John Henry versus the Machine

Leak Detection Past and Present

MARCH-O MADNESS
LB Water
We Make Water Work.
WATERWORKS SEMINAR

540 TECHNOLOGIES™
Environmental and Data Solutions™

The Legend

- In the mountain's heart, where steel meets stone,
  John Henry stands, his strength alone,
  A hammer in hand, his eyes ablaze,
  Against the machine, a fiery maze.

- The steam drill whines, a metal beast,
  Its rhythmic churn, a chilling feast,
  A challenge thrown, a test of might,
  Man versus machine, a day and night.

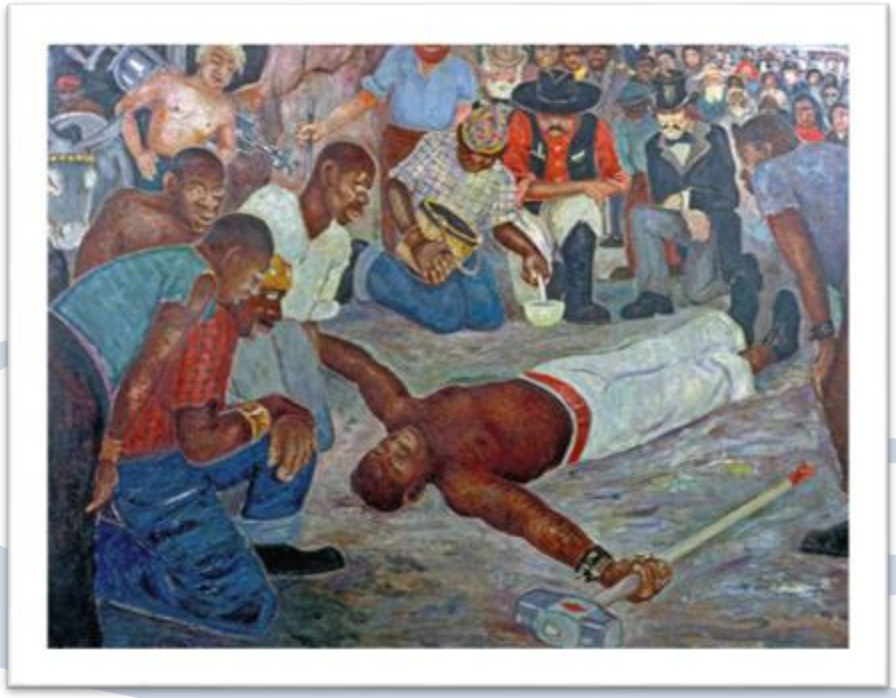
- With sweat and grit, John Henry strikes,
  Each blow a roar, the mountain quakes,
  His muscles strain, his spirit bold,
  A story told, a tale of old.

- The machine roars on, relentless pace,
  But John Henry's will, it cannot erase,
  He drives the steel, his heart in tune,
  A man's resolve, beneath the moon.

- The tunnel deep, the air grows thin,
  His body aches, yet he fights within,
  A final blow, a thunderous sound,
  The mountain echoes, the earth is bound.

- John Henry falls, his work is done,
  A victory won, but life undone,
  A legend lives, his spirit strong,
  The man who beat the machine, in song.

In the story, John Henry, a skilled railroad worker, challenges a steam-powered drill to a contest to prove that human strength and skill are superior to machines. Despite his impressive abilities, John Henry eventually wins the contest but dies from exhaustion shortly afterward.



Water Systems In America

1800s - Early Development

Urbanization began to accelerate, and cities started to consider more organized approaches to water distribution due to population growth, industrialization, and the increasing demand for clean water.

1800:

The first American waterworks system is built in Philadelphia, which uses wooden pipes to deliver water to parts of the city

1820s:

New York City starts developing a water system using a network of wooden pipes to bring water from nearby springs.

1830s - 1840s:

Boston installs its first water main, sourced from the nearby Cochituate Lake.

New York City develops its first significant water supply infrastructure, bringing water from the Croton River (Croton Aqueduct), with the system coming online in 1842.

Cleveland (1830s) and Pittsburgh (1840s) follow suit, beginning to install water mains sourced from nearby rivers and reservoirs.

Water Systems In America

Late 1800s - Expansion and Improvements

1850s - 1870s:

Water systems are established in Chicago, San Francisco, Washington D.C., and other rapidly growing cities. These systems use cast-iron pipes, which replaced wood and lead pipes, providing greater durability and safety.

Cities like Cincinnati and Detroit start expanding their water infrastructure, adding water mains and reservoirs to meet increasing demand.

1880s - 1900:

The Great Chicago Fire of 1871 significantly accelerated the development of the city's water infrastructure. The city adopts modern water systems and expands the use of water mains.

The Philadelphia water system also expands significantly, with the introduction of a filtration plant in 1873.

By the end of the 19th century, many larger cities in the U.S. have established widespread water main networks using new technologies like filtration, chlorination, and larger-scale distribution systems.

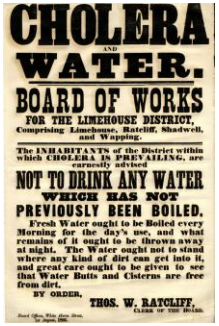
Water Systems In America

Early 1900s - Consolidation and Innovation
1900-1920s:

The advent of new water purification techniques like chlorination and filtration helped further improve water quality and safety.

Cities like Los Angeles and Atlanta begin building out more expansive water systems. Los Angeles, in particular, grows rapidly due to the development of aqueducts, bringing water from distant sources like the Owens Valley.

New York City's water system is expanded with the construction of the Catskill and Delaware aqueducts in the early 20th century, providing an increasingly reliable and high-quality water supply.


CHOLERA
AND
WATER.
BOARD OF WORKS
FOR THE LIMEHOUSE DISTRICT,
Comprising Limehouse, Ratcliff, Shadwell, and Wapping.
The INHABITANTS of the District within which CHOLERA IS PREVAILING, are earnestly advised
NOT TO DRINK ANY WATER
WHICH HAS NOT
PREVIOUSLY BEEN BOILED.
Fresh Water ought to be Boiled every Morning for the day's use, and what remains of it ought to be thrown away at night. The Water ought not to stand where any kind of dirt can get into it, and great care ought to be given to see that Water Butts and Cisterns are free from dirt.
BY ORDER,
THOS. W. RATCLIFF,

Mid-1900s - Post-War Growth and Infrastructure
1930s - 1950s:

In the wake of World War II, cities experience rapid growth, with new suburbs and urban sprawl. Water systems are expanded to serve these new areas, often involving the replacement of old infrastructure.

The development of suburban water systems and the need for more expansive networks of water mains became essential in cities like Los Angeles, Houston, and Phoenix, which saw their populations grow significantly.

1950s - 1960s:

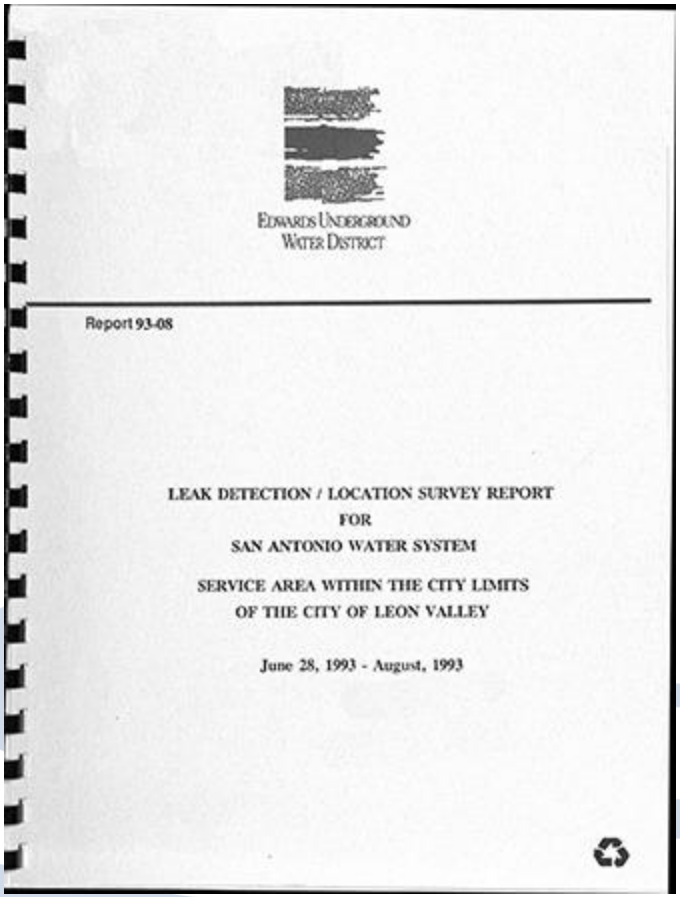
The U.S. federal government invests in major infrastructure projects, leading to further expansion of water mains in cities across the country. The Clean Water Act of 1972 and related federal funding programs help improve water quality standards and system upgrades.

Leakage Was and is Inevitable

- It was only a matter of time until pipe began to leak
- Methods were needed to locate these leaks
- With more treatment lost water became more expensive and more of a priority

Strategic Methods Were Designed To Manage Loss

- Annual surveys became the norm
- But is this the most effective way to manage leakage?



EDWARDS UNDERGROUND WATER DISTRICT

Report 93-08

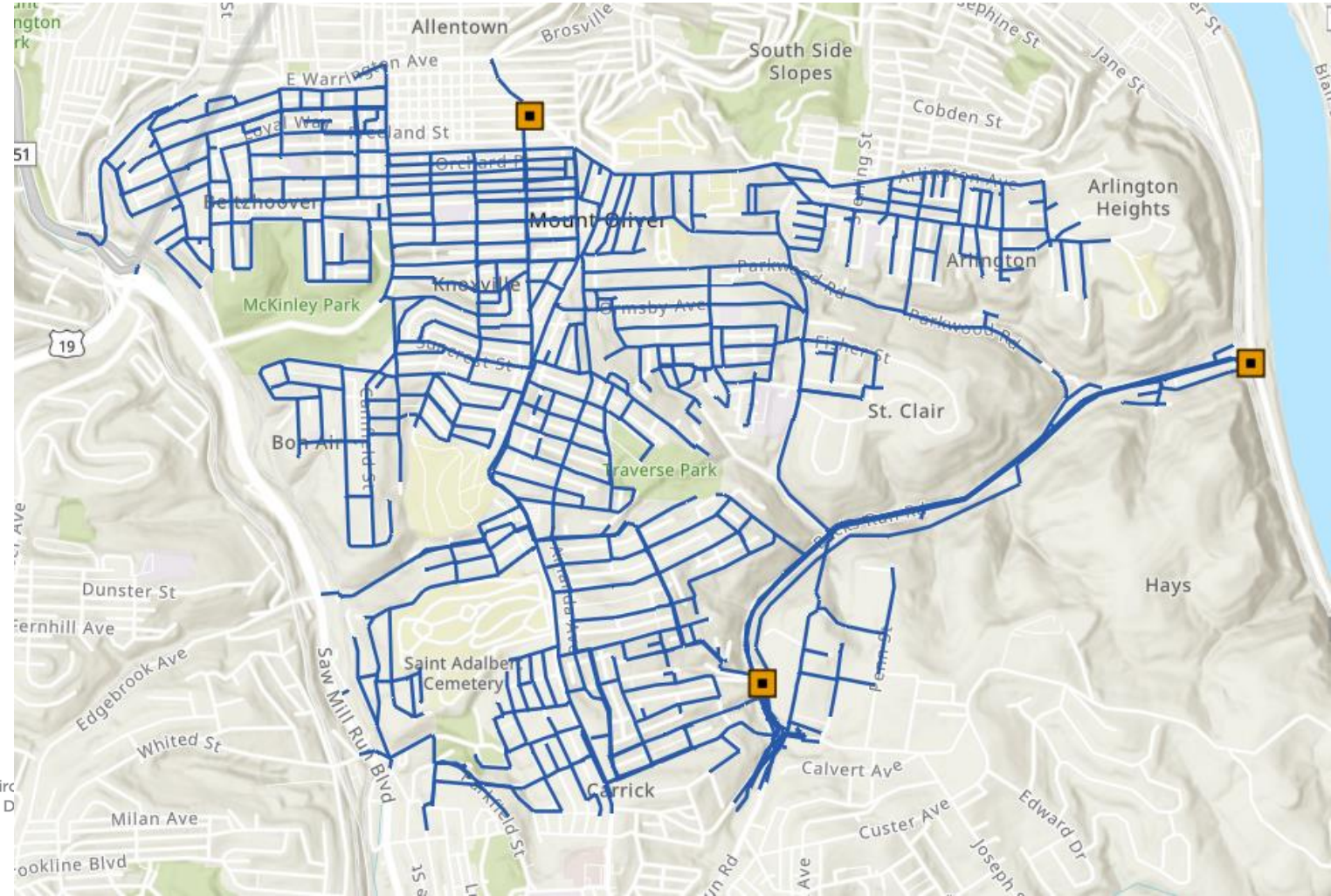
LEAK DETECTION / LOCATION SURVEY REPORT
FOR
SAN ANTONIO WATER SYSTEM

SERVICE AREA WITHIN THE CITY LIMITS
OF THE CITY OF LEON VALLEY

June 28, 1993 - August, 1993

Manual Leak Survey vs Technology

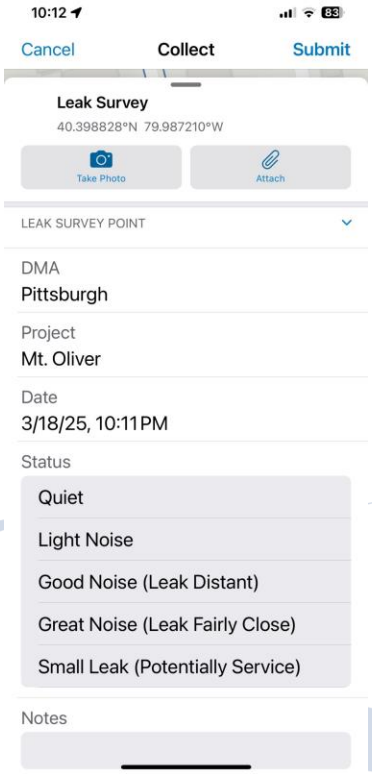
- We decided to find out
- With Pennsylvania American Water we picked the Mt Oliver Pressure Gradient in Pittsburgh, PA
- This Zone contains **65.9 miles of pipe** comprised of a mixture of ductile and cast iron

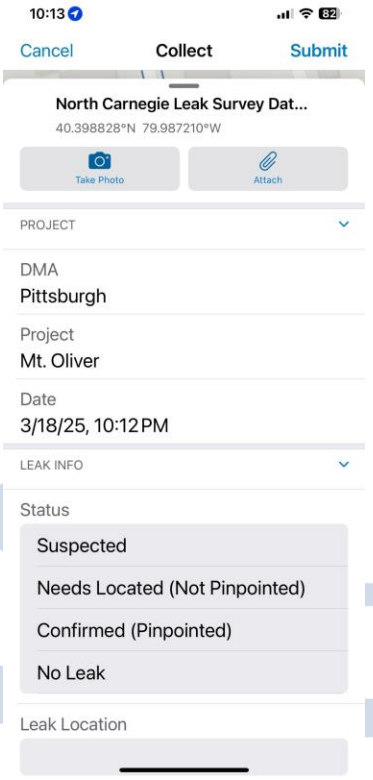


540 TECHNOLOGIES™

Manual Leak Survey vs Technology

- Using the ESRI platform 540 built an **app** and dashboard to log and track all survey and pinpointing efforts

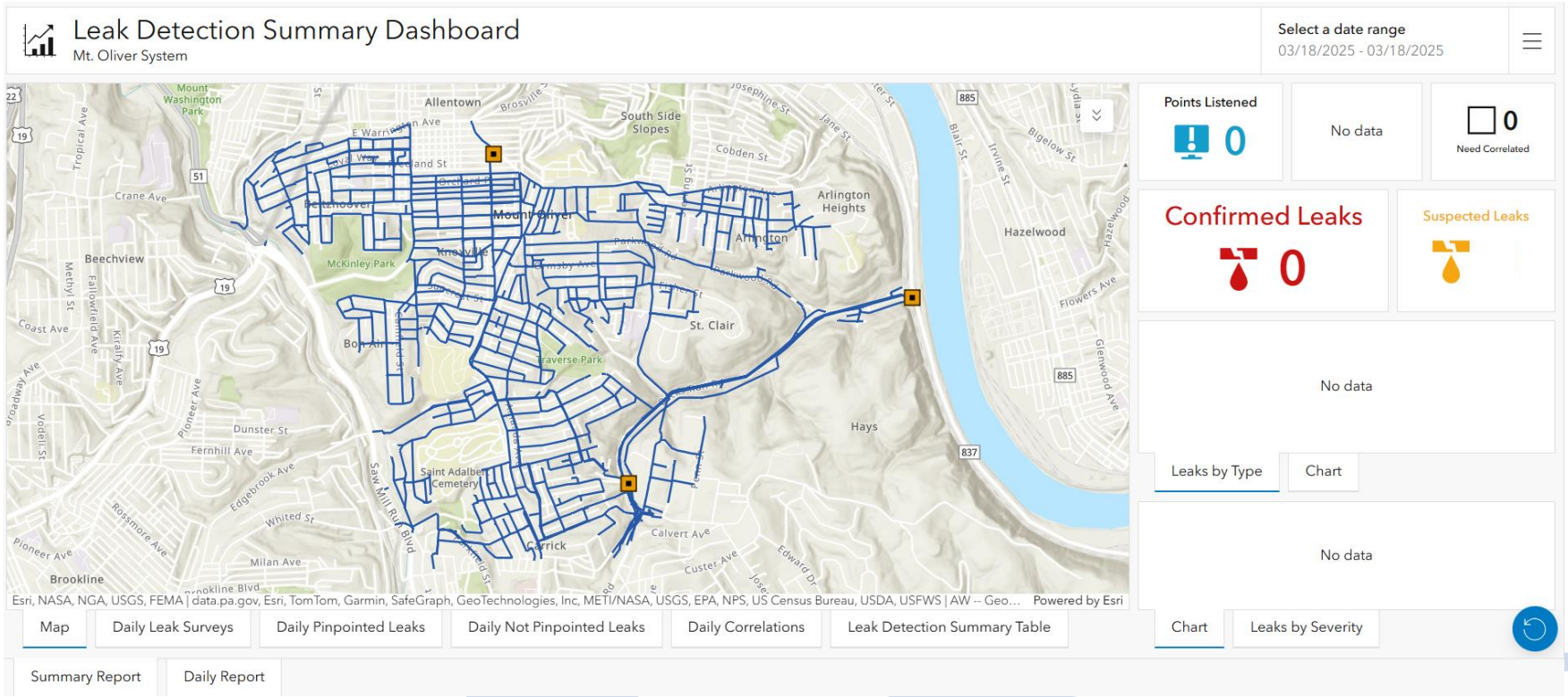




540 TECHNOLOGIES™ Environmental and Data Solutions™

Manual Leak Survey vs Technology

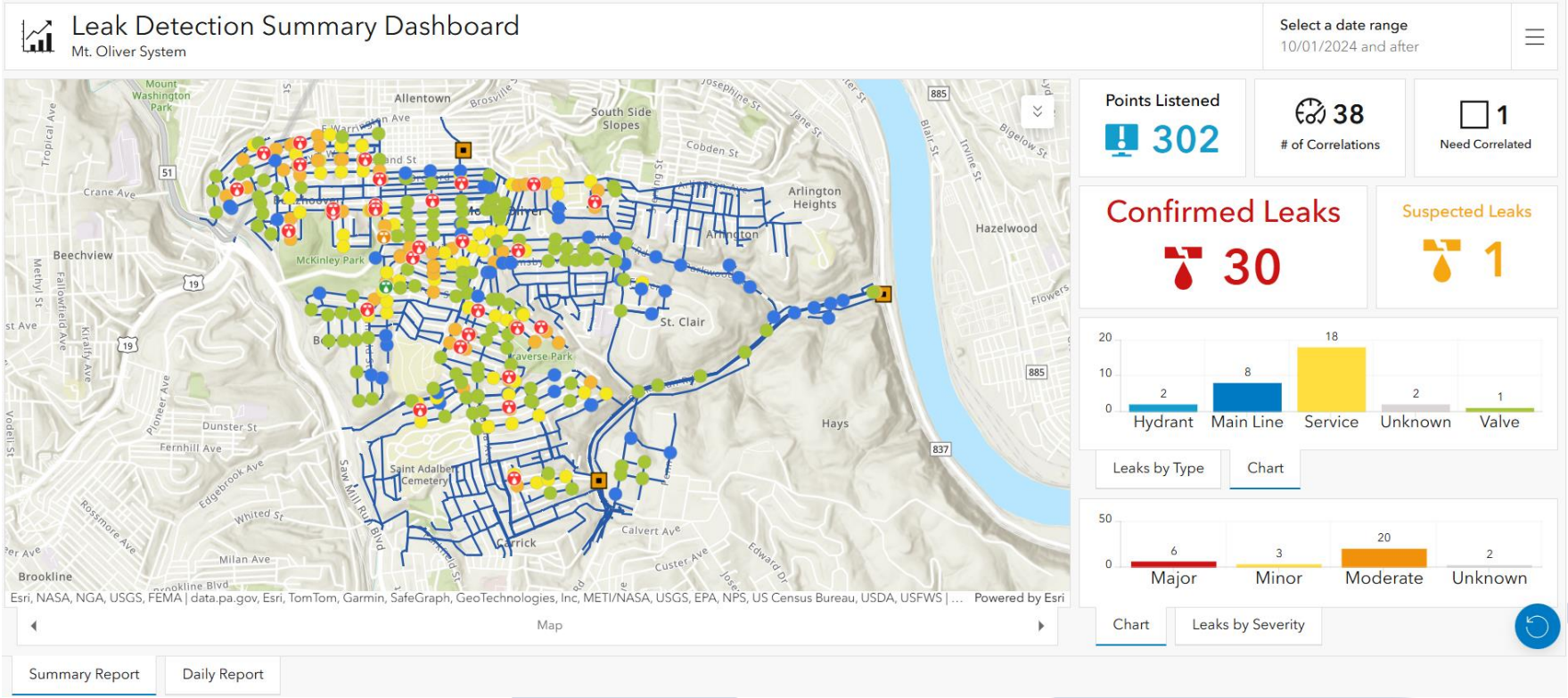
- Using the ESRI platform 540 built an app and **dashboard** to log and track all survey and pinpointing efforts



540 Technologies™ Environmental and Data Solutions™

Manual Leak Survey vs Technology

- 8 days have been completed with 2 remaining to finish the survey



540 Environmental and Data Solutions™ TECHNOLOGIES™

Manual Leak Survey vs Technology

- Leak Cards are submitted daily for crews to repair

Leak Card Report
Mt. Oliver System

Date : March 17, 2025, 7:21 PM

Leak Location: 1635 Leolyn St Pittsburgh, PA 15210 United States

Status:	Confirmed (Pinpointed)	Logger Leak :	No
Leak Type :	Main Line	# Correlations:	3
Priority:	Major	Needs Correlated :	No

Notes:

Loudest noise is at painted water droplet. Also noise on main line running up Leolyn Street. I think the leak is on Cherry Hill where I painted it. Water is also pouring in manhole.

Attachments:



Leak Card Report
Mt. Oliver System

Date : March 17, 2025, 7:32 PM

Leak Location: 147 Linnview Ave Pittsburgh, PA 15210 United States

Status:	Confirmed (Pinpointed)	Logger Leak :	No
Leak Type :	Service	# Correlations:	
Priority:	Moderate	Needs Correlated :	No

Notes:

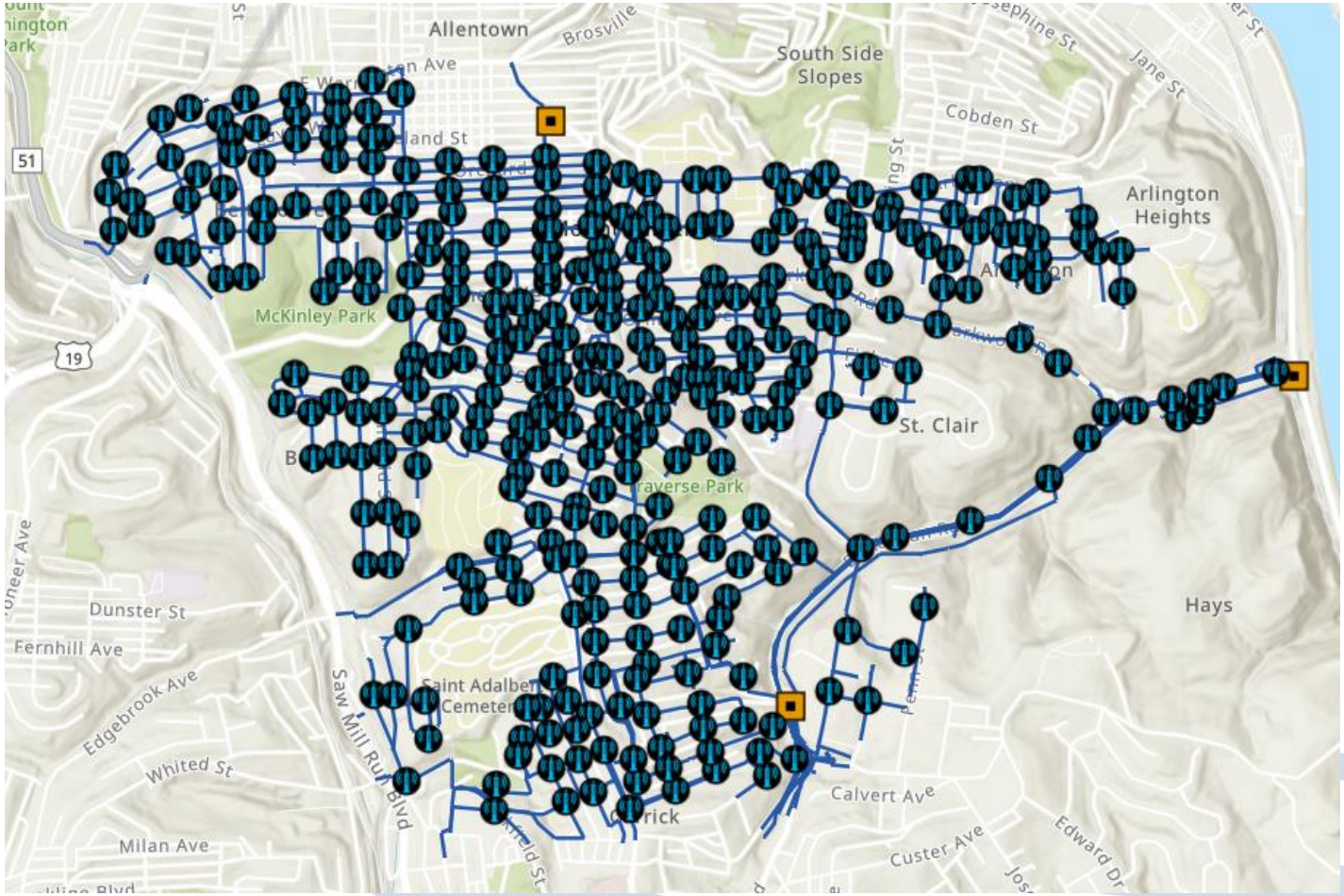
Good service leak here.

Attachments:

540 Technologies™ Environmental and Data Solutions™

Manual Leak Survey vs Technology

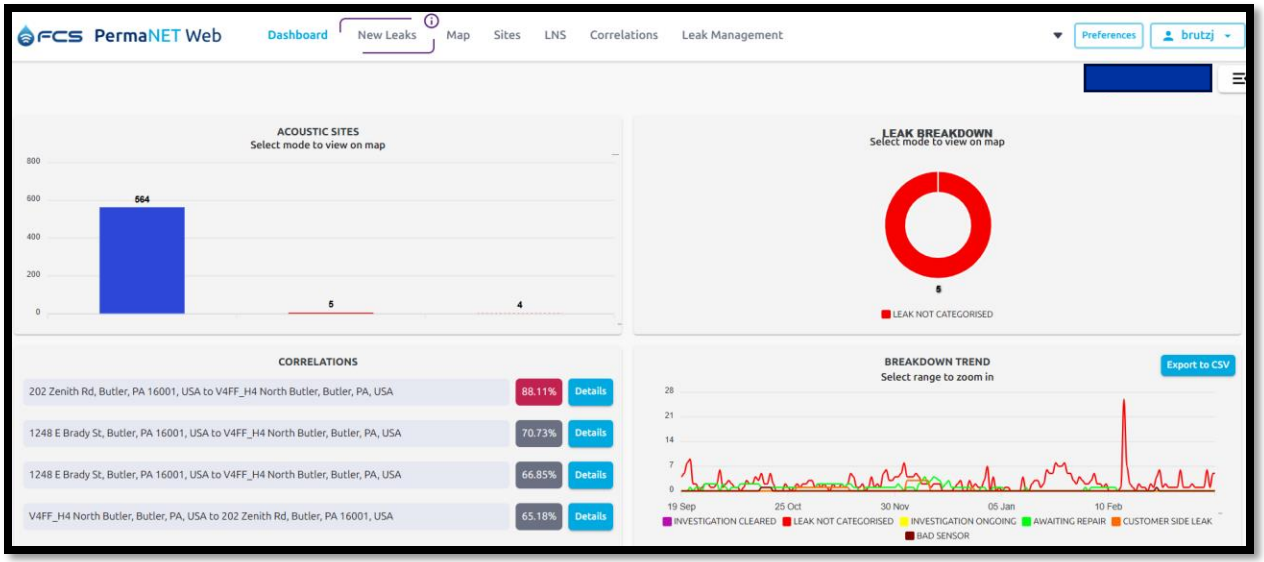
- It would take 349 acoustic loggers to permanently monitor this zone

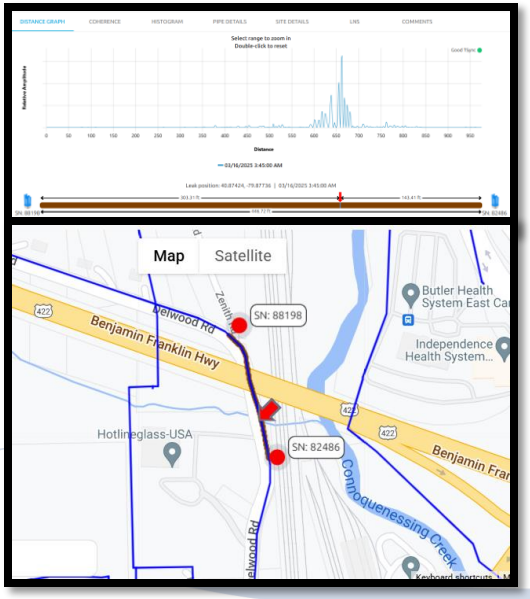


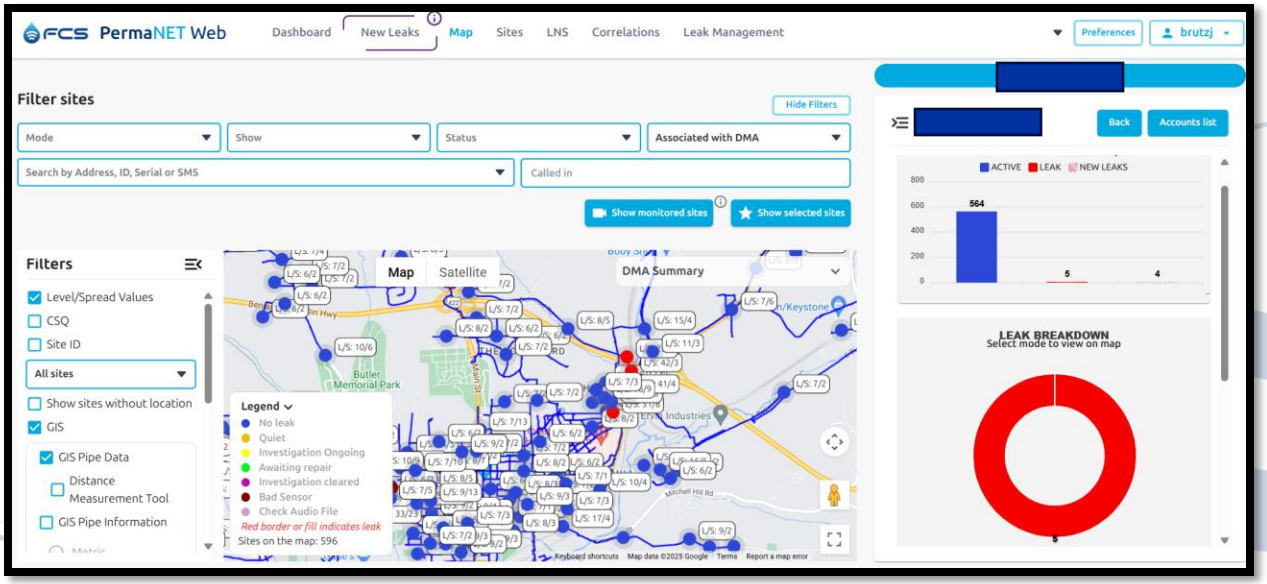
Environmental and Data Solutions™
540 TECHNOLOGIES™

Manual Leak Survey vs Technology

- Once installed loggers report fresh results daily with auto-correlations







Manual Leak Survey vs Technology

- Which is the better value?

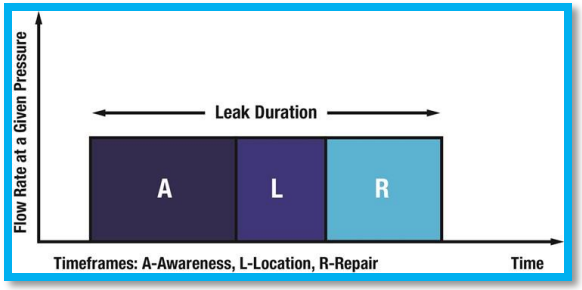
TECHNOLOGY	
Acoustic Loggers (3 year warranty)	349
Approx Total Logger Cost	$590,000
Number of Total System Surveys	1,095
Cost per Survey	$539

MANUAL SURVEY	
Survey Days (10 per sweep)	10
Approx Cost Per Survey	$18,000
Cost for 1,095 Surveys	$19,710,000
Days to Complete 1,095 Surveys	10,950 (30 years)

540 TECHNOLOGIES™ Environmental and Data Solutions™

Why is Leak Run Time Important?

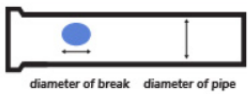
- Leakage losses are affected by run time (AWWA M36)



Water Leak Calculator

Your Water Loss Results

Hole in Pipe



Diameter of Break: **.5 inches**

Pressure in Pipe: **80 PSI**

Cost of Treated Water: **$2 per 1,000 gallons**

46.69	67,234	24,540,264
Gallons Lost Per Minute	Gallons Lost Per Day	Gallons Lost Per Year
$0.09	**$134**	**$49,081**
Dollars Lost Per Minute	Dollars Lost Per Day	Dollars Lost Per Year

540 TECHNOLOGIES™ Environmental and Data Solutions™

Summary

- America's infrastructure is aging and leaking
- Tools were invented to find leaks
- Water has become and continues to get more expensive
- Annual system surveys became the norm
- 540 built a platform to track survey results
- Technology can do the same job faster, more thoroughly, efficiently and reliably
- John Brutz has learned from John Henry and has chosen technology

Thank you!

540 TECHNOLOGIES™ Environmental and Data Solutions™