Reduce Water Loss, Drive Conservation with ArcGIS

Jason Channin, Esri

Christa Campbell, Esri

Pat Harrell, White House Utility District

Carl Alexander, White House Utility District

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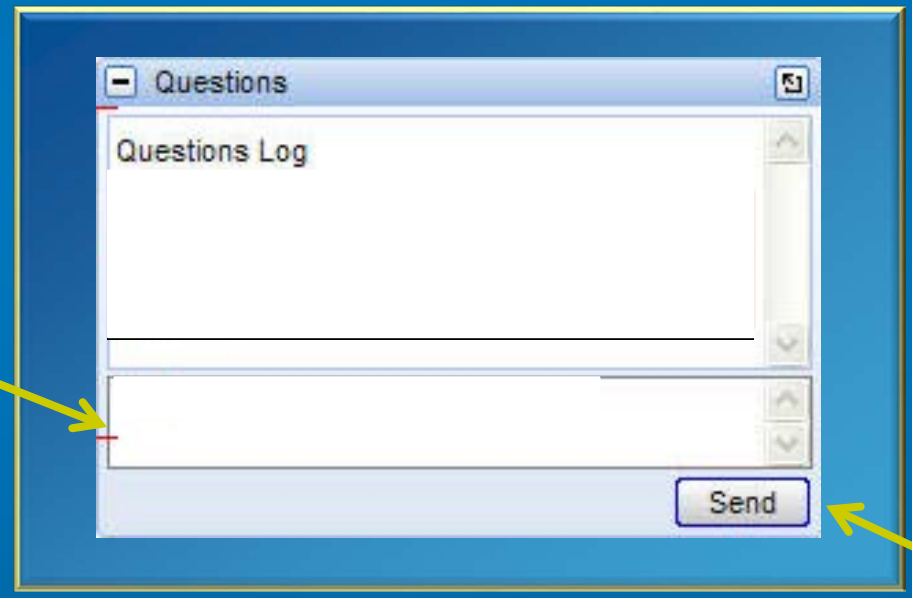

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Save Water with ArcGIS ▶ 4 Part Webinar Series

Introducing Esri's Four-Part Technical Webinar-Series: Save Water with ArcGIS

by Howard Crothers on August 13, 2015

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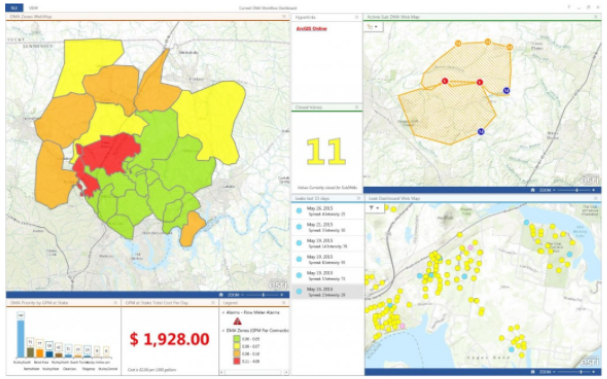
Conserving water is a strategic priority for many water utilities, especially those facing drought. Yet conservation is complex. There are too many moving pieces to have a single, silver-bullet solution. To conserve water in an appreciable way, your utility must focus on increasing water efficiency and reducing customer demand.

You can do both with ArcGIS. Map-based visuals, spatial analytics, and collaboration capabilities help you deploy proven workflows, templates, and applications that save water.



To make sure you're getting the most of your technology for water conservation, we're releasing this four-part, technical webinar mini-series called "Saving Water with ArcGIS."

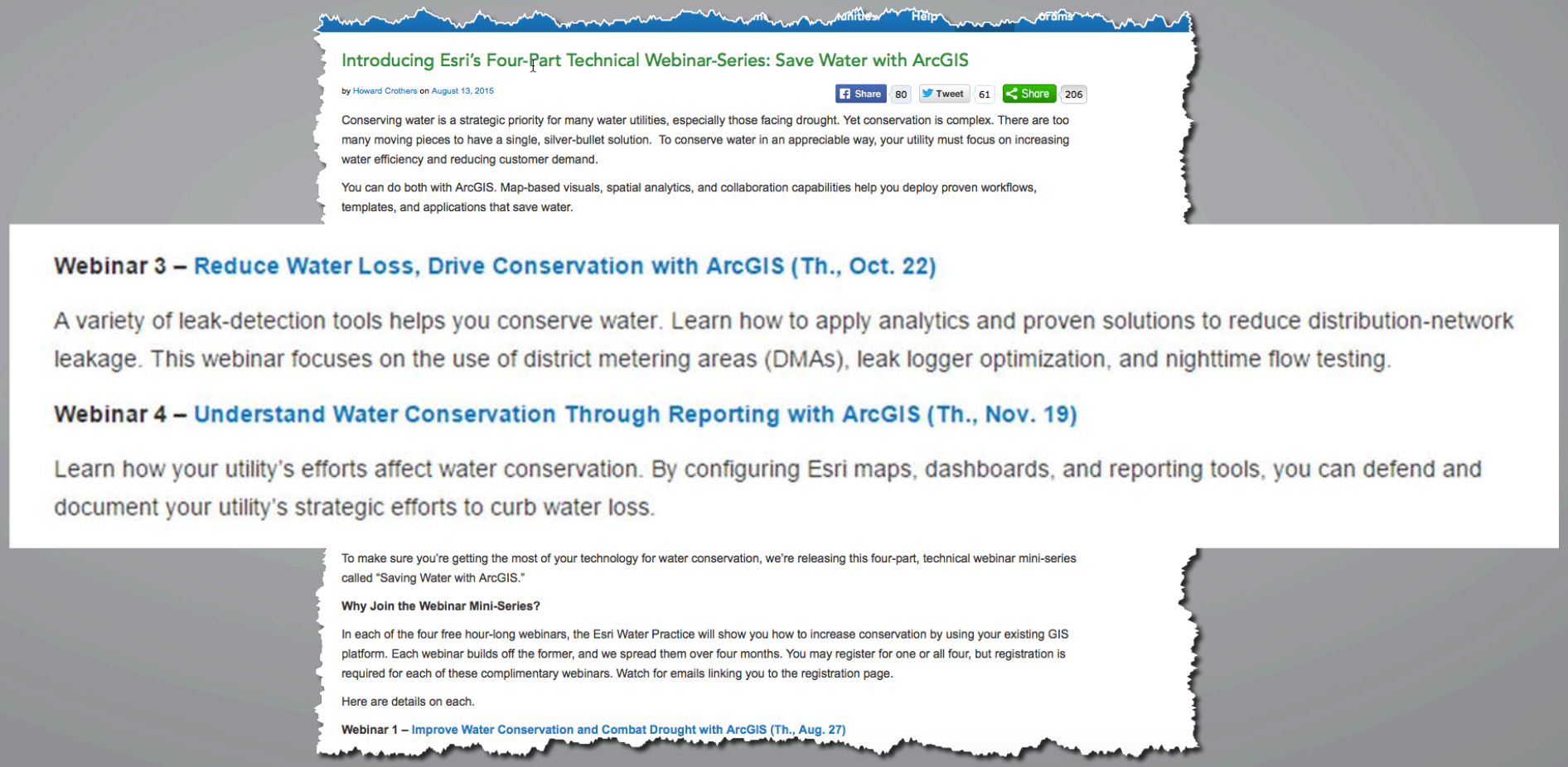
Why Join the Webinar Mini-Series?

In each of the four free hour-long webinars, the Esri Water Practice will show you how to increase conservation by using your existing GIS platform. Each webinar builds off the former, and we spread them over four months. You may register for one or all four, but registration is required for each of these complimentary webinars. Watch for emails linking you to the registration page.

Here are details on each.

Webinar 1 – Improve Water Conservation and Combat Drought with ArcGIS (Th., Aug. 27)

Save Water with ArcGIS ▶ 4 Part Webinar Series



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Webinar 3 – Reduce Water Loss, Drive Conservation with ArcGIS (Th., Oct. 22)

A variety of leak-detection tools helps you conserve water. Learn how to apply analytics and proven solutions to reduce distribution-network leakage. This webinar focuses on the use of district metering areas (DMAs), leak logger optimization, and nighttime flow testing.

Webinar 4 – Understand Water Conservation Through Reporting with ArcGIS (Th., Nov. 19)

Learn how your utility's efforts affect water conservation. By configuring Esri maps, dashboards, and reporting tools, you can defend and document your utility's strategic efforts to curb water loss.

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Webinar 1 – Improve Water Conservation and Combat Drought with ArcGIS (Th., Aug. 27)

WHITE HOUSE UTILITY DISTRICT

Using GIS to Manage Data in WHUD's Water Loss Control Program

Carl Alexander, GISP – GIS Manager
Pat Harrell, PE District Engineer

Overview

- Located in North-Central Tennessee
- 33,000 Drinking Water Customers
- 3,000 Sewer Customers
- Mostly Rural, Domestic Water Users
- 600 Square Mile Service Area
- 85 Employees

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Water Loss - History

- Thru late 1990's NRW as high as 50+%
- Early efforts thru mid-2000's reduced NRW to as low as 26%
- Losses fluctuate between 28 – 32% NRW between 2008 and 2013
- Desire to significantly lower NRW % required change in strategy

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Physical Challenges

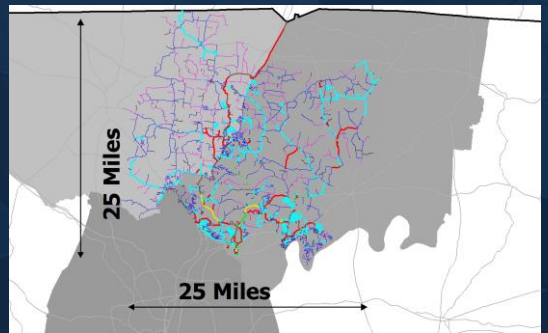
Aging Infrastructure

High System Pressure

Karst Geology

Remote Infrastructure

Large, Rural Service Area



Vision Requirements

GIS-Centric Solution

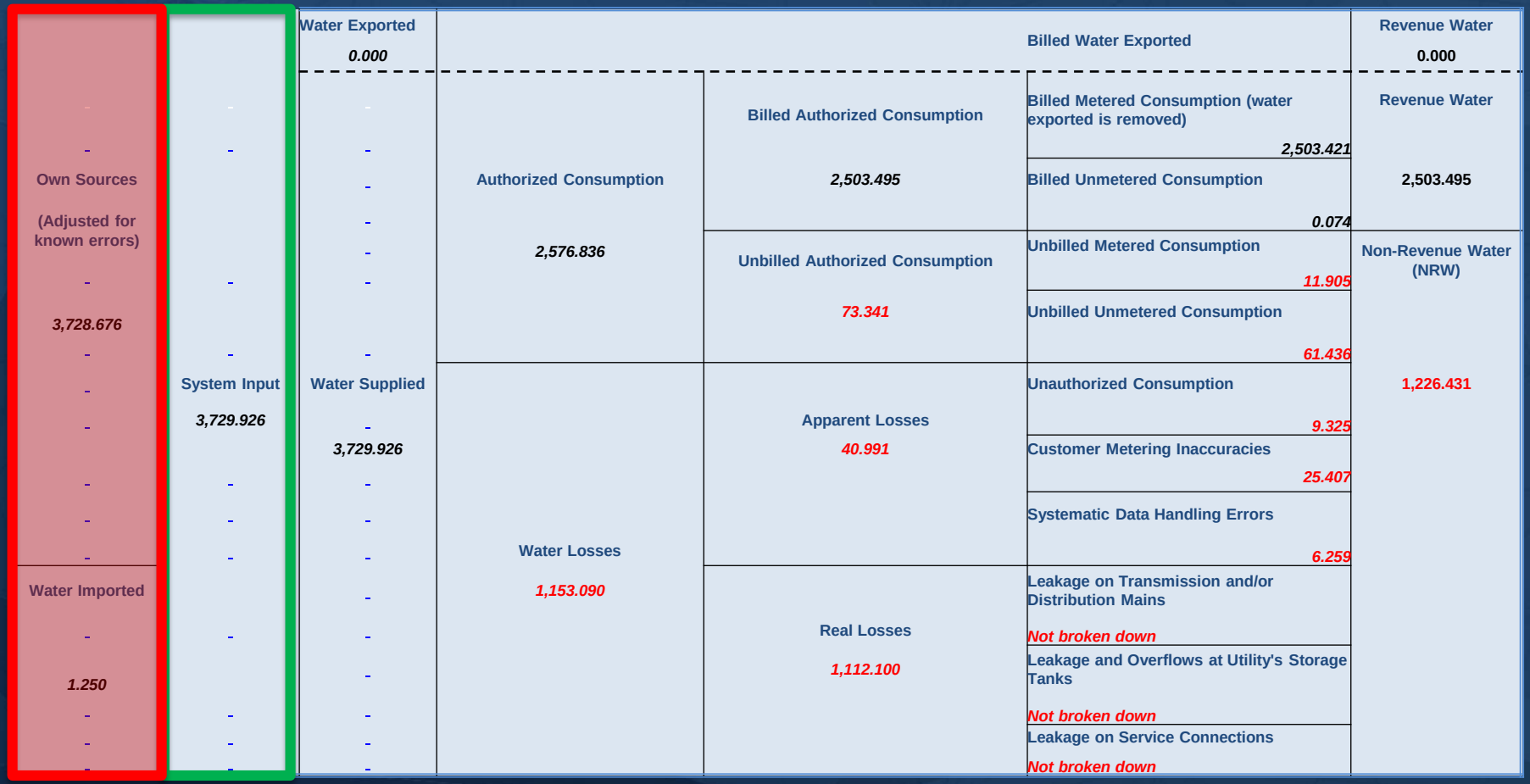
Useful from Field to Executive Level

Significant Capital/Manpower Investments need to make financial sense

WHUD 2014 Water Balance – AWWA Water Audit Software v5.0

		Water Exported 0.000			Billed Water Exported	Revenue Water 0.000
Own Sources (Adjusted for known errors) 3,728.676	System Input 3,729.926	Water Supplied 3,729.926	Authorized Consumption 2,576.836	Billed Authorized Consumption 2,503.495	Billed Metered Consumption (water exported is removed) 2,503.421	Revenue Water 2,503.495
					Billed Unmetered Consumption 0.074	
				Unbilled Authorized Consumption 73.341	Unbilled Metered Consumption 11.905	Non-Revenue Water (NRW) 1,226.431
					Unbilled Unmetered Consumption 61.436	
			Water Losses 1,153.090	Apparent Losses 40.991	Unauthorized Consumption 9.325	
					Customer Metering Inaccuracies 25.407	
					Systematic Data Handling Errors 6.259	
Water Imported 1.250				Real Losses 1,112.100	Leakage on Transmission and/or Distribution Mains Not broken down	
					Leakage and Overflows at Utility's Storage Tanks Not broken down	
					Leakage on Service Connections Not broken down	

WHUD 2014 Water Balance – AWWA Water Audit Software v5.0



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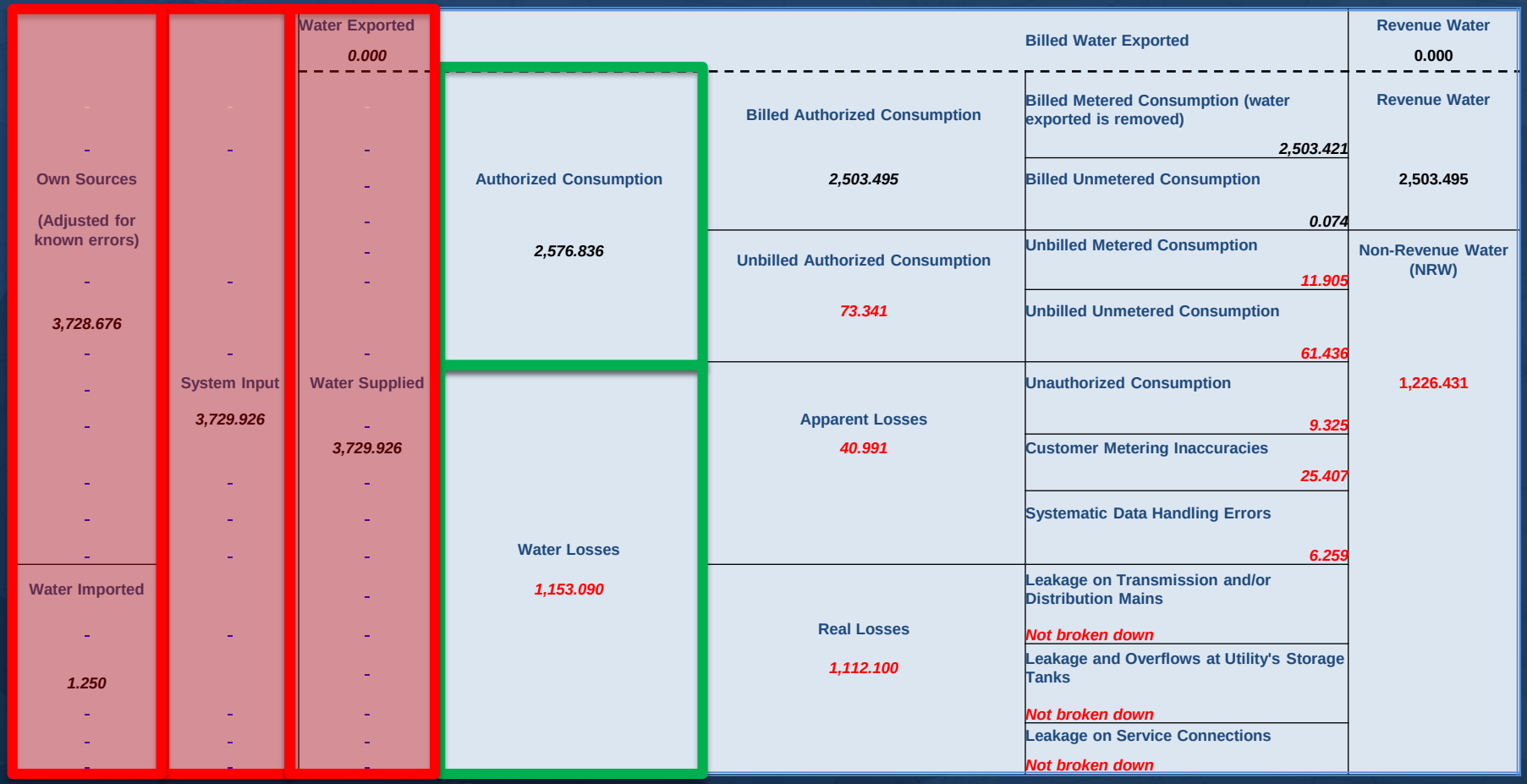

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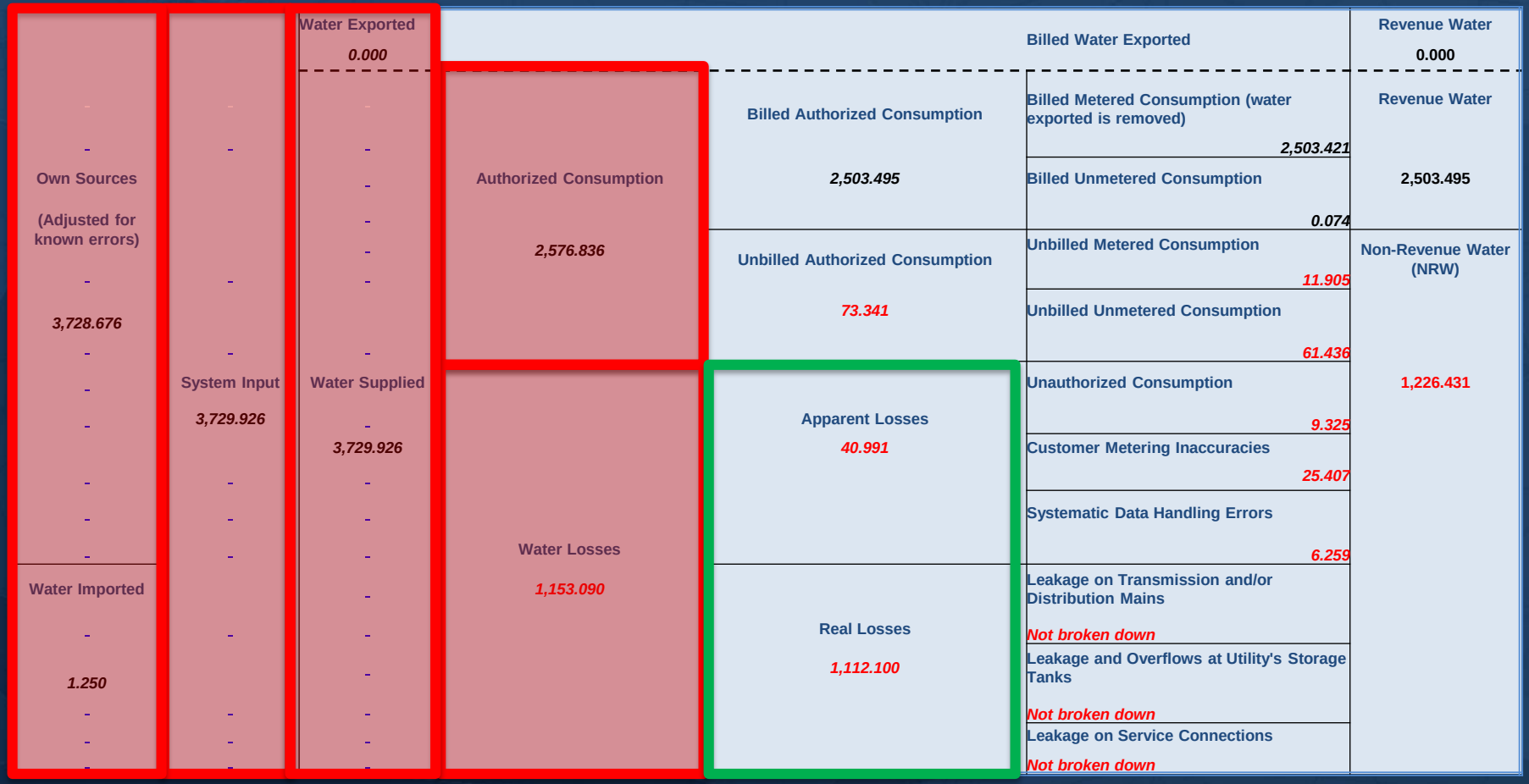

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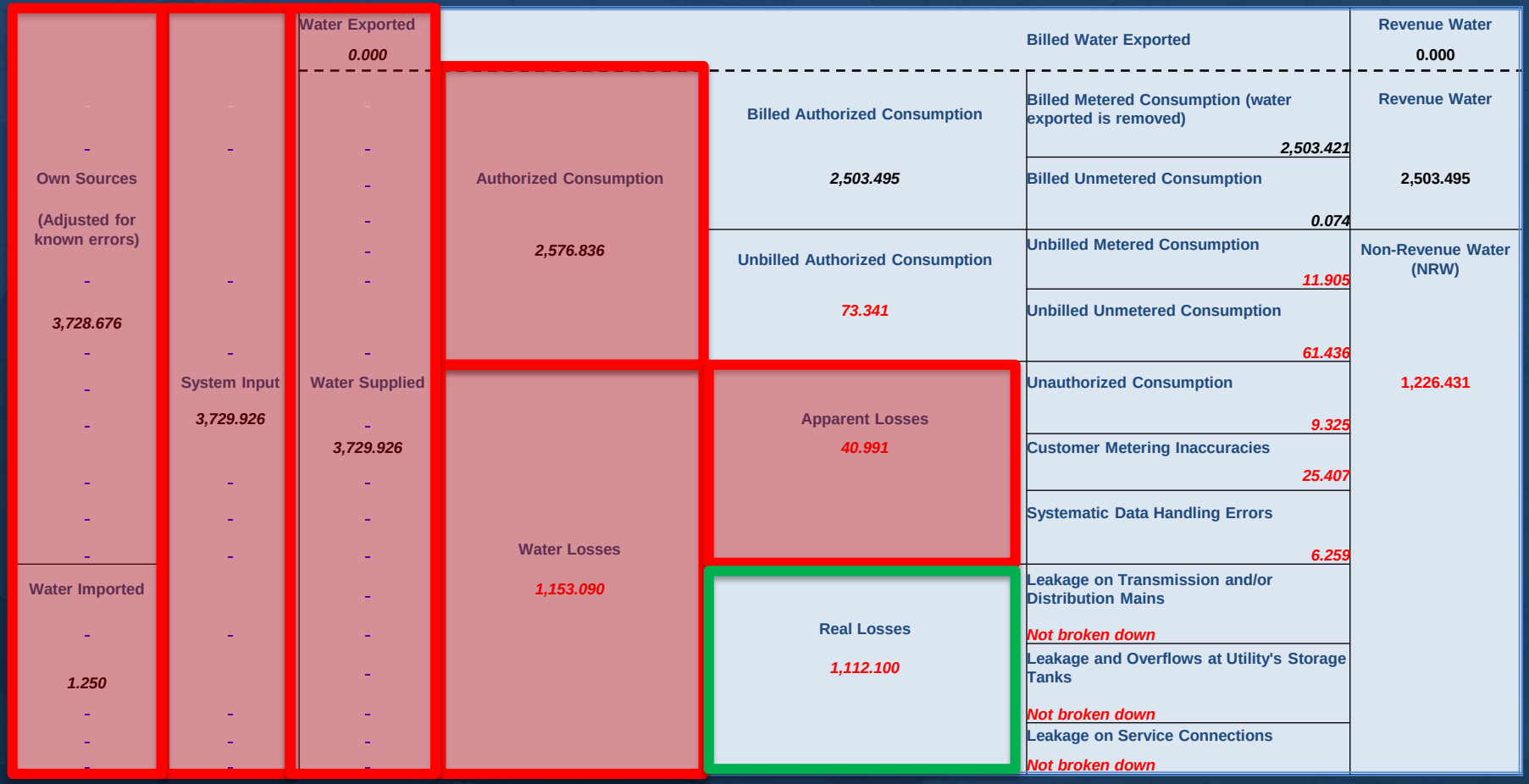

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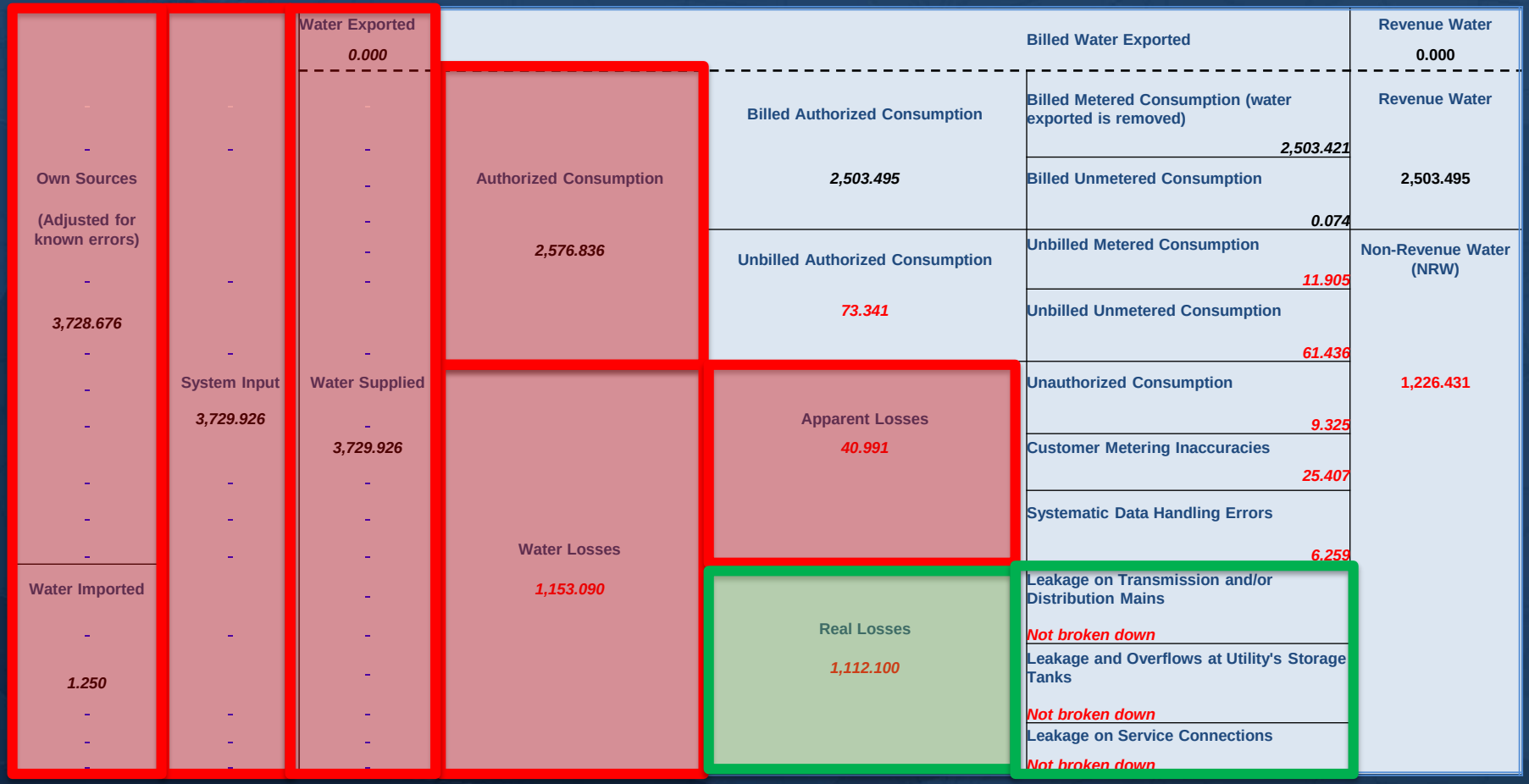

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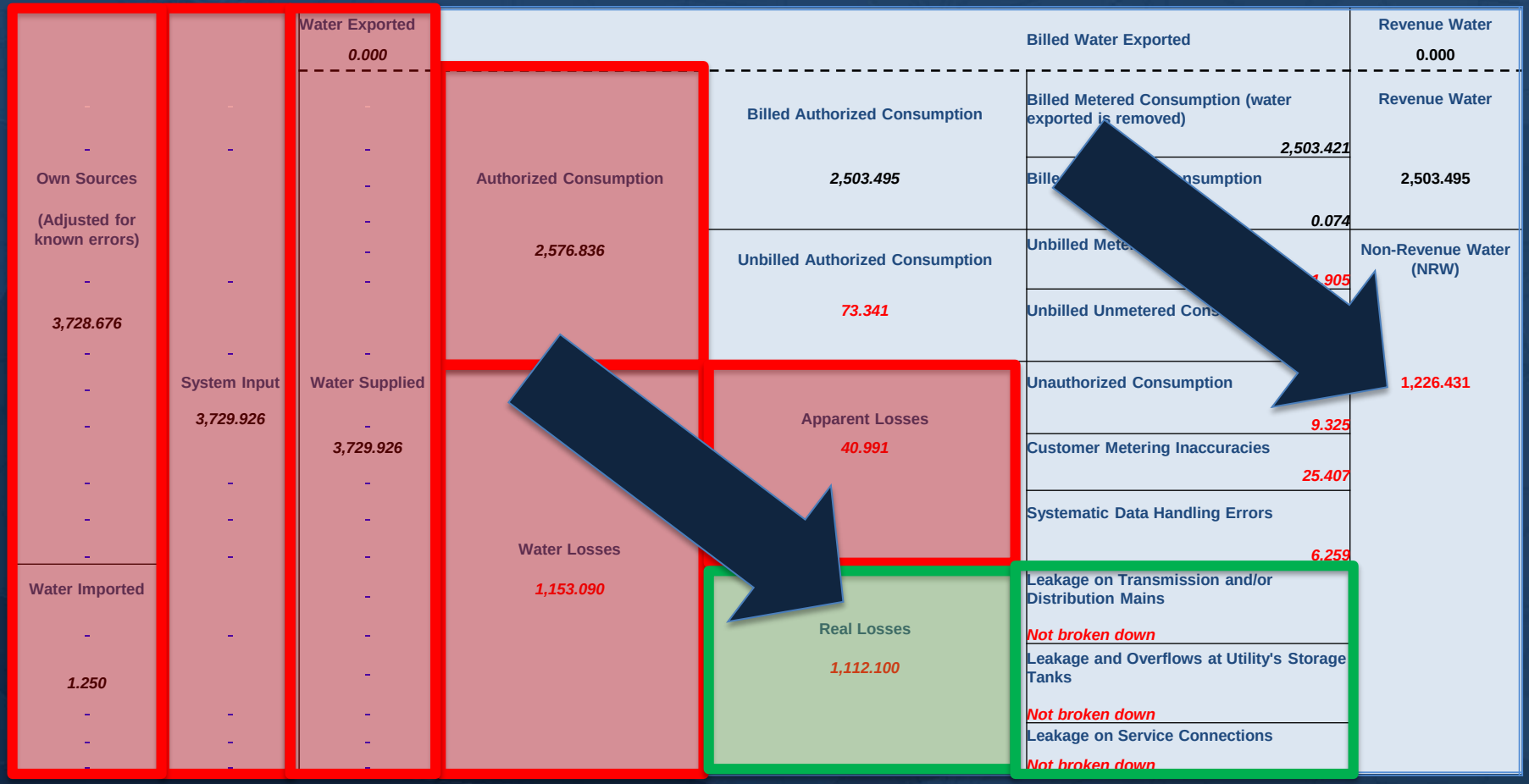

Ok. Leaks are our problem. Now, what do I need to know?

- Where is the water going?
- How much water should be going there?
- How do I reliably and accurately monitor flow?

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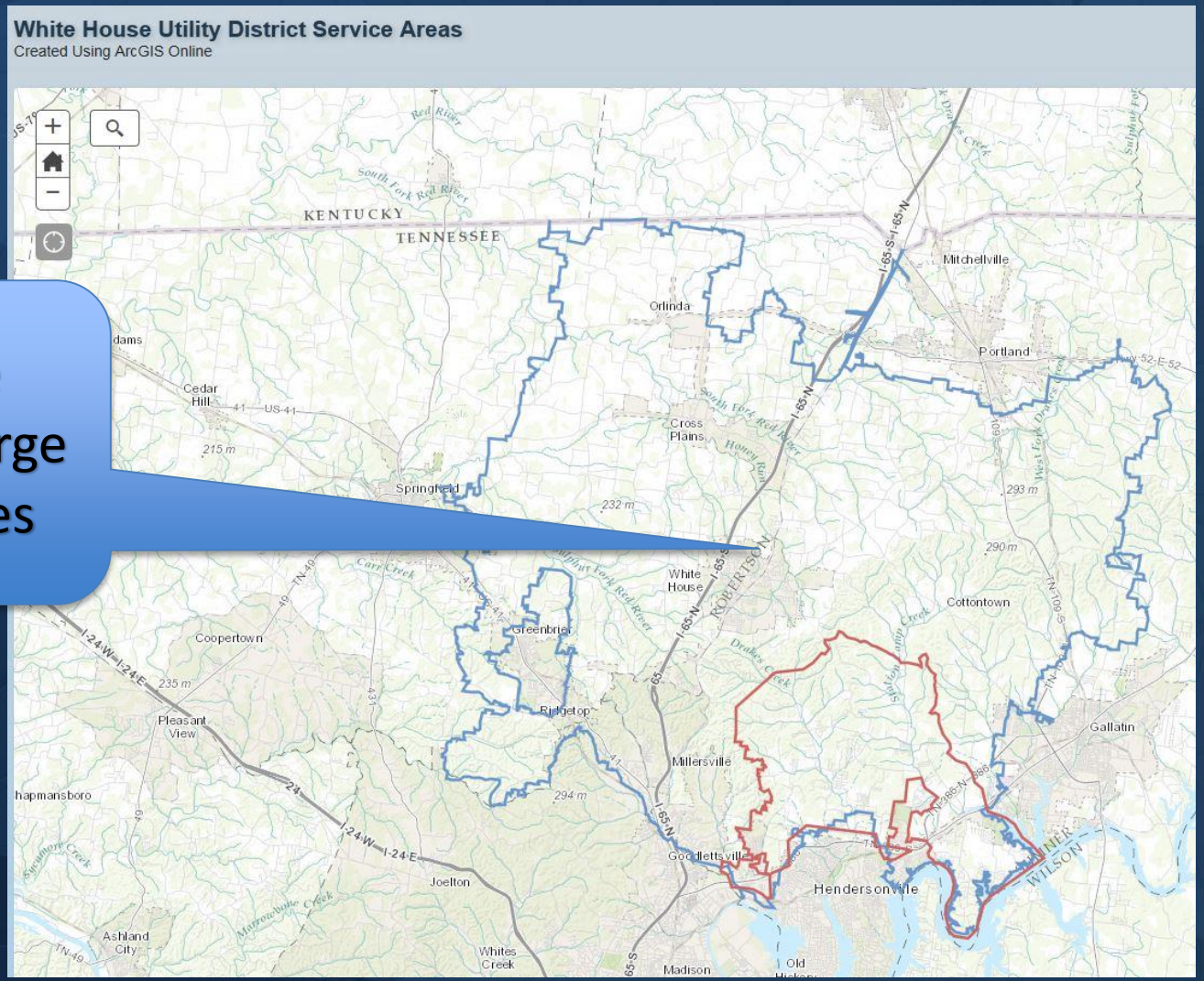
District Metered Area (DMA)

A portion of a water distribution system with metered boundaries that provide a means of determining instantaneous flow rates supplied to the area at specific points in time. Capabilities may also include monitoring of totalized flows over time

Things to consider when selecting DMA's

- How many DMA's to create?
- Permanent or Portable Meters?

  (Or, no meters at all?)
- More Meter sites = More Cost
  - Better Resolution with more sites (Smaller DMA's)
  - Lower Cost with fewer sites (Larger DMA's)
  - What is happy medium? (Financial Analysis)
- Rule of Thumb – 1,000 connections per DMA



600 Square Mile Service Area too large

25 Miles x 25 Miles

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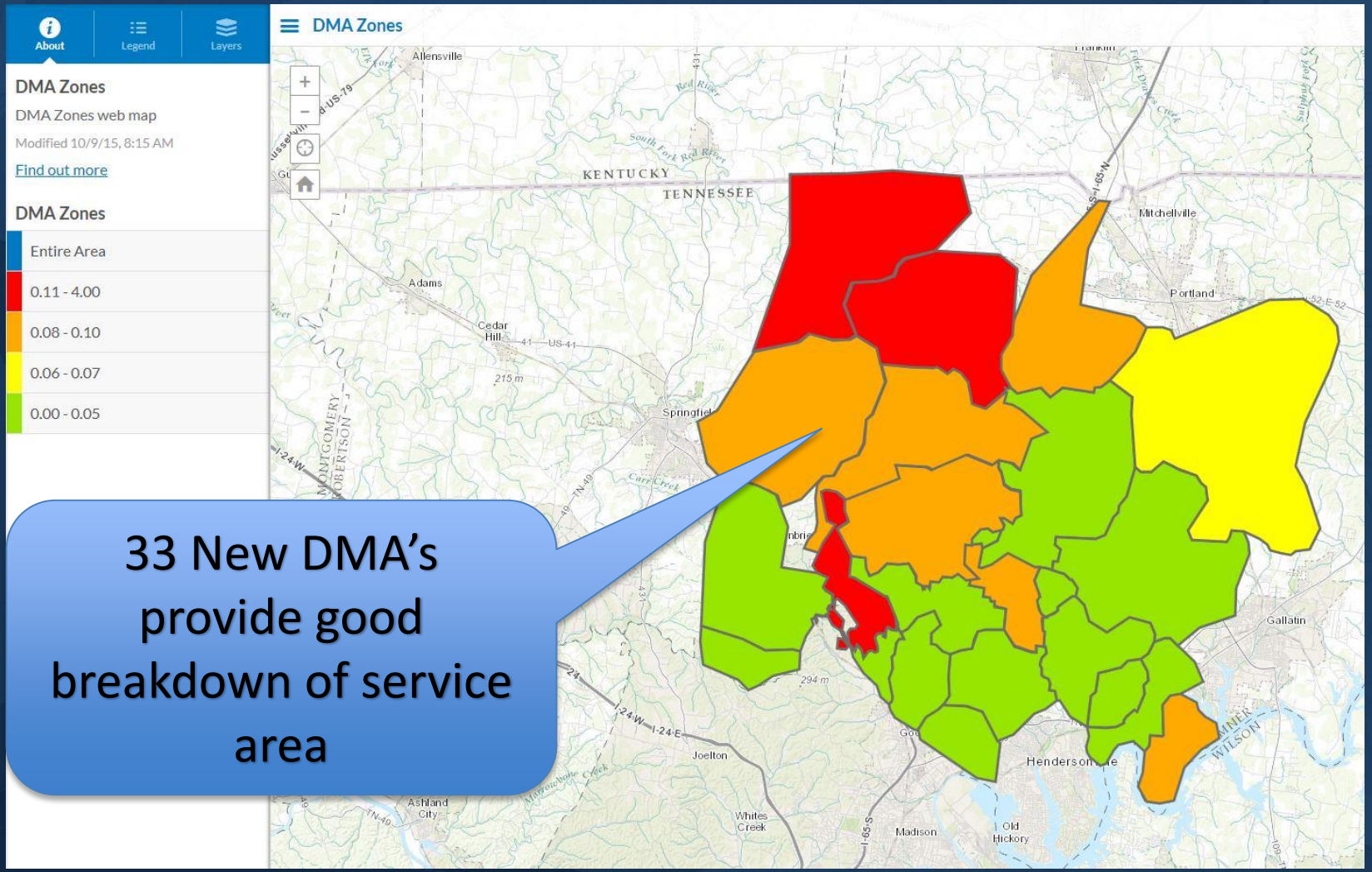

About
Legend
Layers
DMA Zones
DMA Zones web map
Modified 10/9/15, 8:15 AM
Find out more
DMA Zones
Entire Area
0.11 - 4.00
0.08 - 0.10
0.06 - 0.07
0.00 - 0.05
DMA Zones
KENTUCKY
TENNESSEE
Allensville
Adams
Cedar Hill
Springfield
Mitchellville
Portland
Gallatin
Joelton
Ashland City
Whites Creek
Madison
Old Hickory
33 New DMA's provide good breakdown of service area

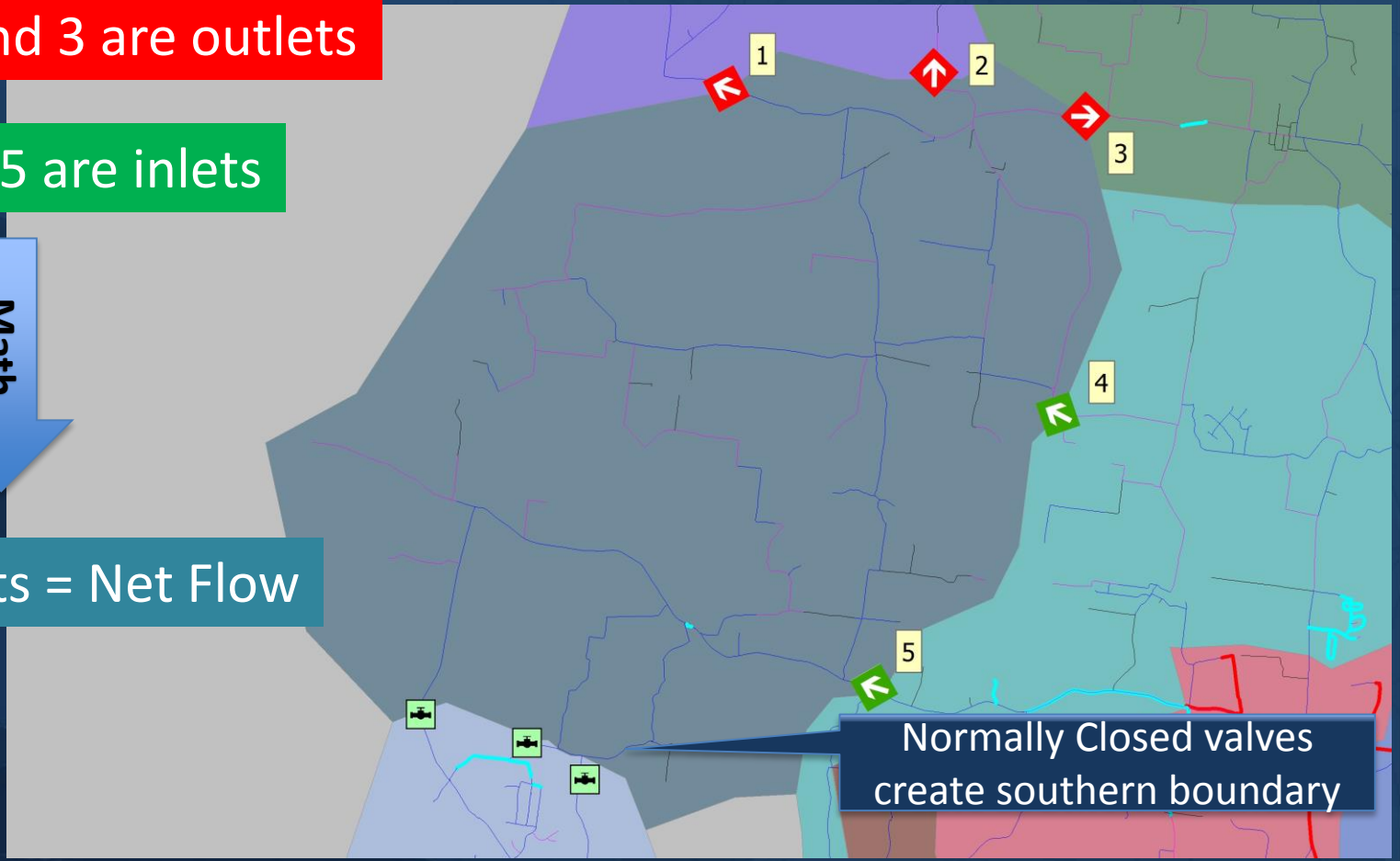
Mulloy West DMA – Example

Meters 1, 2 and 3 are outlets

Meters 4 and 5 are inlets

Math

Inlets – Outlets = Net Flow



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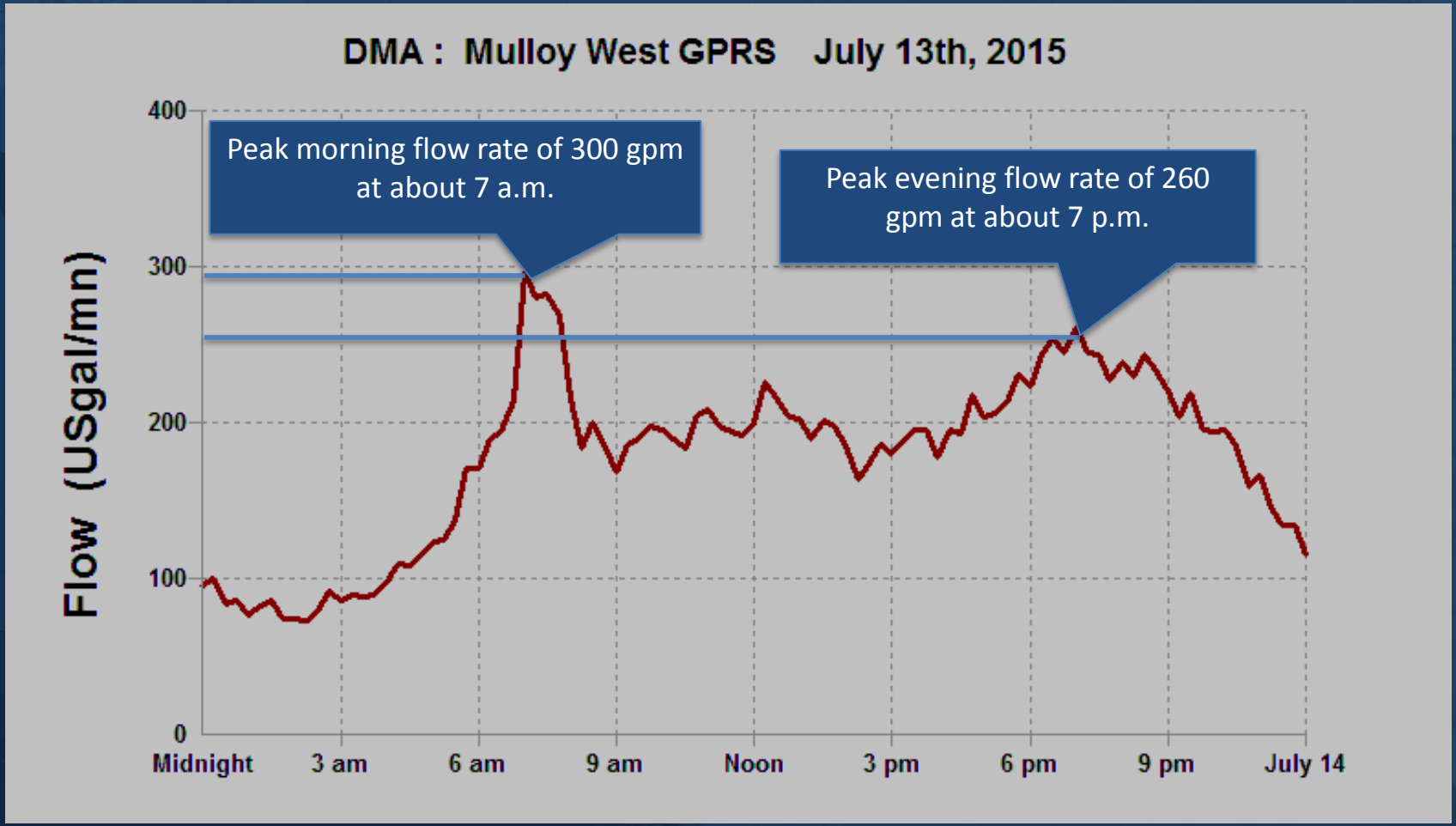
Domestic, Diurnal Flow Pattern



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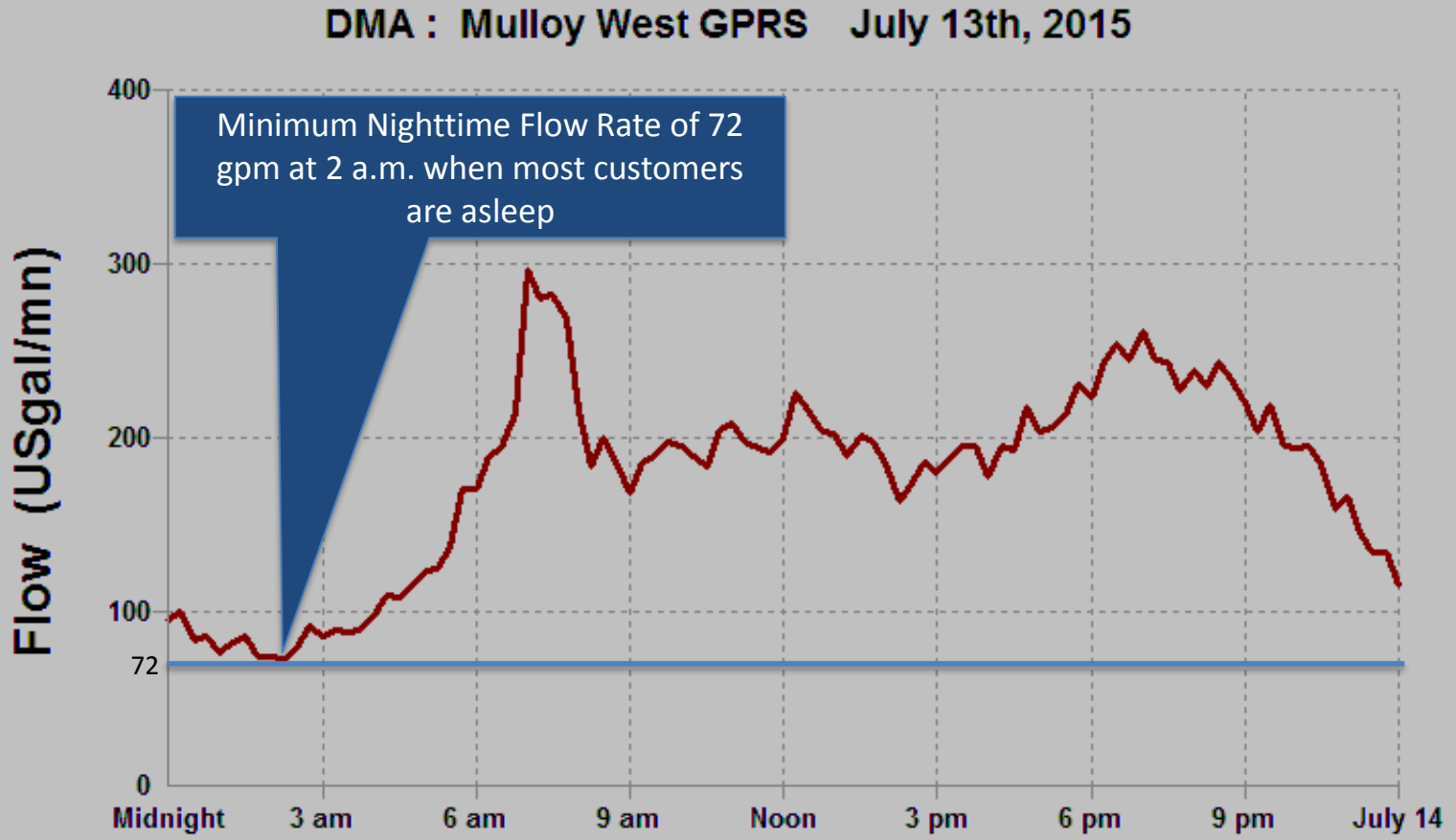
DMA : Mulloy West GPRS July 13th, 2015
Minimum Nighttime Flow Rate of 72 gpm at 2 a.m. when most customers are asleep
Flow (USgal/mn)
400
300
200
100
72
0
Midnight
3 am
6 am
9 am
Noon
3 pm
6 pm
9 pm
July 14

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Infrastructure Needs for 100% DMA Coverage

- 71 new DMA Meter Sites ($1.3M)
- Making use of 10 ex. SCADA meter sites to help create new DMA's
- Phase 1 installation of 30 DMA meter sites in Fall 2014
- Phase 2 installation of 41 more DMA meter sites Fall 2015

DMA Meter – Hardware Selection Criteria

- Familiar, Easy to Use Measurement Technology
- Simple Installation
- Adequate, repeatable accuracy
- Continuous Monitoring
- No AC Power Needed (Would add about 30% to installation cost for AC power to sites)
- Comms not requiring full SCADA site (Would add about 45% to installation cost for SCADA)

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DMA Meter Hardware / Installation

FRP Vault w/ Lockable Hatch

Magnetic Wing Antenna

Datalogger with Cell Modem

Insertion Magnetic Flow Meter

Pressure Transmitter

Install through 1” Tap

DMA Meter Hardware / Installation

- Flow Measurement Updates every 5 seconds
- Flow Values Logged every 15 minutes
  (Can log more frequently)
- Logged Flow Values (96/day) Transmitted Daily to WHUD's FTP Server – along with totalized flow value
  (Can transmit more frequently)
- Configurable text/email for alarm conditions

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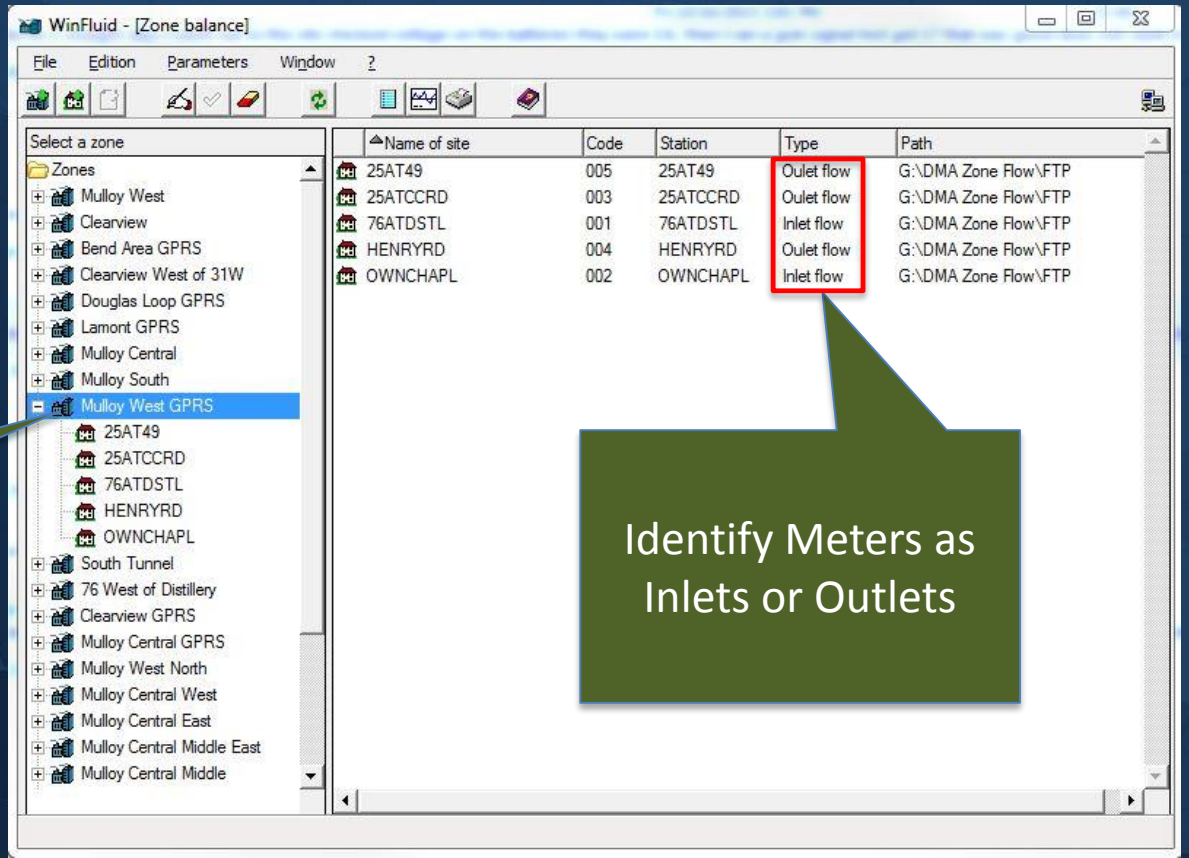
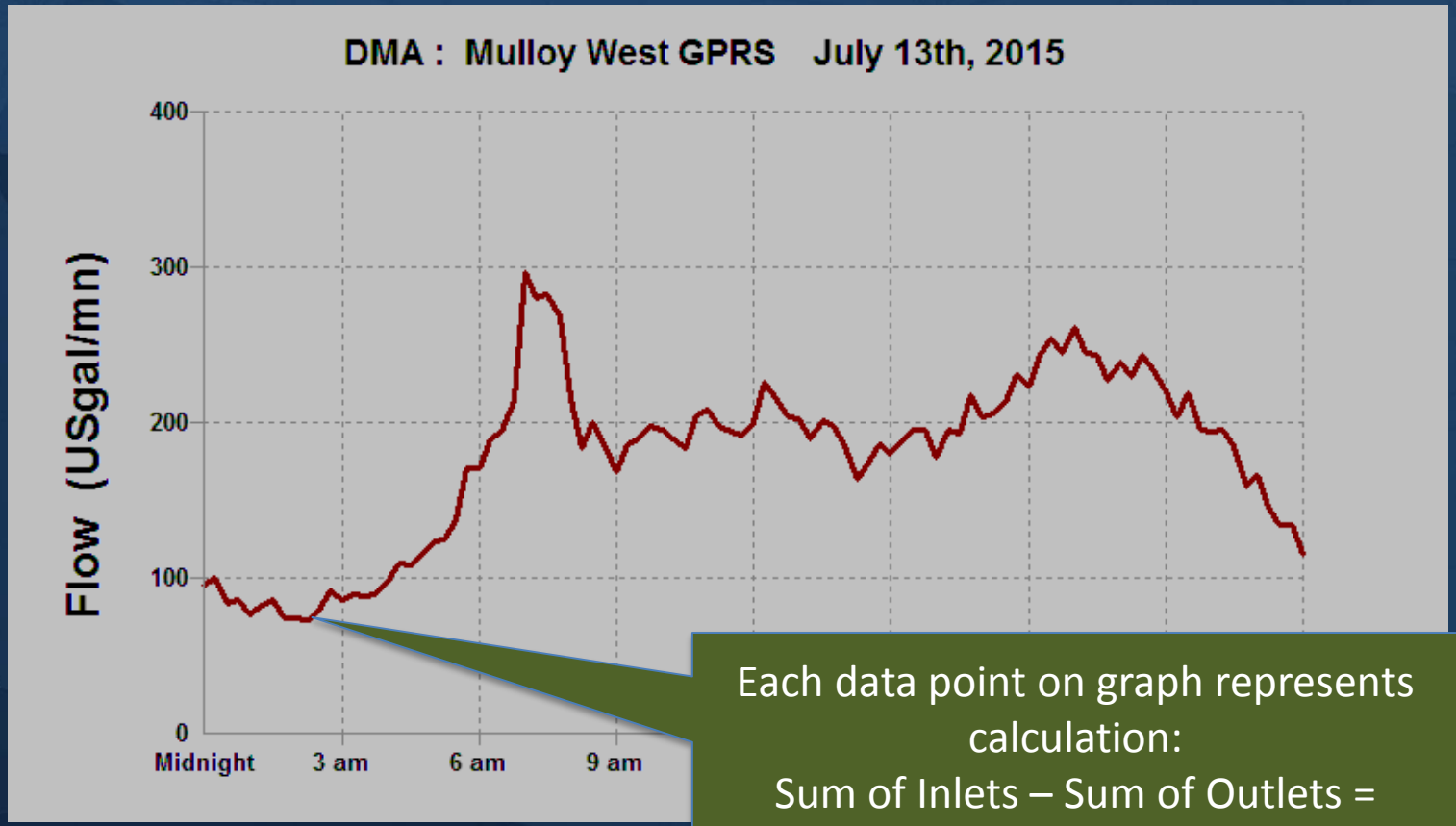
DMA Meter Vendor Software Manages Meter Data



Software Produces Daily Flow Profiles for each DMA



Each data point on graph represents calculation:
Sum of Inlets – Sum of Outlets =
Net Flow Rate at Point in Time

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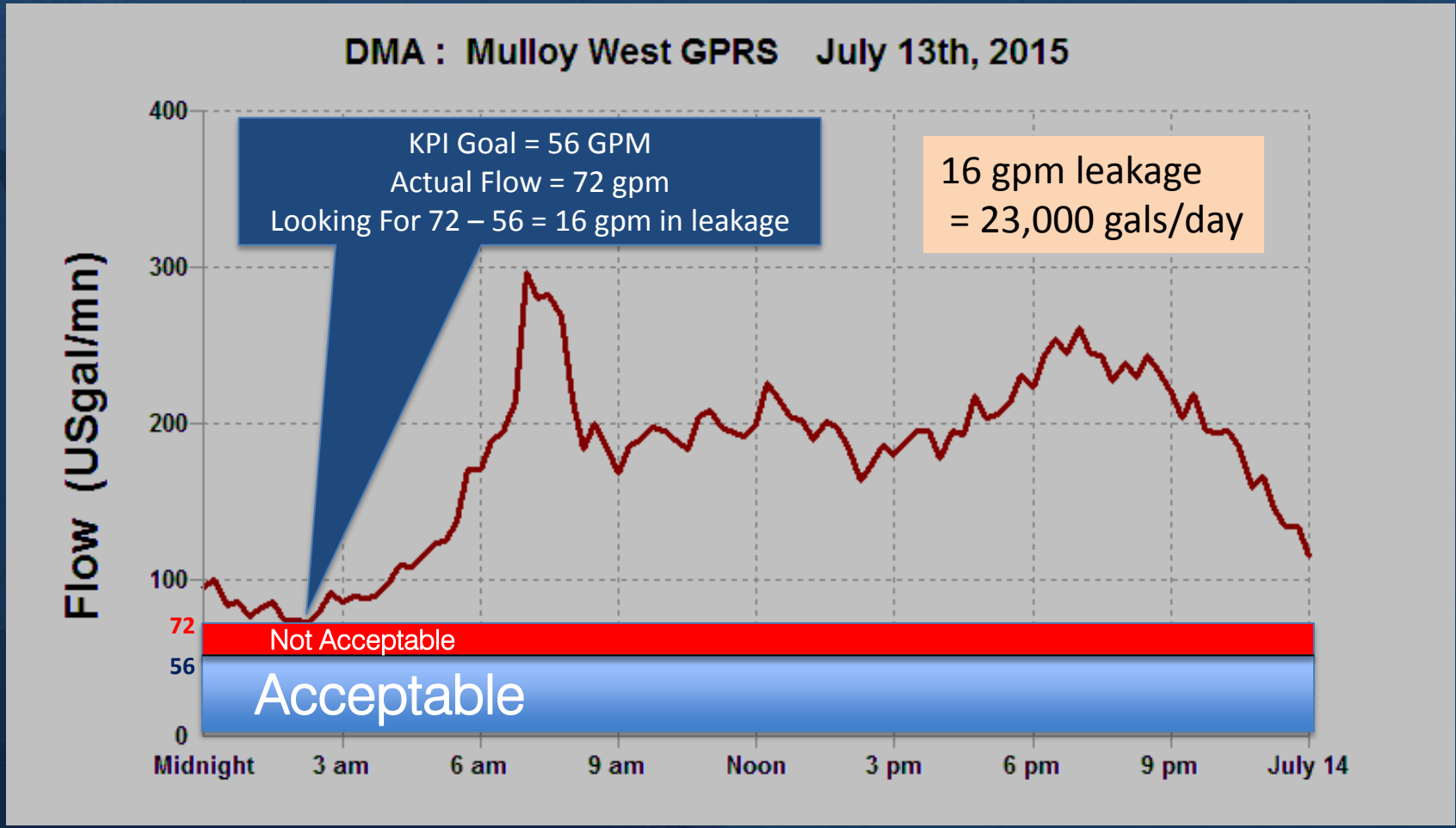
Use KPI's to Determine Whether Excess Leakage exists in DMA

Example: Mulloy West DMA

- 1,131 Connections in rural area
- Assume:
  Acceptable consumption/leak rate per connection of
  0.05 gallons per minute per connection at time of
  lowest legitimate consumption (Usually 1 – 4 A.M.)
- Calculation of KPI:
  0.05 gpm/connection x 1,131 connections = **56 gpm**

*So, not initially concerned about leakage in this area till MNF>56 gpm

Compare MNF to KPI in each DMA



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Use SubDMA's to reduce search area

- After seeing excess flow into DMA, can cut it up further into SubDMA's
- Temporarily shut valves and do calclulations with pertinent meters to get values for SubDMA's
- Keep reducing size with DMA's until at street/subdivision level

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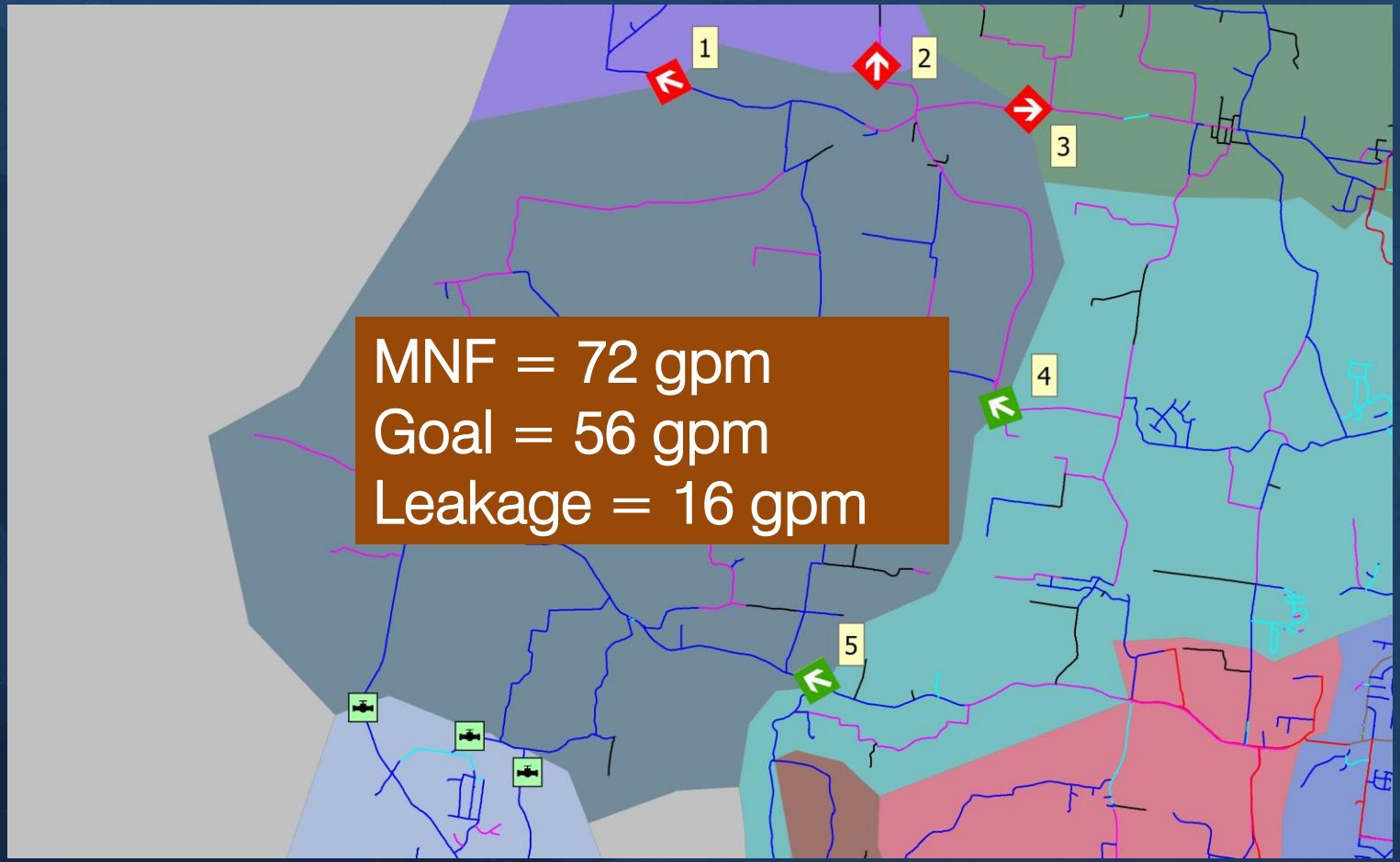
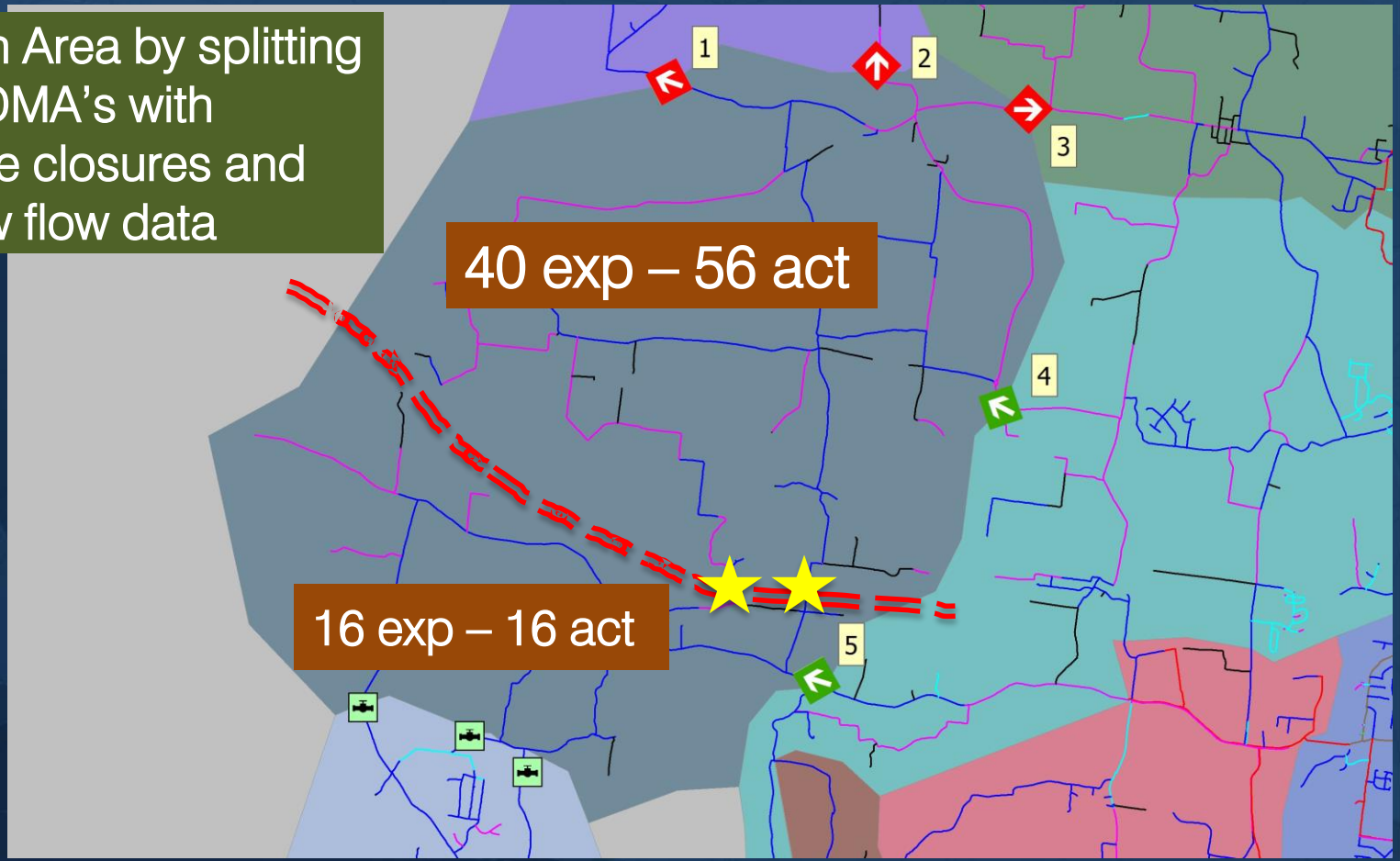
Mulloy West DMA – 34 Square Mile Area, 57 Miles of Pipe



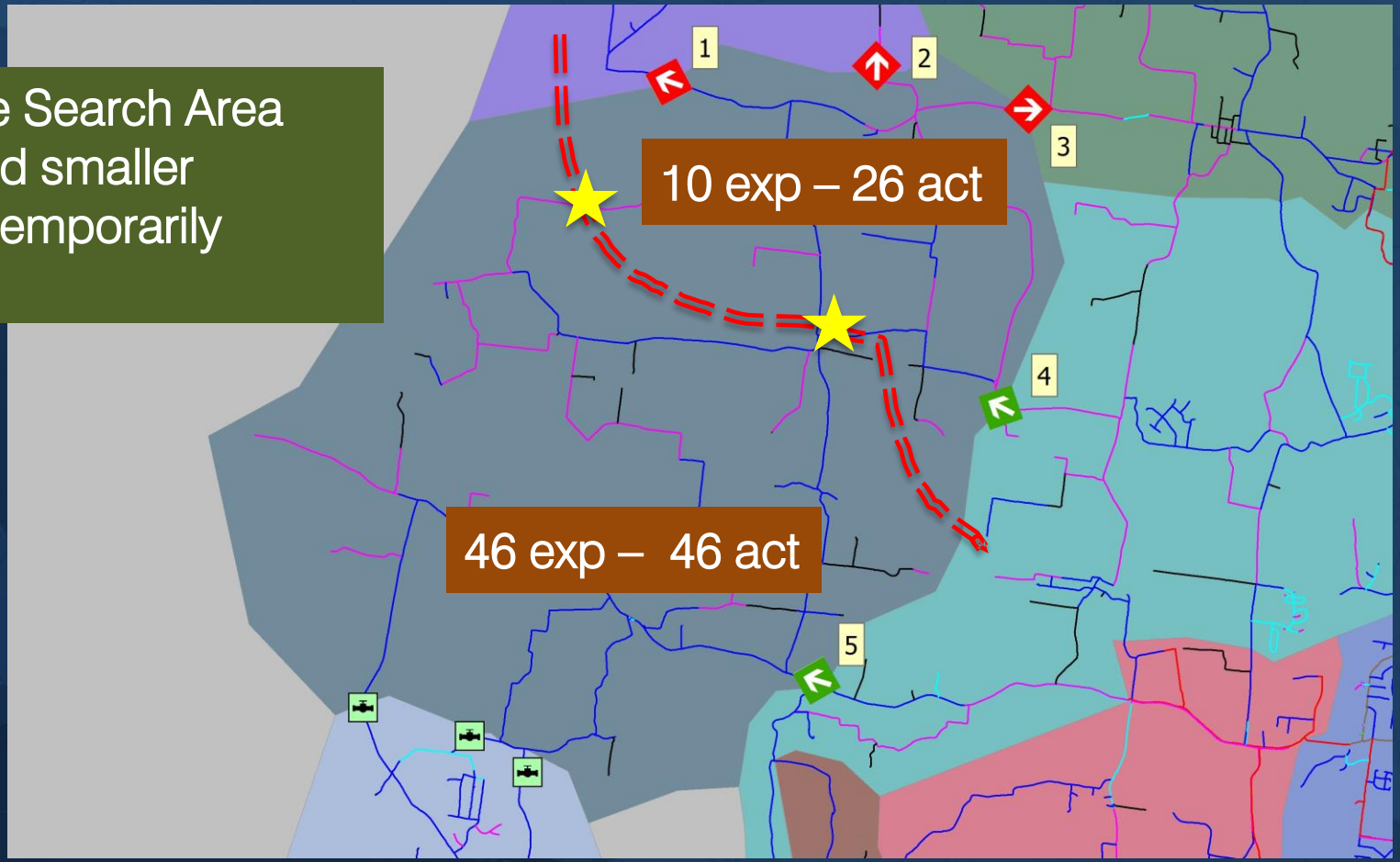
Mulloy West DMA – Split into Northern/Southern halves (SubDMA's)

Reduce Search Area by splitting DMA into SubDMA's with temporary valve closures and comparing new flow data



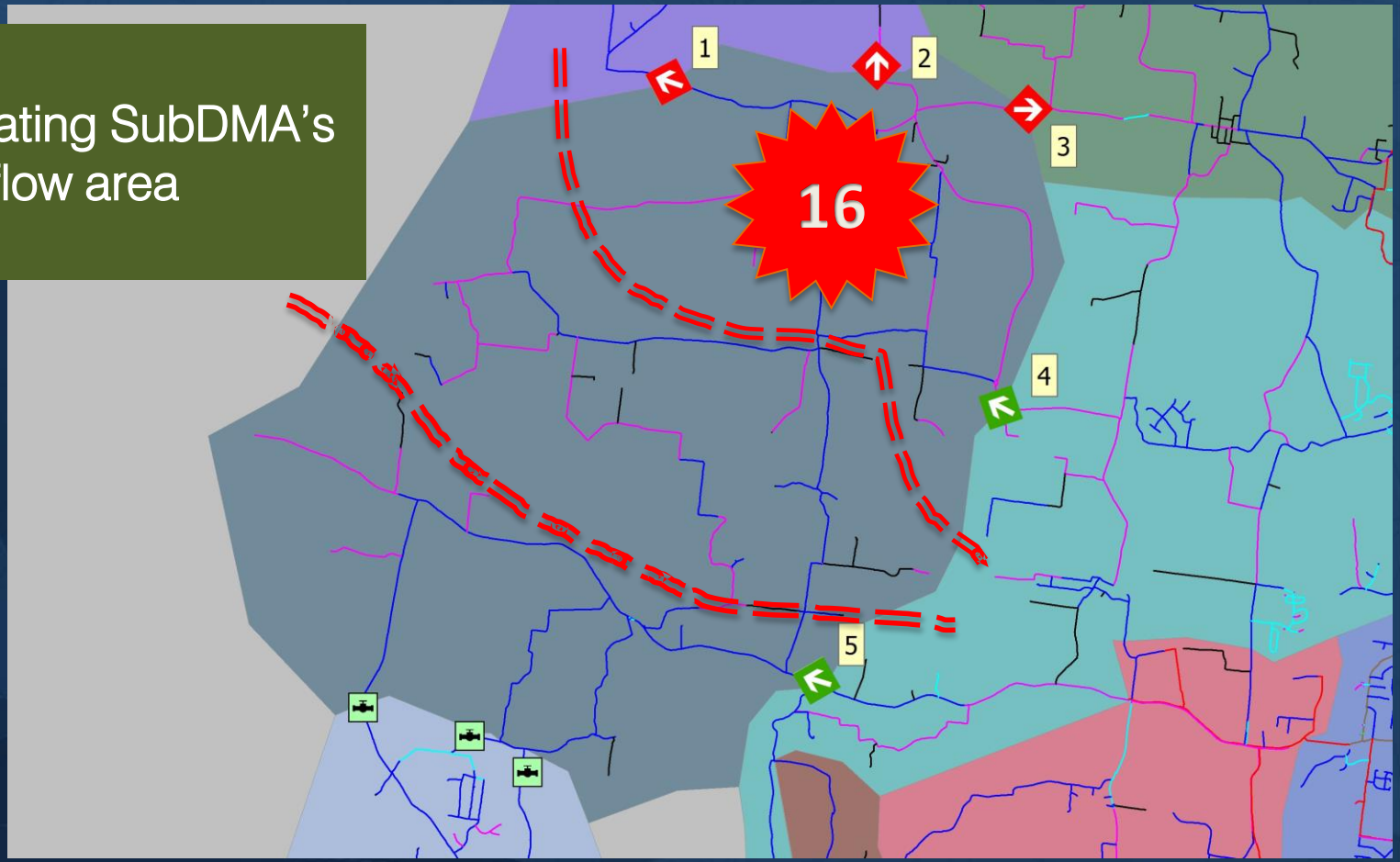
Mulloy West DMA – Split Northern Half again

Further Reduce Search Area with smaller and smaller SubDMA's by temporarily closing valves



Mulloy West DMA

Iterations of creating SubDMA's will reveal high flow area

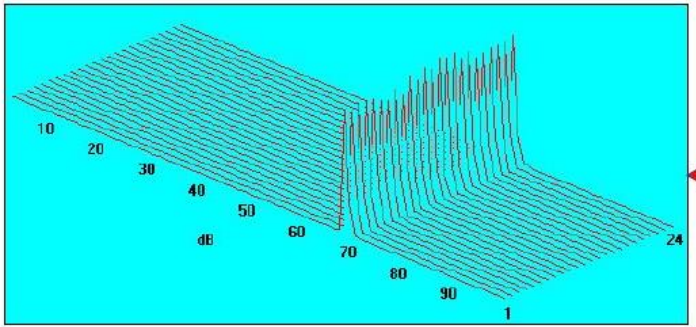


Acoustic Leak Loggers for pinpointing individual leaks

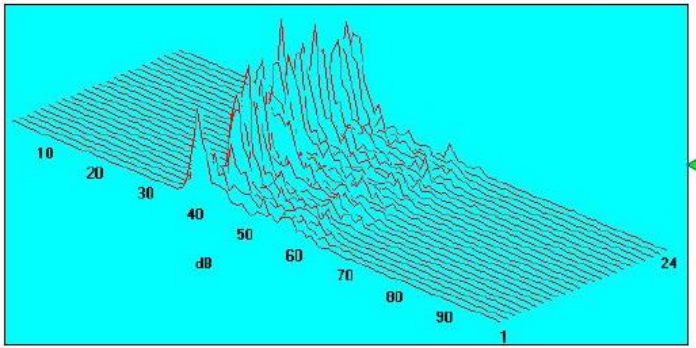
Not all noises are leaks

Leak Localisation – Noise Logging

Halma Water Management



Permalog+ unit in “Aqualog” recording mode showing noise level and spread. This profile indicates a leak.



Permalog+ unit in “Aqualog” recording mode showing noise level and spread. This profile indicates no leak.

A HALMA COMPANY

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Leak Loggers for surveying smaller search area

- Sound travels better through some pipe types than others
  - Might be 500’ of coverage in all directions from a single logger for metallic pipe, but only 250’ for non-metallic like PVC

- Need to consider pipe material when planning logger deployment to make sure no “gaps” in coverage where leaks could be missed

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Demos

Lesson Learned

- Carefully select DMA meter locations – understand limitations of equipment/abilities and set expectations accordingly
- Know your system – how should water move?
- You will find some things you didn't anticipate
- Staff accordingly
- Call on manufacturers and consultants if needed for help

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Water Loss Savings:
$250,000

Workflow optimisation Savings:
$100,000

Capital Improvement Savings:
$32.5M

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Delivering
Real Value

Stay Connected

- Explore ArcGIS for Water Utilities Configurations
  - http://solutions.arcgis.com/utilities/
- Register for part four of the webinar series
  - http://esri.com/savewater
  - November 19th – Understand Water Conservation through Reporting with ArcGIS
- Join the conversation on GeoNet
  - http://geonet.esri.com/
- Register for the 2016 Esri Water Conference
  - http://www.esri.com/events/water
  - February 9-11 Austin, Tx

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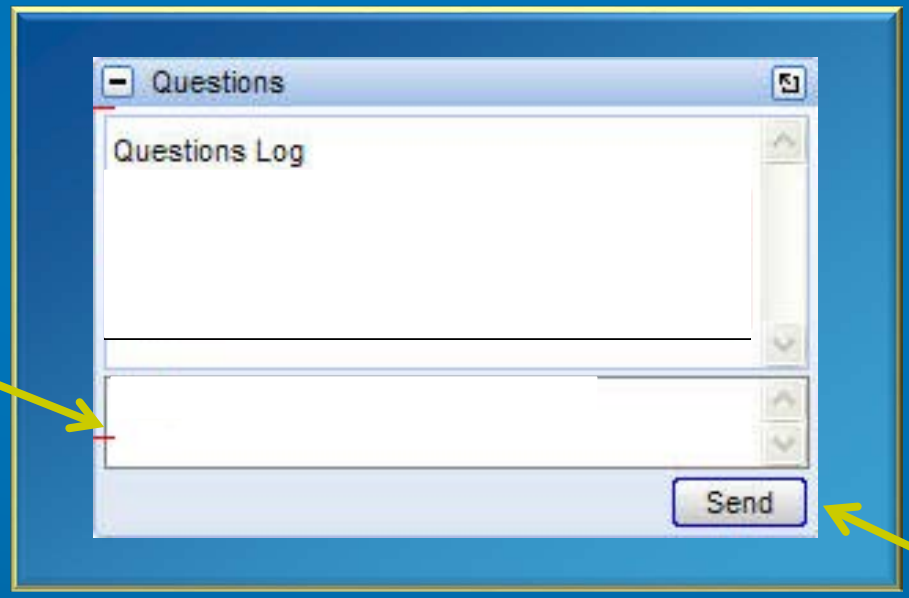

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