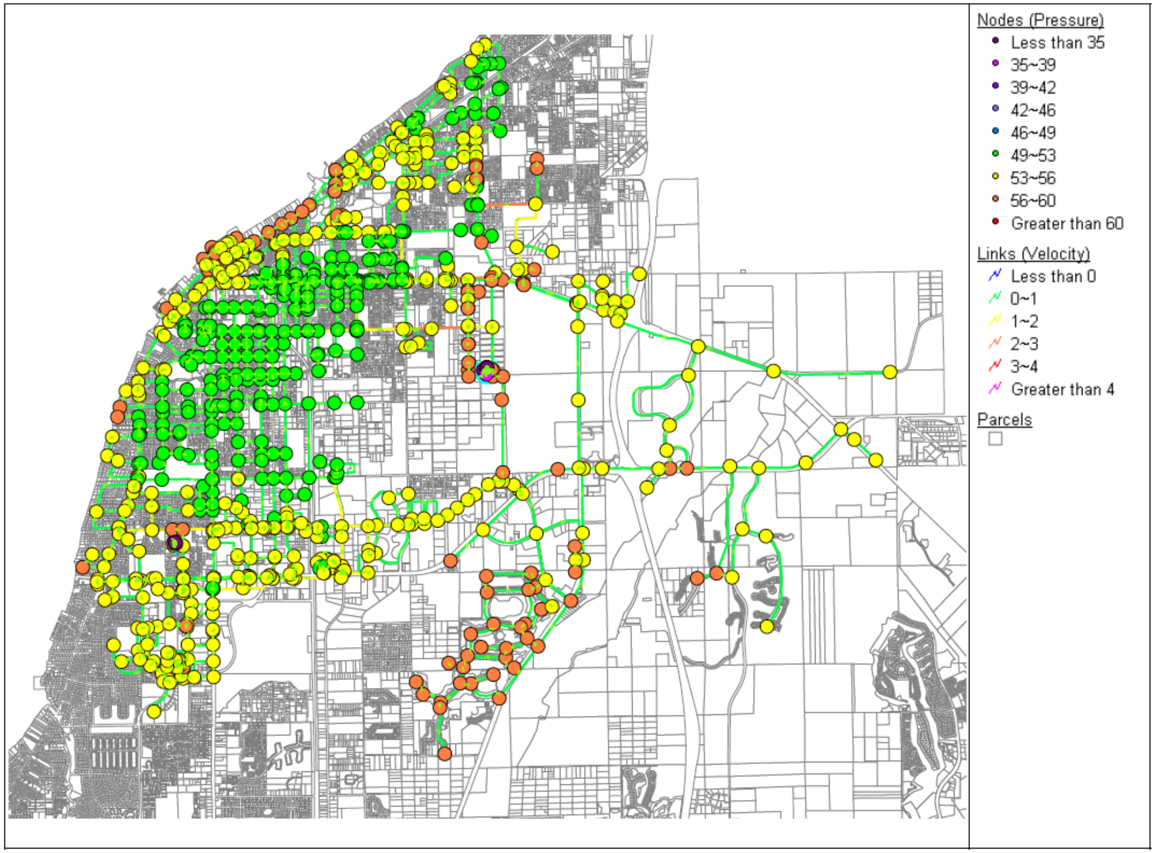
Pressure Profile

Existing Model 9:00 PM Peak Hour Residential Demand



Prepared By: Malcolm Pirnie, Inc. City of Fort Myers Water Master Plan Figure 5.15

Pressure Profile/ Hydraulic Model

Aspect	Pressure Profile	Hydraulic Model
Pump/Tank Elevation Optimization	Information to optimize	Models, flow, level, and pump operation for what ifs
Customer Service	End point service connection measurement	End point service connection measurement
Leak Detection	Indicate potential areas to reduce pressure, find big leaks	Proactively locate leaks
Water Quality	No current benefits	Model water quality throughout the system
System Design	Pressure information only	Design future pipe sizes, fire service, tanks, using demand flow and pressure
Fire Flow	Service Pressure Indication	Changes with Flow
Pipe Replacement	No current benefits	Uses pressure and flow to determine friction factor to aid with pipe replacement schedule

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Smart Water

Data Fusion, Analytics and Applications – Smart Water Applications

Data Management and Display – RNI, DM, Hadoop

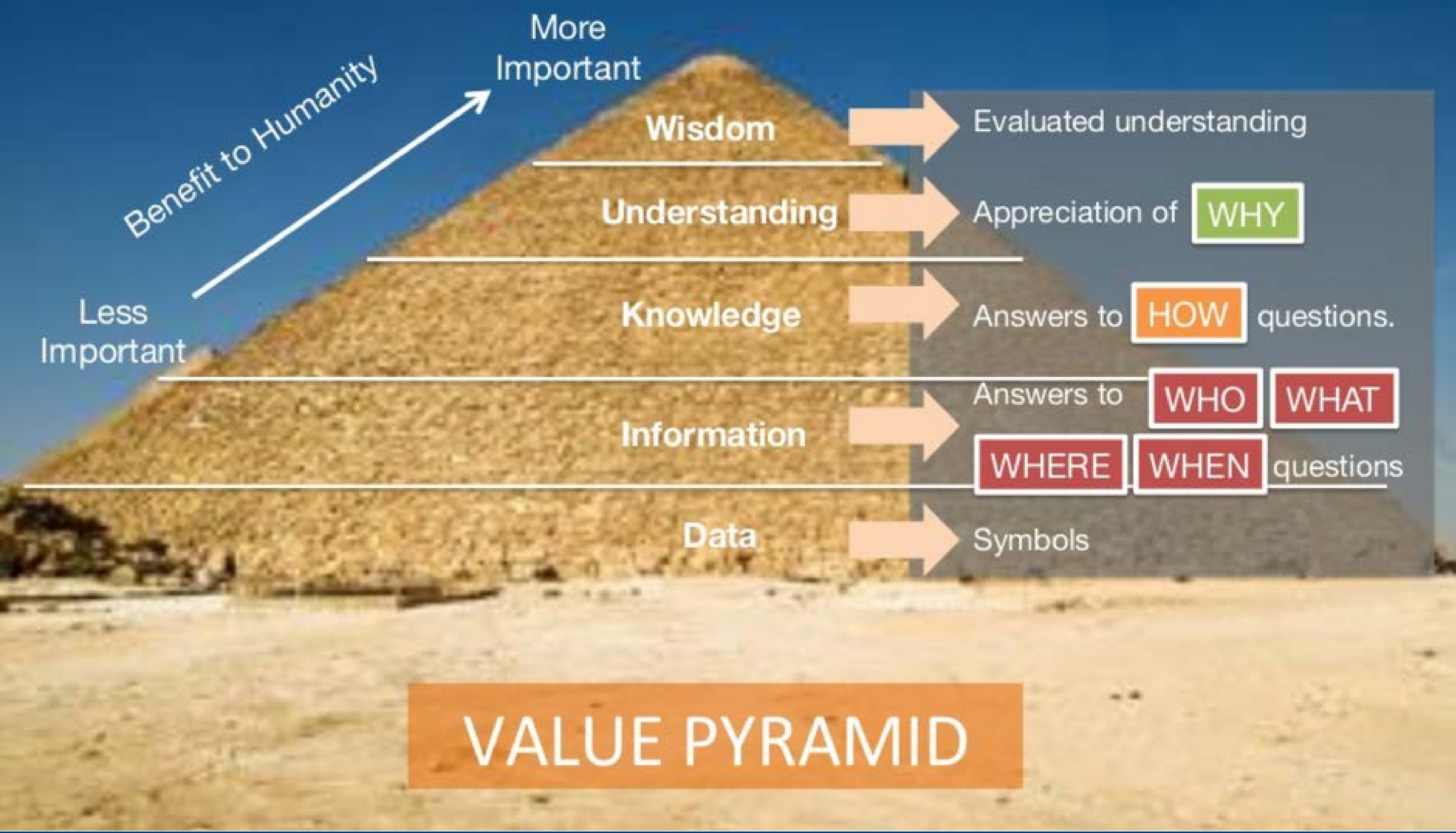
Collection and Communication – Collectors and 2 Way Devices

Sensing and Control – Meters and Sensors

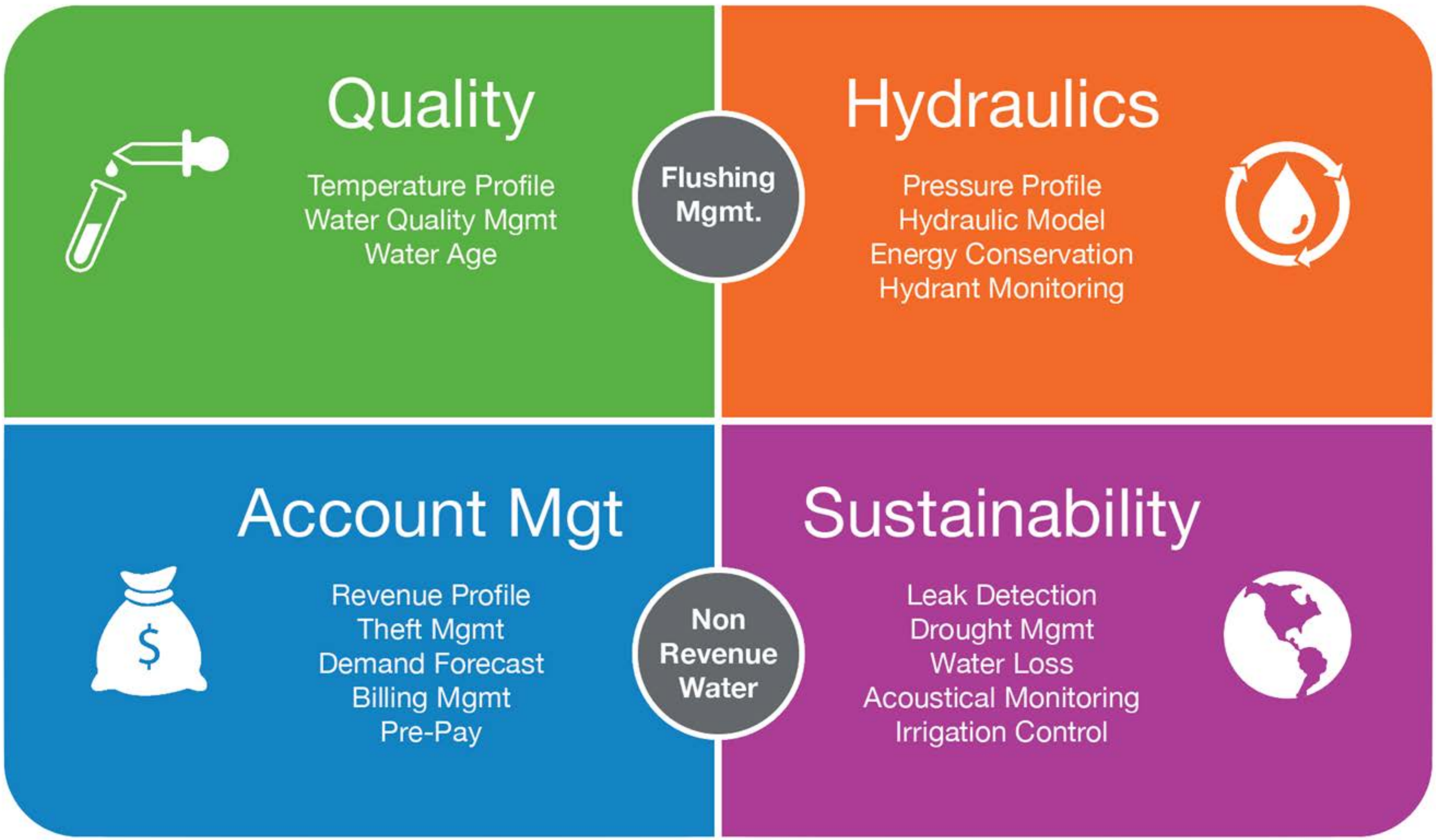
Physical Assets – Pipe, Hydrants, Treatment Plants, Wells

SENSUS

VALUE IS CREATED BY MAKING SENSE OF DATA



Water Utility Missions



Hydraulics and Water Quality

Two approaches for estimating the spread of a suspected contaminant through a water system are: 1) application of operational knowledge of the system, and 2) application of a hydraulic model of the distribution system. The first approach requires knowledge of pressure zones and typical flow patterns through a distribution system, as well as information derived from SCADA, to estimate the spread of a possible contaminant slug through a system. The second approach involves the use of hydraulic models such as EPA Net, PipelineNet, MWHSoft, Stoner, and Haestad, among others. While this latter approach is more rigorous, these models are sophisticated and require a certain level of skill and a significant amount of time to run; thus, it may not be practical to use such models for the purpose of identifying investigation sites. Furthermore, the first approach may be sufficient for identifying secondary investigation sites for field testing and water sampling.

EPA United States Environmental Protection Agency

Response Protocol Toolbox:
Planning for and Responding to Drinking Water Contamination Threats and Incidents

Interim Final - December 2003

Module 3:
Site Characterization and Sampling Guide

In all cases, it is critically important to identify investigation sites promptly so that site characterization activities can begin shortly after discovery of a contamination threat. The objective of site characterization is to gather information quickly in order to evaluate whether or not a threat is 'credible.' As discussed in Module 2, it is important to make this credibility determination in a relatively short period of time (**the target time period is less than eight hours from the time the threat warning is received**) such that response actions to protect public health can be implemented if necessary.

The Sum is Greater than the Parts