Suez Water / Advanced Solutions

PNWS AWWA CONFERENCE
BOISE IDAHO

May 5, 2016

DISTRIBUTION NETORK MONITORING

Paul Meschino, P.E. – Vice President - West Region

Wayne Spittal – Smart Solutions – CEO Derceto Group

Water Advanced Solutions
Utility Service Group

Agenda

- SUEZ Water Advanced Solutions
- What, why and how do I monitor my water distribution system
- Overview on NRW, Water Balance, and Energy Efficiency
- DMA and the *Sectorization* approaches and practical applications
- Advanced energy solution
- Q&A

Who is Suez Water Advanced Solutions?

Water systems solution provider

- **Global leader in water and wastewater solutions and technologies**
- **51 year history of providing services in US**
  - Drinking water systems
  - Wastewater and sewer collection systems
- **National network of service operations centers**
  - 11 operating centers
  - Local water system consultants
- **The North American leader in Asset Management Solutions**
  - Over 6,000 assets under our programs

Utility Service Group

R+i Alliance

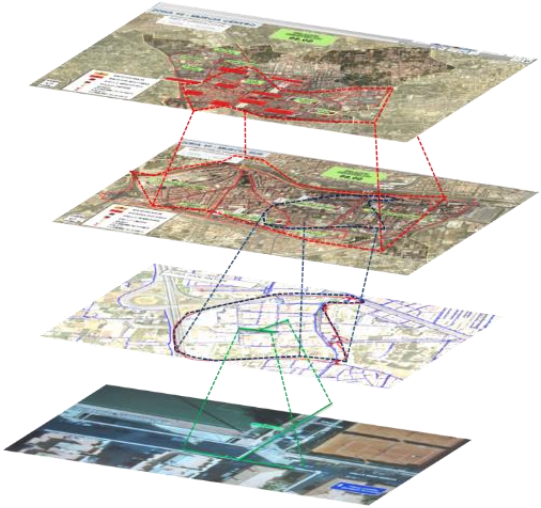
suez

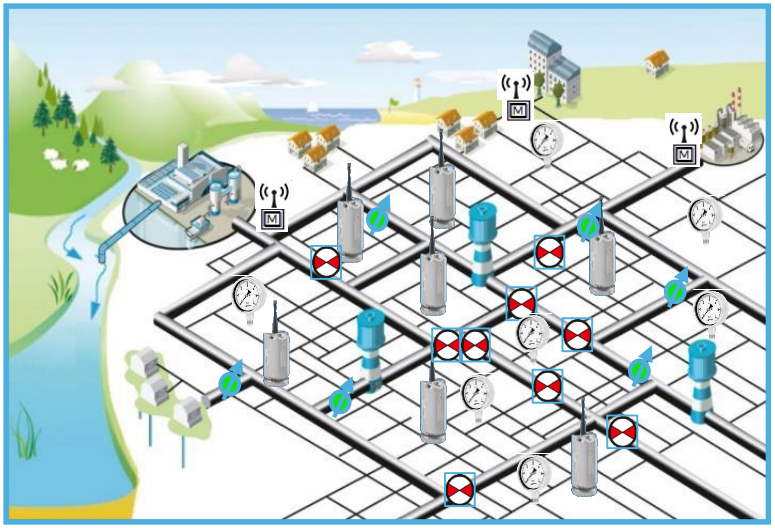
Networks become smarter

Every day more and more:

- Knowledge comes from the network
- Data are collected (quality, flow, pressure)
- Networks are optimized

Networks Management



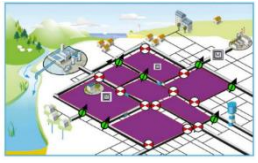


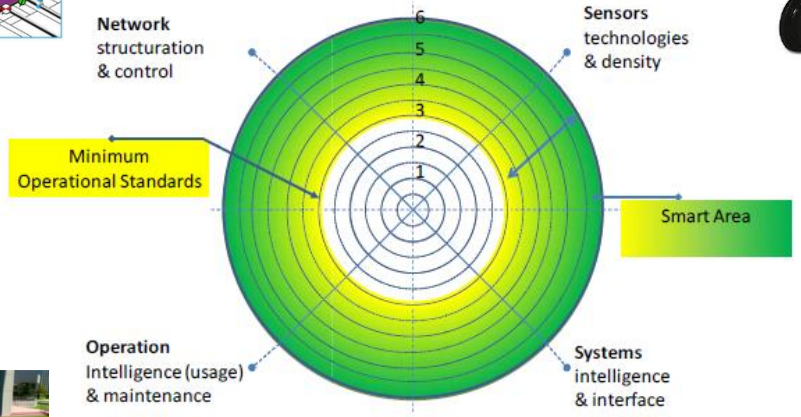
Need to analyze the information considering

- **business process**
- **network structure**
- **timescale and space**

in order to **MAKE THE DATA VALUABLE**

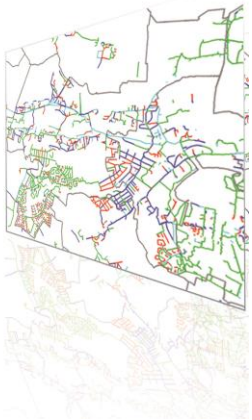
Smart Water Management





AQUADVANCED

An innovative solution to support water distribution operation



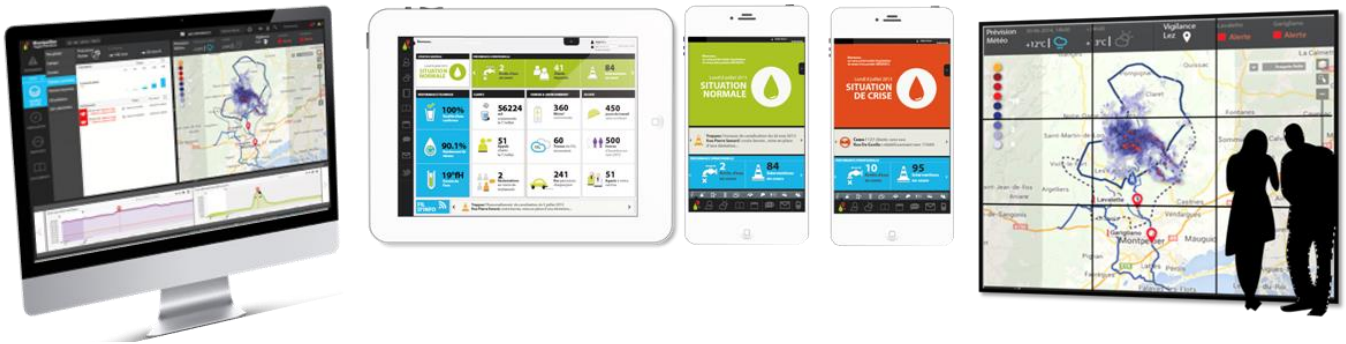
Energy Management

Water Management

Aquadvanced
An innovative solution to support water distribution operation

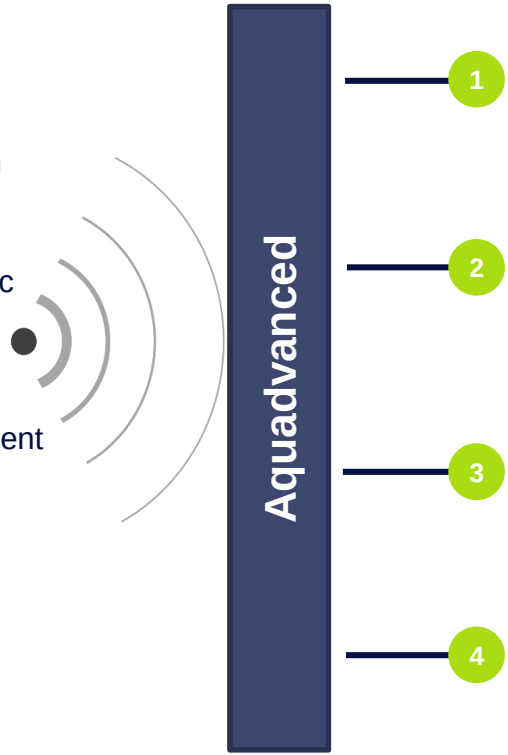
Operation Support System, to help monitor, act and control the water supply

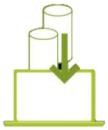
Decision Support System to provide dashboard tools to help in decision making



AQUADVANCED: how does it work?
Connected to most commonly used systems

- SCADA
- Energy Data, Pressure, Flows…
- Geographical Information System
- Data historian
- Simulation tool based on hydraulic model
- AMR system
- Laboratory Information Management System
- Enterprise Asset Management
- Workforce management
- Customer Information System





Data collection

Events Detection

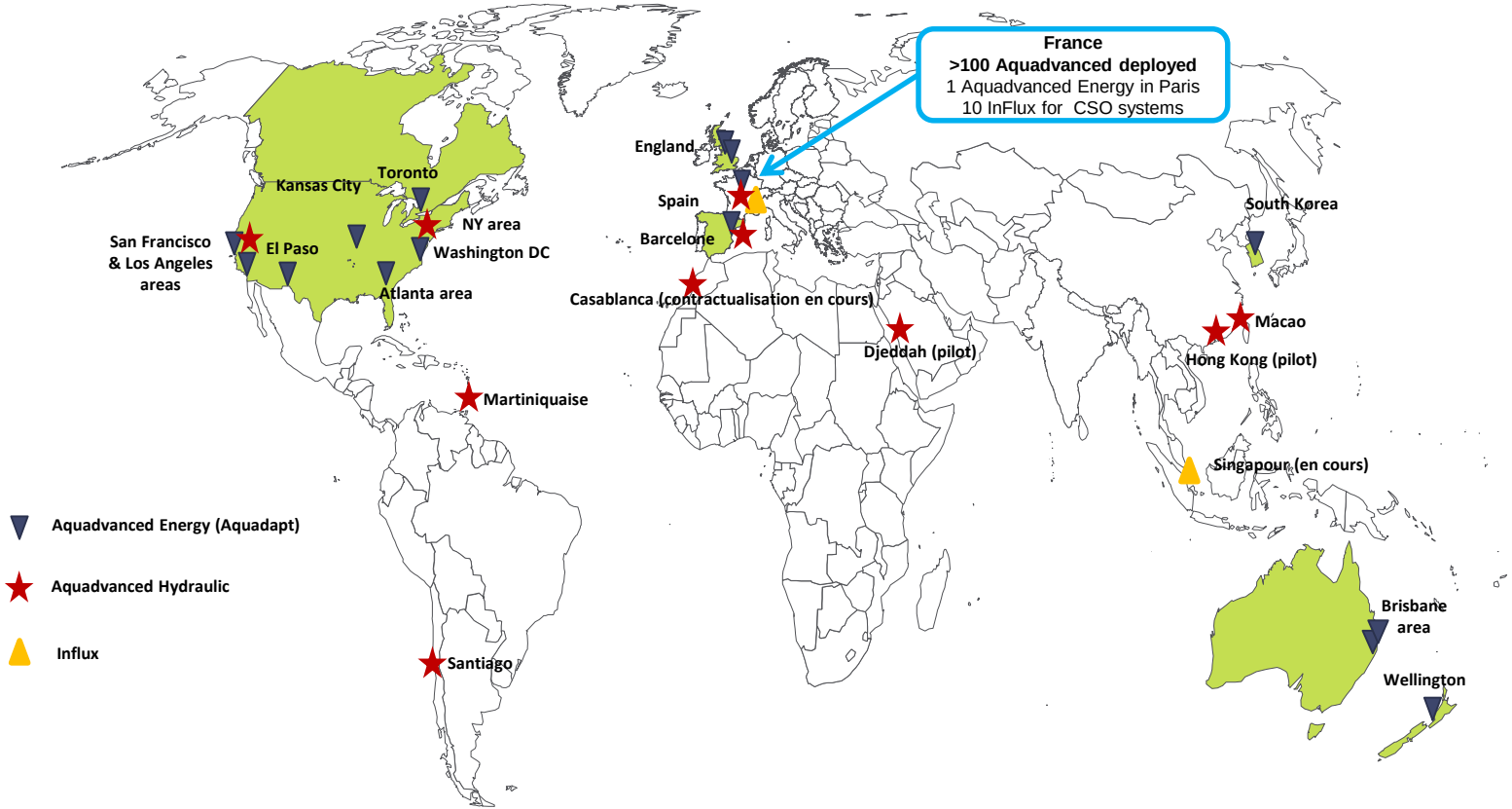
Dashboard / KPIs

Geographical display

Demonstration

International Deployment of Smart Water Solutions

Aquadvanced Water & Energy



Network Monitoring / Management
Benefits based on our experiences

Why should I monitor my distribution system?

- **Leakage reductions up to 30%,**
- **Burst reductions up to 40%**
- **Energy savings of up to 20%**
- **Return of investment between 1 to 3 years**
  - Considering costs savings, despite the impact on water sales
  - In the long term, the network longevity is extended 5 to 10 years

What should I monitor and control?

FLOW

- Zone demand
- Consumption
- Water loss

PRESSURE

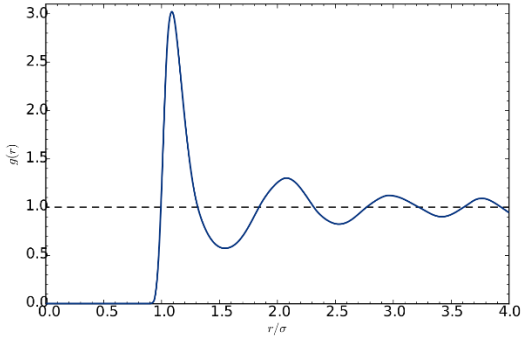
- Customer service
- Water Loss
- Breaks

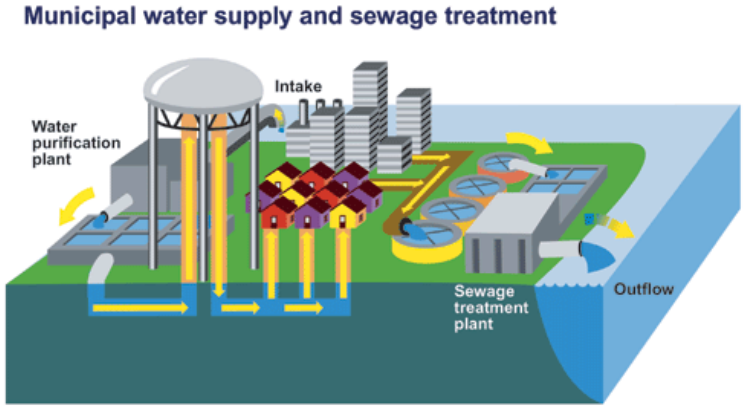
ENERGY

- Spend
- Efficiency

WATER QUALITY

- Residual
- THM
- Contaminants





Data logging/telemetry

Battery powered

Pressure

Hydrant installatio n

Flo W

transLogger

Pressure + Others

Integrated pressure + external A/D inputs

Water Quality + Others

Cl, pH, [illegible] pressure/level

External power (plug)

Mixers, TRS

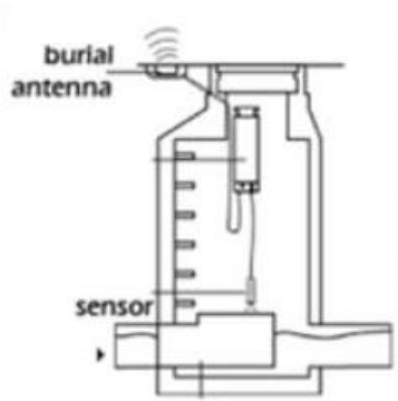
Multi-purpose

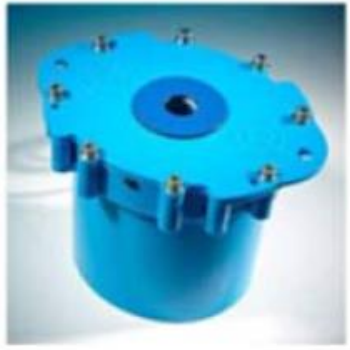
Wells

Pressure sensor/logger

- Data logger

  Dimensions: 4.92” x 4.53” x 4.13”
- GPRS, SMS capacity
- Up to 300 psi





Real and Apparent Losses

Water Loss = Non Revenue Water = Apparent + Real Losses

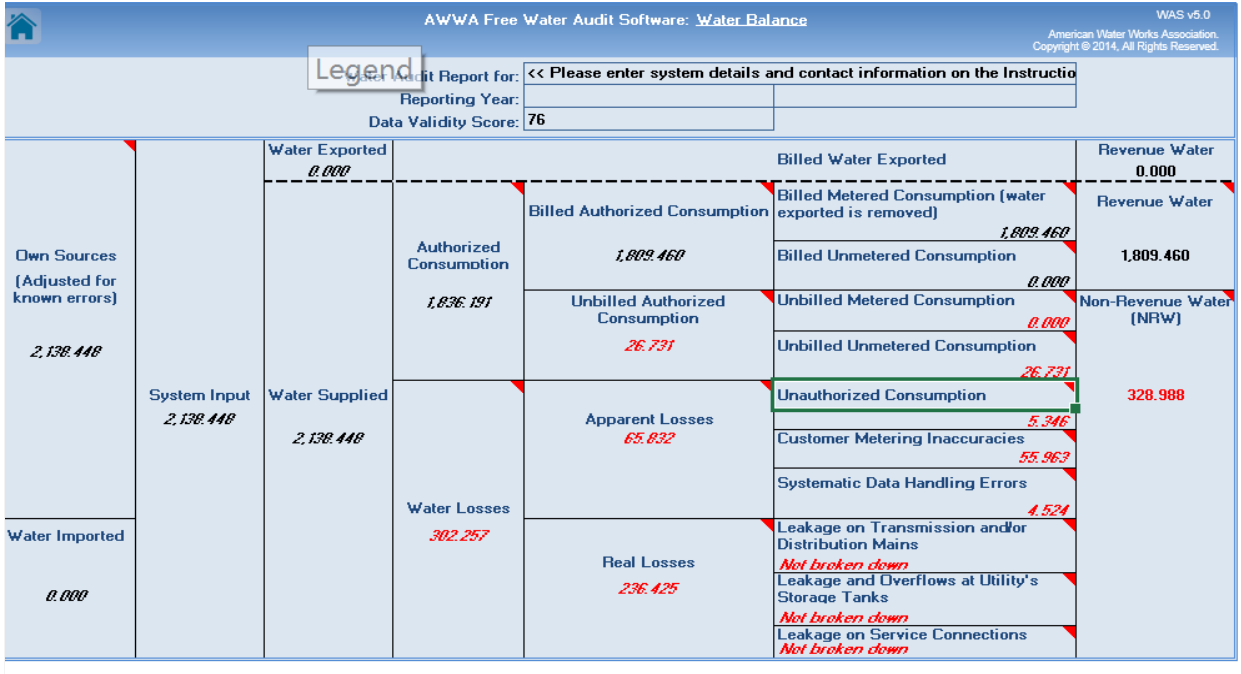
Apparent Loss

- Meter inaccuracy
- Unauthorized consumption
- Data handling errors
- Reducing apparent losses **increases revenue**

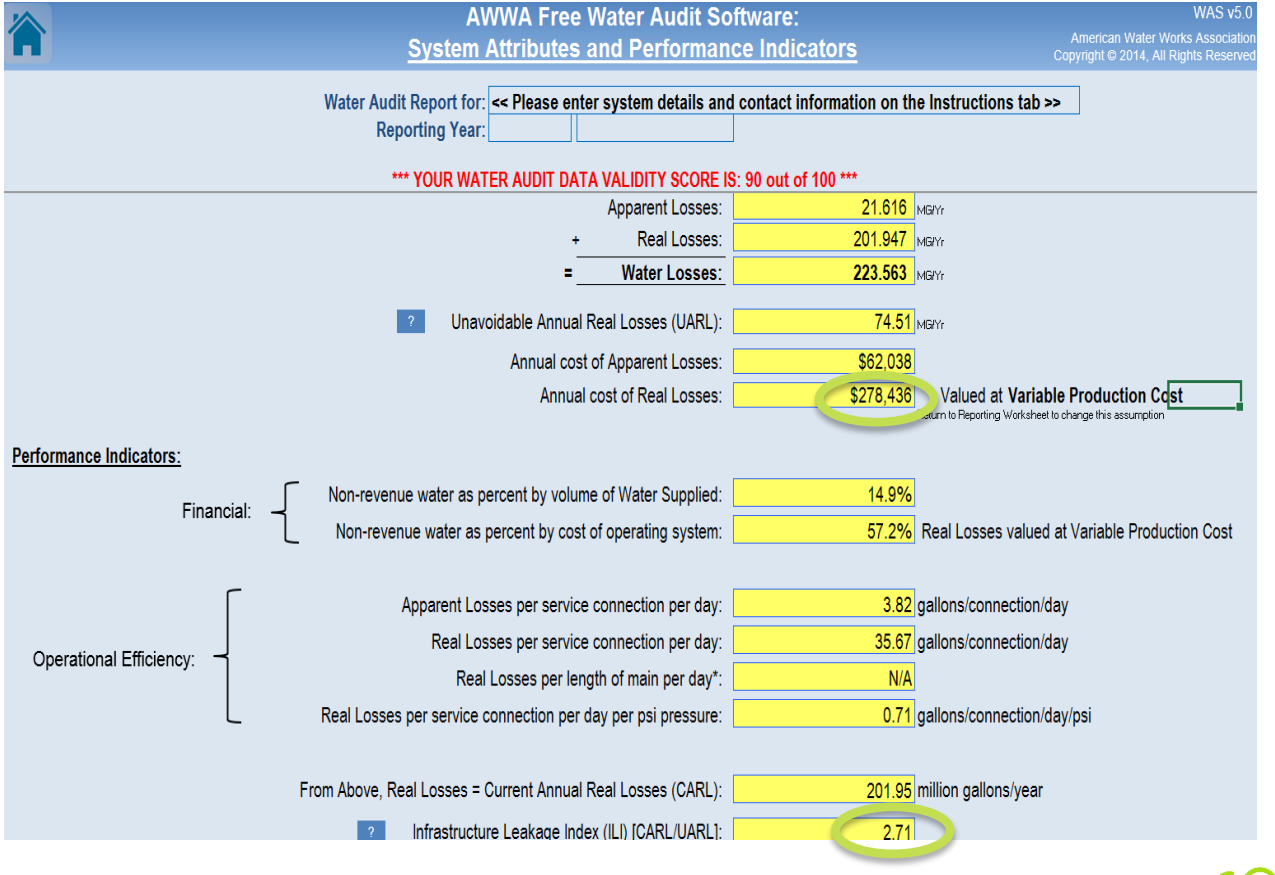
Real Loss

- Leaks
- Reducing real losses **recovers water**
  - Reduces production / purchased water costs
  - Reduced **energy** spend

Water Balance AWWA Free Audit Software



Performance Indicators



AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0

Water Audit Report for: << Please enter system details and contact information on the Instructions tab >>
Reporting Year:

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 90 out of 100 ***

Apparent Losses:	21.616	MG/Yr
+ Real Losses:	201.947	MG/Yr
= Water Losses:	223.563	MG/Yr
? Unavoidable Annual Real Losses (UARL):	74.51	MG/Yr
Annual cost of Apparent Losses:	$62,038	
Annual cost of Real Losses:	$278,436	Valued at Variable Production Cost

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:

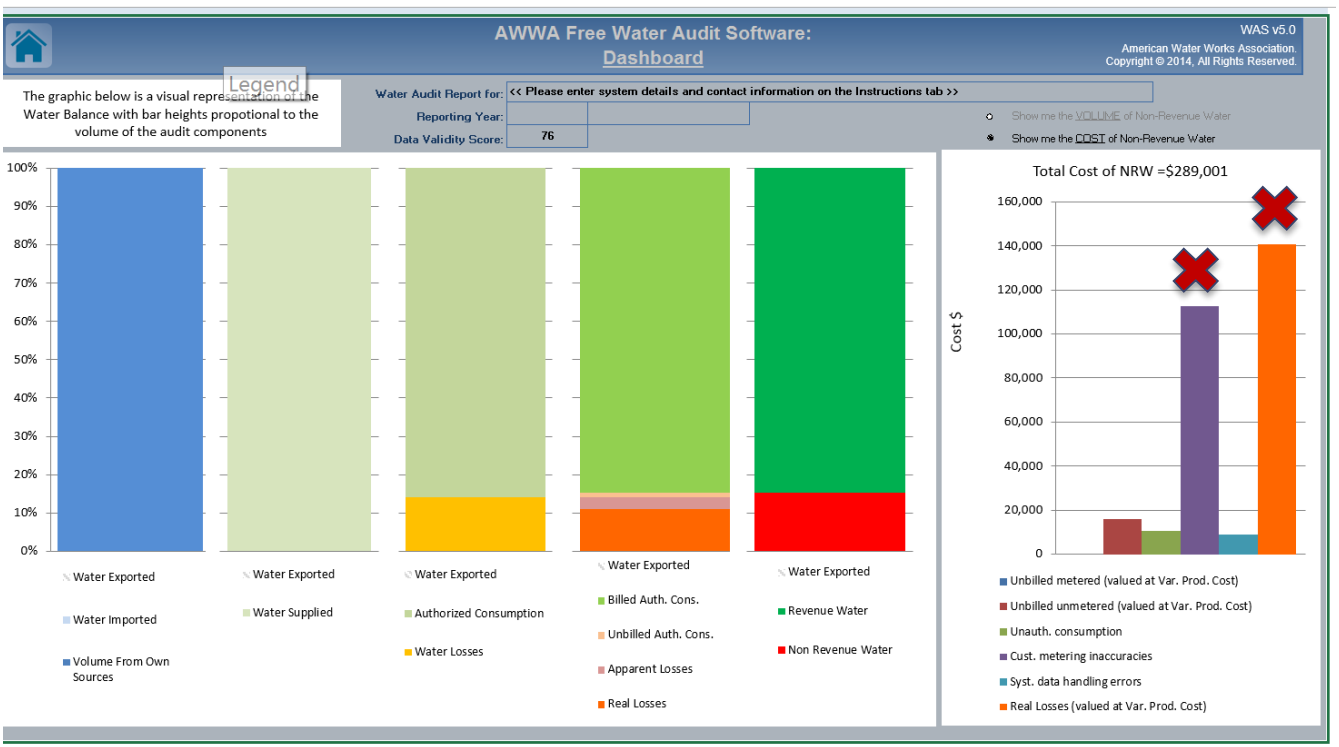
Non-revenue water as percent by volume of Water Supplied:	14.9%	
Non-revenue water as percent by cost of operating system:	57.2%	Real Losses valued at Variable Production Cost

Operational Efficiency:

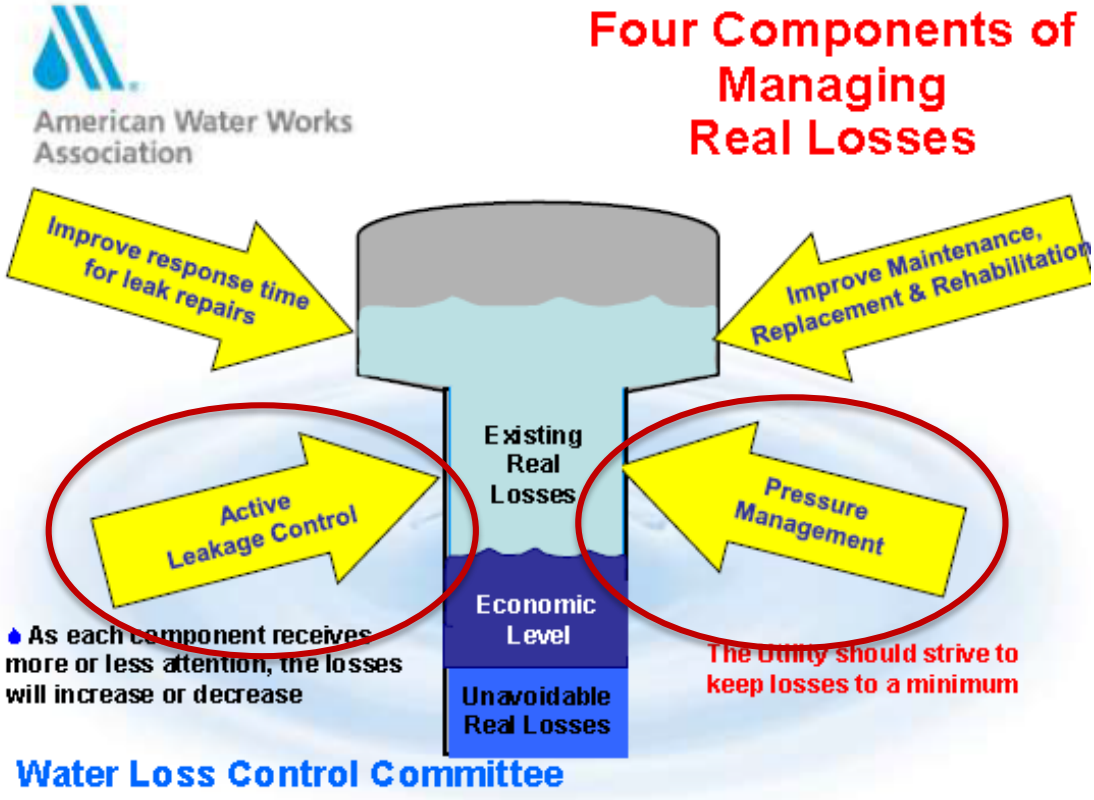
Apparent Losses per service connection per day:	3.82	gallons/connection/day
Real Losses per service connection per day:	35.67	gallons/connection/day
Real Losses per length of main per day*:	N/A	
Real Losses per service connection per day per psi pressure:	0.71	gallons/connection/day/psi

From Above, Real Losses = Current Annual Real Losses (CARL):	201.95	million gallons/year
? Infrastructure Leakage Index (ILI) [CARL/UARL]:	2.71	

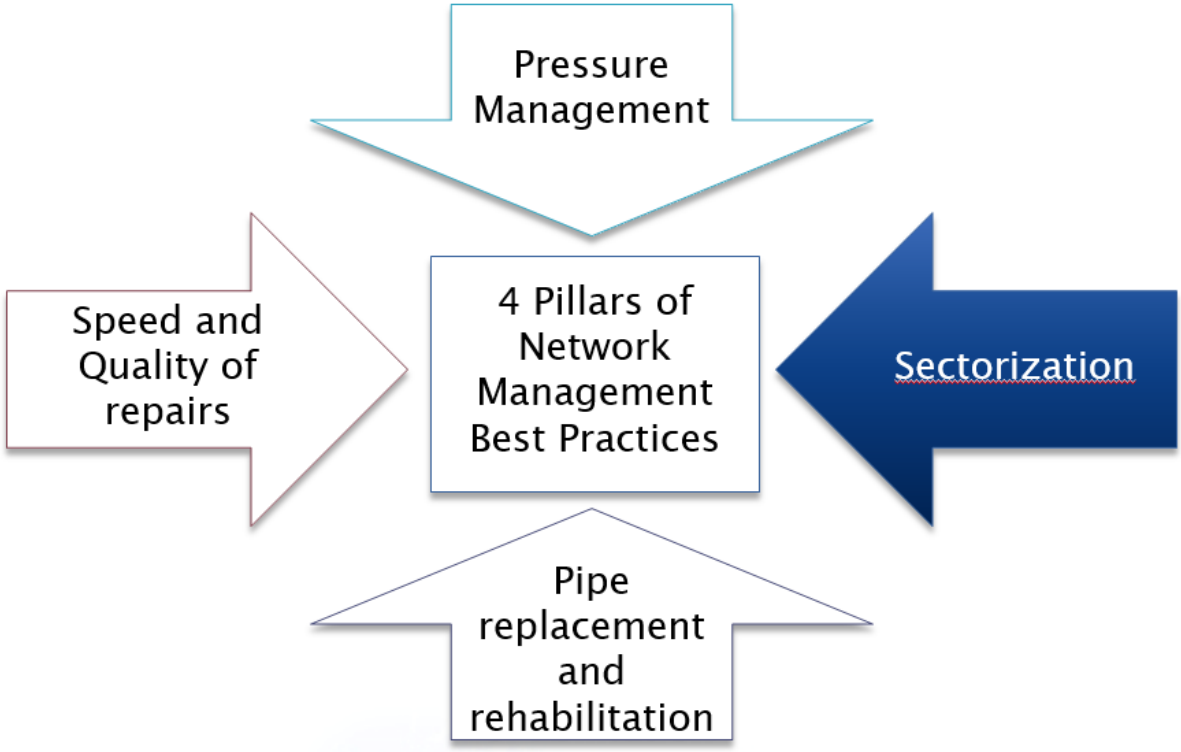
Water Audit Dashboard



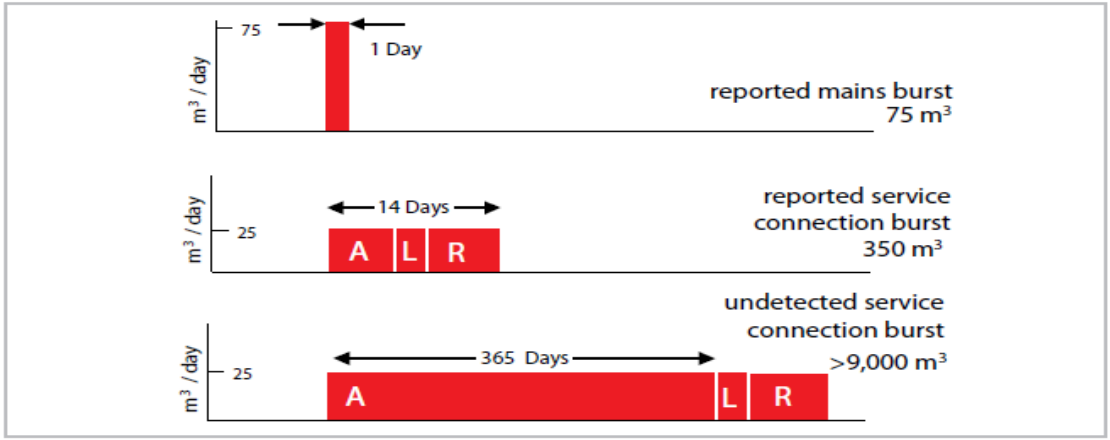
Real Loss Control Options – AWWA Standards

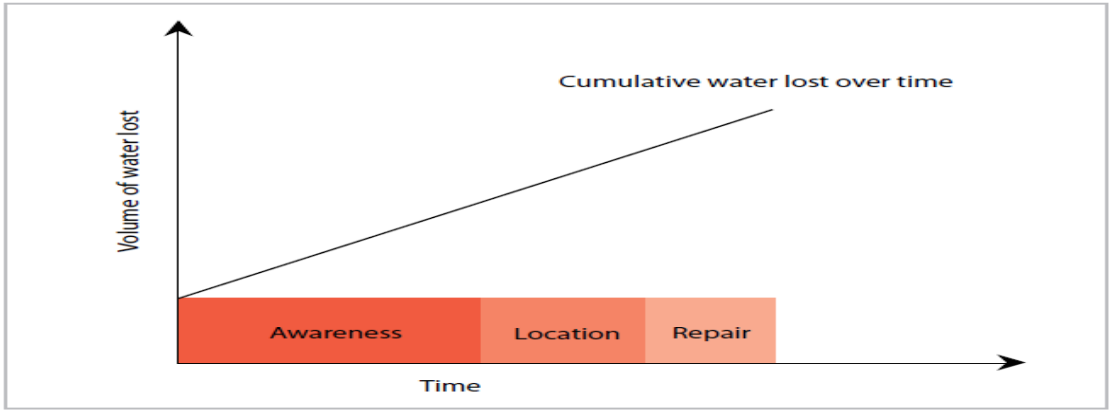


Best Practices - NRW



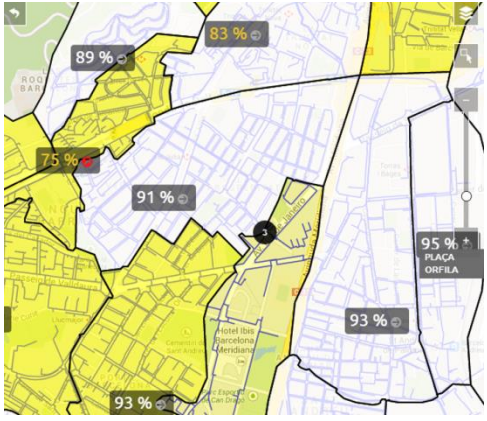
Awareness, Location & Repair (ALR)





Traditional Approach to DMA

DMA is one of the most recommended techniques to manage NRW in water distribution networks.

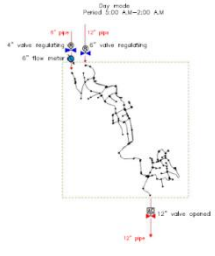


The Characteristics are:

- Small engineered isolated zones dividing the water distribution network.
- Limited number of Inlets and Outlets, controlled and monitored continuously.
- Estimation or real-time consumption data.

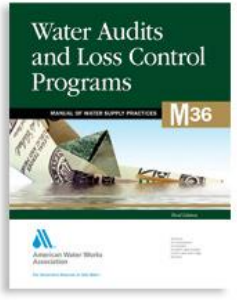
Objectives:

- Reduction of water losses (via data analyses to identify leaks and bursts)
- Monitoring and control of operational parameters
- Reduction in leakage run time



What challenges do we face when creating DMA's?

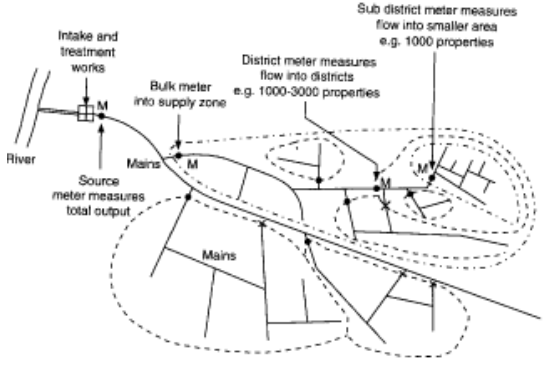
There is great complexity of *sectoring* dense water networks in order to obtain Minimum Night Flows for a quick detection of fresh leakage AND reduce ALR to 1 weeks time



TRADITION DMA SOLUTION

DMA. Static Sectoring

- Complex hydraulic / WQ studies and network modeling.
- High investment in order to close /create small areas leaving a single entry (enlarge pipe diameters).
- Risk of pressure variations modifying the standard water supply regime.
- Keeping water-tightness of the area.
- Low supply security in case of failure.
- Water quality problems (multiple dead-ends in the distribution system)



Best Practices for NRW

Awareness, Location & Repair

Efficiency (%)

$$100x(1 - \frac{NRW}{Total\ inflow})$$

WATER BALANCE

DMA NRW = Total DMA Inflow – Total DMA Consumption

DMA meters

Customer meters*

AMI

Hourly/Daily

AMR

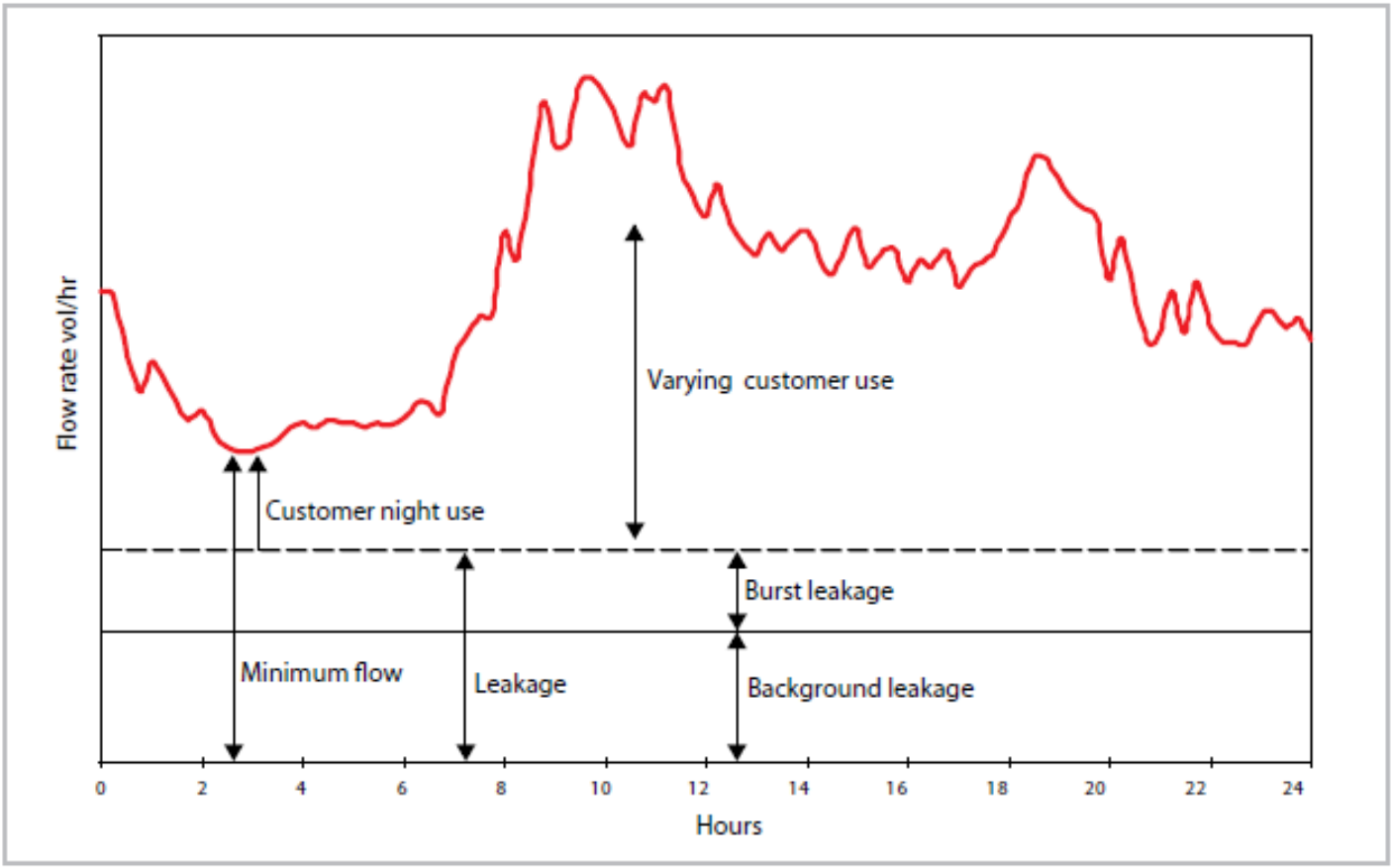
Monthly

Manual reading

2-3 months (billing)

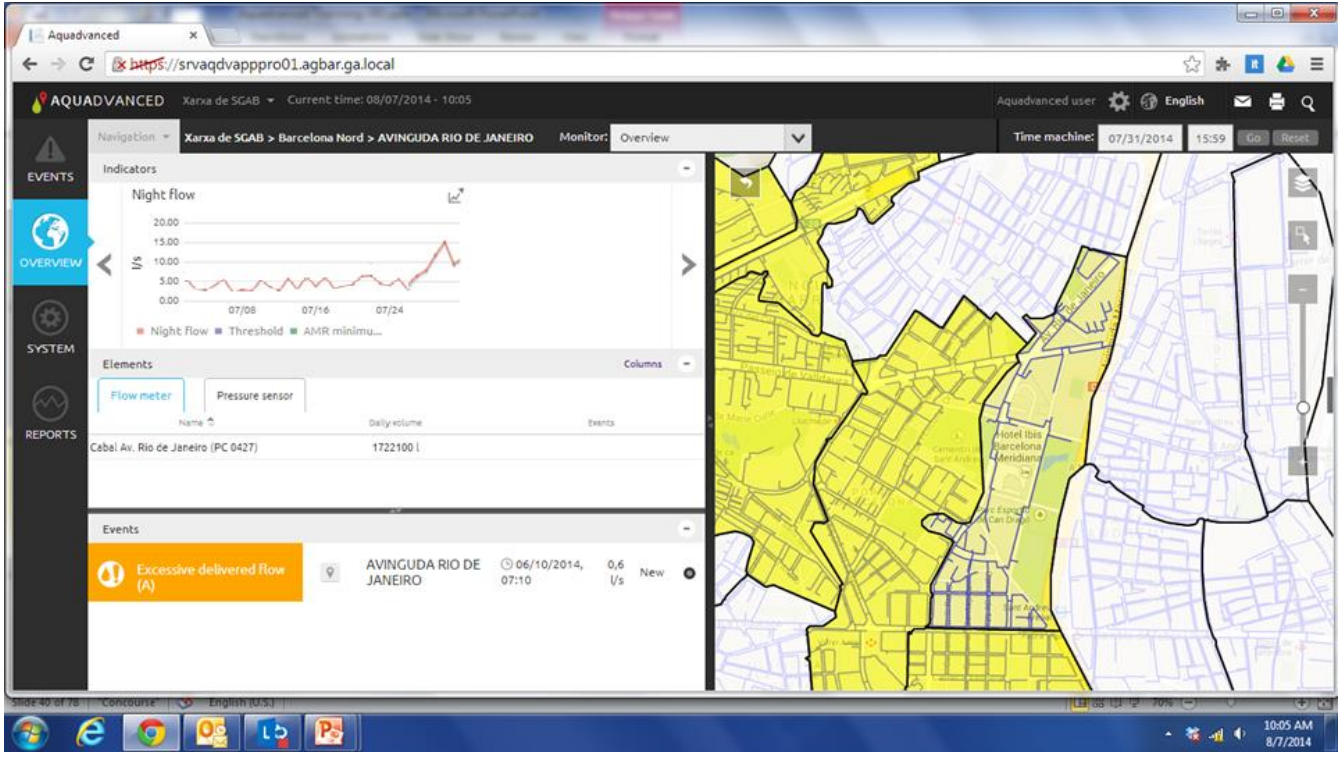
***Customer meter readings needs to be synchronized with production and zone metering**

Minimum Night Flow Analysis

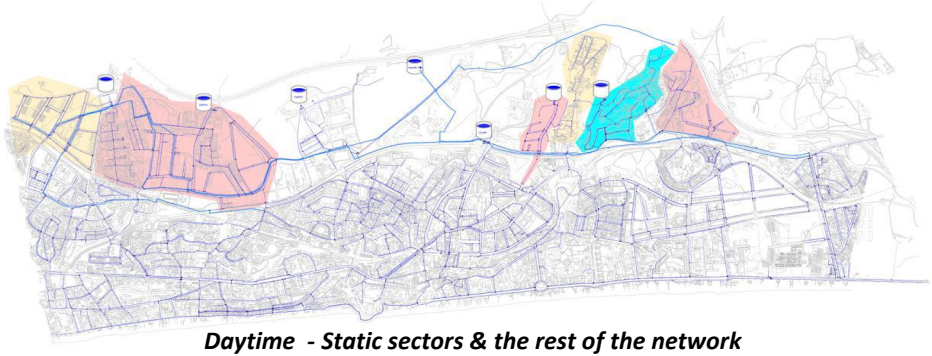


Minimum Night Flow analysis

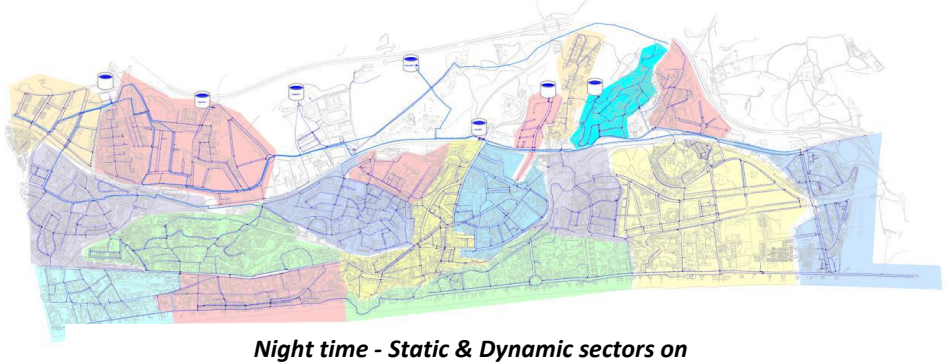
Minimum Night Flow analysis



Dynamic Sectorization – an Innovative Approach



Daytime - Static sectors & the rest of the network



Night time - Static & Dynamic sectors on

Off

On

Creating the Dynamic Zones

How Dynamic Sectorization works

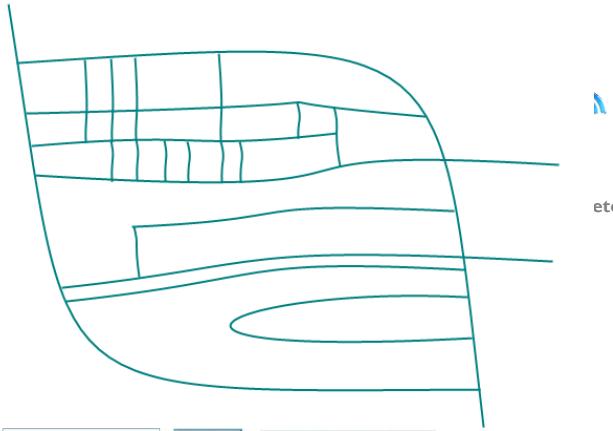
DS allows, in a cost-effective way, calculation and monitoring of the minimum night flows into small sectors with no modification of normal distribution conditions or water quality.

Water Inputs

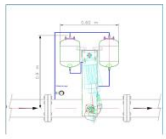
1am valves **close**

Minimum night flow measurement
Signals sent to *Aquadvanced*

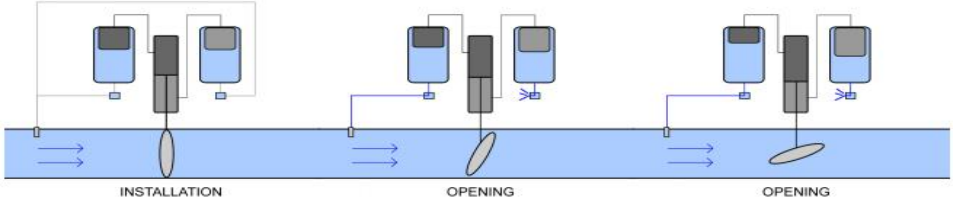
5am valves **open**



IWA Project Innovation Awards



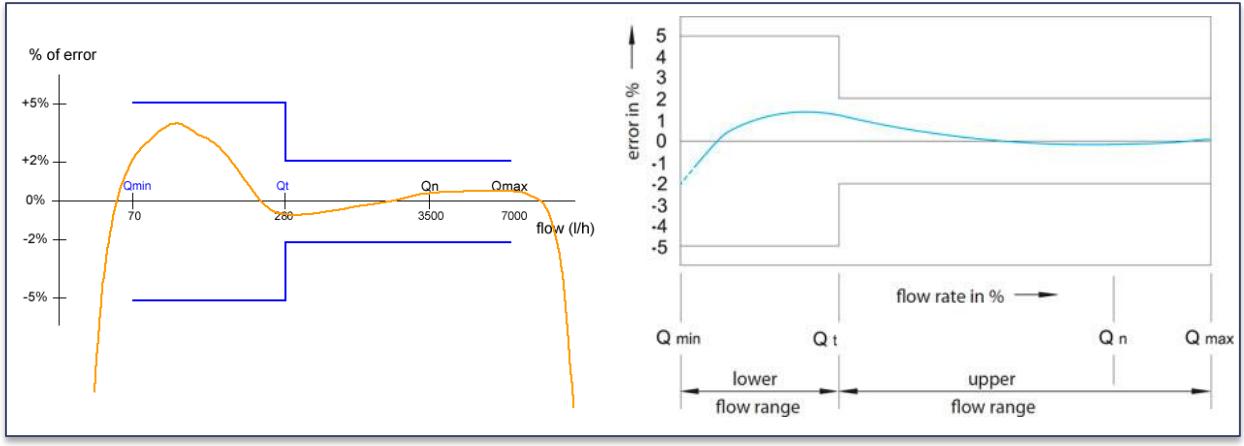
Hydraulic actuator



How the open/close actuator works

Open/close actuators for DMS

Flowmeter accuracy

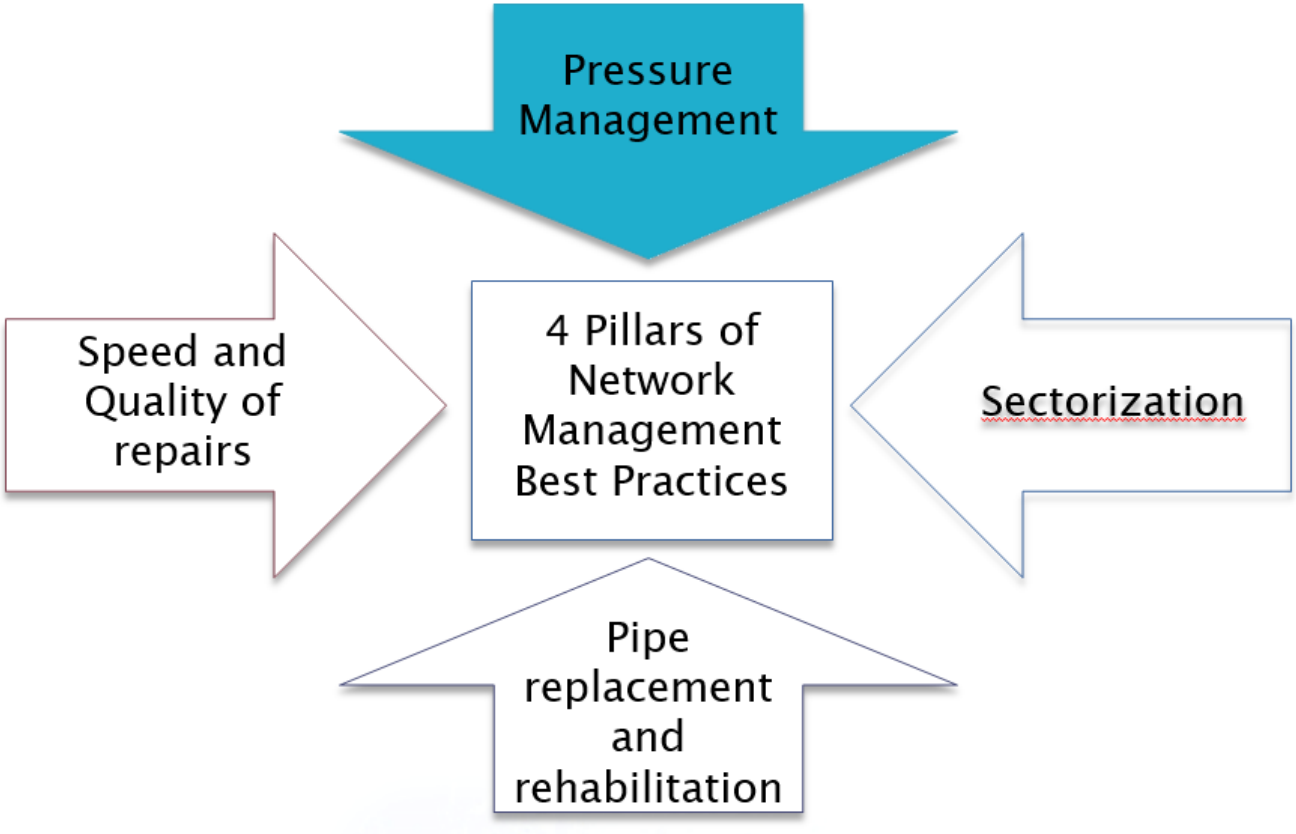


Typical accuracy curves for different type of flowmeters

Equipment/Method	Approximate Accuracy Range
Electromagnetic Flow Meters	<0.15 -0.5%
Ultrasonic Flow Meters	0.5 - 1%
Insertion Meters	<2%
Mechanical Meters	1.0 - 2%
Venturi Meter	0.5 - 3%
Meas. Weirs in open channels	10 - 50%
Volume calculated with pump curves	10 - 50%

Note: Actual meter accuracy will depend on many factors (like flow profile, calibration, meter installation, maintenance) and has to be verified case by case

Best Practices - NRW



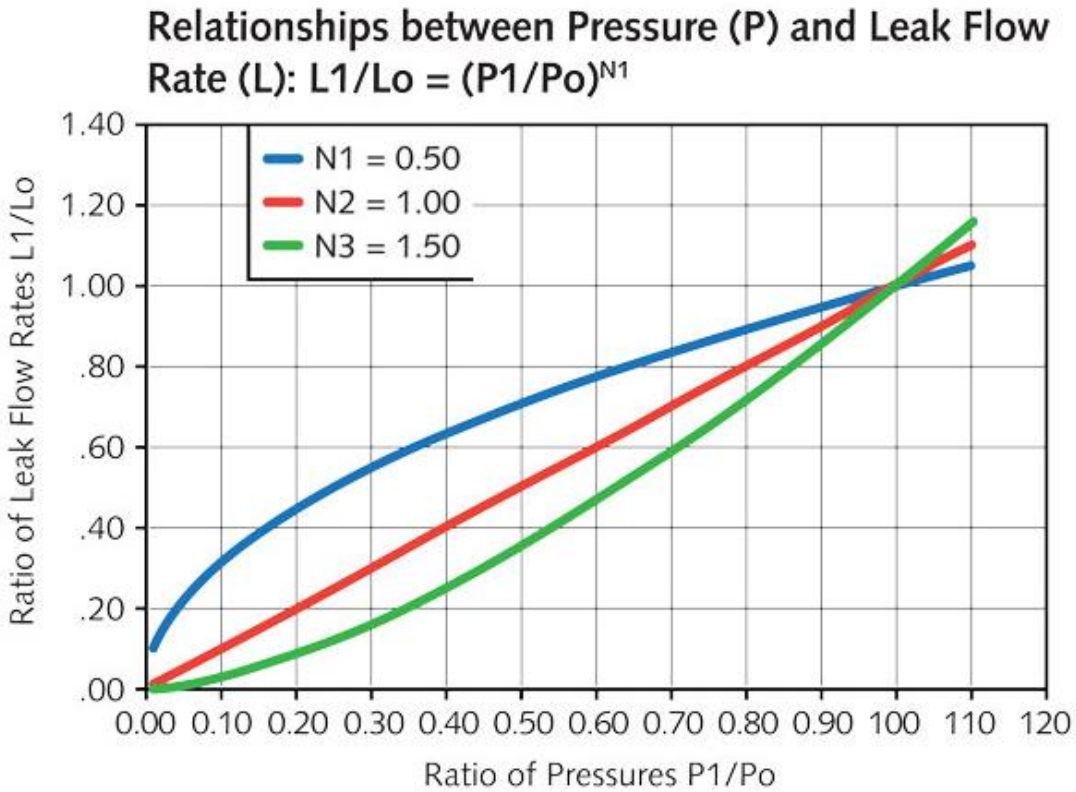
Pressure effects

High pressure
- Main breaks
- High water loss
- Energy consumption

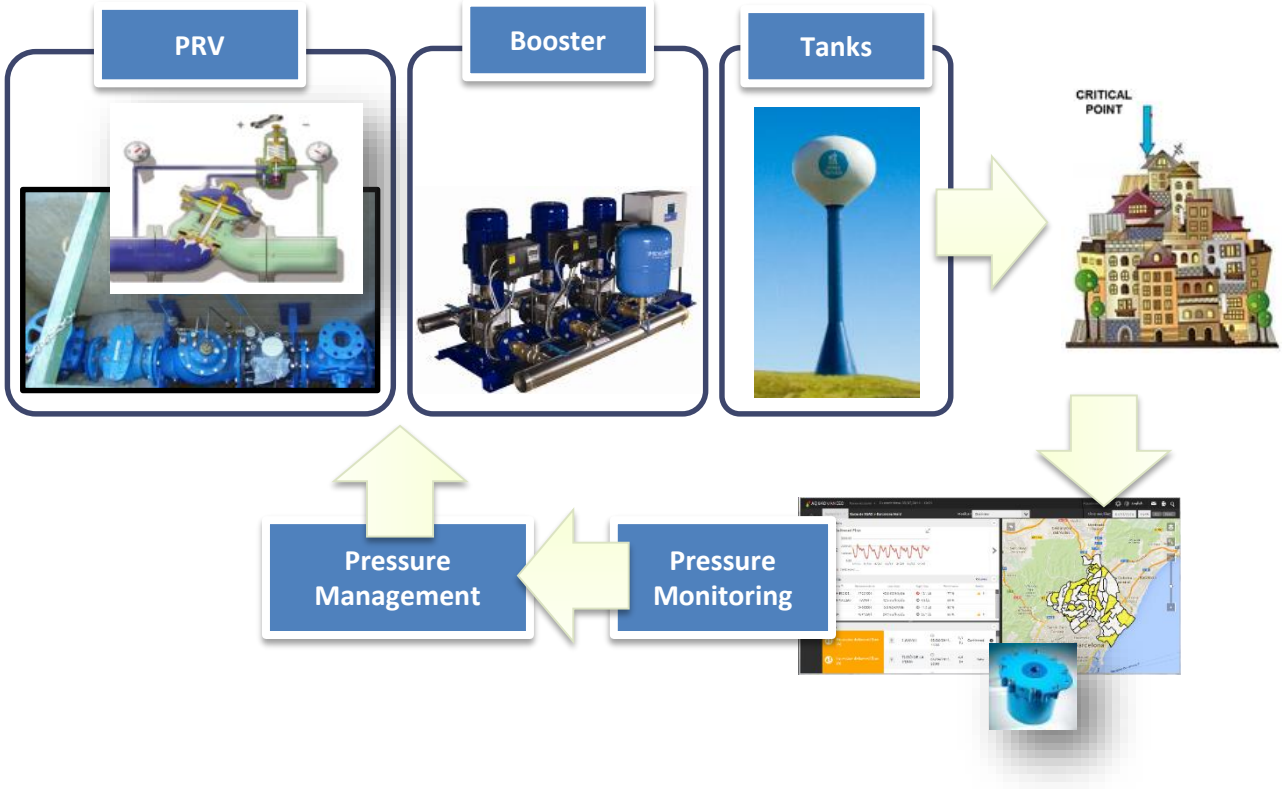
Low pressure
- Poor service in some areas
- Customer complaints
- Fire emergencies
- Water quality

Regulatory Violations

Pressure Management



Pressure Management



Pressure Management Benefits

Pressure Management Reduction of Excess Average and Maximum Pressures								
Conservation Benefits			Water Utility Benefits				Customer Benefits	
Reduced Flow Rates			Reduced Frequency of Bursts and Leaks					
Reduced Excess or Unwanted Consumption	Reduced Flow Rates of Leaks and Bursts	Reduced and More efficient Use of Energy	Reduced Repair and Reinstatement Costs, Mains & Services	Reduced Liability Costs and Reduced bad publicity	Deferred Renewals and Extended Asset Life	Reduced Cost of Active Leakage Control	Fewer Customer Complaints	Fewer Problems on Customer Plumbing & Appliances

San Jose Water Company

Over one million customers
2400 miles of pipe
23 well fields with almost 100 wells
Two Water Treatment plants
14 Imported Water Turnouts
98 storage tanks and reservoirs
140 Distribution system sample taps

Best Practices for NRW
Pressure Management

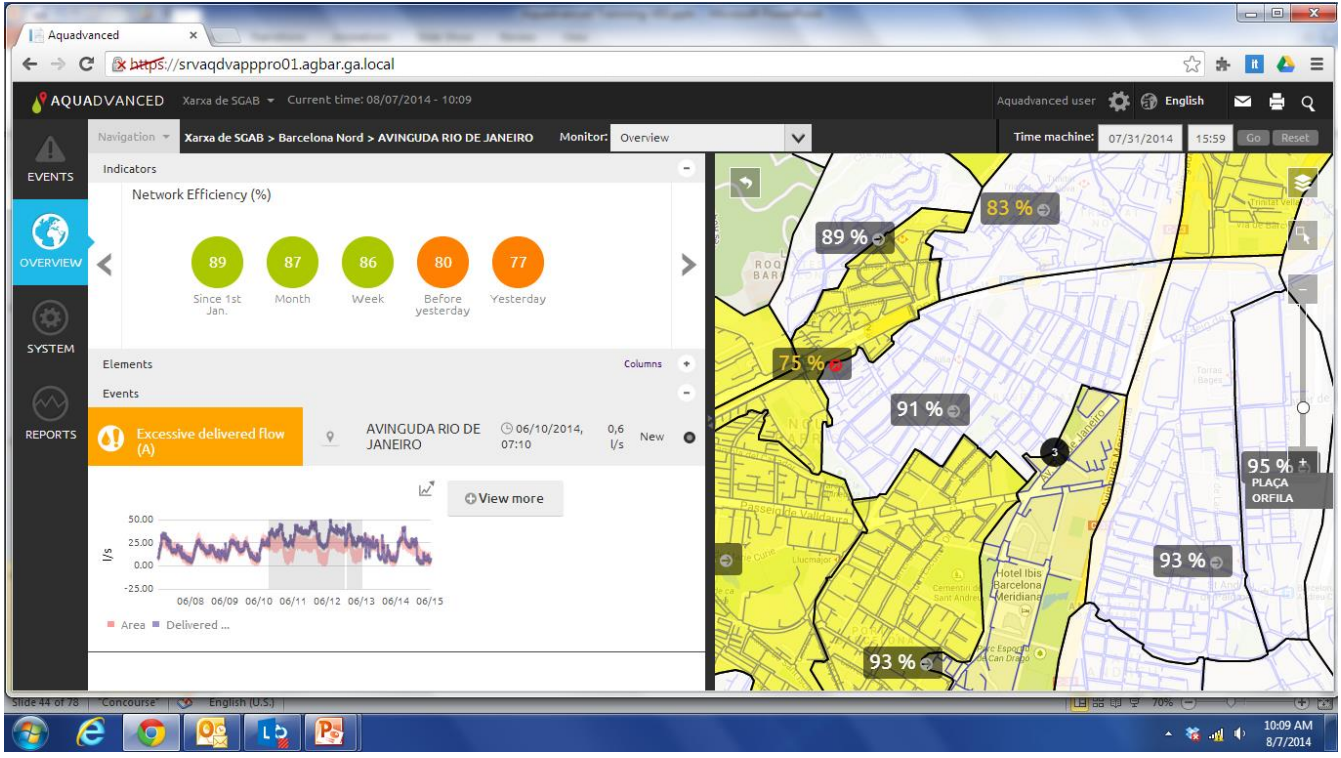
Partnership for Safe Water

Distribution system optimization (DSOP) to go beyond regulatory requirements

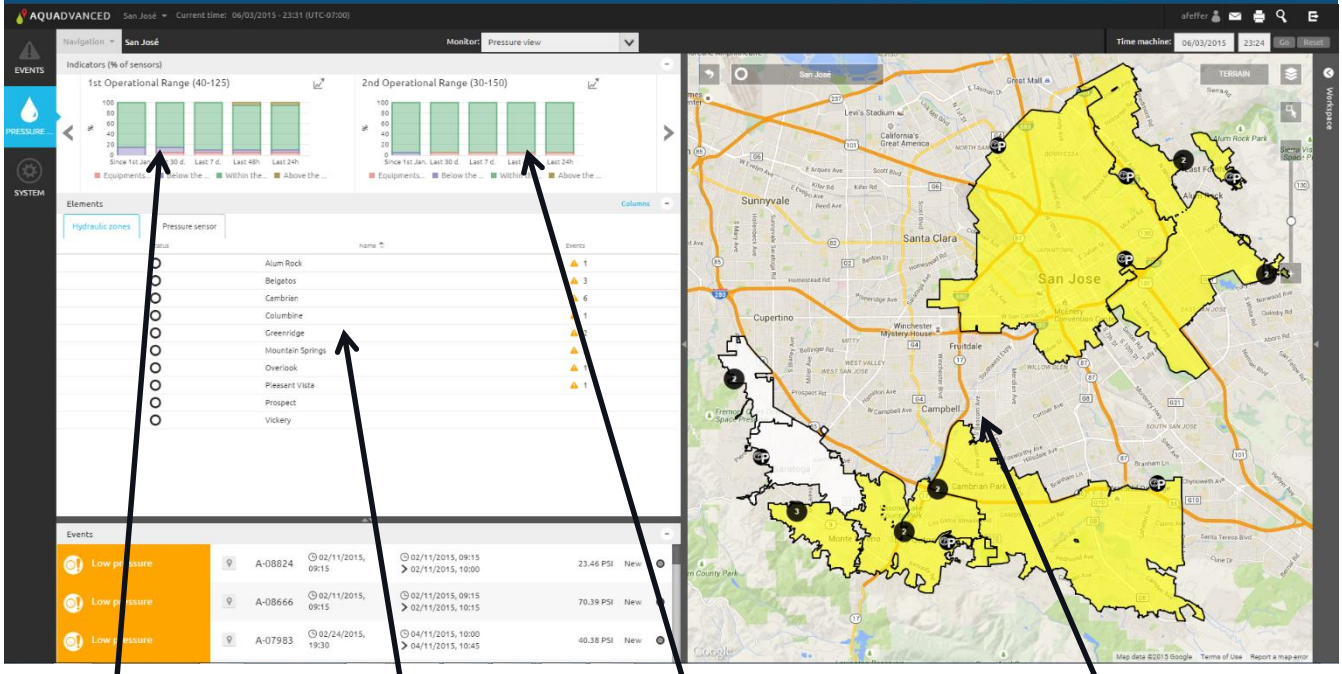
- **Disinfectant residual (>95% of meas.)**
  - Free Chlorine: ≥ 0.20 and ≤ 4.0 mg/L
  - Total Chlorine: ≥ 0.50 and ≤ 4.0 mg/L
  - Chlorine Dioxide: ≥ 0.20 and ≤ 0.80 mg/L
  - No consecutive residual measurements outside target concentrations at optimized routine sample locations
  - DBPs within regulatory requirements
- **Main break frequency**
  - ≤ 15/100 miles of pipe/year (for reported leaks and breaks in utility-controlled distribution and transmission piping)
  - Or declining 5-year main break frequency trend demonstrating progress towards optimization
- **Pressure management**
  - Continuous pressure monitors at high and low pressure sites within each pressure zone
  - Minimum Pressure (≥ 99.5% of meas.)
    - Pressure: ≥20 psi for daily minimum
  - Maximum pressure (≥ 95% of meas.)
    - Does not exceed utility specified maximum
  - Pressure fluctuations (≥ 95% of meas.)
    - Does not exceed range specified by utility

American Water Works Association
The Authoritative Resource on Safe Water®

Performance Management



Events Detection & Alarms



GO 103 operational range compliance

Active Events per zone

PHD and MHD range compliance

Map View of installed sensors

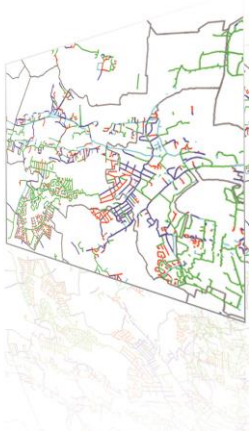
AquaAdvanced Portal

Why Network Monitoring

- **Unacceptable levels of water loss**
- **High cost of water (energy)**
  - Production
  - Distribution
  - Purchase from wholesaler / wheeling
- **Frequent main breaks**
  - Extend the life of the assets
- **Pressure variances in the system (high or low)**
  - Pressure complaints
- **Wanting to improve operational knowledge of the water system**
- **Reporting**

AQUADVANCED Energy

An innovative solution to support water distribution operation



Energy Management

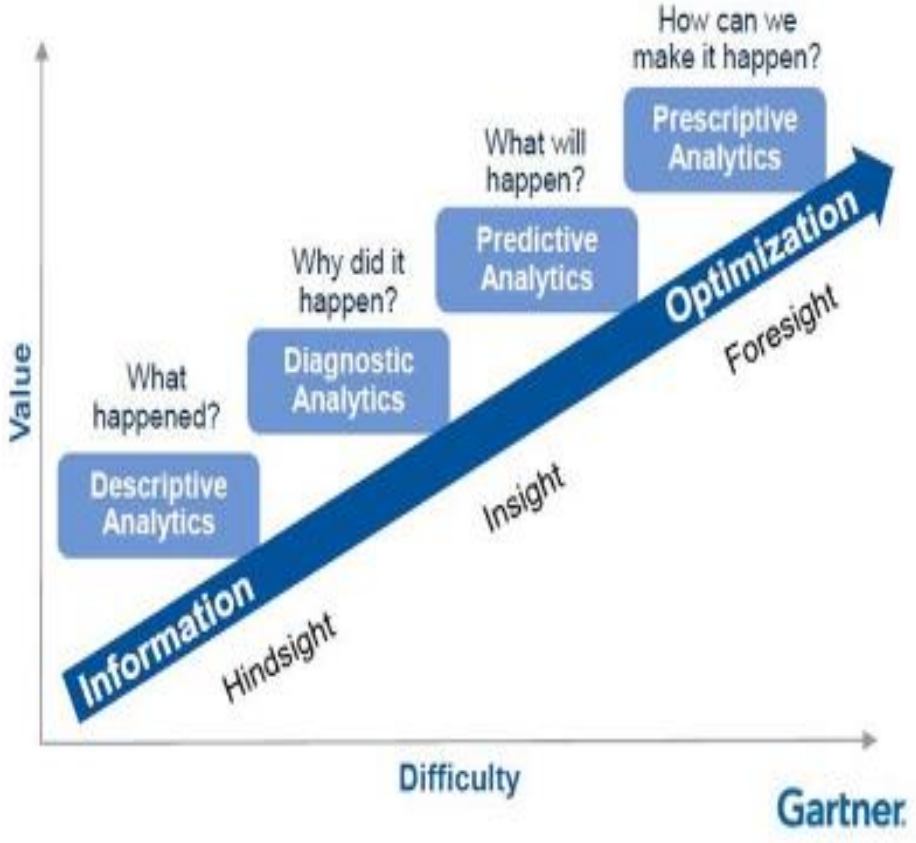
Water Management

PREDICTIVE ANALYTICS

Increased value from information insight to foresight and optimization

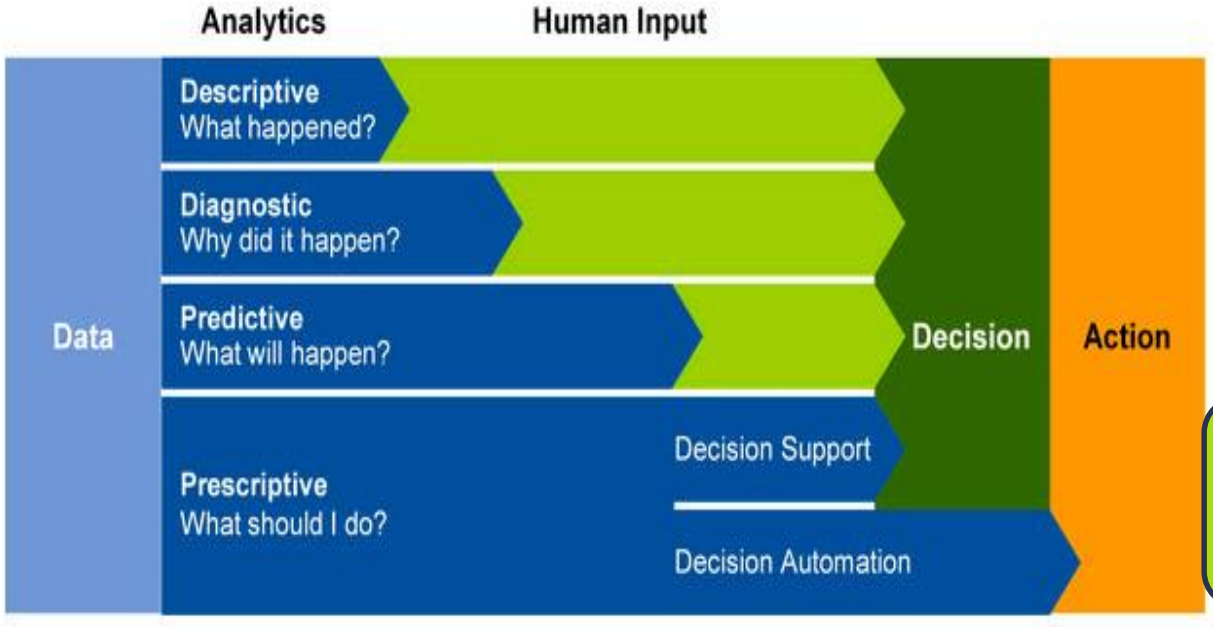
Predictive Analytics describes an approach to data mining with four key attributes:

- An emphasis on prediction (rather than description)
- Rapid data analysis (within hours not months)
- Using better insight for relevant business decisions
- Targeting ease of use (for business operators)



PREDICTIVE ANALYTICS for Energy Management

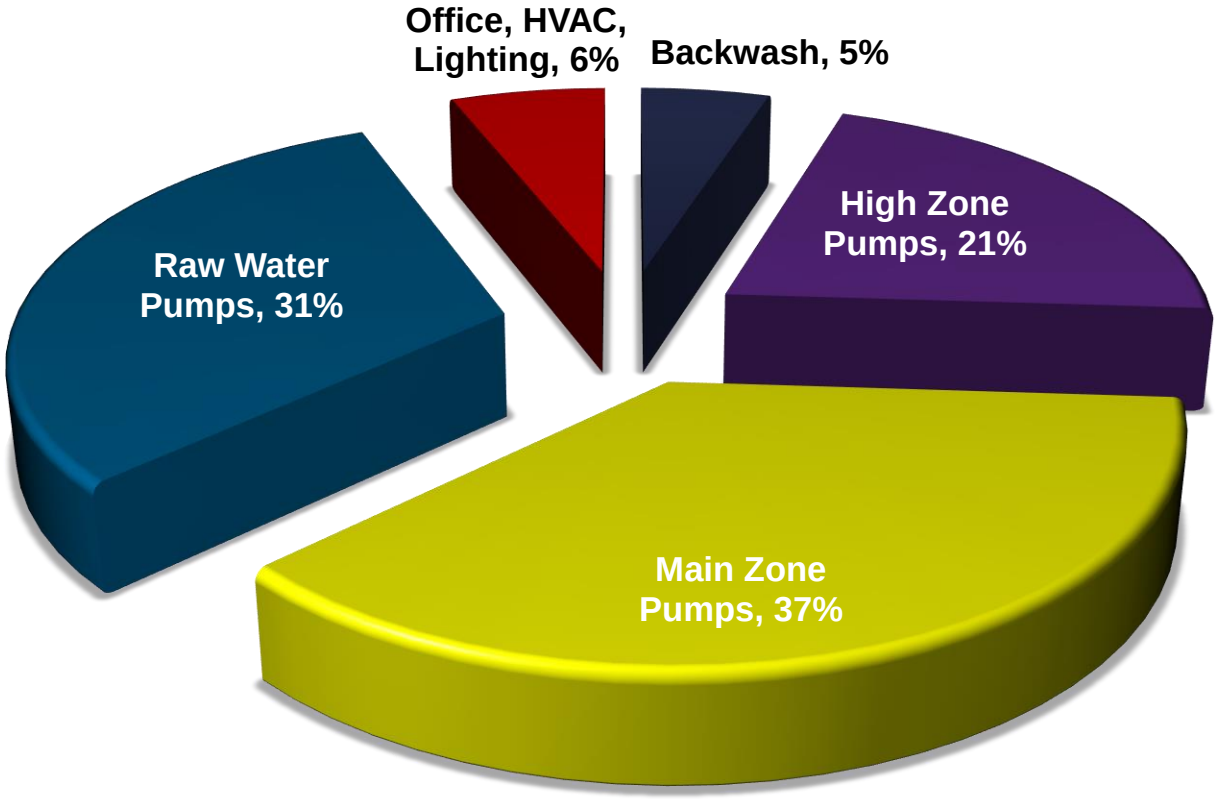
Moving from monitoring to forecasting to optimization



Source: Gartner (October 2014)

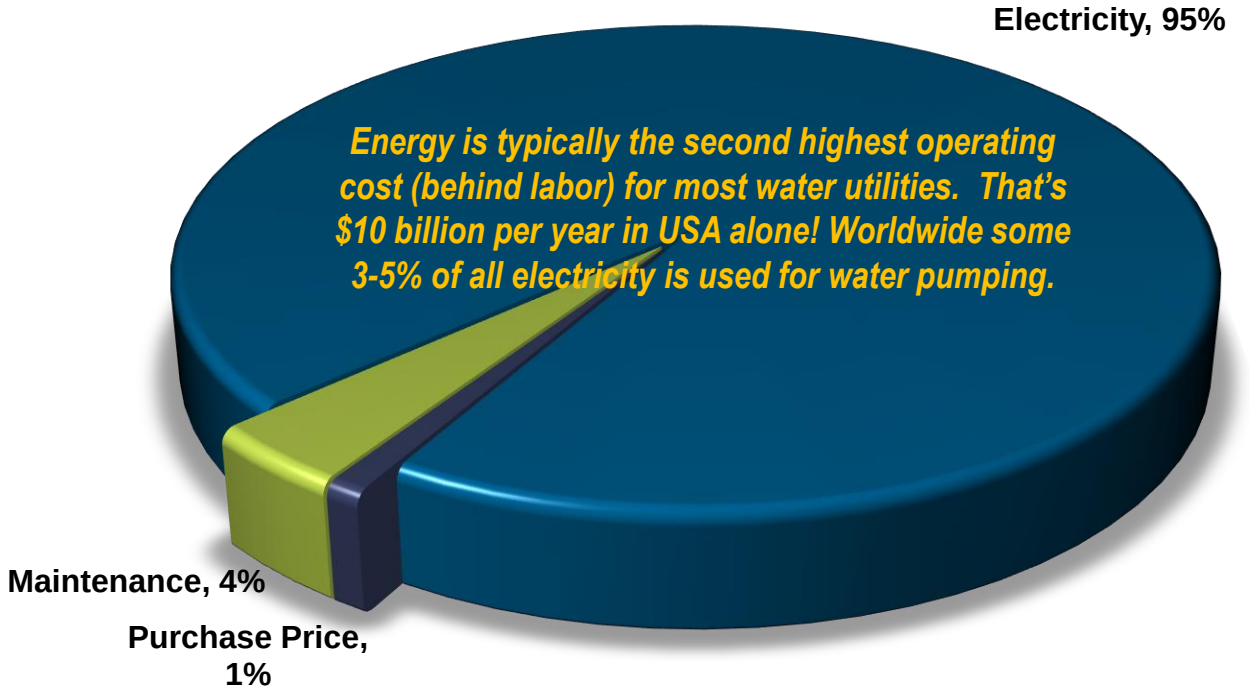
Water Utility Energy Consumption

Pumping is the dominant energy expenditure in a drinking water system



KEY ISSUE – Pump Life Cycle Cost

Pump capital and maintenance costs are dwarfed by operating costs



Main Components of Energy (Cost) Management

Energy use and cost reduction needs to consider a number of elements

Electrical Load Shifting

Operate pumps on electric tariff profile to maximise utilisation of low cost energy

System-wide Efficiency Improvement

Minimise energy consumption to deliver the same volume of water

Production Source Optimisation

Maximise use of lowest cost sources of water (production and chemical cost)

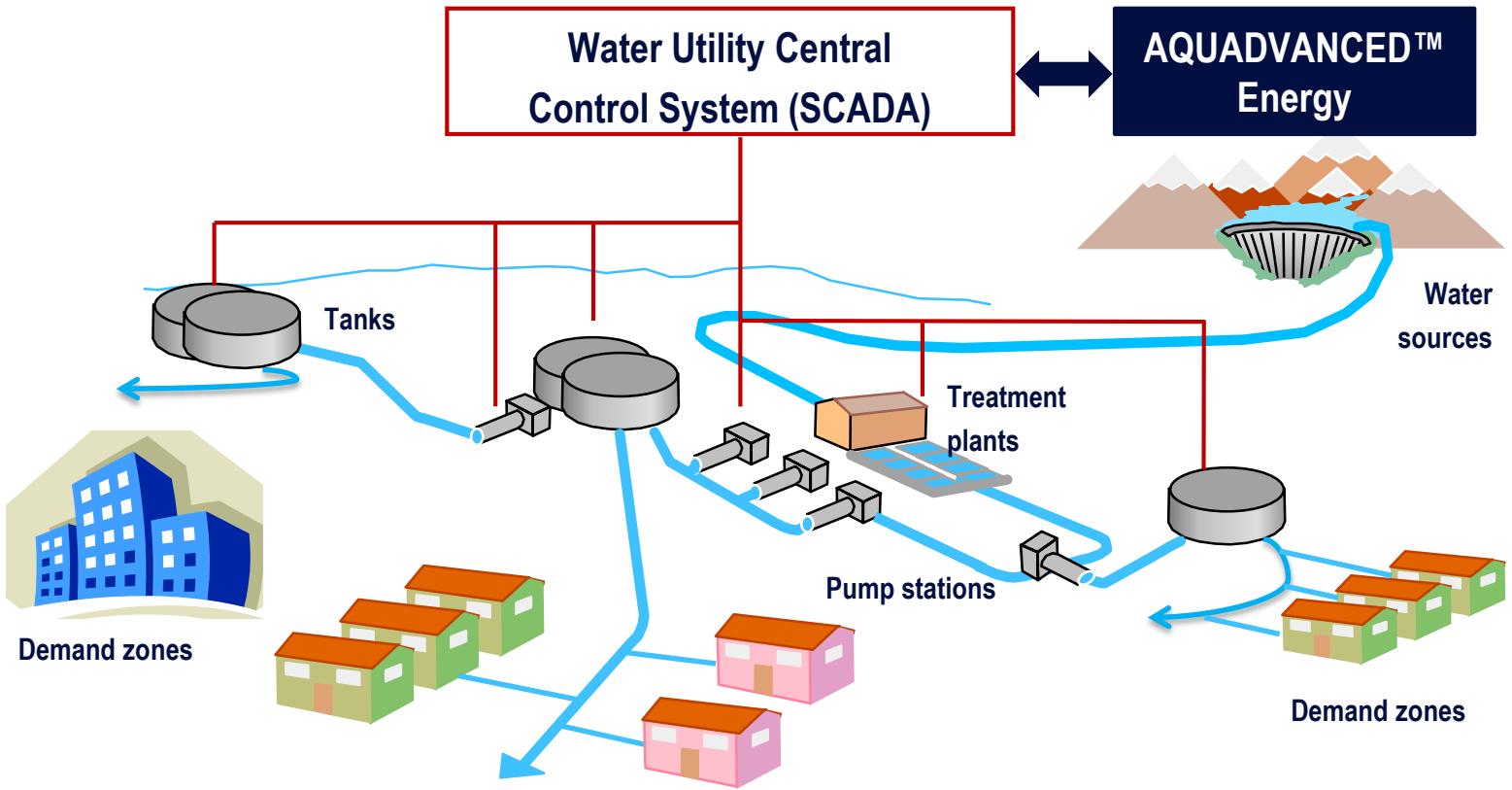
Water Transportation Paths

Use of most efficient path from source to customer

KW Demand Charge Management

Operate within the limits and reduce electricity peak kW demand

AQUADVANCED™ Energy: Overview



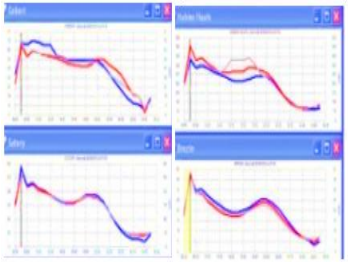
AQUADVANCED™ Energy: How does it work?

1 DATA ACQUISITION, ANALYSIS AND FUTURE PREDICTION

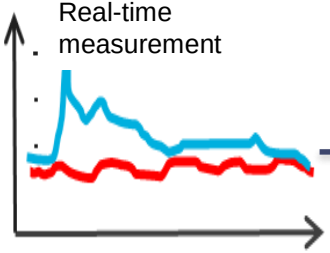
2 REAL-TIME MODELLING AND OPTIMISATION

3 AUTOMATED PUMP AND VALVE CONTROL

Demand prediction

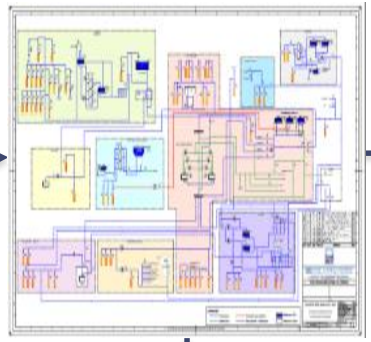


Real-time measurement

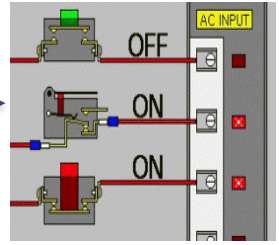


Calculation of optimised control strategies

Confirm safe operation with a real-time hydraulic model

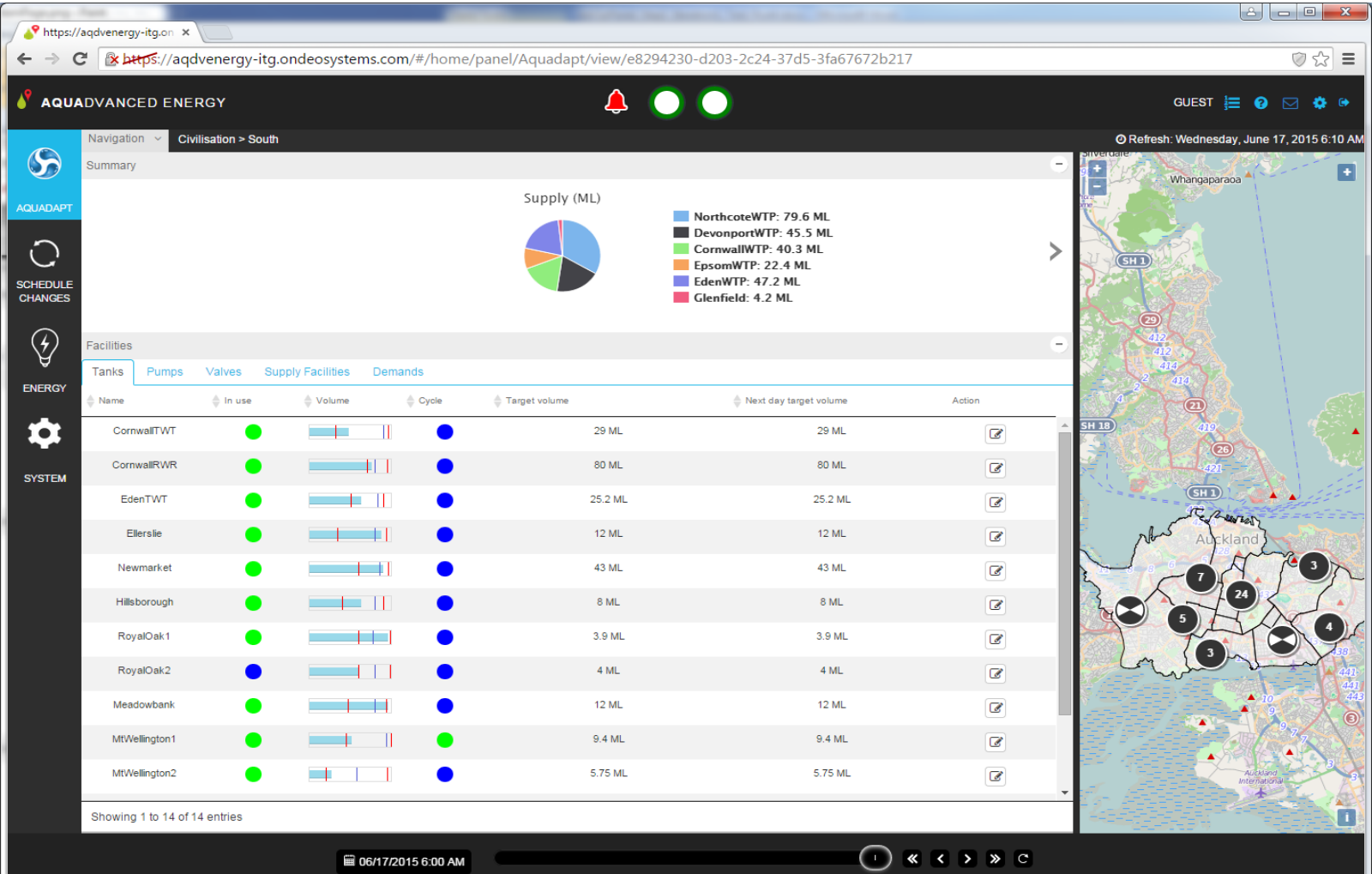


Send commands and set-points via SCADA to pumps and valves

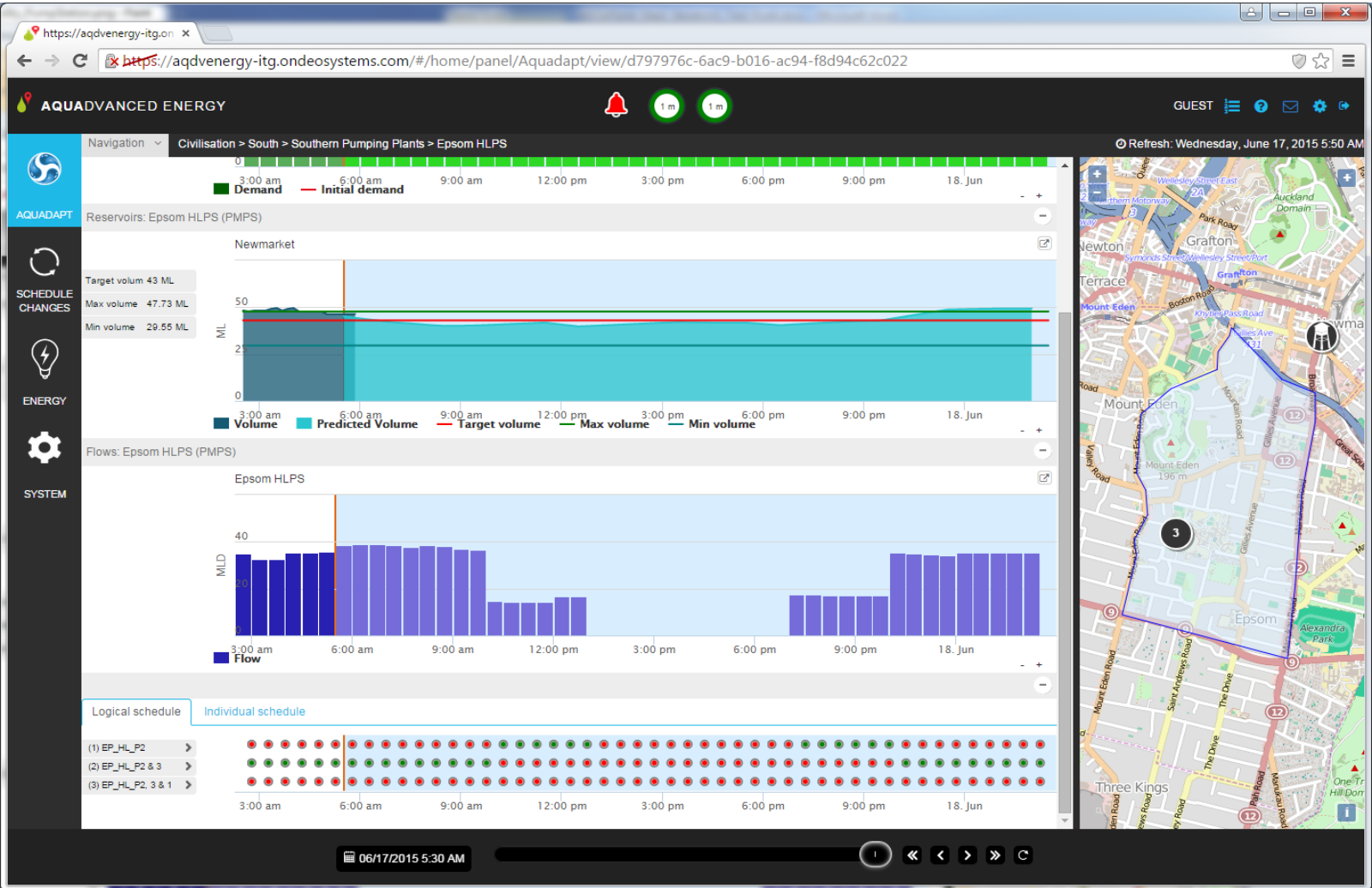


Seek better solution if required

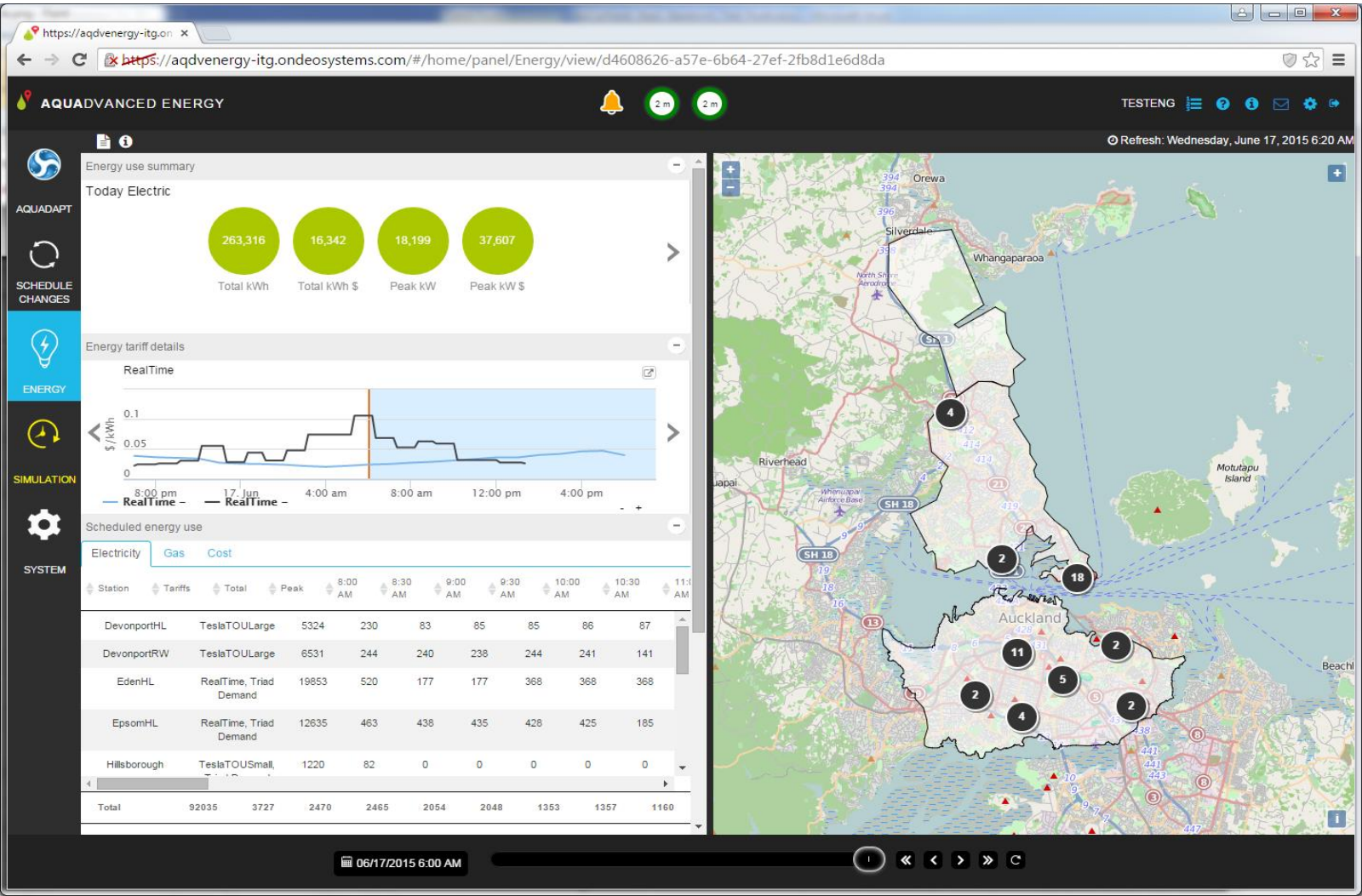
AQUADVANCED™ Energy - Operator Interface Summary



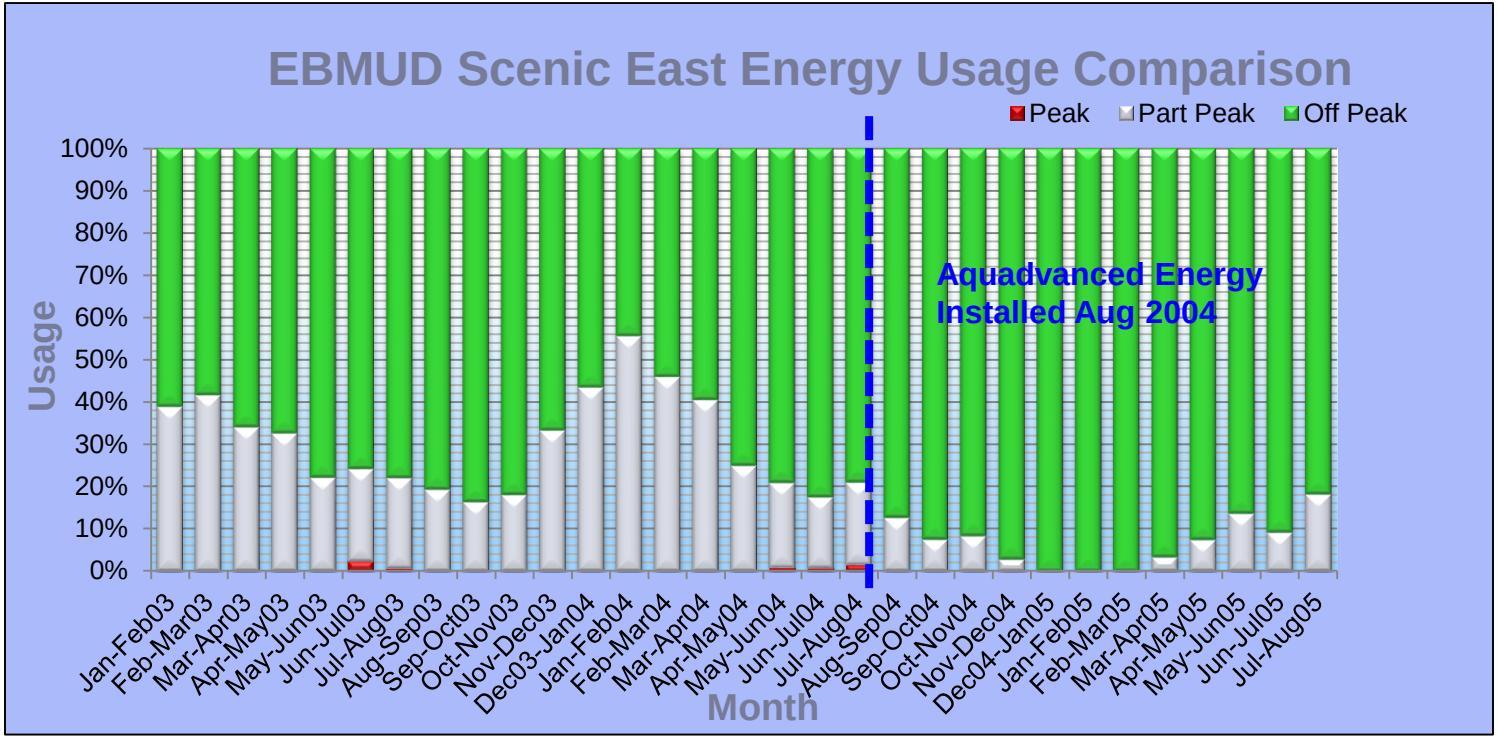
AQUADVANCED™ Energy – Pump Schedules & Tank Levels



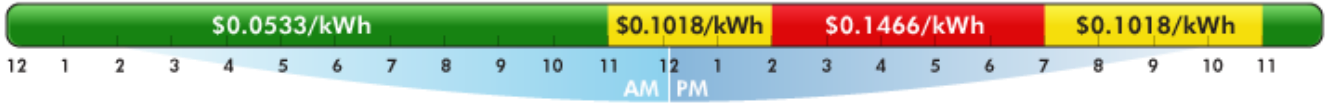
AQUADVANCED™ Energy – Energy Use per Facility



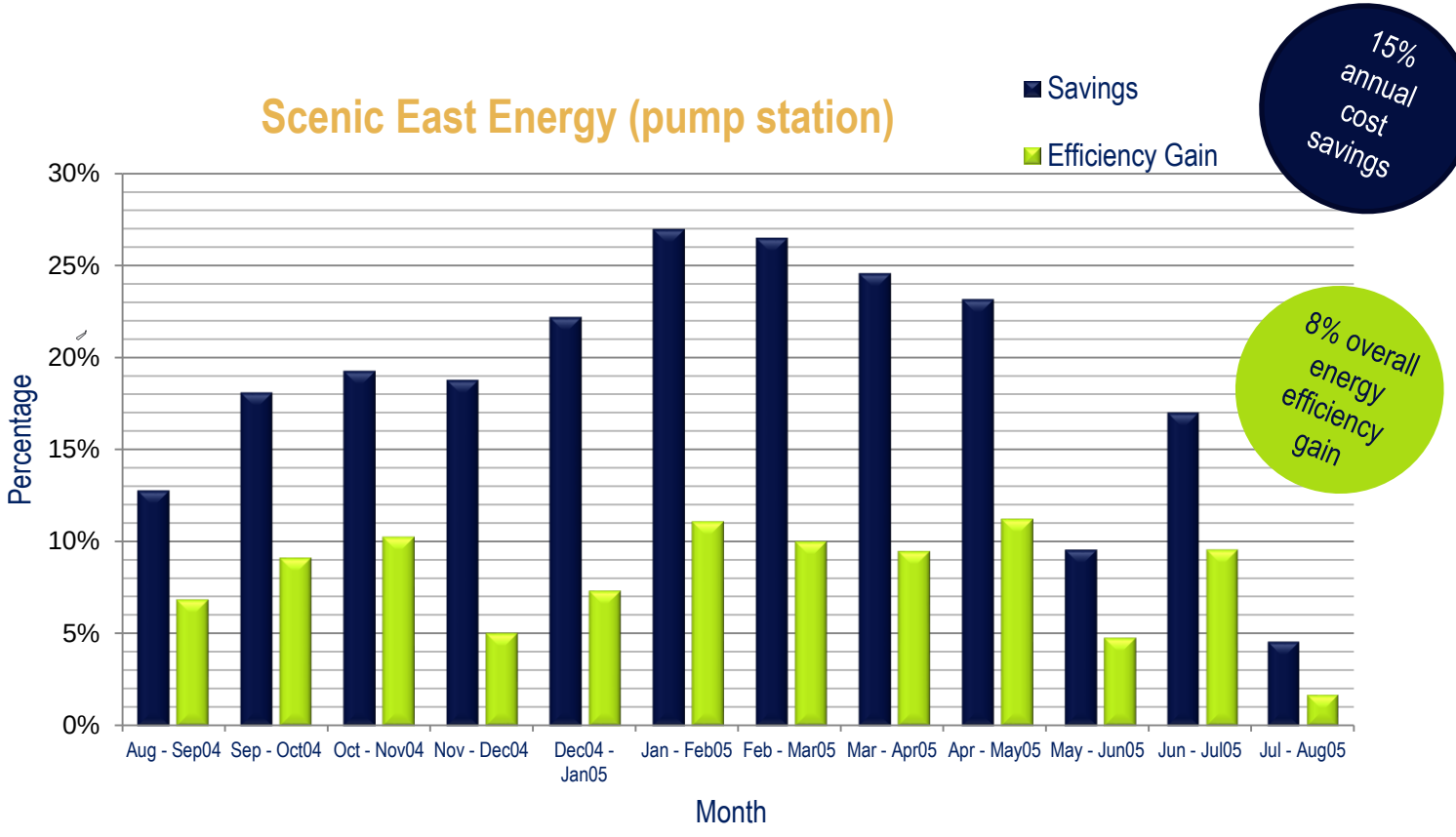
AQUADVANCED™ Energy – kWh Load Shifting



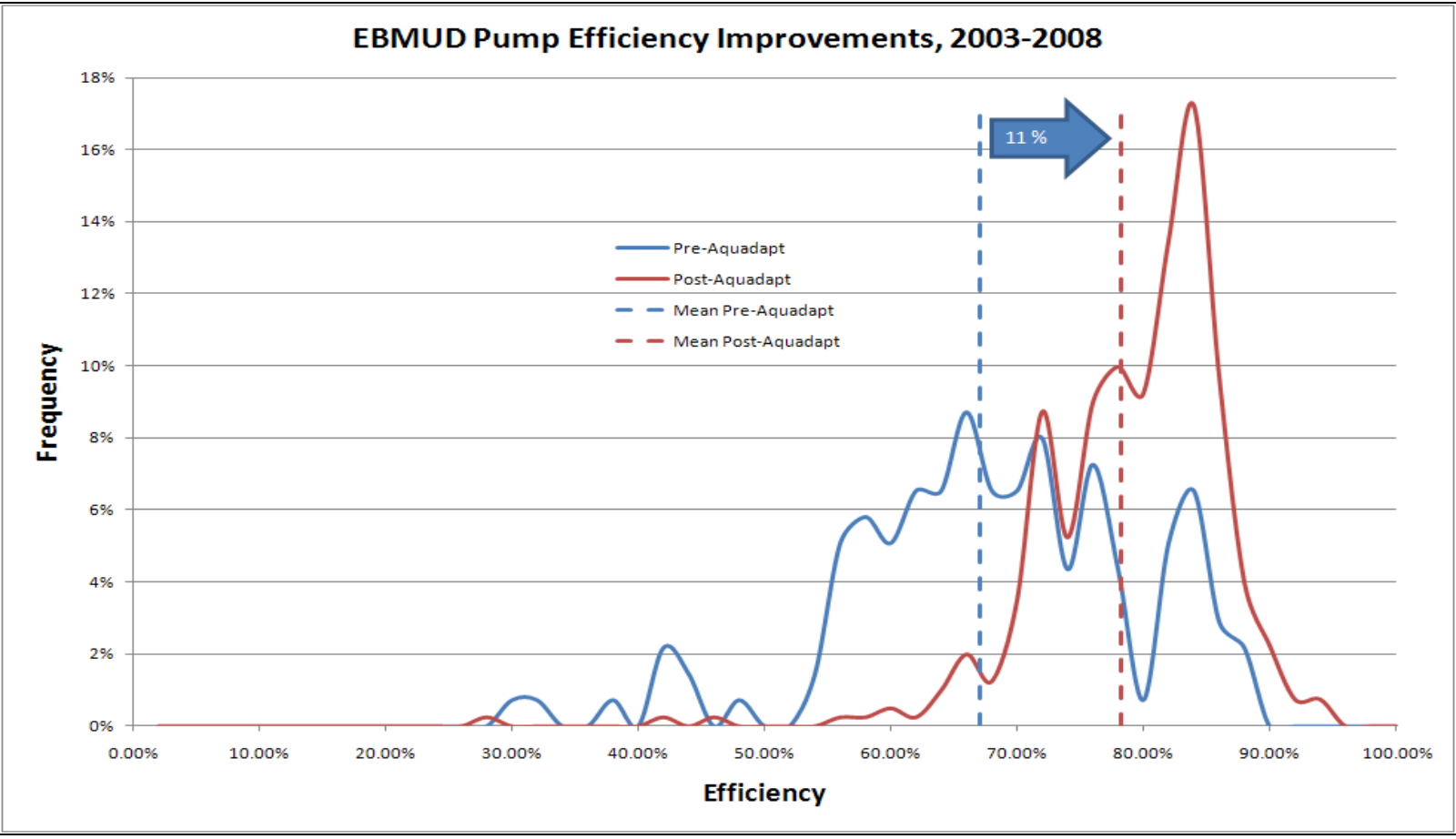
Summer time-of-use (TOU) electric rate structure (tariff)



AQUADVANCED™ Energy – Overall Cost Savings



AQUADVANCED™ Energy – System-wide Efficiency Gains



AQUADVANCED™ Energy – Reference Installations

Water Utility Name, Location, System	Installation Completed	Total Utility Population (000)	Energy Cost Savings	Annual Savings (USD 000)	Efficiency Gains	Annual GHG Reduction Tonne
GWRC New Zealand, Stage 1	Apr-00	400	10%	N/A	N/A	N/A
GWRC New Zealand, Stage 2	Aug-08					
EBMUD CA-USA, Stage 1	Aug-04	1,300	12%	360	6%	800
Unity Water QLD-Australia, Maroochydore	Apr-05	700	N/A	N/A	N/A	N/A
Unity Water QLD-Australia, Caloundra	Apr-11					
Unity Water QLD-Australia, Moreton Bay	Jun-15					
WaterOne KS-USA, Full system	May-06	400	20%	1,100	6%	4,800
WSSC MD-USA, Full System	May-06	1,800	11%	870	8%	4,500
EMWD CA-USA, Stage 1	Aug-06	700	10%	120	8%	300
EMWD CA-USA, Stage 2/3	Sep-07		15%	190		240
EMWD CA-USA, Stage 4	Feb-11		N/A	90		N/A
LinkWater QLD-Australia, SWRP	Apr-09	2,900	20%	400	N/A	N/A
LinkWater QLD-Australia, NPI	Jul-09					
Gwinnett GA –USA, Full System	Dec-09	800	10%	490	6%	2,300
Peel Region ON-Canada, Full System	Feb-13	1,300	10%	1,600	6%	5,600
K Water South Korea, Cheongju	Aug-11	900	4%	250	N/A	N/A
NWL England, Essex	Mar-12	4,500	7%	596	TBD	TBD
NWL England, Teesside	Aug-11			TBD		
NWL England, Central	Nov-11			TBD		
NWL England, Tyneside	Jun-12			TBD		
NWL England, Suffolk (waiting on SCADA)	TBA			N/A		
EPWU TX-USA, Stage 1	Dec-12	780	10%	620	6%	1,700
EPWU TX-USA, Stage 2	Nov-14					
Consorci d'Aiguies de Tarragona, Spain	Oct-14	660	15%	885	TBD	TBD
Suez Water Idaho, Boise	Oct-16					
Suez Water France, Paris South	Nov-16					

AQUADVANCED™ Energy – Customer Feedback

- *“ The Derceto Aquadapt system has never been turned off and operated faultlessly for 10+ years (at Greater Wellington Water).”*
- *“Derceto has delivered consistently through major changes to our business (Unitywater).”*
- *“You can’t argue with the bottom line. Derceto’s Aquadapt is saving WaterOne more than a million dollars a year.”*
- *“One of the biggest benefits from Aquadapt is operational consistency (at Gwinnett County).”*
- *“ We (Northumbrian Water Group) certainly found no other product that would do what Aquadapt can do.”*

Distribution Network Monitoring

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