7th March 2024

Innovative Strategies to Prevent & Reduce Water Loss

2024 Utility Technology Conference

Simon Wick

Utility Solutions & Automation, LLC

Tennessee Association of Utility Districts

Vital for Tennessee's future

Seth Fischer, PE

First Utility District of Knox County

Let’s Talk About Big Leaks…

IWA/AWWA Water Balance

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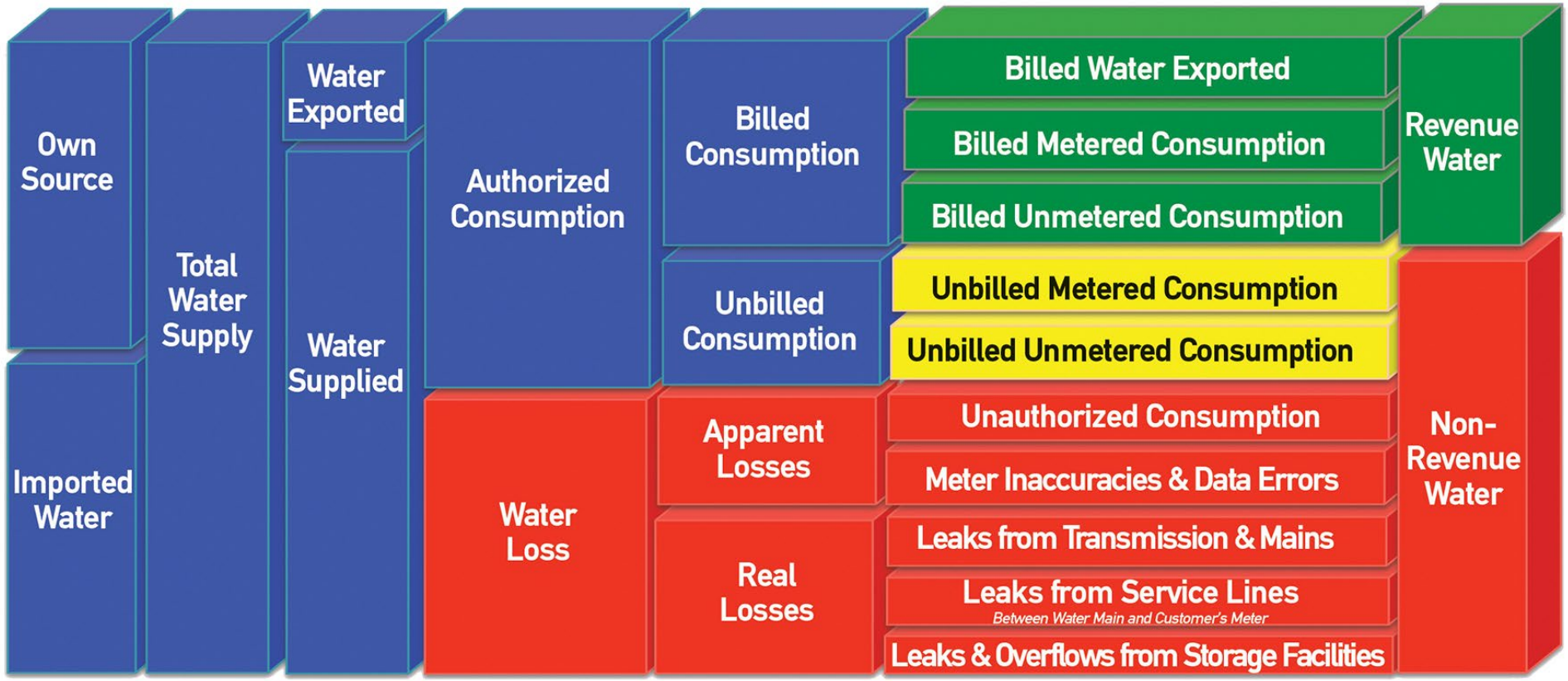


Requires accurate data to be meaningful

Improve your data validity score every year

USA & Canada Study Results

Utility Solutions & Automation, LLC

MORE THAN **800** WATER UTILITIES SURVEYED

260,000 PIPE FAILURES ANNUALLY
11.1 BREAKS PER 100 MILES

20% OF PIPES NEED TO BE REPLACED
A $452 BILLION SHORTFALL

Approximately 20% of Installed Water Mains Have Not Been Replaced Due to Lack of Funds

A total of 19.4% of installed water mains are beyond their useful lives, representing approximately 452,000 miles of pipe. In 2012 and 2018, the percentages were 8% and 16%, respectively. This indicates a lack of funding for critical water infrastructure estimated at $452 billion.

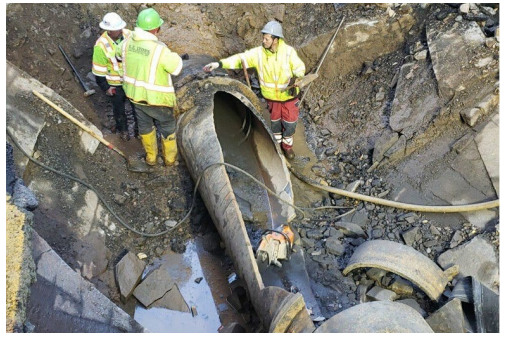
Average Leak Rate (all leak types) in US is Circa 1 Leak Per Mile

** As reported by the Utah State University - Water Main Breaks Study – Dec 2023*

USA & Canada Study Results cont...

Distribution Pipes Fail Five Times More Often than Transmission Mains Distribution pipes

(12 inches and smaller), which represent 86% of all water mains in the US and Canada, have overall failure rates of 13.3 breaks/(100 mi-yr) compared to transmission mains at 2.2 breaks/(100 mi-yr). Some materials have significantly large differences in break rates between transmission and distribution mains.



** As reported by the Utah State University - Water Main Breaks Study – Dec 2023*

Why Care About Transmission Main Breaks?

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The Consequence & Likelihood of Failure

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Consequence of Failure

Likelihood of Failure

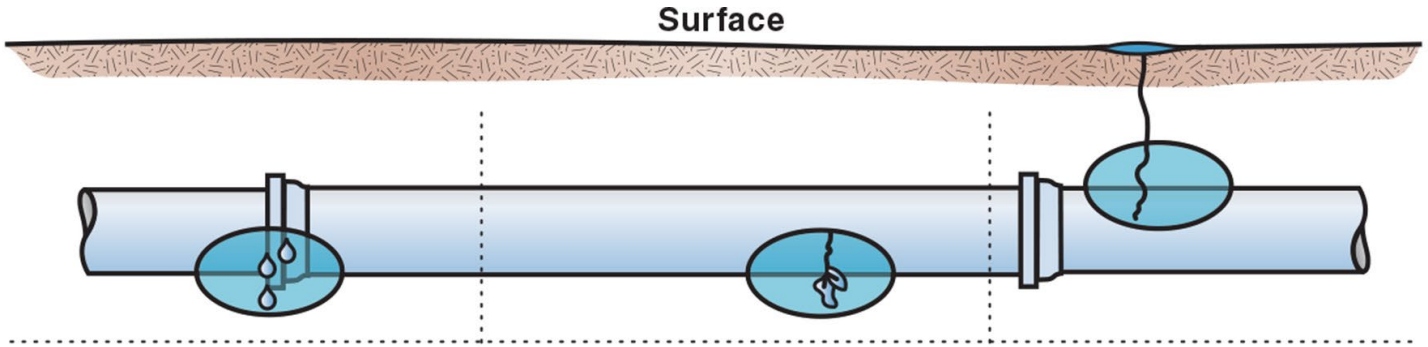
	Very Low	Low	Moderate	High	Very High
Very High					
High					
Moderate					
Low					
Very Low					

Avoid being …

Step 1 – Acceptance

- What keeps you up at night?
- What pipes should be monitored?
- What are the alternatives?
- Could you improve your NRW?
- Improve the validity of your Water Audit?
- Do you need actionable data?

Right Tools For The Job



Background Leakage

Unreported and undetectable using traditional acoustic equipment

Tools

- Pressure stabilization
- Pressure reduction
- Main and service line replacement
- Reduction in the number of joints and fittings

Unreported Leakage

Often does not surface but is detectable using traditional acoustic equipment

Tools

- Pressure stabilization
- Pressure reduction
- Main and service line replacement
- Reduction in the number of joints and fittings
- Proactive leak detection

Reported Leakage

Often surfaces and is reported by the public or utility workers

Tools

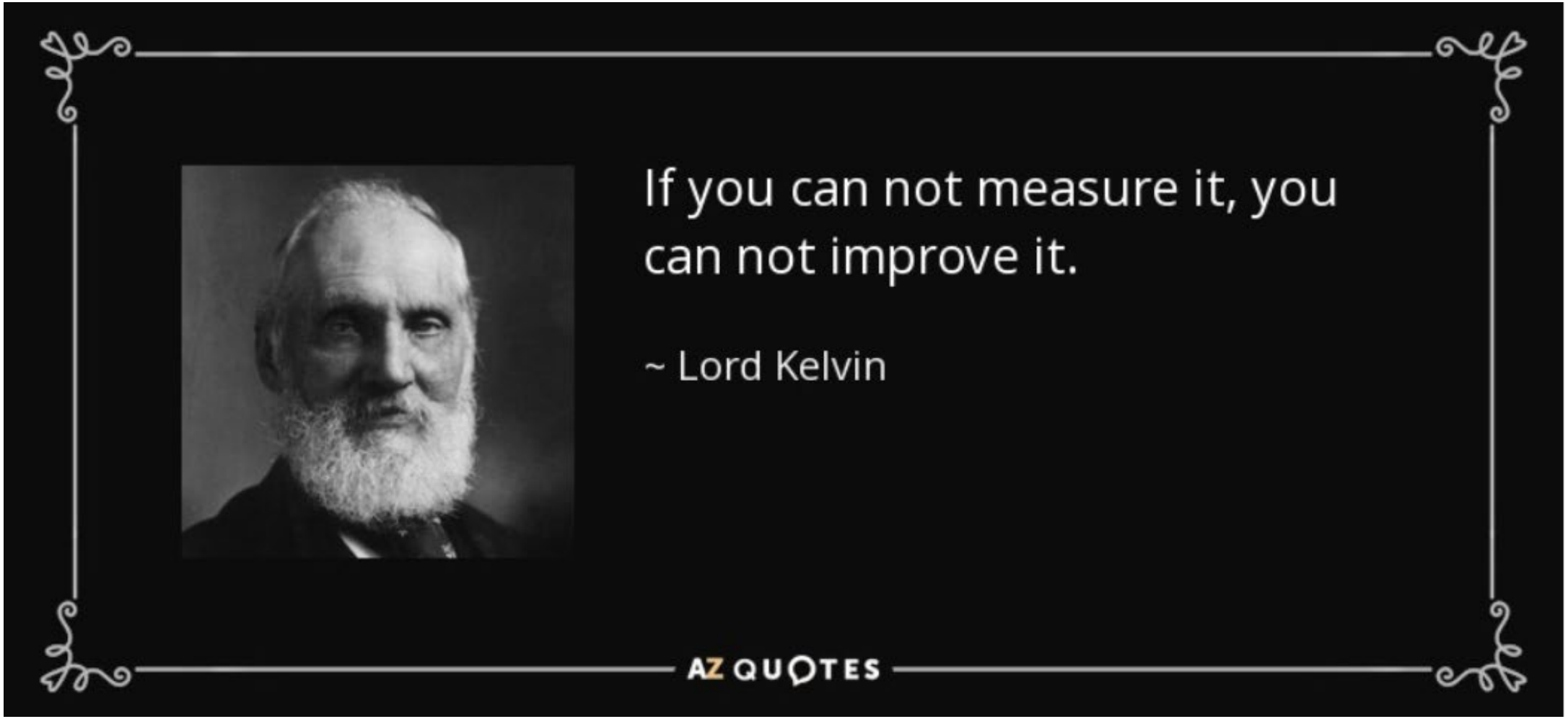
- Pressure stabilization
- Pressure reduction
- Main and service line replacement
- Optimized repair time

Source: Tardelli, J. 2005, in Abastecimento de Água. Tsutiya, M., Escola Politénica USP, Sao Paulo, Brazil

Step 1 – Explore Solutions

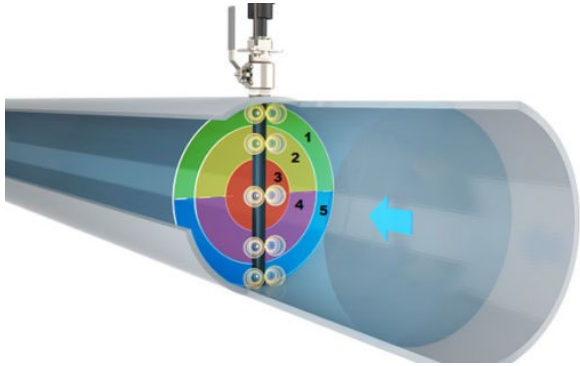
- MEASURE ACCURATELY
- Pressure Management – Create a calm network
- DMA's – Chase the Gallons NOT the noise
- Survey's or Permanent Monitoring
- Leak Detection – Acoustic and/or other?
- Pursue Actionable Data
- Reduce Leak Run Time

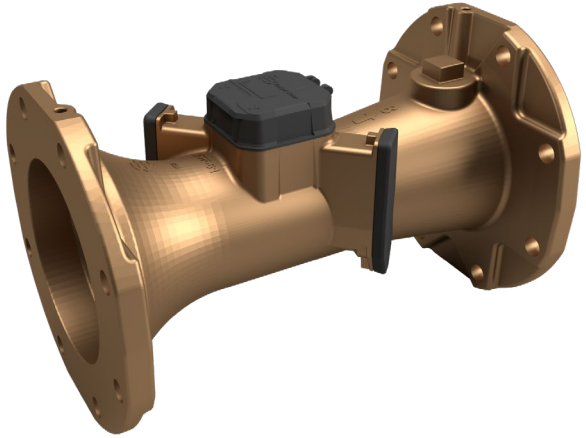
Step 2 – Measure Accurately



Step 2 – Measure Accurately

- Source Meters
- Residential
- C&I
- Other (flushing etc)





Step 2 – Pressure Management

- PRV / Zones
- Transient
- Standard

STANDARD

Flexible power options
(battery, mains, solar)

EXTERNAL SENSOR

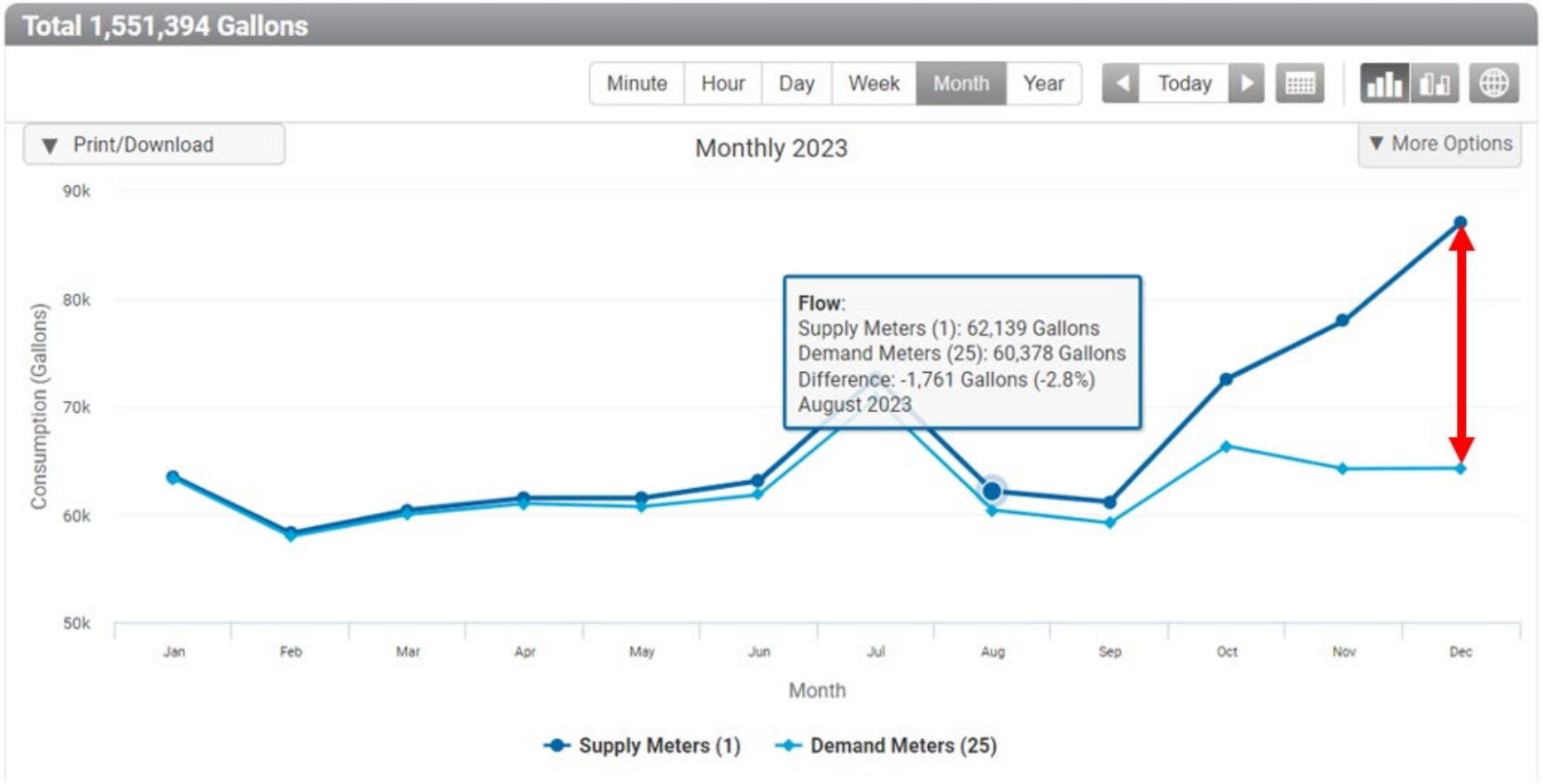
For deep chambers or
threat of frost

HYDRANT

Fast, easy hydrant-mounting
Self-commissioning

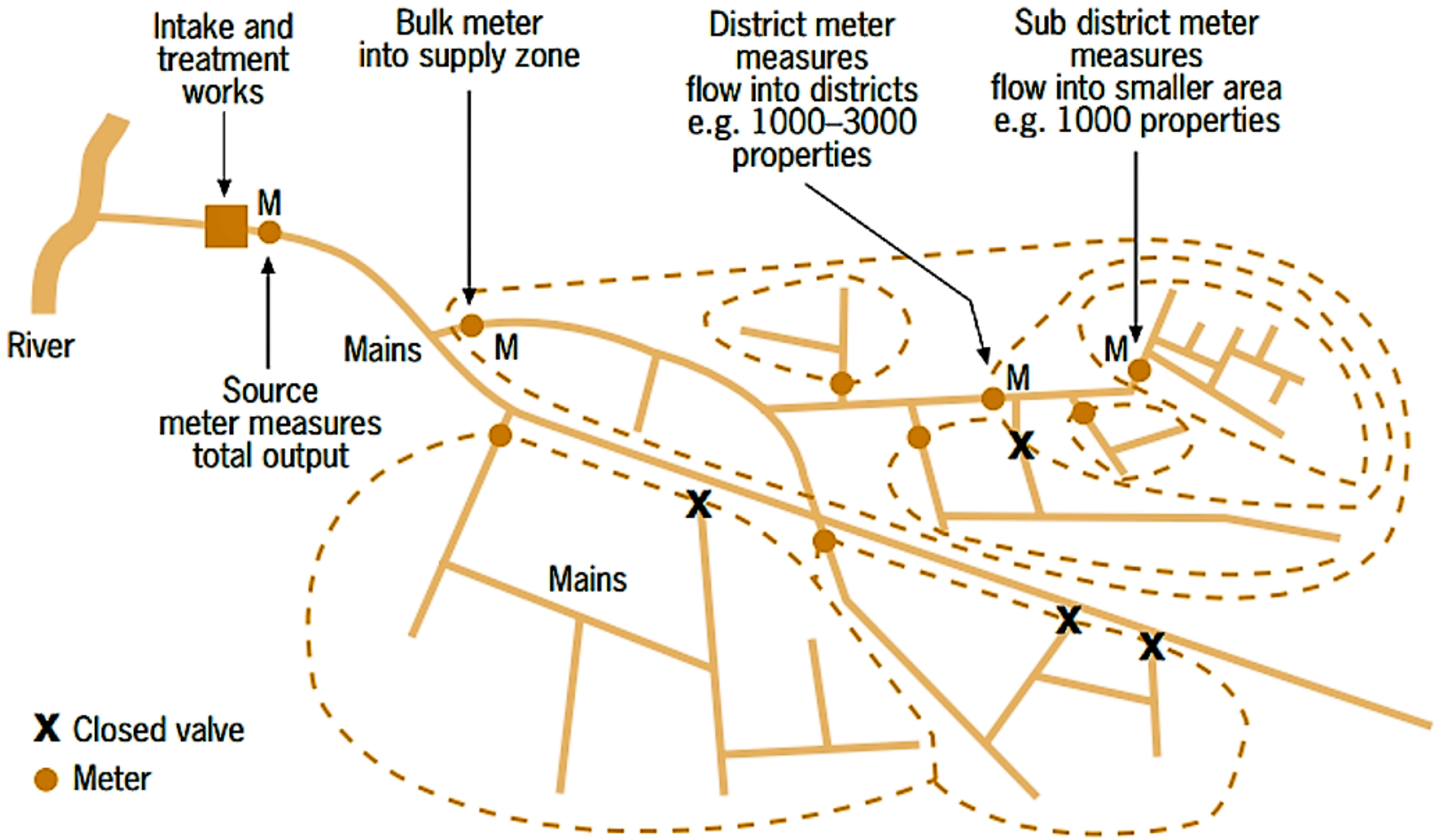
Step 2 – District Metered Area's (DMA's)

- Hydraulic
- Virtual



Chase the Gallons with Actionable Data

Step 2 – Hydraulic DMA's



Chase the Gallons with Actionable Data

Step 2 – Virtual DMA's

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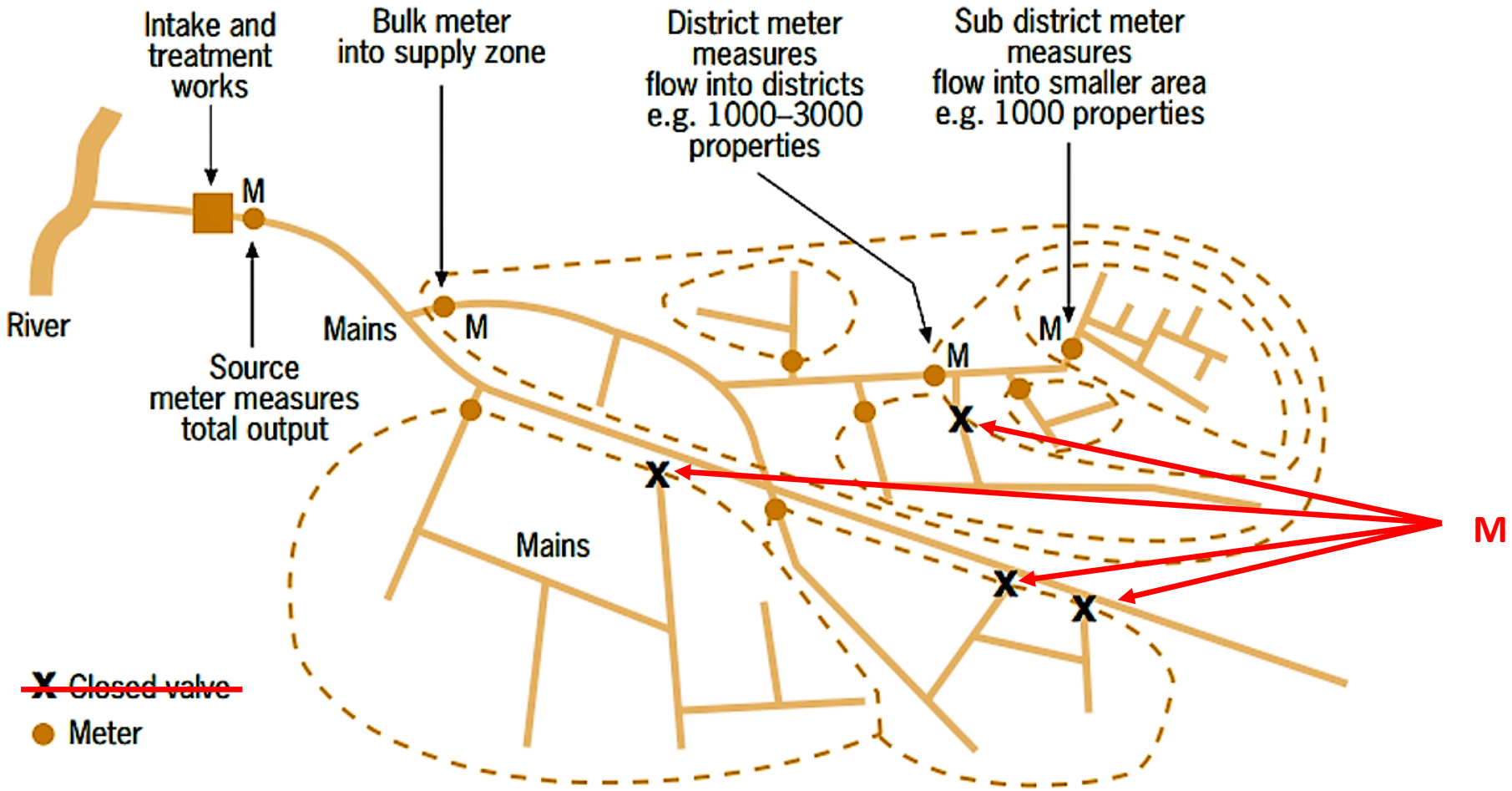
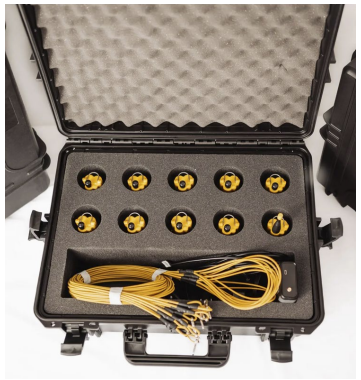


Add More Meters
Remove closed valves

Chase the Gallons with Actionable Data

Step 2 – Leak Detection

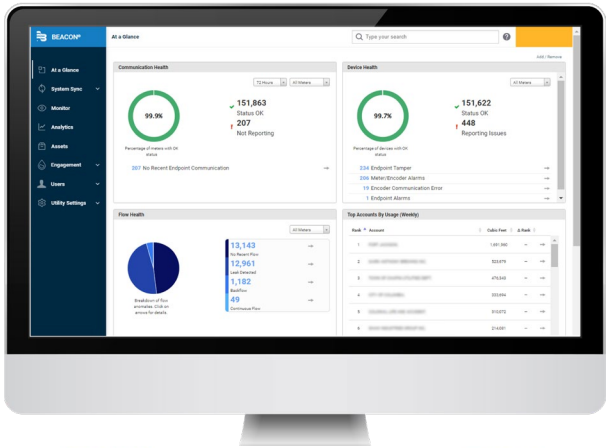
- Traditional Surveys
- Lift N Shift
- Satellite
- Permanent
- Accelerometer or Hydrophone tech

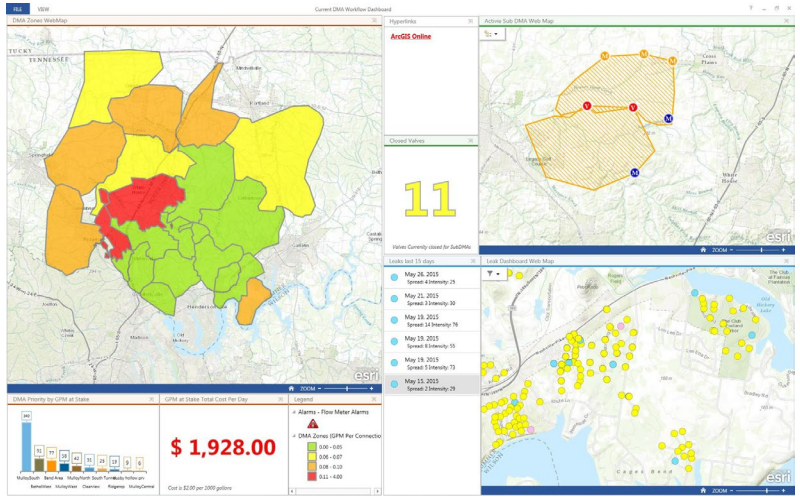


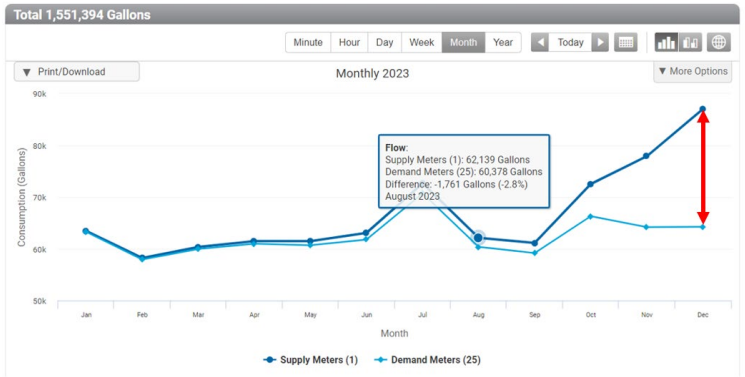
Each Area May Require a Different Approach

Step 2 – Actionable Data

- Most improved area
- Ai
- Rapid growth



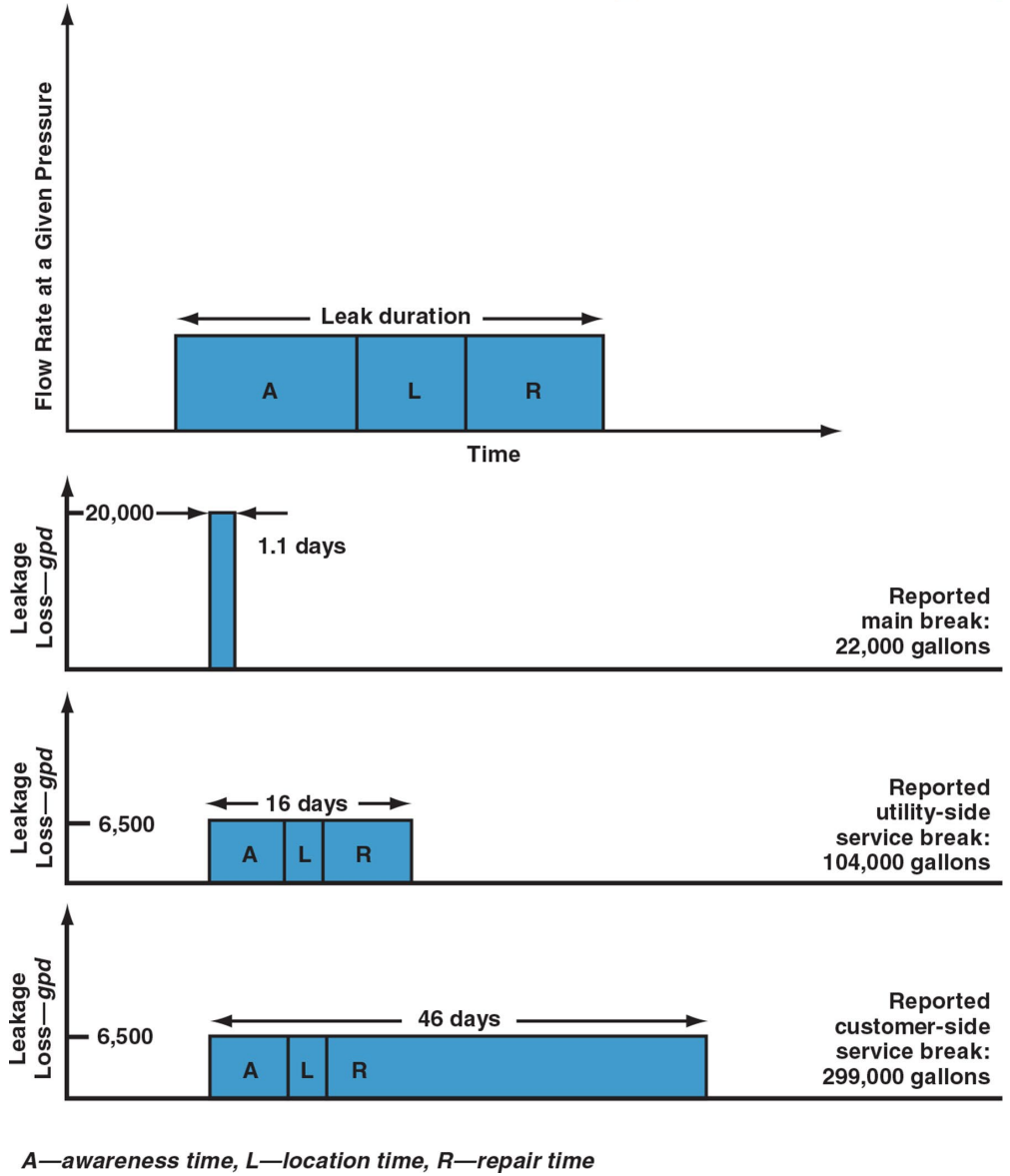




GOAL = Easy Access to Daily Actionable Data

Step 2 – Reduce Leak Run Time

- Your NRW is mostly a lot of smaller leaks
- Gallons & dollars saved
- Increased operational Efficiencies
- Increased customer service



Step 3 – ACTION

- Go at your pace
- Execute Pilot Trials
- It’s ok not to win every time
- There is no silver bullet
- Commitment & dedication will win the day

Reduce Your Carbon Footprint

- IWA Initiative
- Relationship between Real Losses and Energy
- Reducing Water Loss = Reduction in Carbon Footprint
- Creating Carbon Leakage Credits
- Promoting Outside Corporate Investment

https://iwa-network.org/groups/water-loss/

First UTILITY DISTRICT OF KNOX COUNTY

Where community comes first.

Syrinix

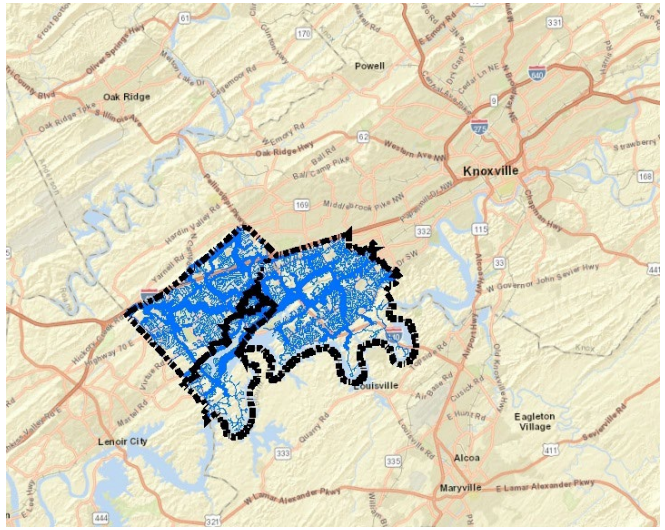
Pressure Management

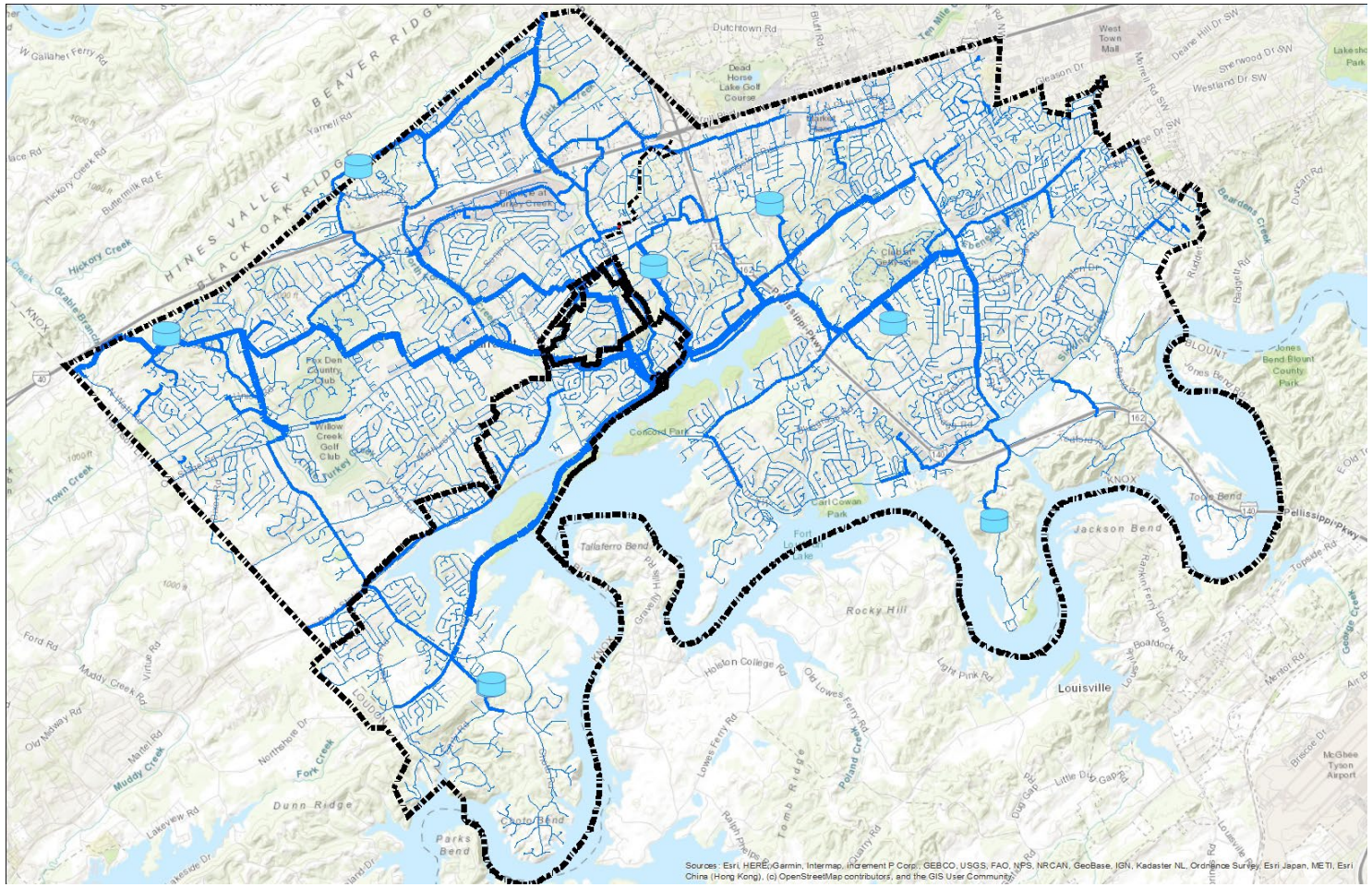
Seth Fischer, PE

March 7, 2024

First Utility District of Knox County – Knoxville, TN

- Population ~100,000
- 35,900 water meters
- 600 miles of water line
- WTP – 34 MGD
- ADD - 10 MGD
- PDD – 21 MGD





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“Know what we have, how it works, what the rules are.”

FUD has considered transients one of the last unknowns in both our distribution and collection systems.

Aging Assets – minimize breaks and maximize life

- Considered surge tanks on force mains and at WTP
  - Jacobs Surge Analysis November 2019

- Considered adding surge or hammer license to our hydraulic modeling software

- In 2021 FUD Purchased
  - 3 Syrinix Pipeminder One Internal – Water Transmission Mains
  - 7 Syrinix Pipeminder One External – Sewer Force Mains
  - 2 Trimble Telog HPR-32iA

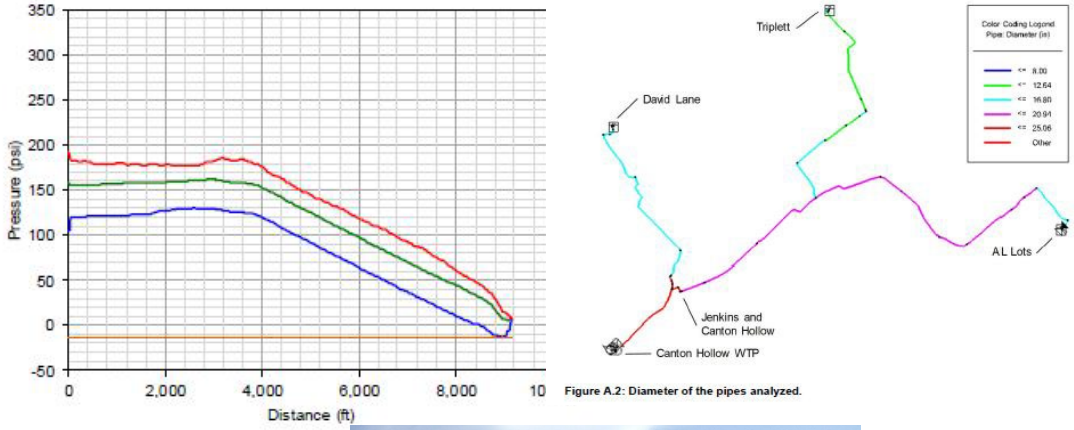

Figure A.2: Diameter of the pipes analyzed.

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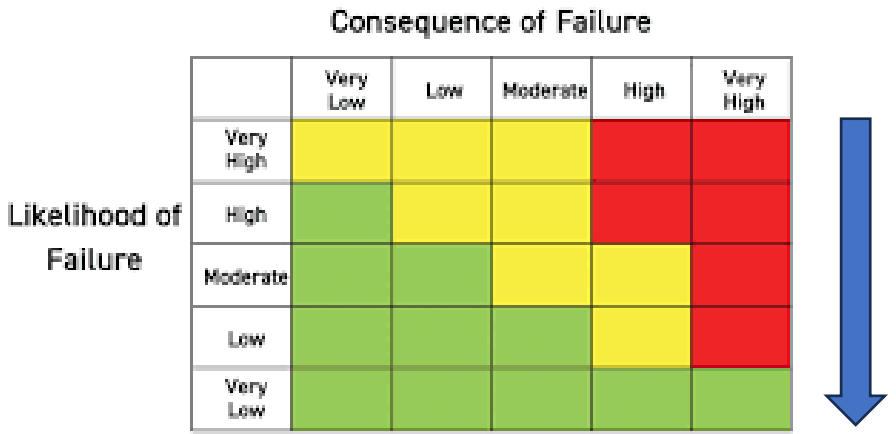
Pressure Management

- System calming
  - Protect aging assets
  - Surge Protection?
  - Pump operation at WTP
  - Distribution system operation
- Model Calibration
- Design for WTP Phase 1 and Phase 2
- Customer Claims



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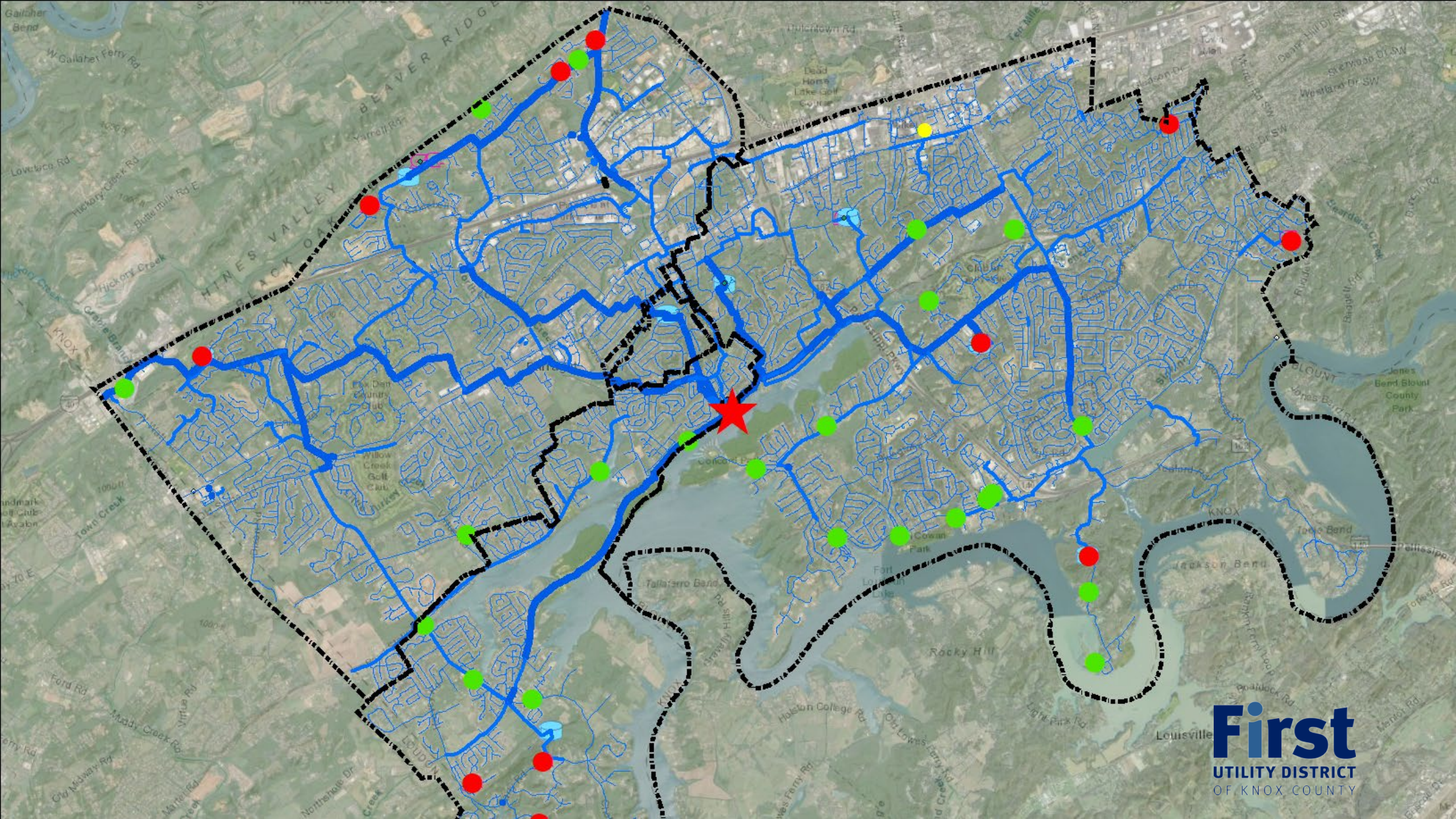
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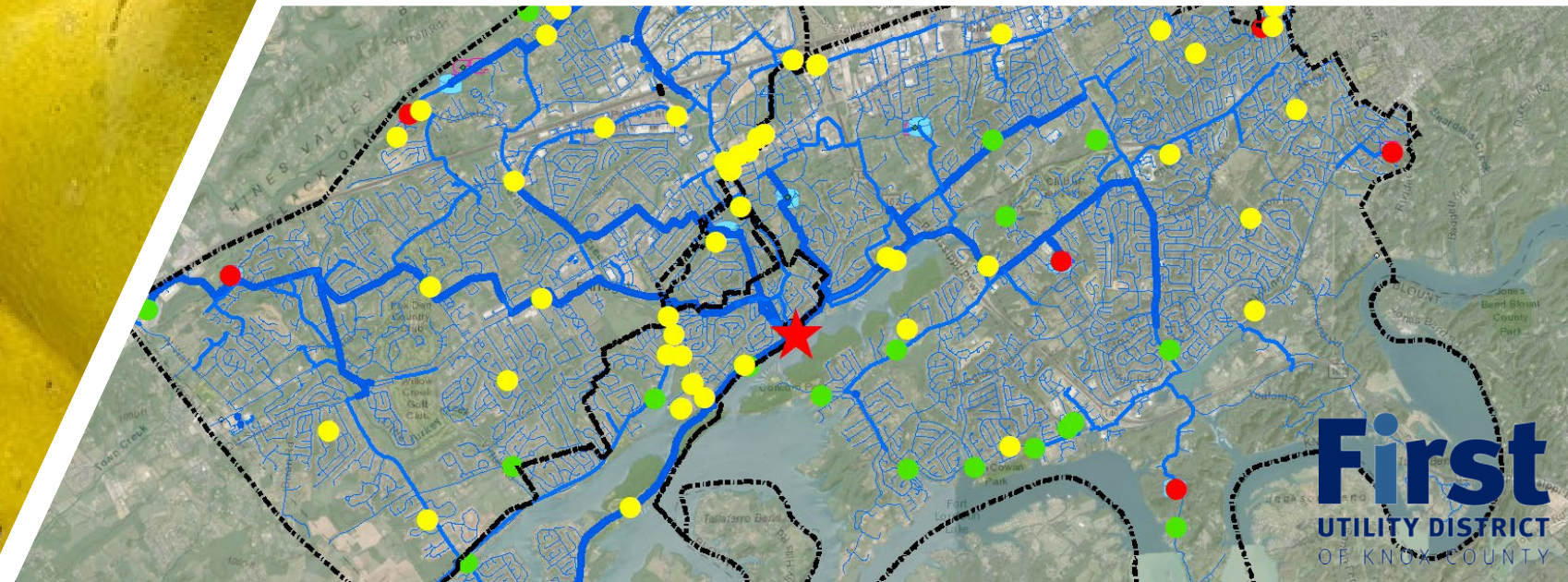
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Syrinix
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Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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Sewer Pumping Stations

Title	Status	Device	Device model	Review
Ten Mile 02 SWPS	Online	1614212A	C3	Okay
Ten Mile 01 SWPS	Online	1614232A	C3	Okay
S4 SWPS	Online	16142849	C3	Lots of big transients
Statesview SWPS	Offline	1614432A	C3	Device Offline
Greystone Point SWPS	Online	1614332A	C3	Okay
Riversound SWPS	Online	1614372A	C3	Regular low pressure
Sinking Creek SWPS	Online	1614192A	C3	Regular low pressure

Water Treatment Plant

Title	Status	Device	Device model	Review
Everett Transmission Main	Offline	1614061F	S3	Device Offline
Choto Transmission Main	Online	16140E20	S3	Okay
David Lane Transmission Main	Online	16142121	S3	Okay

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S4 SWPS

- https://radar.syrinix.io/site/1000011503
- Device online (Okay battery)
- No data missed in the last month
- The pressure seems to go through cycles where the surge and the oscillation after the pump stop are larger
  - 59 psi to 69 psi
  - The larger periods also seem to run for a shorter amount of time. Less damaged pump?
- The device did have go through some period where it produced a pump cycle transient which will have used a lot of power. This is not currently the case
- The delivery pressure has a large range, meaning we're either very close to the pump or the pump is somewhat damaged
  - The periods discussed earlier also seem to show a marginal difference in range during the delivery pressure
- The delivery pressure drops down as the cycle continues. Likely to be the dropping of the level in a wet well

Statesview SWPS

- https://radar.syrinix.io/site/1000011504
- Device offline (Battery seems okay)
- Last communication was 6th April 2021
- When device was online, showed Good Pump, Bad Pump. Possible damaged pump?
- Static head was quite unstable, passing Check valve?

David Lane transmission main

- https://radar.syrinix.io/site/1000011510
- Device online (Battery seems okay, needs a battery type)
- No data gaps
- This main operates around 165 psi g
  - Some transients go as high as 200 psi g
  - Some as low as 104 psi g
- There is one particular transient on 2nd August with an S3 of 142

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I was wondering if you guys could look at the (Syrinix) system on Thursday evening and Friday and see how it reacted to what we did. My only concern was when we turned down to allow black road to drop we had to turn off one of the big vertical turbines and then later in the evening bring it back on. Just curious how the system reacted to that and if we need to modify this in any way. My plan is to incorporate these drops three or so times a week. I appreciate your help.

Seth the only thing that correlates is that we had one large pump on in finished 4, and the operator slowed it down , he lowered the flow rate.

Yessir, the operator switched from a 1500 gpm pump to 1200 however allowed no time for things to settle,

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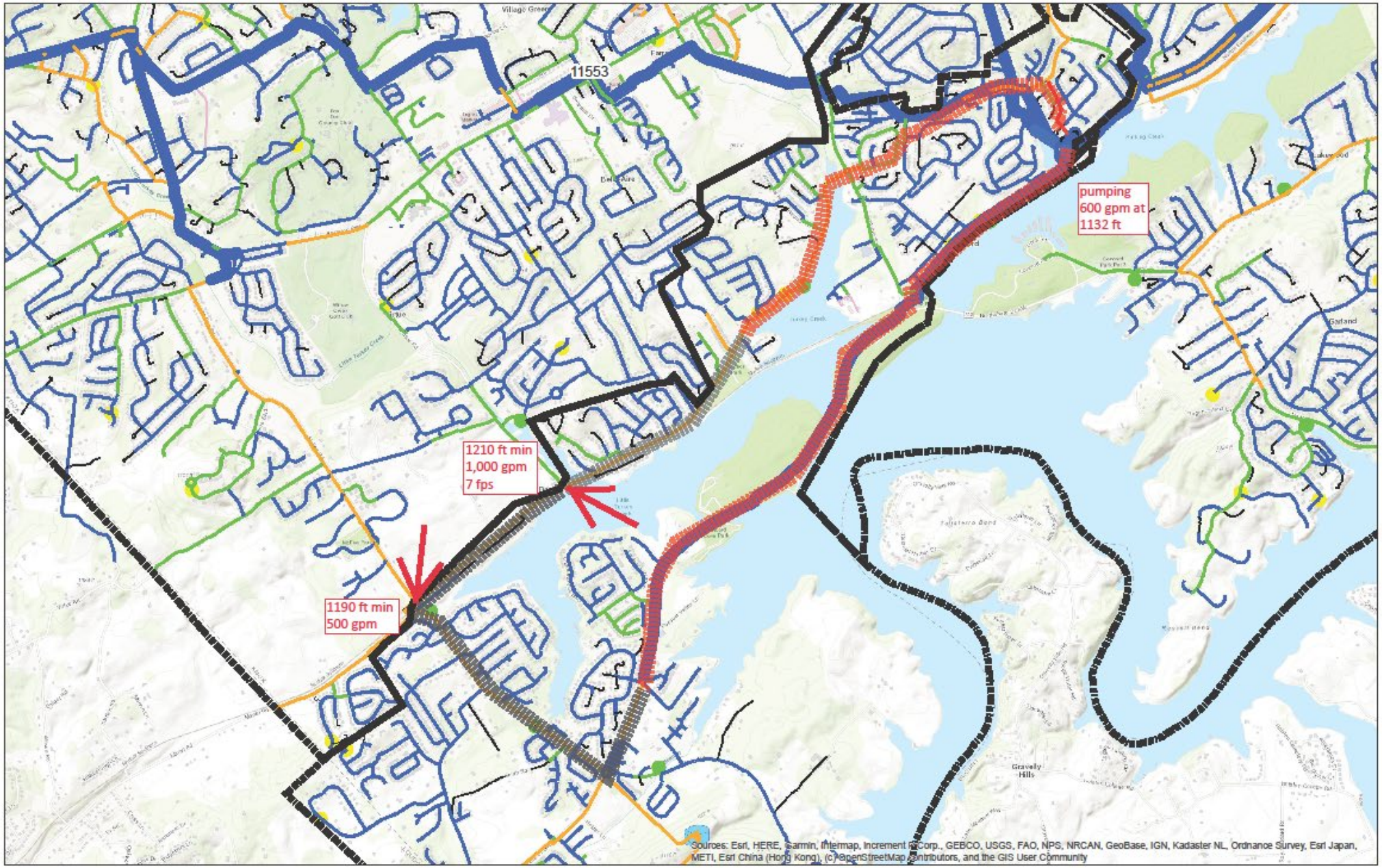
SUPREME
Racing



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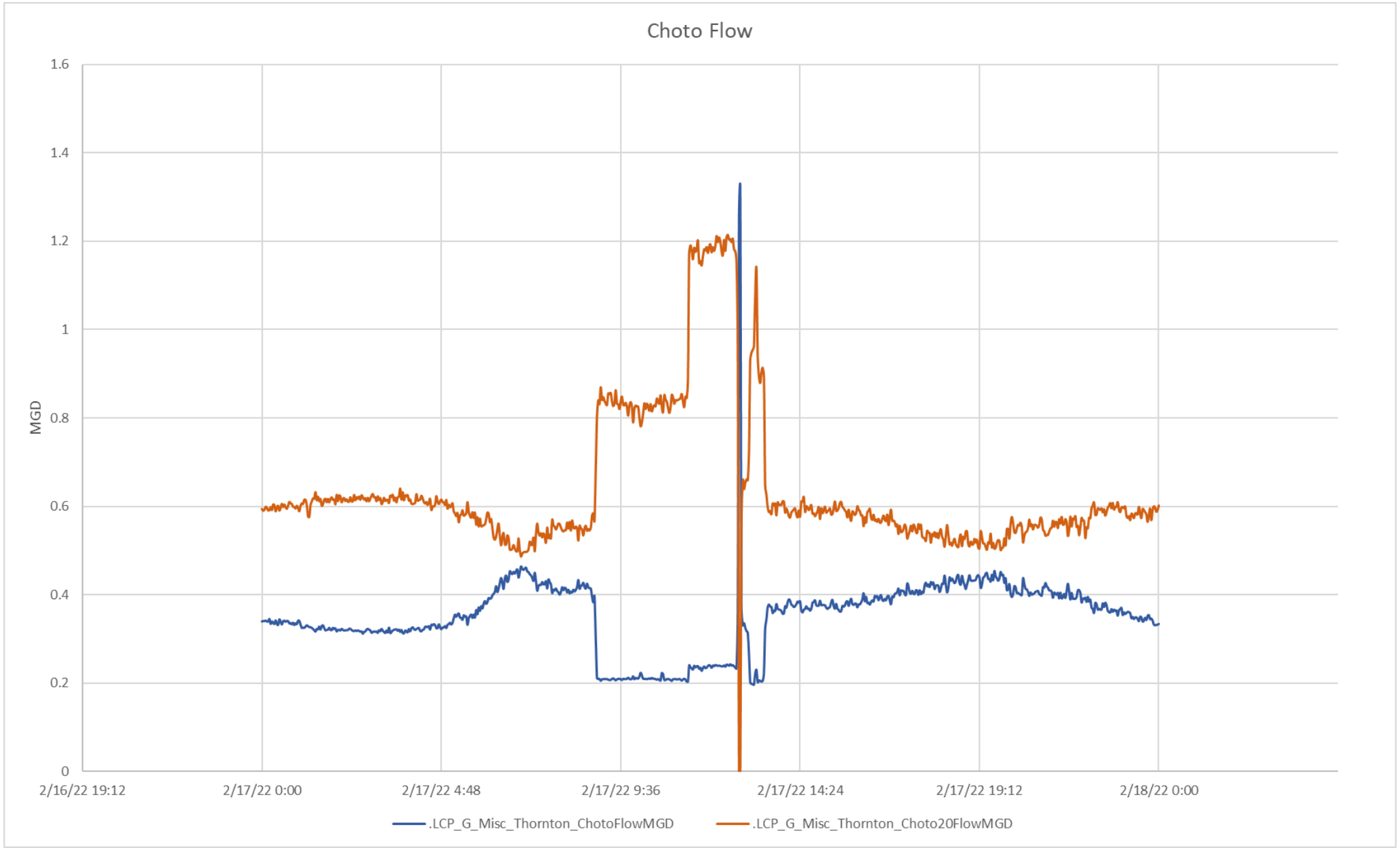

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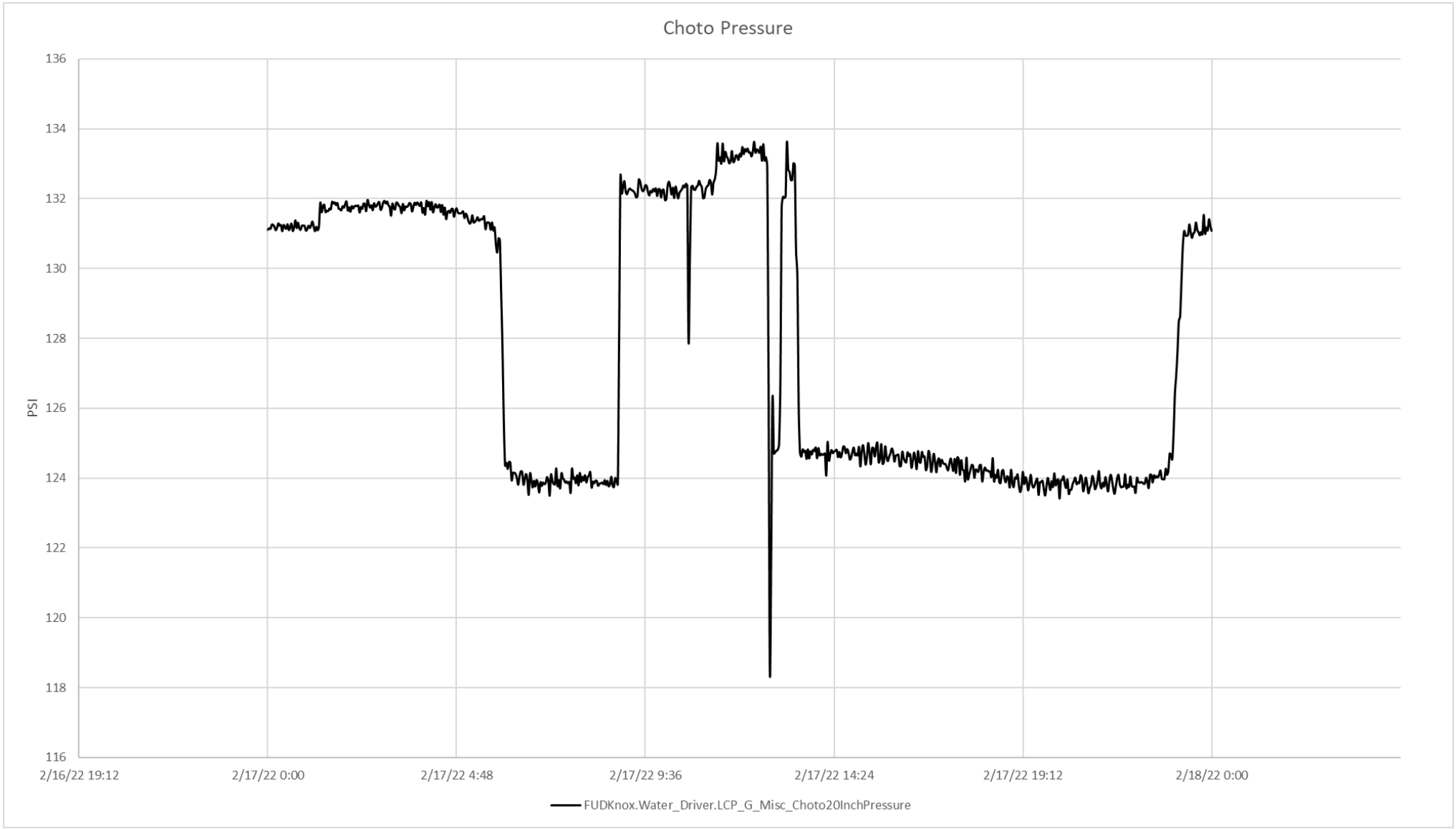

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Hi Seth,

See below an overview of the recent activity that you have subscribed to.

Transient Events

Choto Transmission Main

Transient Event **Duration:** 3 minutes

S3 Score	Min Pressure	Max Pressure	Pressure Change
394	-17.605	322.98	340.585

Negative Pressure Detected

02/17/2022 09:33:01 View Event

View Notifications Go to RADAR

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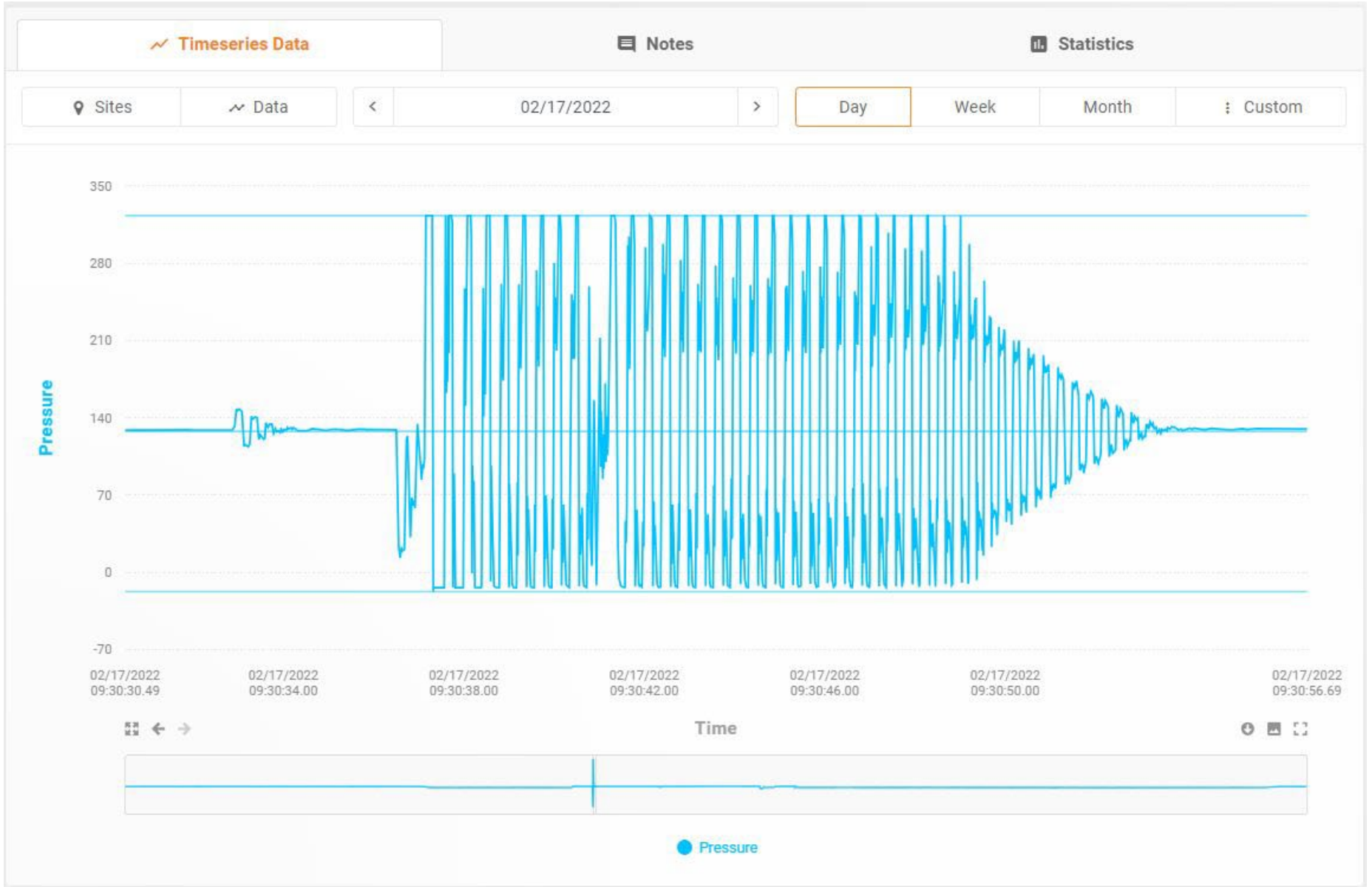

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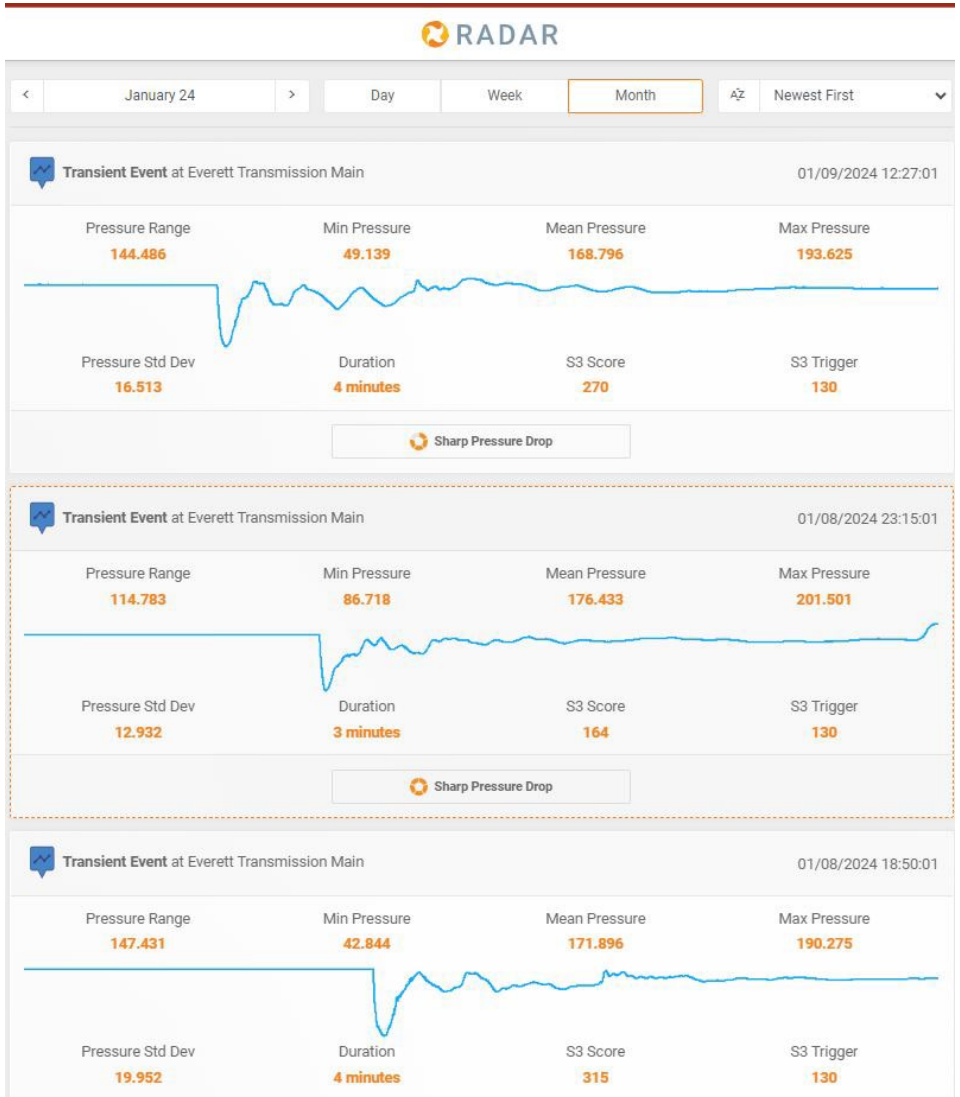

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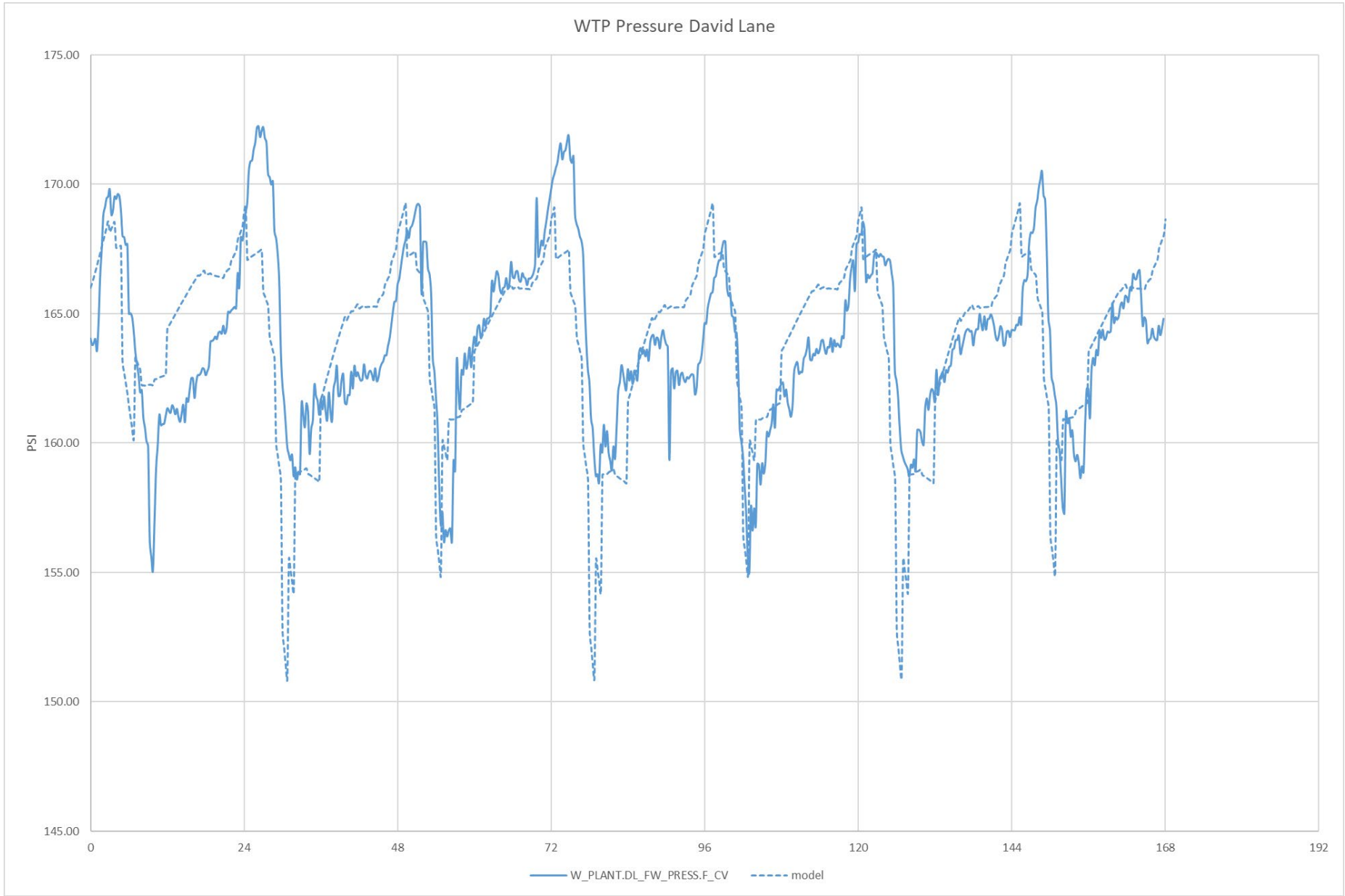

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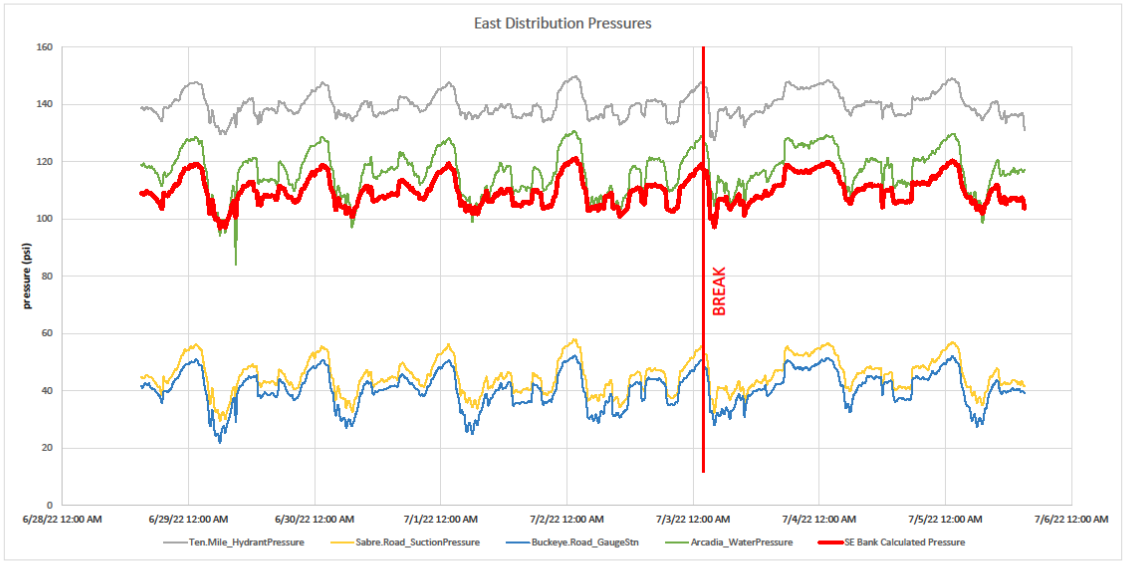

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- What’s next for FUD
  - Monitoring Lift Stations that haven’t been monitored yet.
  - Increasing coverage in water distribution system

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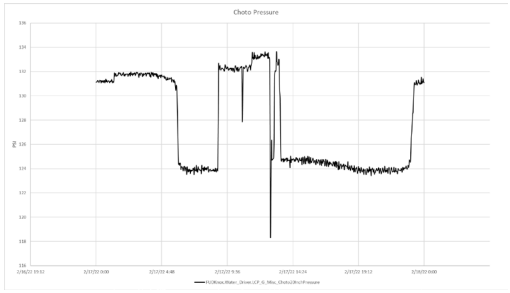
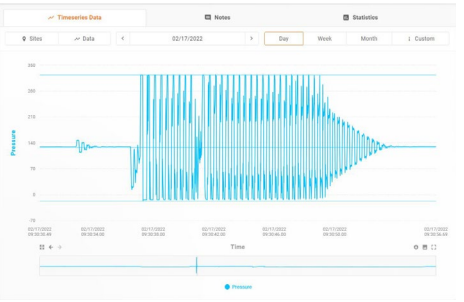
Takeaways

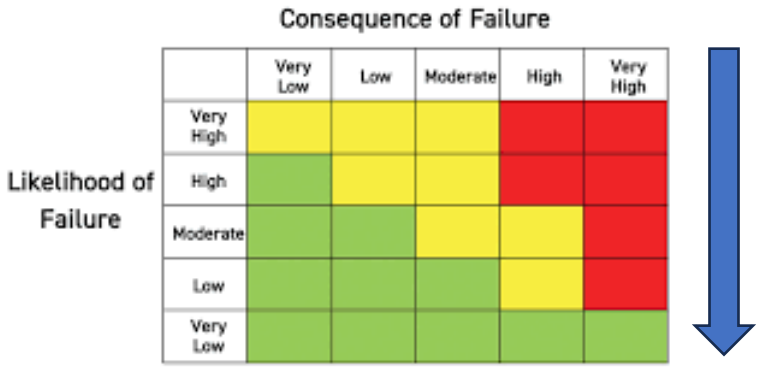
1. Know what you have and how it works





2. An ounce of prevention is worth a pound of cure.

3. Let the technology work for you – then ACT on it.



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Questions?

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Tennessee Association of Utility Districts

Vital for Tennessee's future

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