Michigan Department of Environmental Quality

Drinking Water Asset Management

Wayne Pratt
Wachs Water
SERVICES

Agenda

- 10:00 Distribution System Assessment
- 10:30 Leak Detection
- 11:00 Pipeline Condition Assessment

90 minutes

An Integrated Approach to Asset Management

Distribution System

The Challenge

- Water systems are comprised of both control & delivery assets
- Control points (valves) are designed and installed to control delivery assets (pipes)
- Control points can be renewed (thereby reducing risk) at a fraction of the cost of renewing delivery assets
- Control points were rarely used in the early years because of the relative good condition of delivery assets

The Challenge

- Catch-22 - control points worked when they weren't needed and now largely do not work when they are needed
- While many delivery assets are not controllable in the short term -- control points, in the ground today, are controllable in the short term
- A focus on control points before delivery assets delivers faster results and prepares utilities for the huge ongoing costs of infrastructure renewal

What are the Failures?

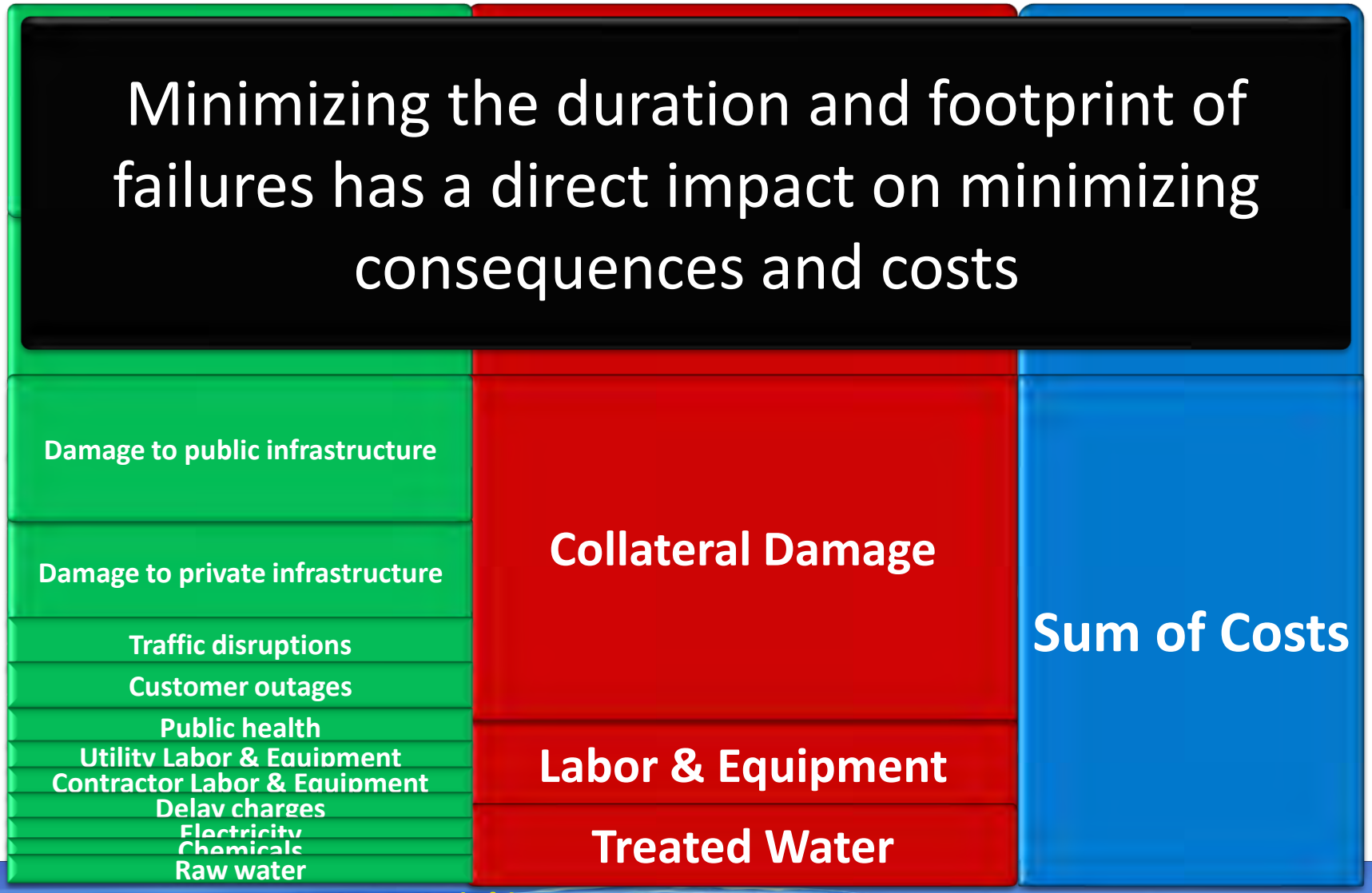
- Failure to control the system by shutting it down efficiently to manage a main break
- Failure to control the system by shutting it down efficiently to perform construction
- Failure to deliver service to a customer that shouldn’t be affected by a shutdown
- Failure to efficiently deliver quality water
- Failure to deliver optimal fire-fighting capacity

What are the Costs of Failure

- Utility field service staff labor costs
- detour time during "Time A"

- telephone utility
- Traffic & Business Disruptions

Opportunity to Minimize Costs



The Value of System Control

Control is a function of:

- Asset Usability
- Information Usability

The Value of Control

In this context, control is a function of;

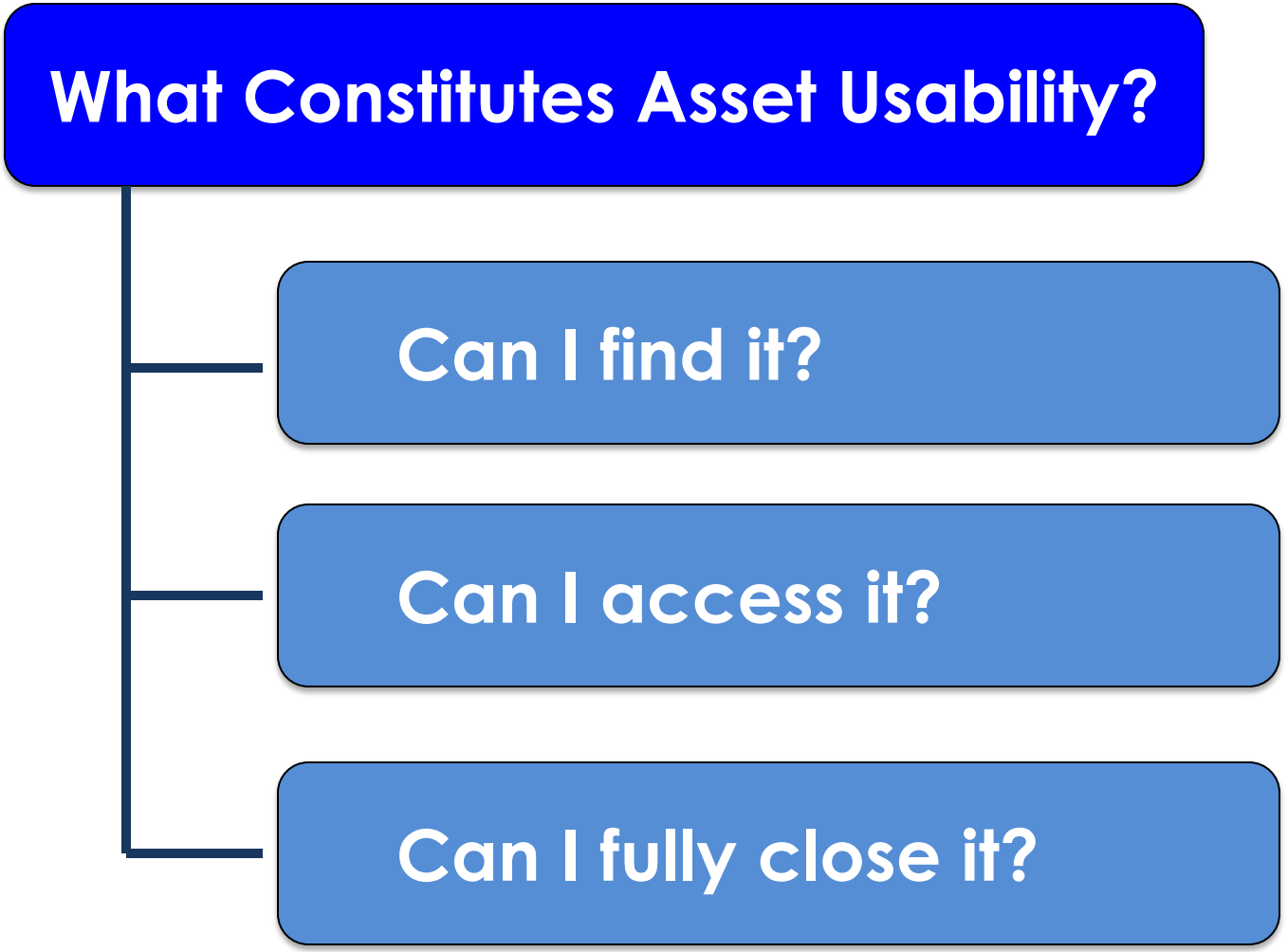
- Asset usability
- Information usability

The value of control is realized in both;

- O&M budgets by reducing costs
- Capital budgets by deferring investments

- *Plus* cost avoidance for the city
  - Collateral damage
  - Political fall out
  - Business disruption

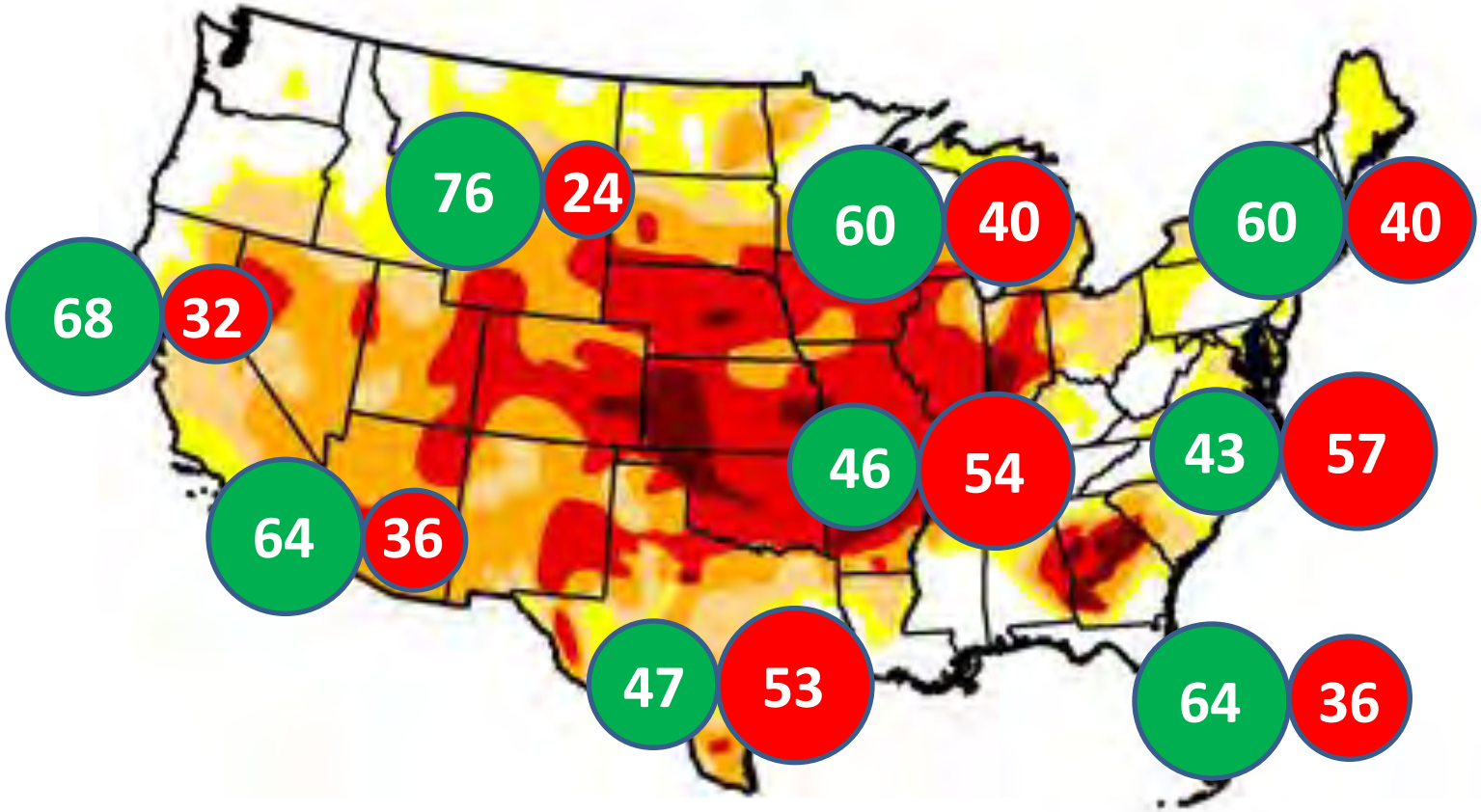
Control Asset Usability



Control Asset Usability

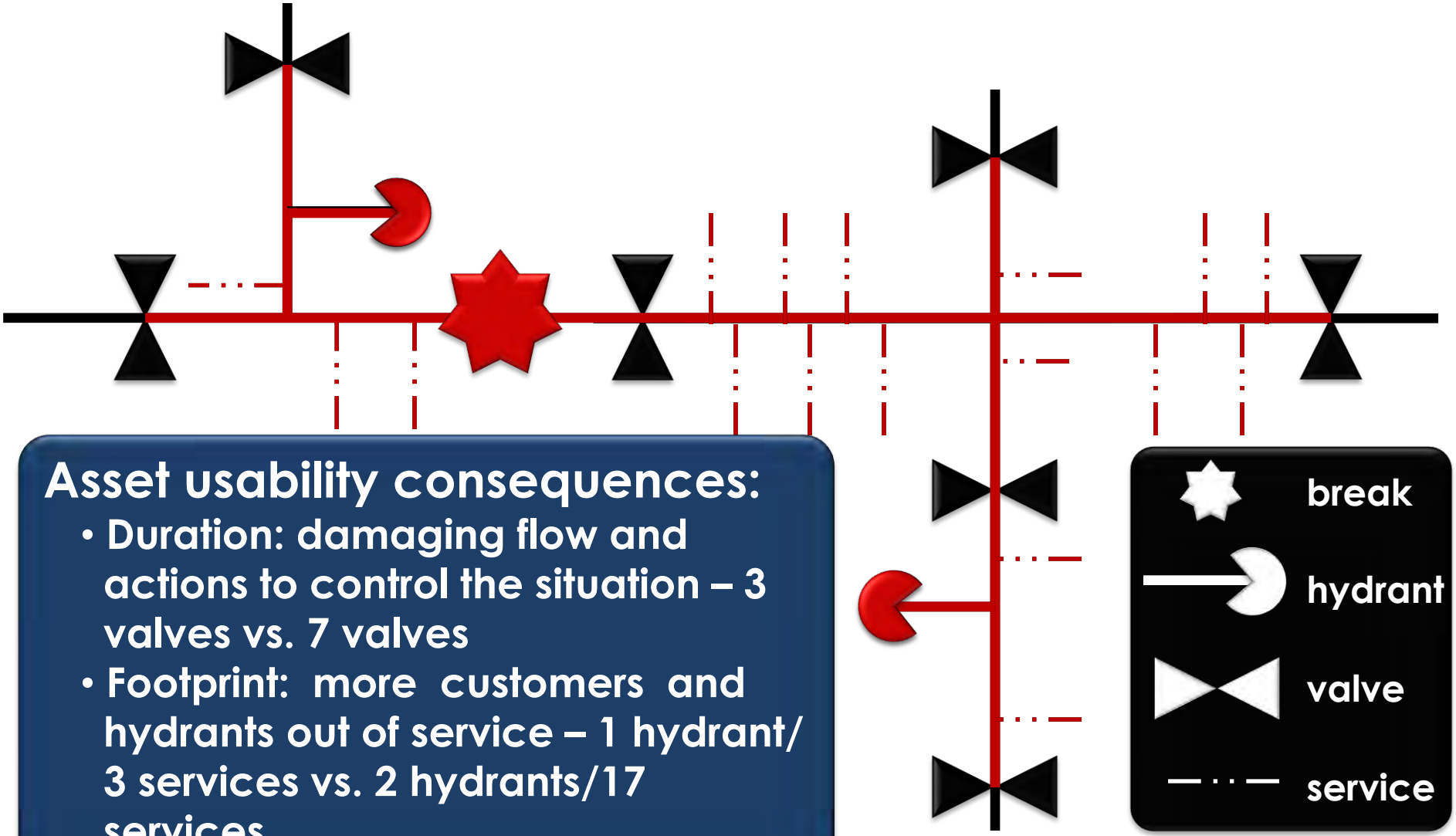
Nationwide Control Point Operability

Based on the inspection of over 500,000 valve control points by Wachs Water Services.



60% = National Average Operability

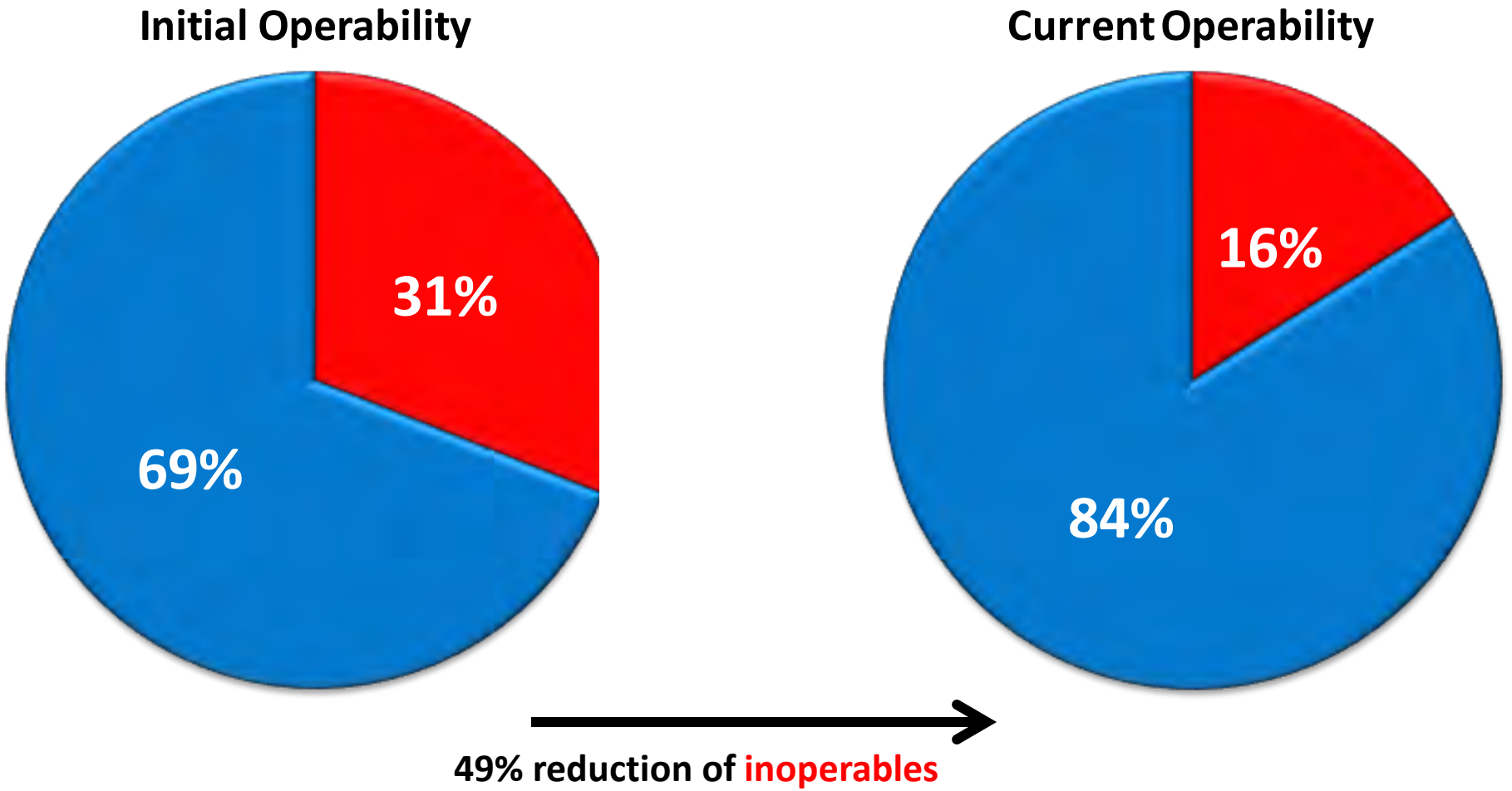
Control Asset Usability



Asset usability consequences:

- Duration: damaging flow and actions to control the situation – 3 valves vs. 7 valves
- Footprint: more customers and hydrants out of service – 1 hydrant/ 3 services vs. 2 hydrants/17 services

Valve Operability Comparison

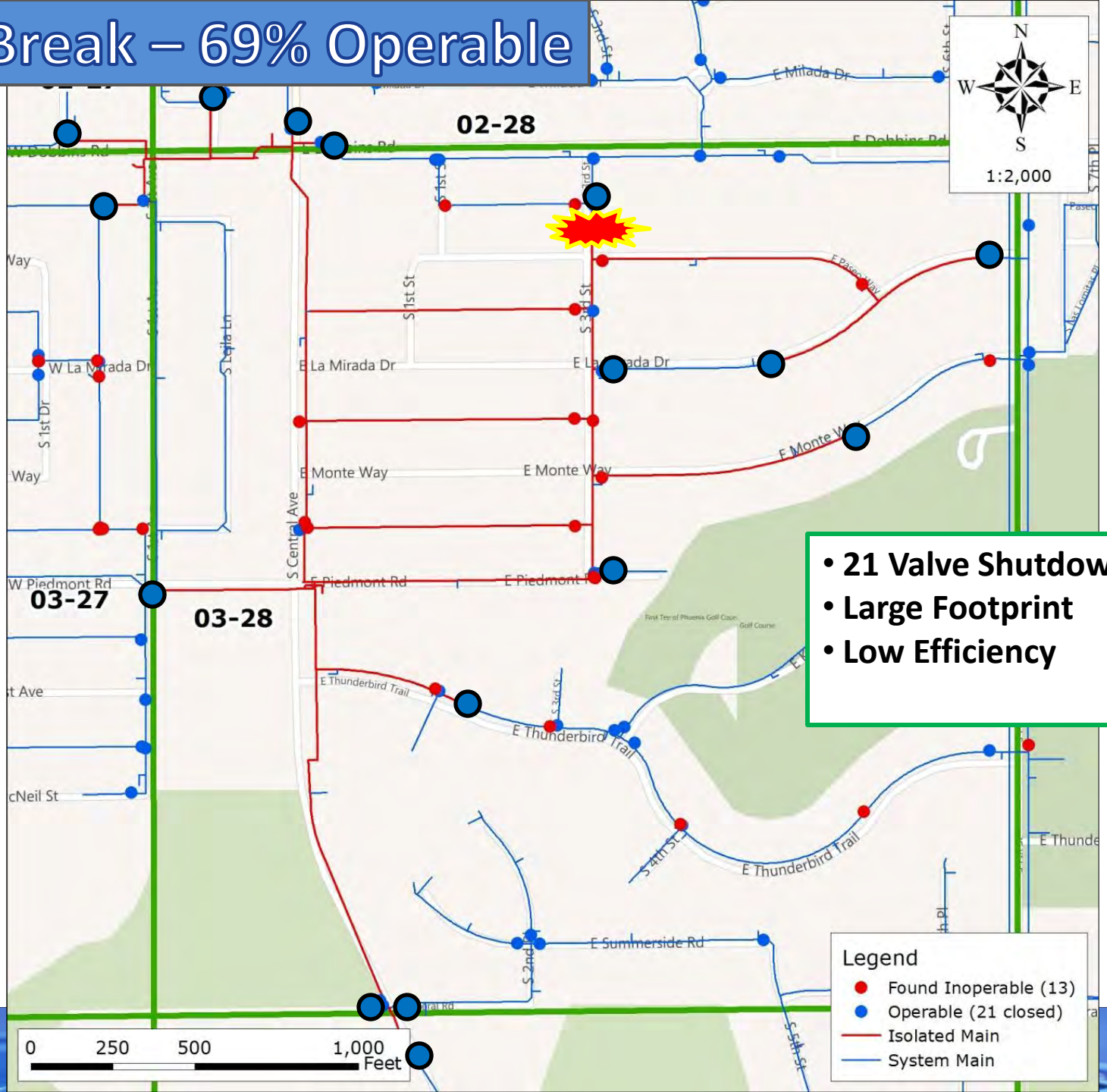


69% Operable

02-28
03-27
03-28
N
W
E
S
1:2,000
E Milada Dr
W Dobbins Rd
E Dobbins Rd
S 1st St
S 3rd St
E Paseo Way
W La Mirada Dr
E La Mirada Dr
S Leila Ln
S 1st Dr
E Monte Way
S Central Ave
W Piedmont Rd
E Piedmont Rd
First Tee of Phoenix Golf Course
E Kachina Trail
E Thunderbird Trail
S 4th St
E Summerside Rd
S 2nd Pl
S 6th Pl
0 250 500 1,000 Feet
Legend
Found Inoperable (28)
Operable (65)
System Main

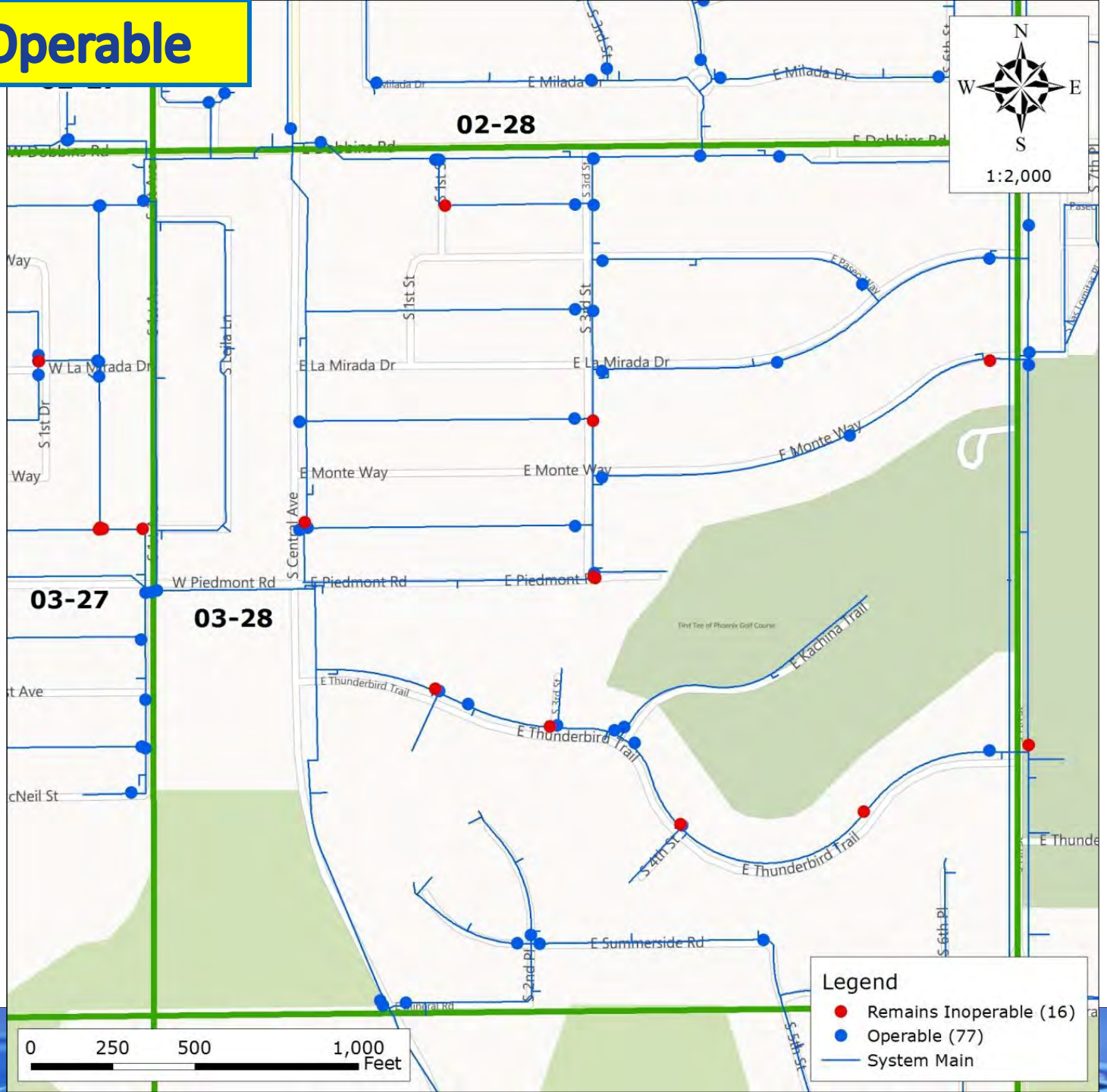
Main Break - 69% Operable

Main Break – 69% Operable



- **21 Valve Shutdown**
- **Large Footprint**
- **Low Efficiency**

84% Operable


02-28
03-27
03-28
E Milada Dr
W Dobbins Rd
E Dobbins Rd
S 1st St
S 3rd St
E Pasco Way
W La Mirada Dr
E La Mirada Dr
S Leila Ln
S 1st Dr
E Monte Way
S Central Ave
W Piedmont Rd
E Piedmont Rd
First Tee of Phoenix Golf Course
E Kachina Trail
E Thunderbird Trail
S 4th St
E Summerside Rd
S 2nd Pl
S 6th Pl
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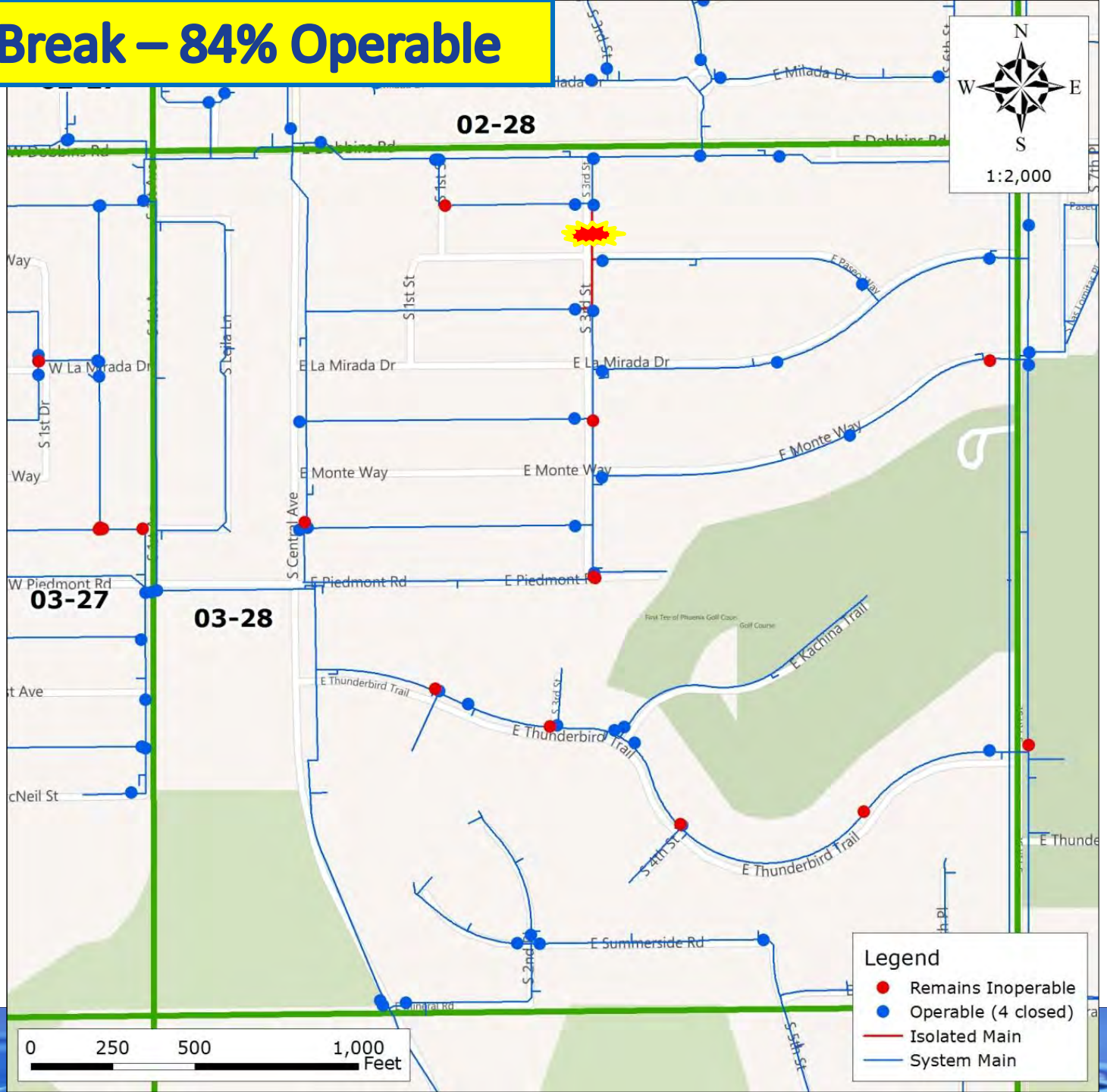
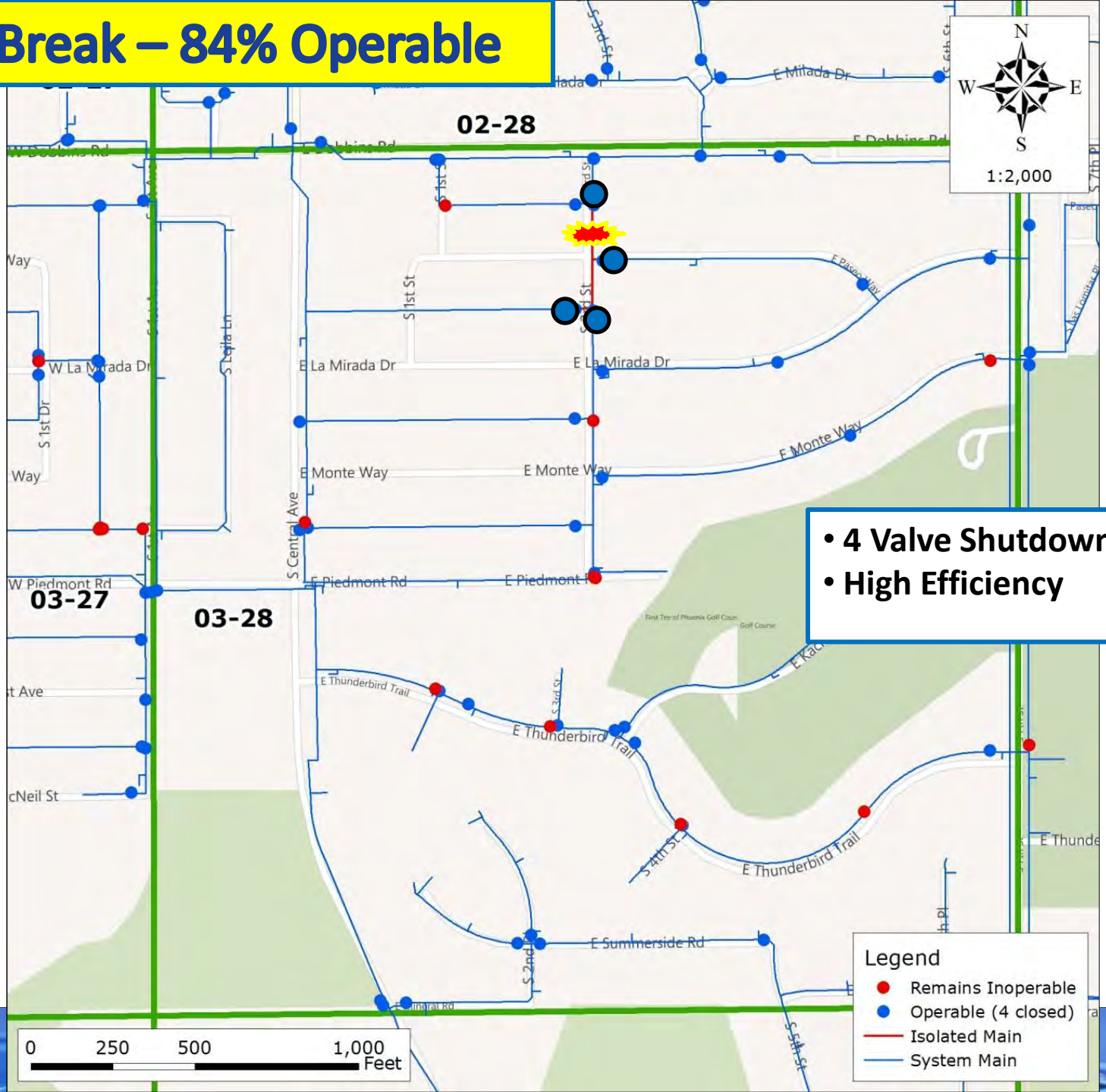
0 250 500 1,000 Feet
Legend
Remains Inoperable (16)
Operable (77)
System Main

Main Break – 84% Operable

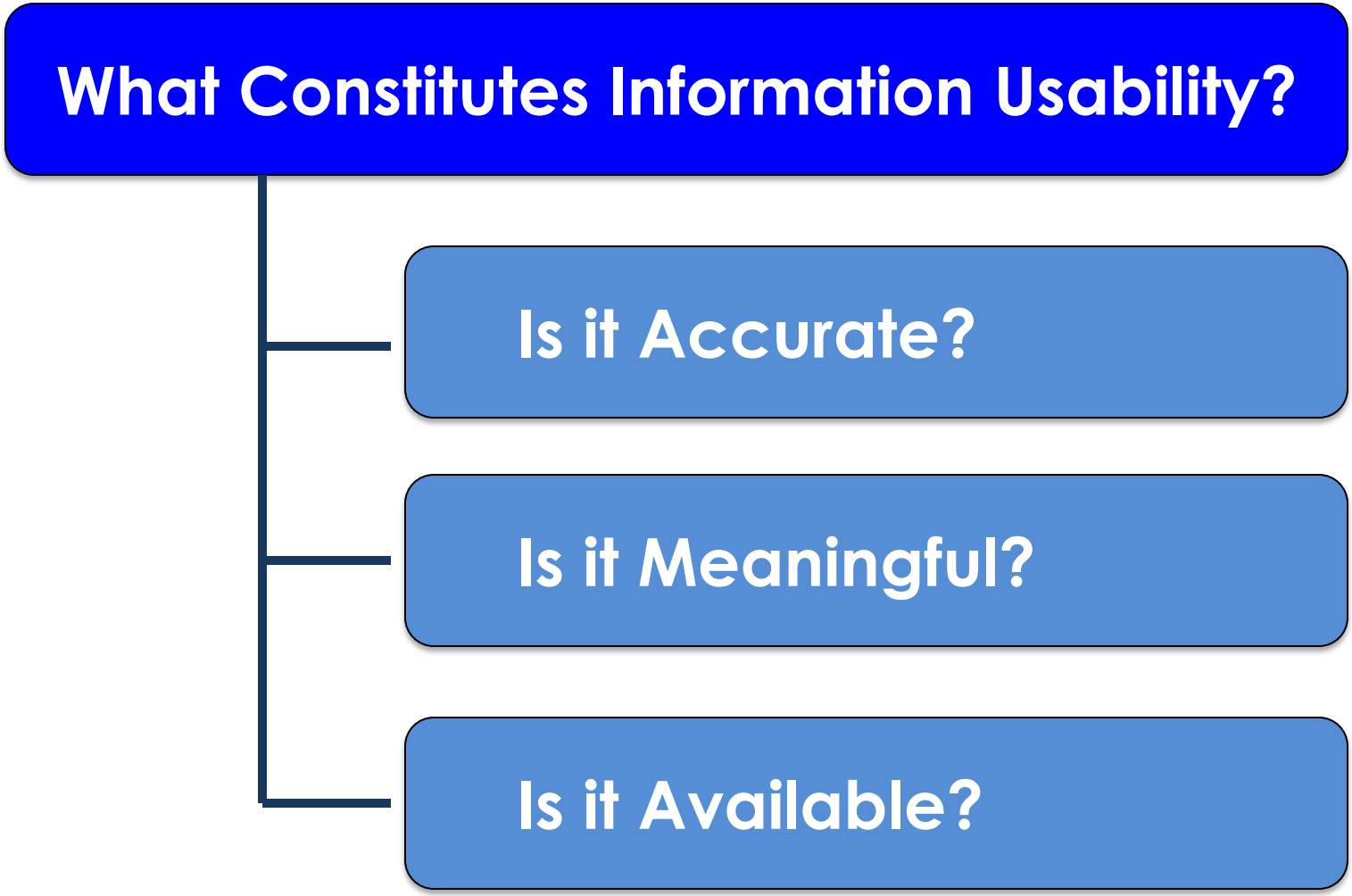


Main Break – 84% Operable

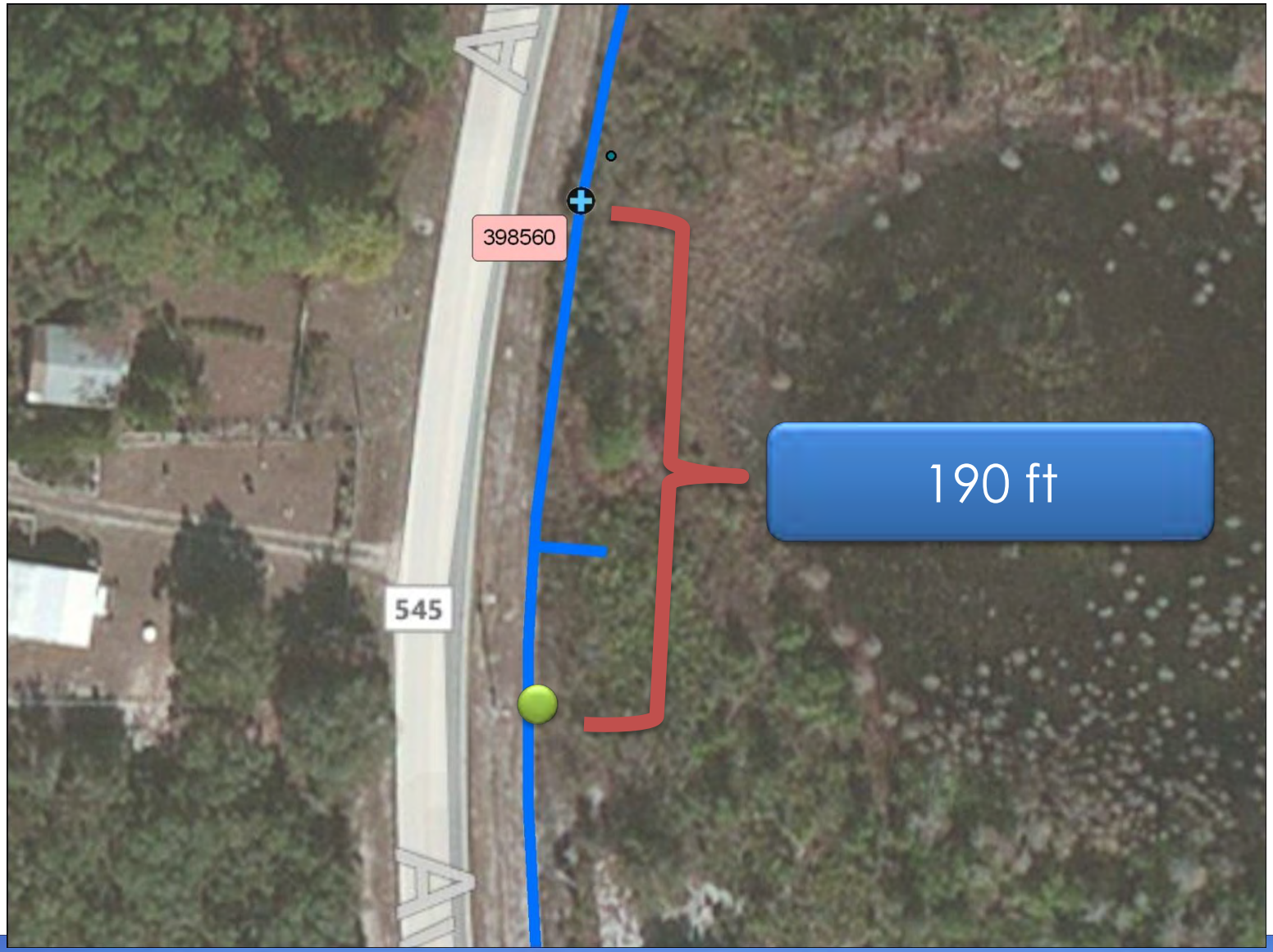


- 4 Valve Shutdown
- High Efficiency

Information Usability

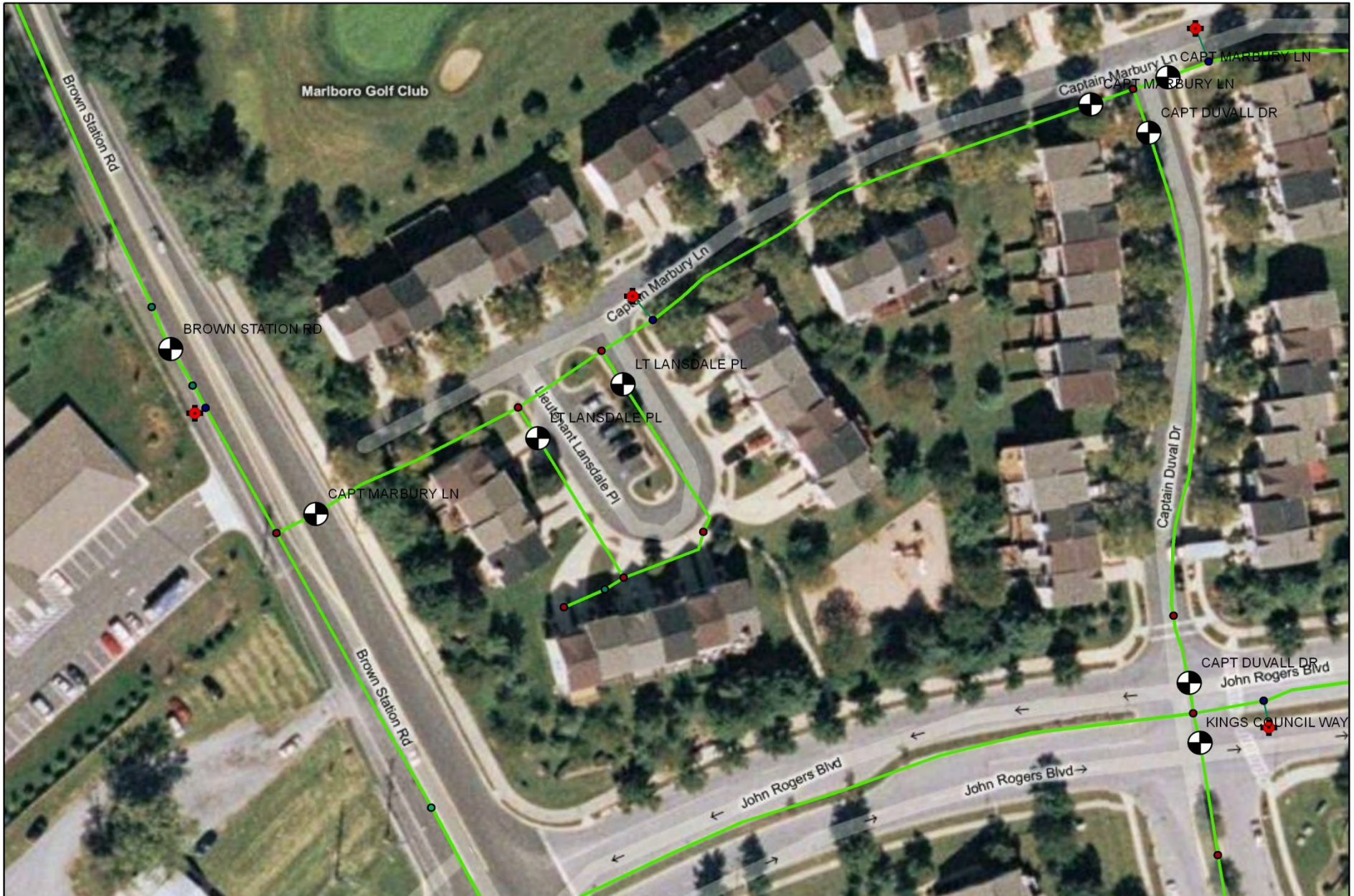


Information Spatial Accuracy



Information Spatial Accuracy

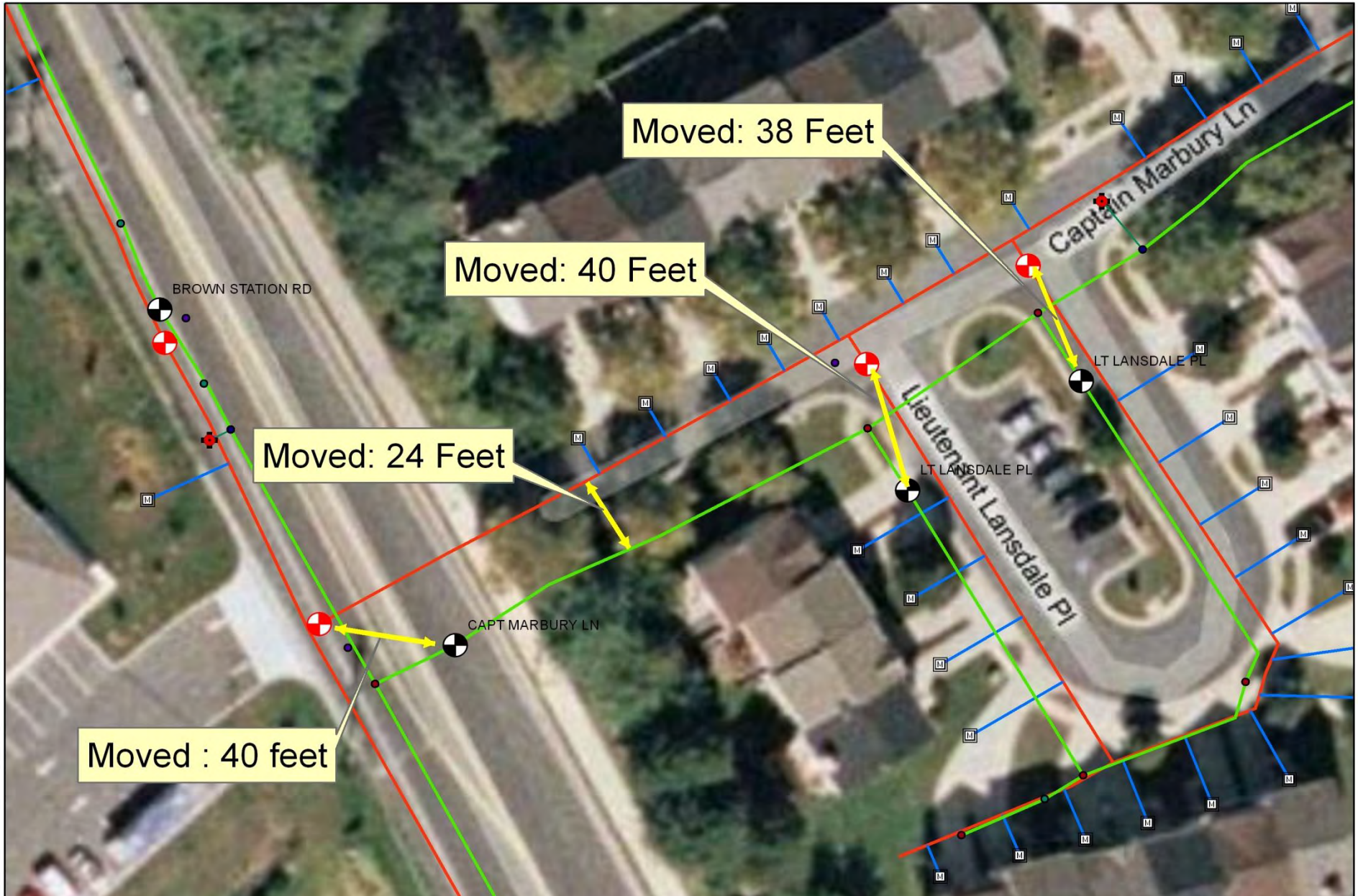
Information Accuracy - Before



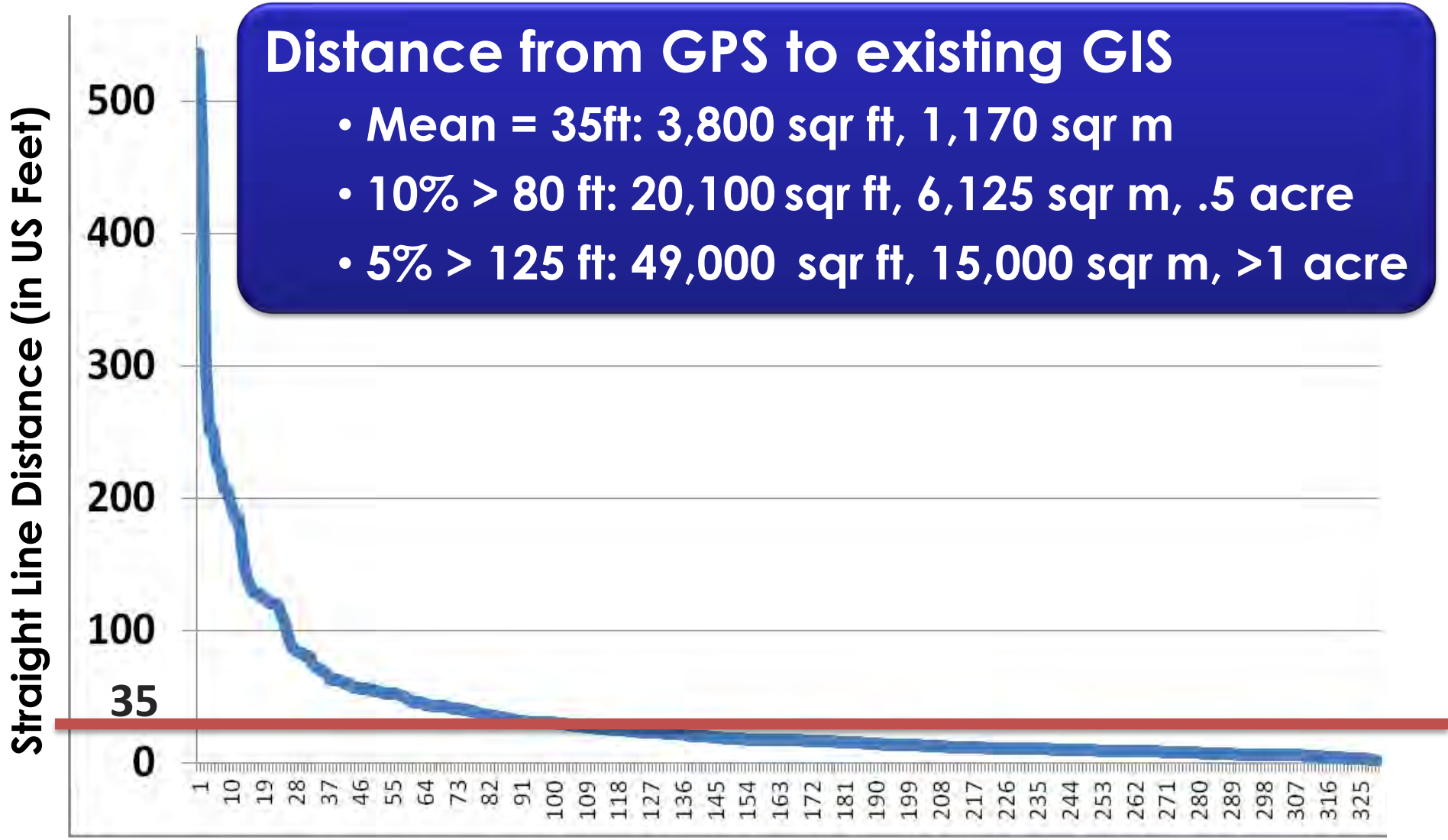
Information Accuracy - After

Information Accuracy - Comparison

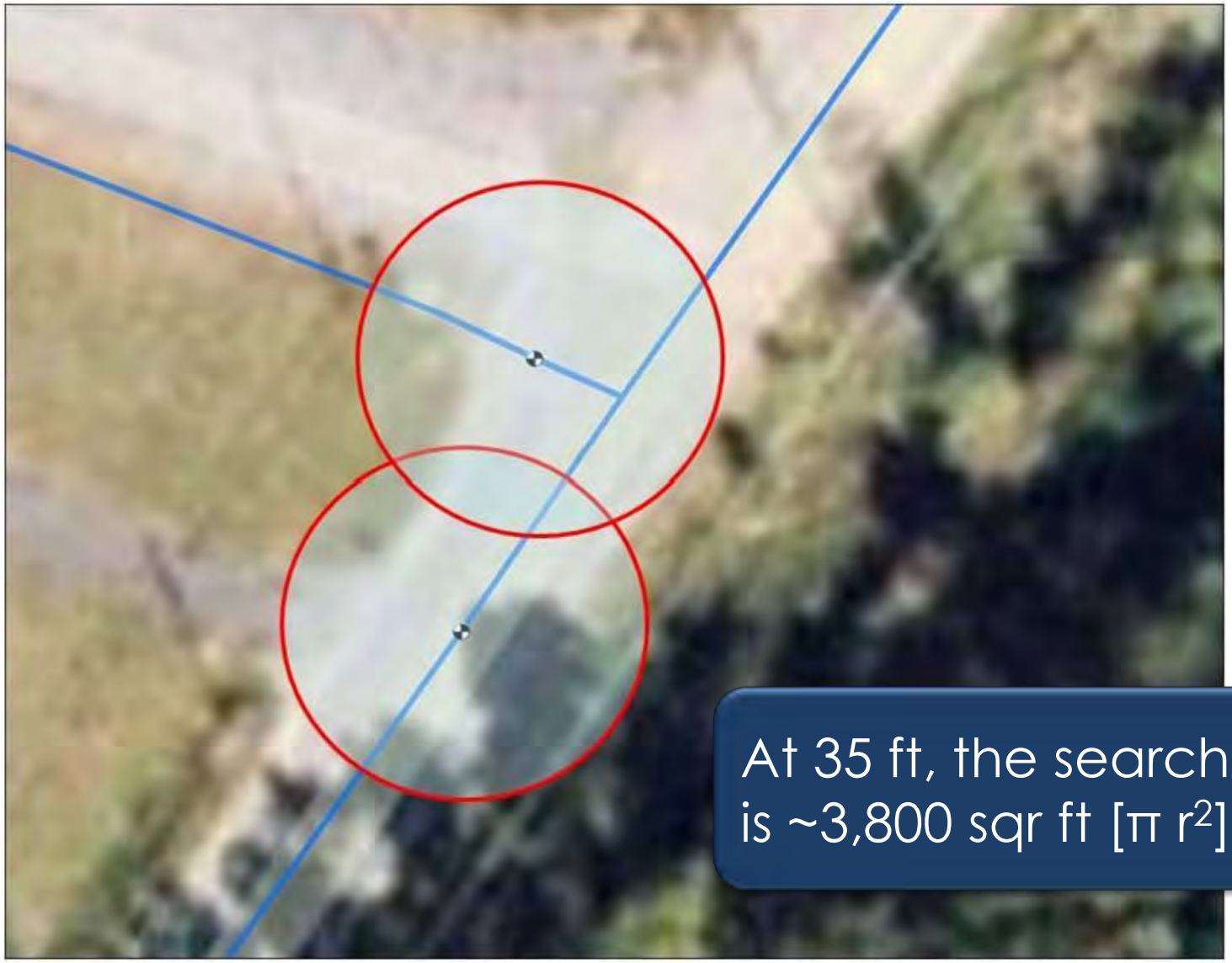
Information Accuracy - Results



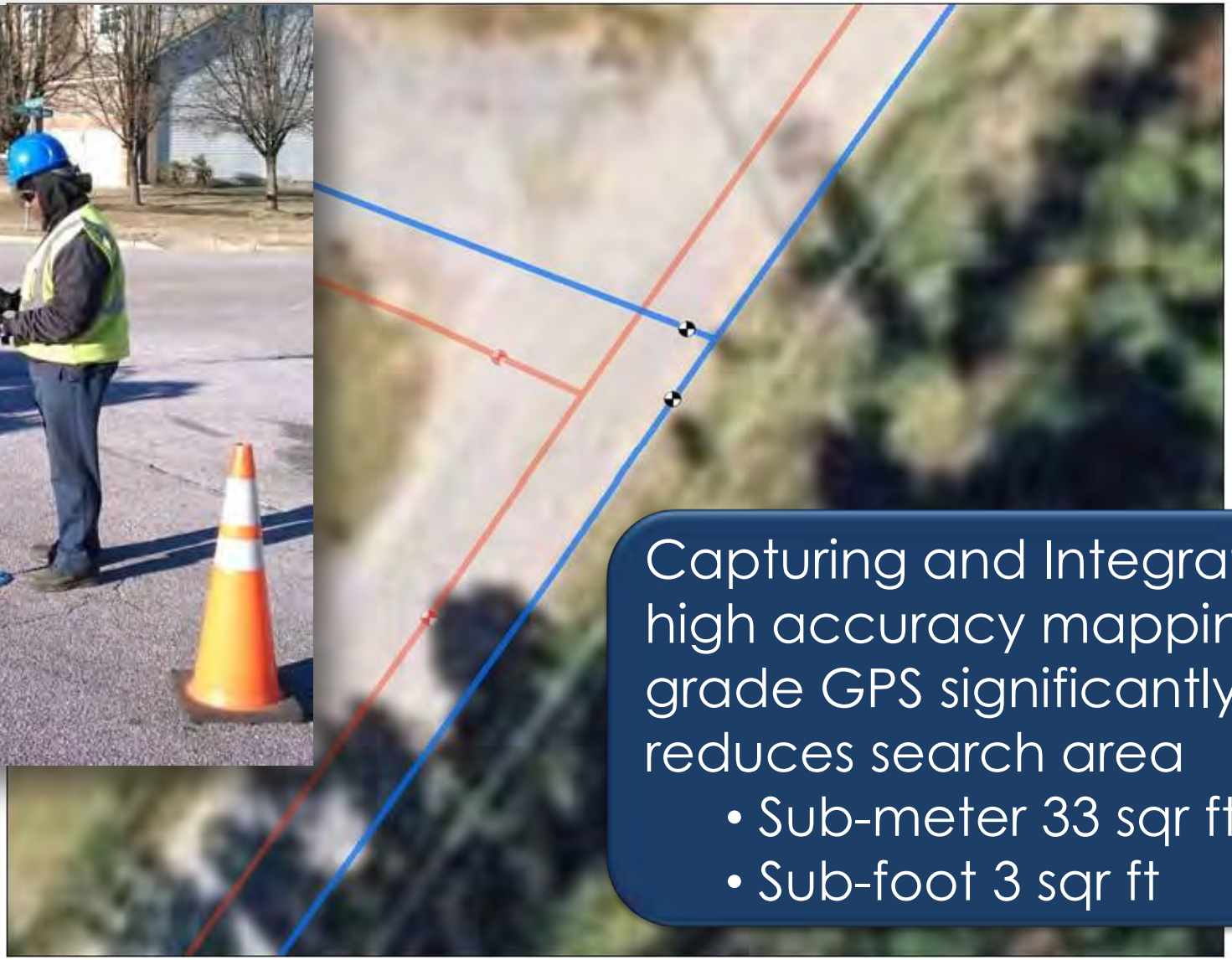
Information Accuracy



Information Accuracy



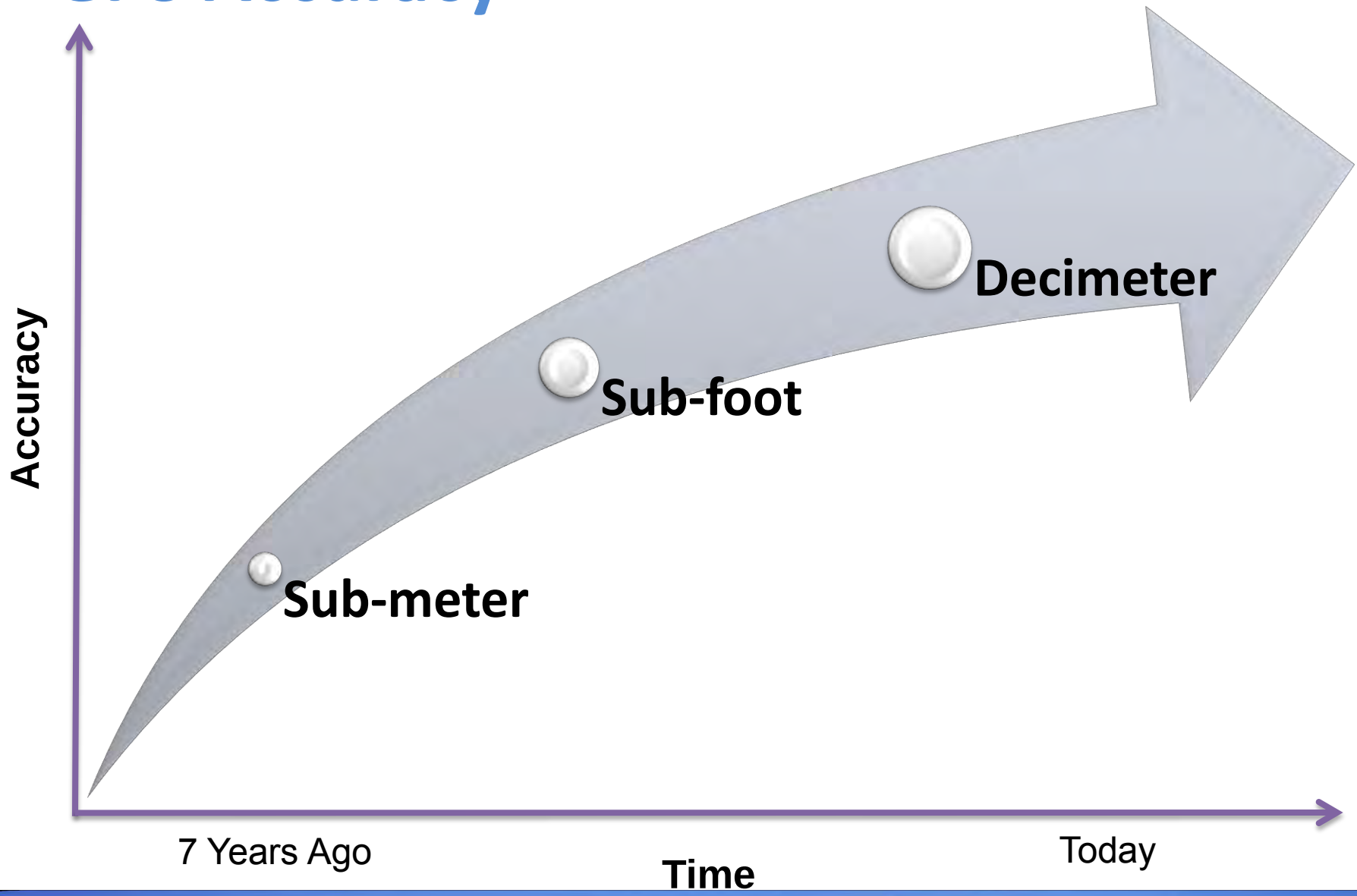
Information Accuracy



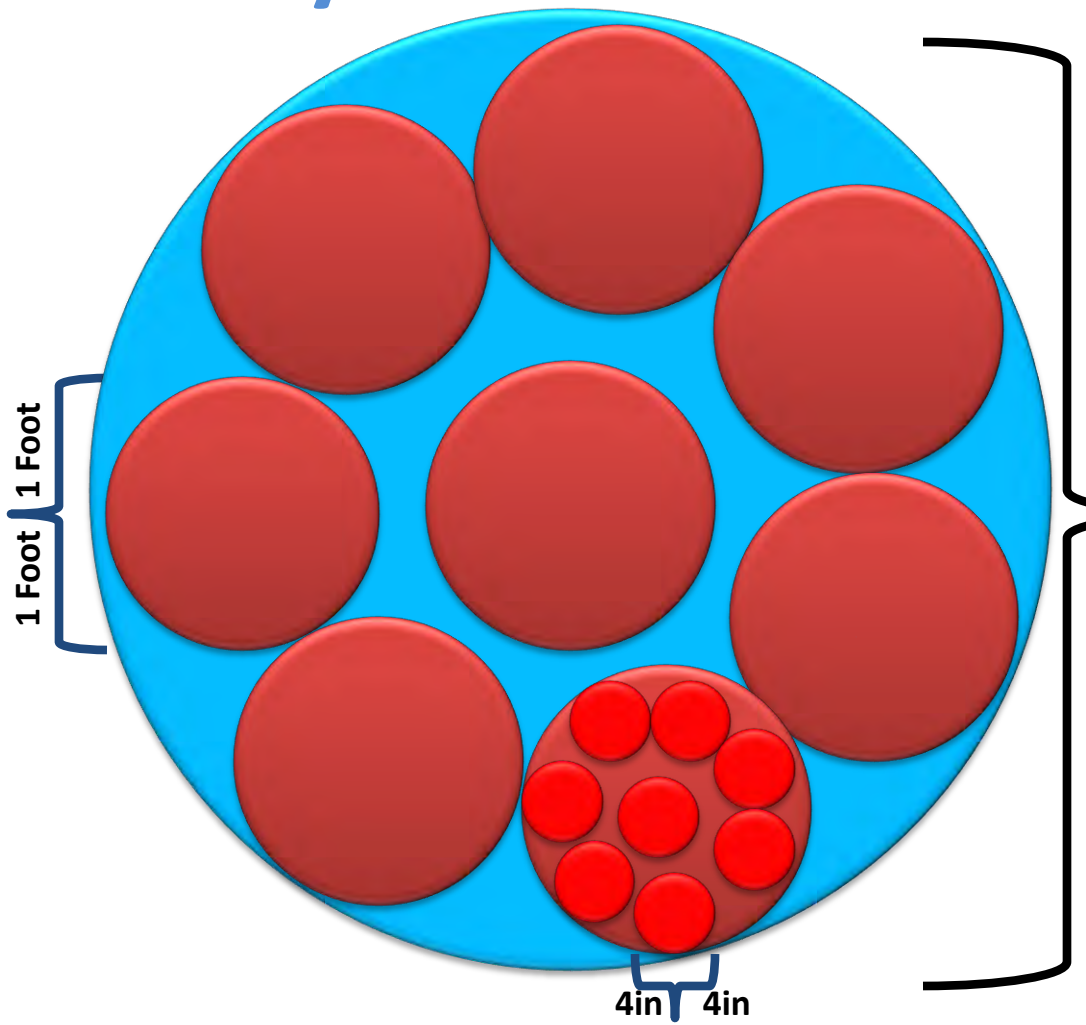
Capturing and Integrating high accuracy mapping grade GPS significantly reduces search area

- Sub-meter 33 sqr ft
- Sub-foot 3 sqr ft

GPS Accuracy



GPS Accuracy



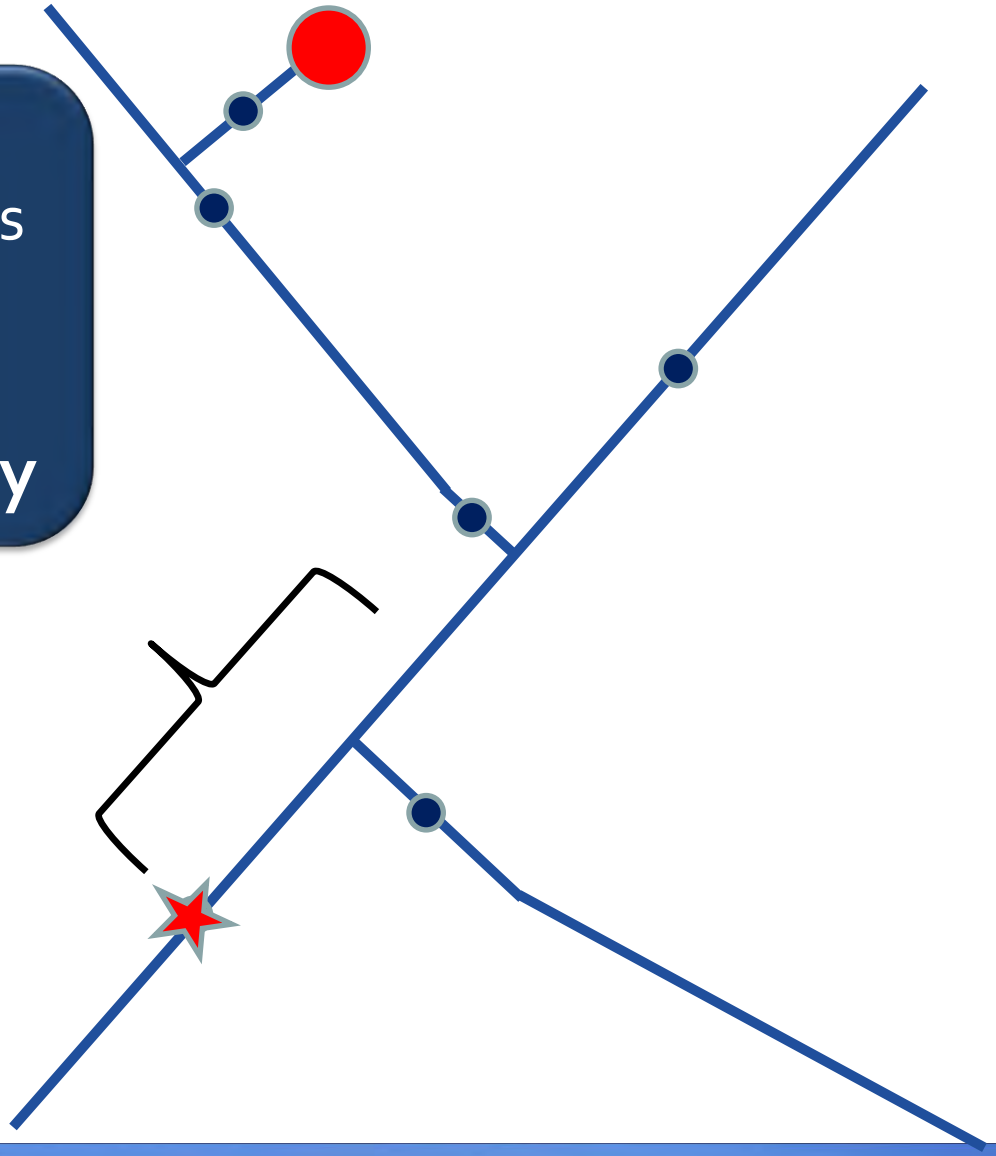
Sub-Foot Search Area = 3.14^2 Feet, Less than 10% of Sub-Meter Search Area

Sub-Meter Search Area = 33.78^2 Feet

Decimeter Search Area = 0.34^2 Feet, ~4^2 Inches – roughly the size of a roadway box lid
1% of Sub-Meter Search Area, 11% of Sub-Foot

Information Accuracy

Valve field-verified to be north of connection, this is an example of a **Hydraulically Significant Discrepancy**



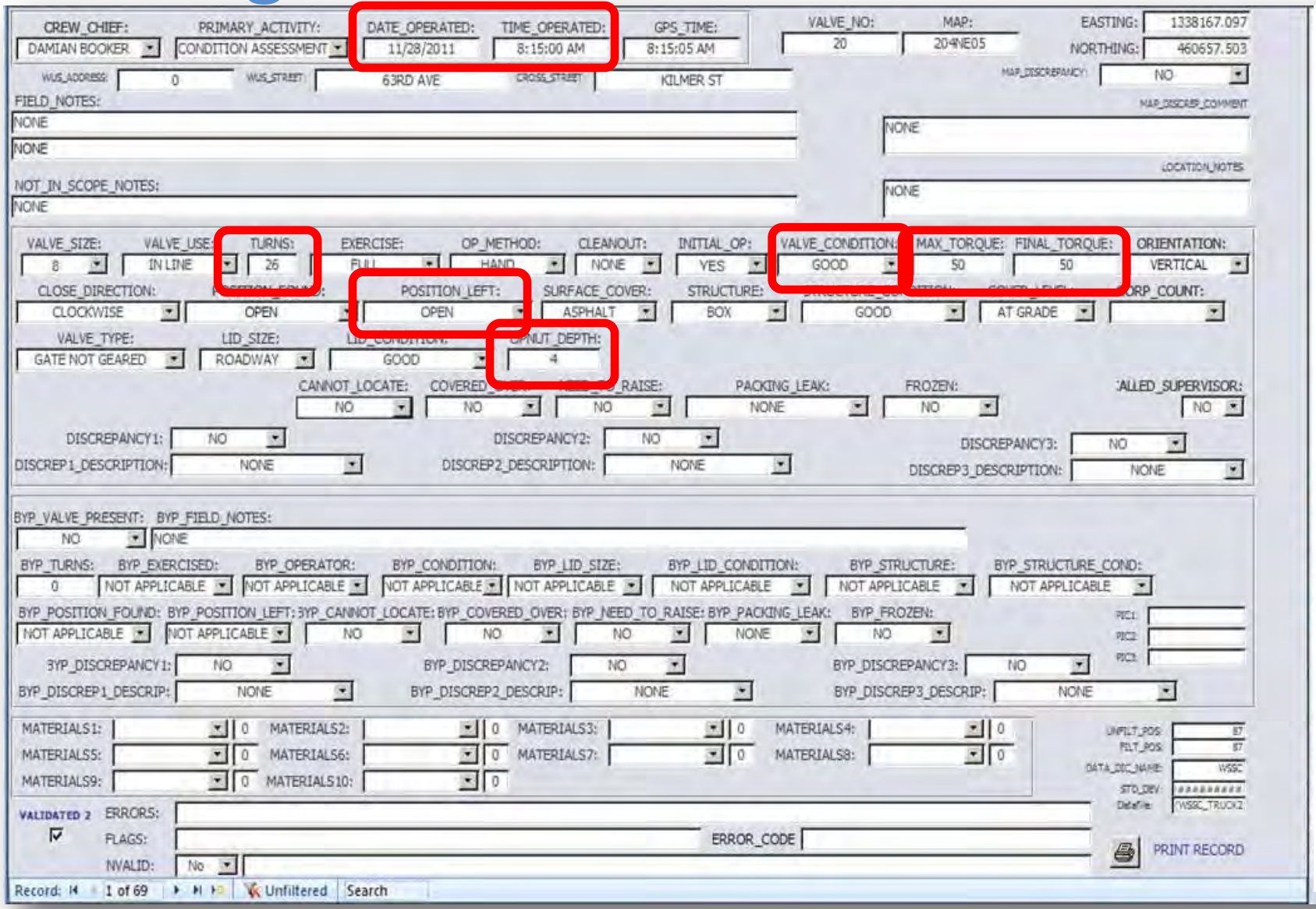
Information Accuracy

Map Size (pipe size)	Actual turns	CWW GIS Diameter	CWW Turns	Map Discrepancy Details
24	104	10	32	GIS SHOWS 10" VALVE ON 24" MAIN
12	19	0	0	MAP SHOWS 12” INLINE, IS 6” GOING TO THE HYDRANT
12	37	12	39	GIS SHOWS 12" VALVE ON 6" MAIN
12	0	10	32	GIS SHOWS 10" VALVE ON 6" MAIN
12	38	0	0	GIS SHOWS NO VALVE SIZE ON 16" MAIN
8	0	10	32	GIS SHOWS 10" VALVE ON 6" MAIN
8	25	10	32	GIS SHOWS 10" VALVE ON 8" MAIN
6	20	8	26	GIS SHOWS 8" VALVE ON 6" MAIN
6	18	10	32	GIS SHOWS 10" VALVE ON 6" MAIN
6	20	10	32	GIS SHOWS 10" VALVE ON 6" MAIN
6	19	10	32	GIS SHOWS 10" VALVE ON 6" MAIN
6	18	10	32	GIS SHOWS 10" VALVE ON 6" MAIN

Information Accuracy

Hydraulically Significant Discrepancies Resolved	Utility A <1,000 Customers	Utility B ~10,000 Customers	Utility C ~50,000 Customers	Summary
Attribute	2	11	46	59
Not on Map	2	69	378	449
Network Configuration	4	8	90	102
	8	88	514	610

Meaningful Content



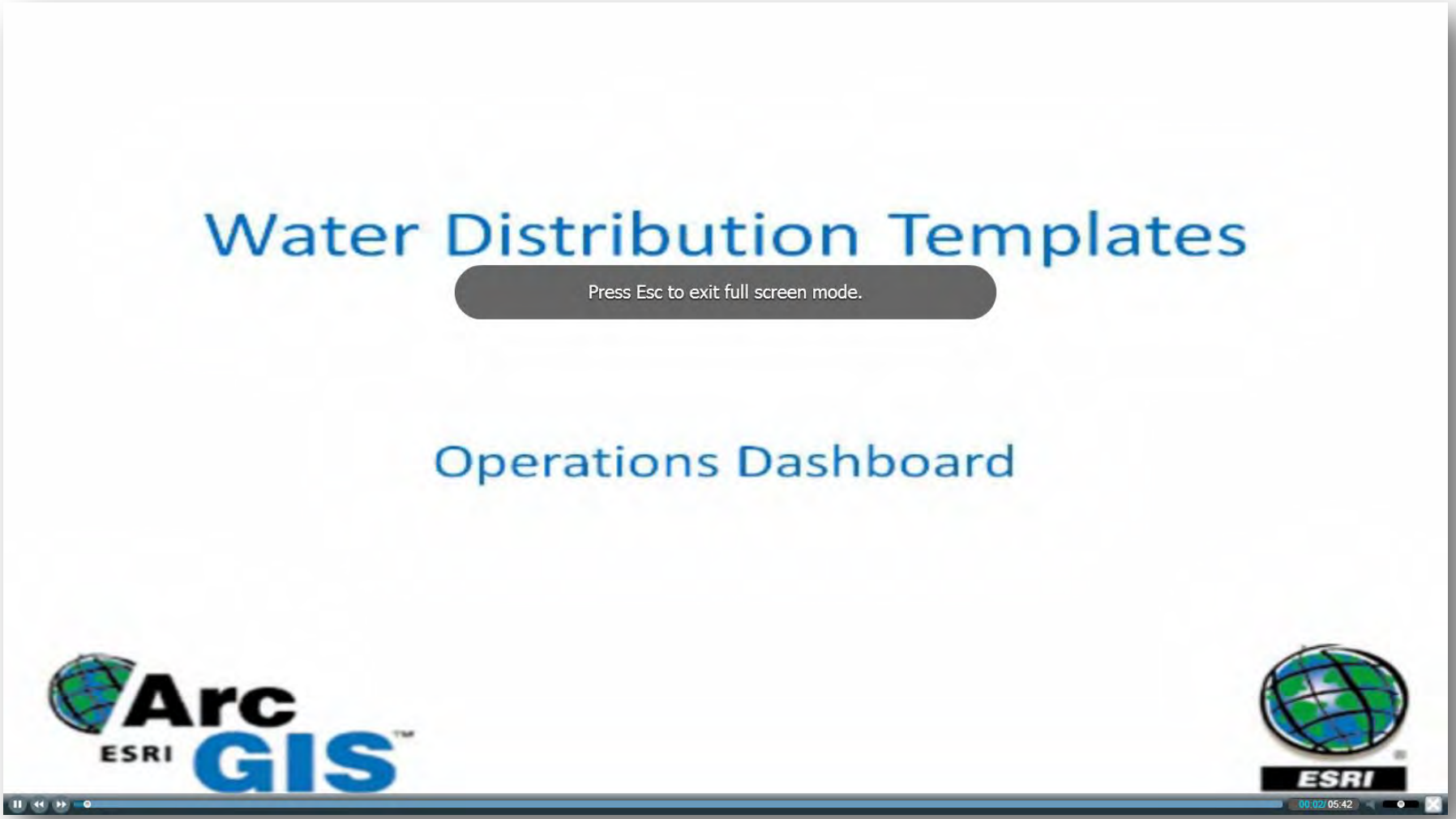
Before	
FacilityID	**CWSV-A0900**
Diameter	**10 inch**
BypassValve	<null>
RightToClose	TRUE
CurrentlyOpen	TRUE
NormallyOpen	TRUE
PercentOpen	100
TurnsToClose	**32**
Operable	<null>
EnclosureType	**ValveBox**

After	
Transferred_UNITID	CWSV-A0900
VALVE_SIZE	24
BYP_VALVE_PRESENT	YES
BYP_EXERCISED	YES
BYP_TURNS	10
BYP_OPERATOR	OPERATING NUT
BYP_FIELD_NOTES	12 INCH BOX STOPS HARD BOTH WAYS
BYP_CONDITION	GOOD
BYP_LID_SIZE	OTHER
BYP_LID_CONDITION	GOOD
BYPASS_STRUCTURE	BOX
BYP_STRUCTURE_COND	GOOD
BYP_POSITION_FOUND	CLOSED
BYP_POSITION_LEFT	CLOSED
CLOSE_DIRECTION	RIGHT HAND
POSITION_FOUND	OPEN
POSITION_LEFT	OPEN
TURNS	104
VALVE_CONDITION	GOOD
STRUCTURE	VAULT
STRUCTURE_CONDITION	GOOD
LID_SIZE	27"
LID_CONDITION	GOOD
FIELD_NOTES	27 INCH VAULT LID MARKED SEWER
OPERATOR_TYPE	OPERATING NUT
MAP_DISCREPANCY	OTHER
MAP_DISCREP_COMMENT	GIS SHOWS 10" VALVE ON 24" MAIN
SURFACE_COVER	ASPHALT
COVER_LEVEL	AT GRADE
VALVE_TYPE	INTERNAL GEARED GATE
ORIENTATION	HORIZONTAL
OPNUT_DEPTH	2
EXERCISE	FULL
INITIAL_OP	YES
OP_METHOD	TRUCK MOUNT
MAX_TORQUE	300
FINAL_TORQUE	50

Is it Accurate?

Is it Meaningful?

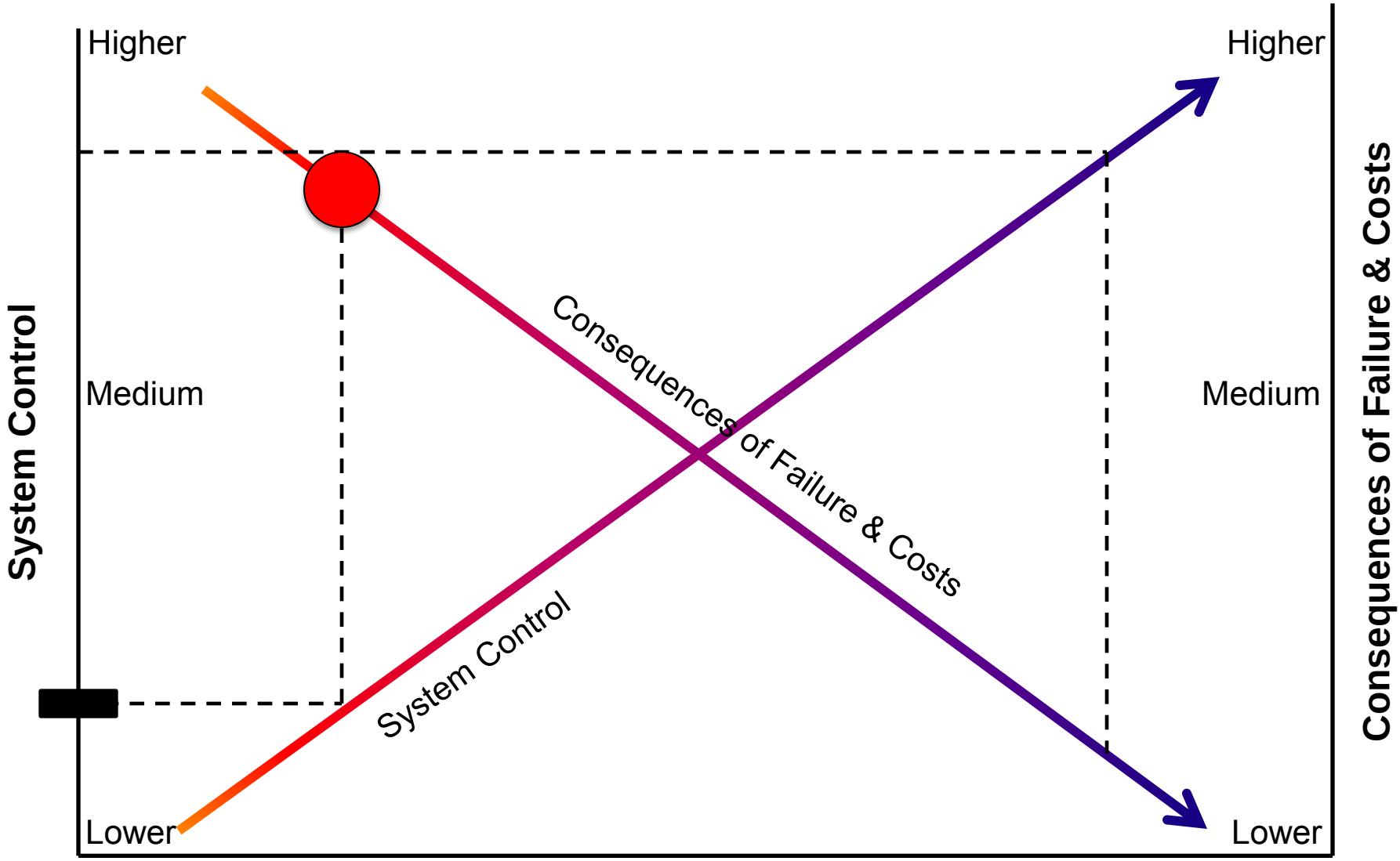
ESRI Operations Dashboard



http://resources.arcgis.com/gallery/video/water-utilities/details?entryID=BF652315-1422-2418-7FFF-46FC1D789F9F

Learn more: "Getting Started with GIS" http://training.esri.com/gateway/index.cfm?fa=catalog.webCourseDetail&CourseID=1911

The Value of System Control



Investing in System Control

Canton : Atlanta : Kansas City : San Antonio : Detroit : Petoskey : WSSC : Ft. Lauderdale : Houston : Knoxville : Dallas : Austin : Phoenix : Charlotte : Baltimore : Raleigh : St Joe : Washington DC : Tampa : American Water : LADWP : Nashville : Wilmington : West Springfield : Annapolis : Gillette : Skokie : New Braunfels : Coconut Creek : Hollywood : Corona : Pittsburgh : Rochester : Napoleon

Drinking Water Asset Management

Varying Levels of "Investment"

Basic Control Activities

- Valve Assessments
- Hydrant Assessments
- Global Positioning
- Information Management
- Minor Valve & Hydrant Repairs
- System Testing
- Structure Improvements

Advanced Control Activities

- Large Valve Repair
- Leak Detection
- Valve & Hydrant Replacement
- System Troubleshooting
- Pipeline Inspection
- System Installation
- Construction Shuts / Emergencies

Conventional Leak Detection

Utility in Central Texas

- Proactive Utility Committed to Reducing Non-Revenue Water
- ~890K Customers Supplied via 3,600 Miles of Main
  - 3,000 Miles are </=16”
  - PVC, Cast Iron & Ductile Iron Pipe
  - 200,000 Service Connections
- Leak Sounding and Investigator™ Utilized

Leak Detection Program

- 700+ miles of Distribution Main
- Leak Sounding Performed on Multiple Service connections:
  - meter boxes
  - valves
  - hydrants
  - air release valves
- Utility Selects Inspection Areas - 120 Mile Increments
- Leak Noise Correlation Performed at Night
  - During times of low flow over longer distances by Utility

Leak Detection Program Results

(470 miles of reporting to date)

	Assets Inspected	Leaks Located	Water Visible	Can Not Locate	Paved Over	Not In Service
Air Release Valves	3			3		
Flush Valves	1			1		
Fire Hydrants	101	78	2	17		4
Meter Boxes	29	16	16			
Service Fittings	9	9	3			
Valves	220				12	
Total	363	103	21	21	12	4

Texas Project Insights

- Leak Sounding & Correlation is Cost-effective “Broad Brush” Approach
- Water did not Surface in Majority of Cases
- Leak sounding Improve Overall System Efficiency
- Extend Asset Life Through Identifying and Fixing Small Problems
- Maximizing Asset Visits Increases Value

Typical Leak Sources

Faulty Valve Seat

Service Line Leak

Valve Leak – Packing Replaced

Undocumented Chamber

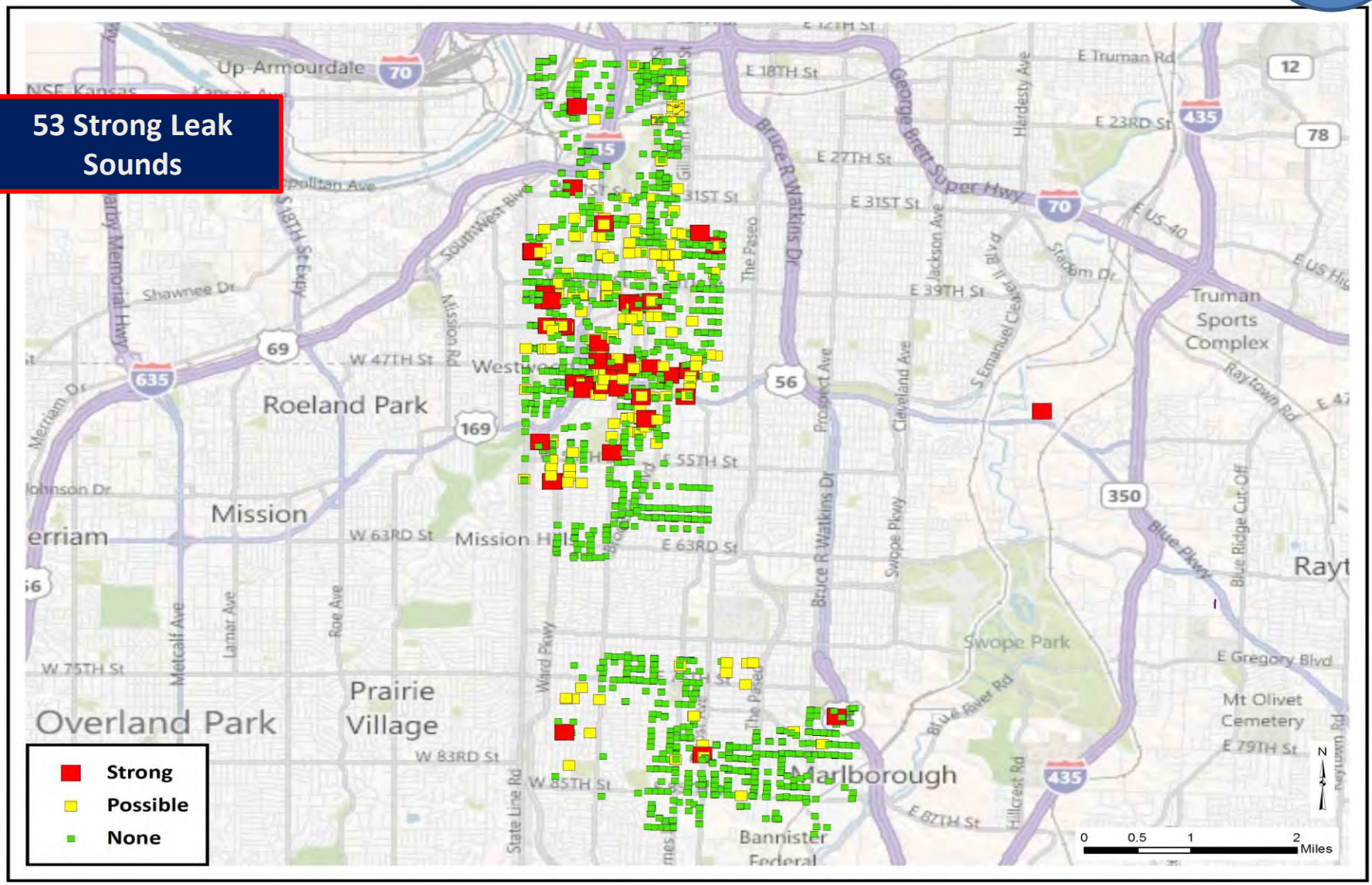
Conventional Leak Detection

Deerfield Golf Club – 3 gpm Leak on Main

Thought to be Abandoned

Midwest - Leak Sounding Pilot

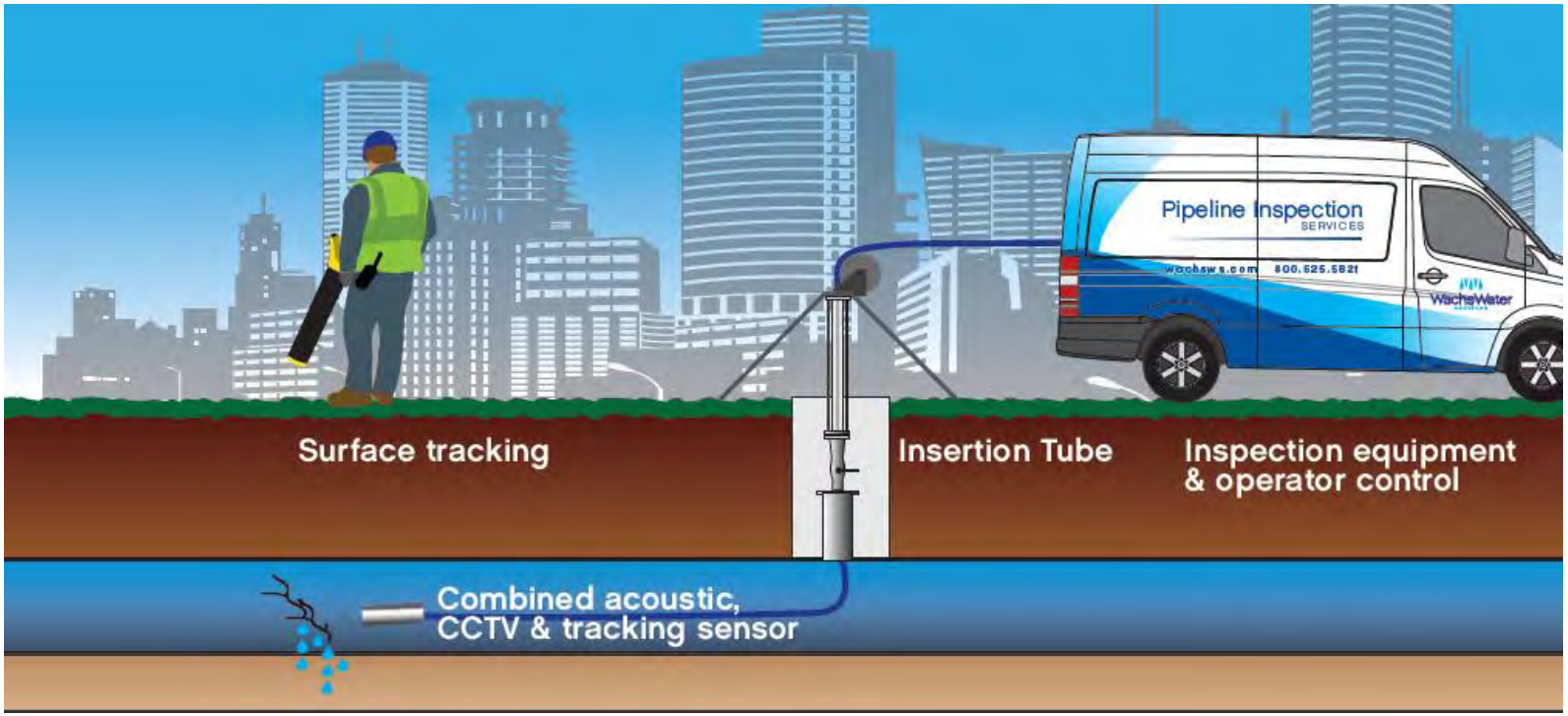
53 Strong Leak Sounds



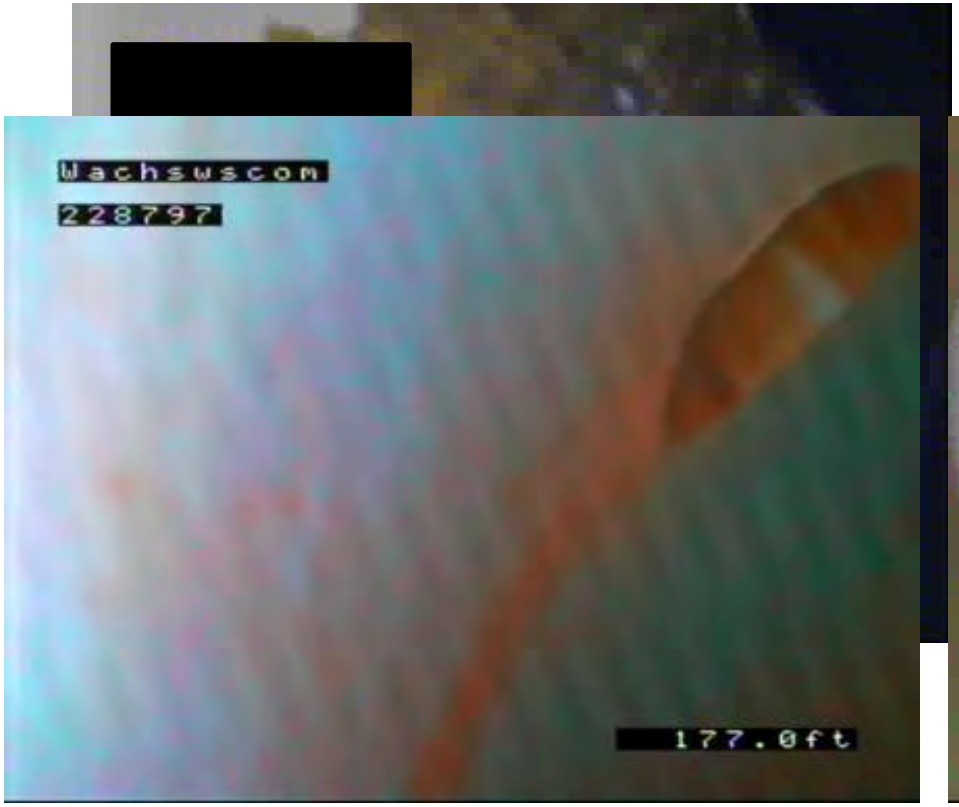
Advanced Technology – Pipeline Inspection “Investigator”

Transmission Main QA Inspection

- LDS1000™ for transmission mains ranging in diameter from 16 to 96-inch
- Acoustic / video inspection with 3,000 ft deployment length per insertion
- Utilities should invest in access points (2-inch minimum) during pipe installation



Locating Service Connections



Know What's Inside Your Pipe

Investigator can identify:

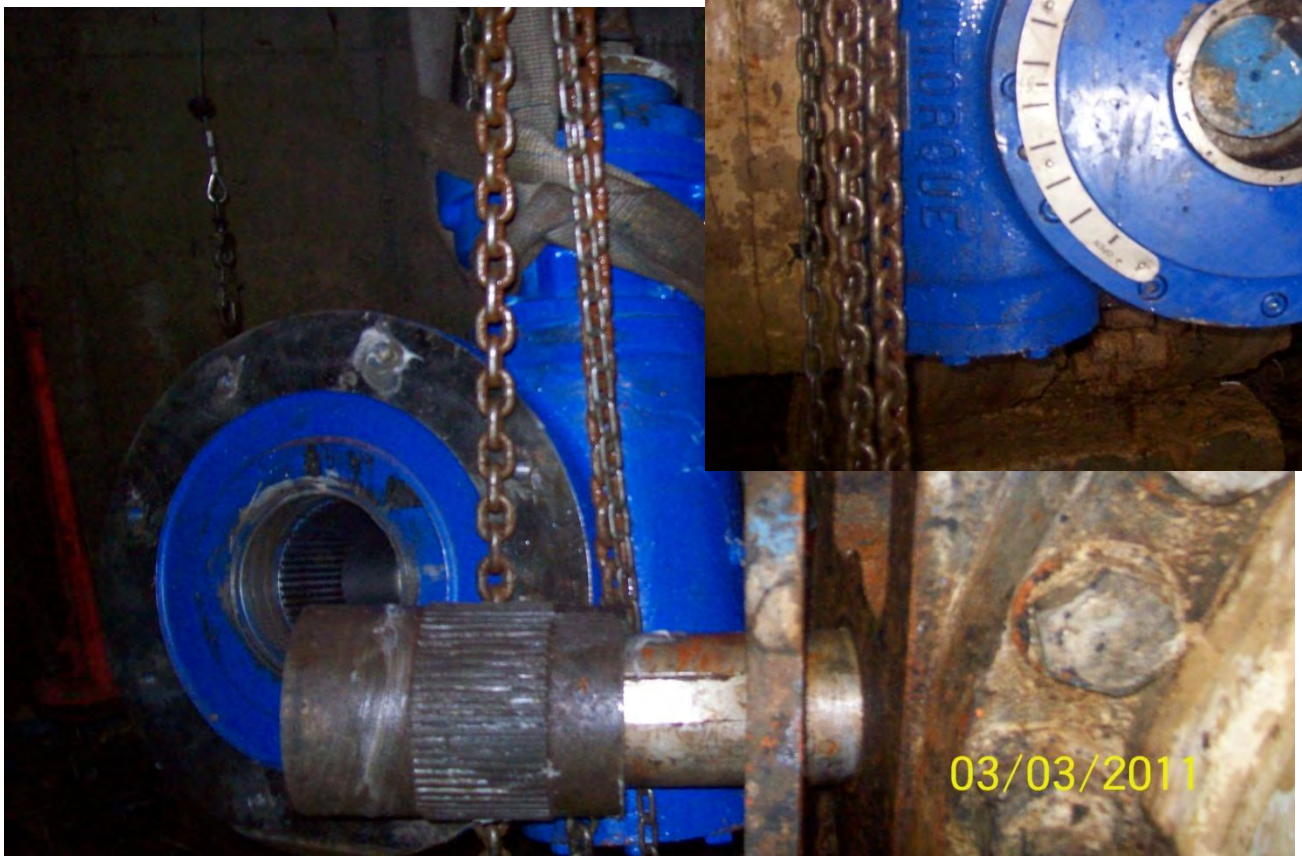
- Closed valves
- Lost valves
- Lost tools
- **Undocumented air release valves**
- **Undocumented drain valves**
- **Undocumented valves**
- Illegal service connections
- **Undocumented junctions**
- Pipeline direction
- Pipeline material
- Improperly installed liner
- Improperly repaired cracks
- **Diameter changes**
- Corrosion
- Pipe blockages & flow restrictions
- Improper backfill
- Damaged pipe joints
- Damages service connections
- Leaks
- Damaged pipe walls
- Air pockets
- Screw plugs
- Hardwood dowel repairs
- Operability of valves
- Tuberculation levels
- Debris accumulation

What else do you want to KNOW about?

BEAR CREEK LIMITORQUE REPLACEMENT

Damaged Limitorque Operator – 36” BF

New Limitorque Installation

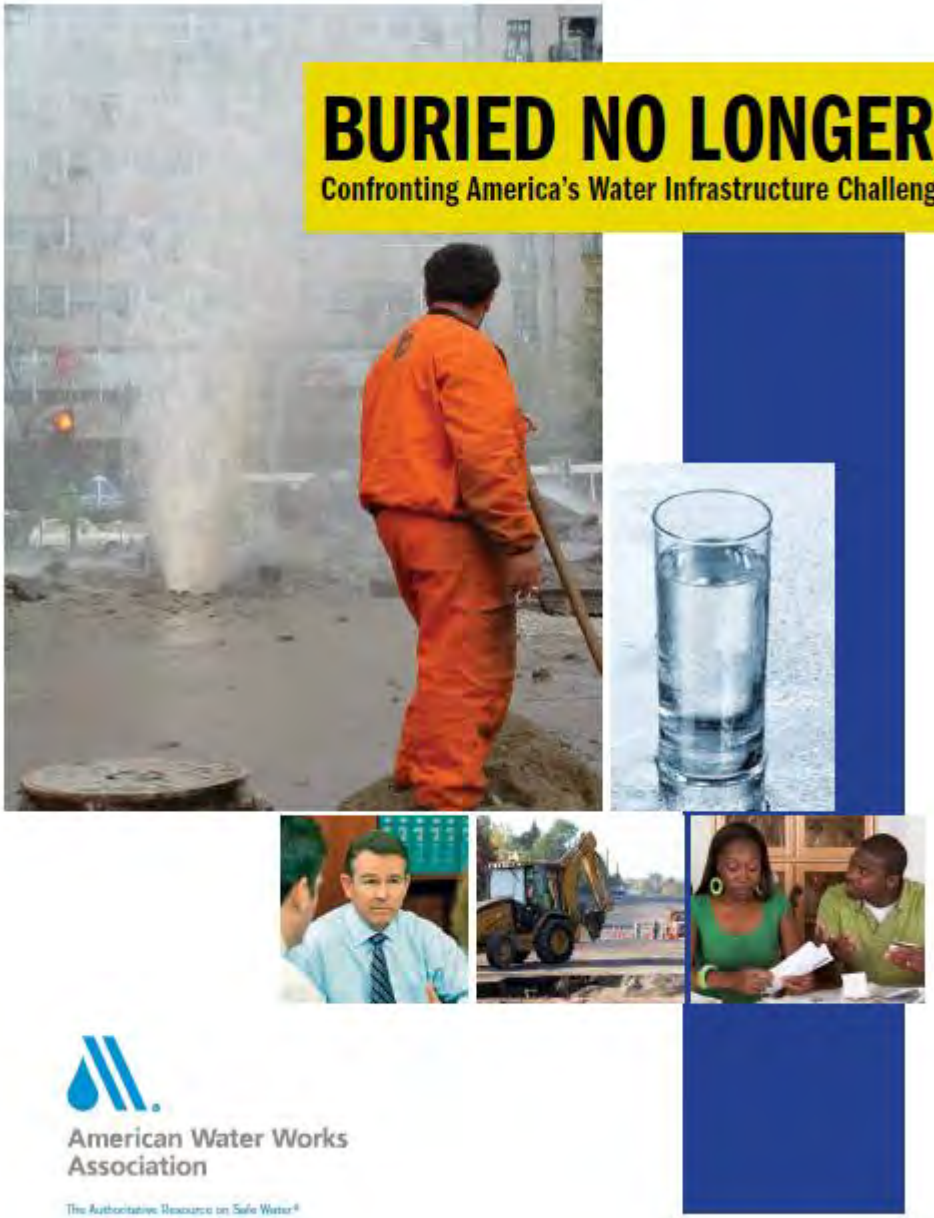


Investigator Inspection of 36” BF

Bear Creek Debris Removal

33’ of Air Duct Pulled from Main

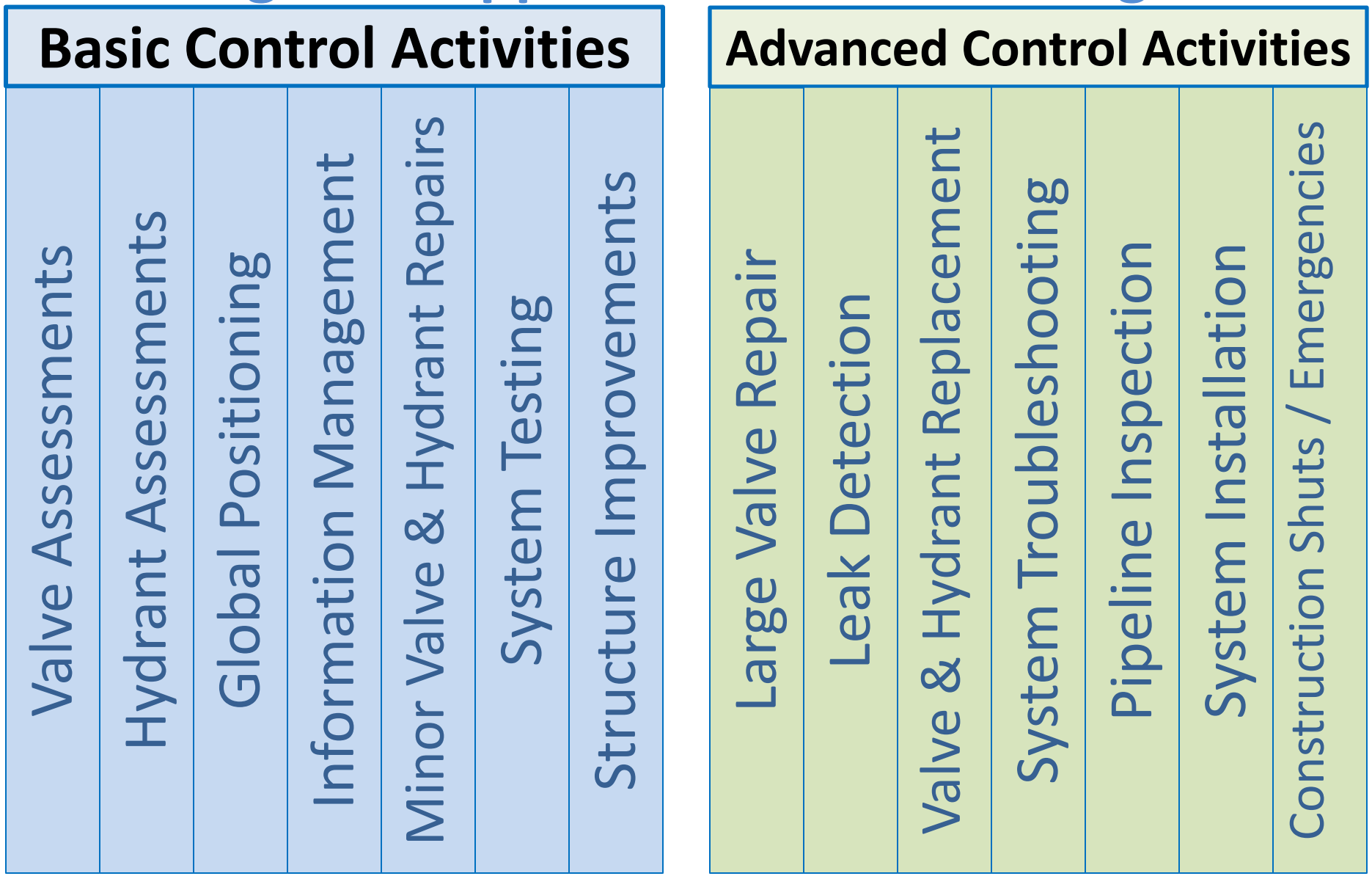
February 2012



"The cost of repairing and expanding U.S. drinking water infrastructure will top $1 trillion in the next 25 years"

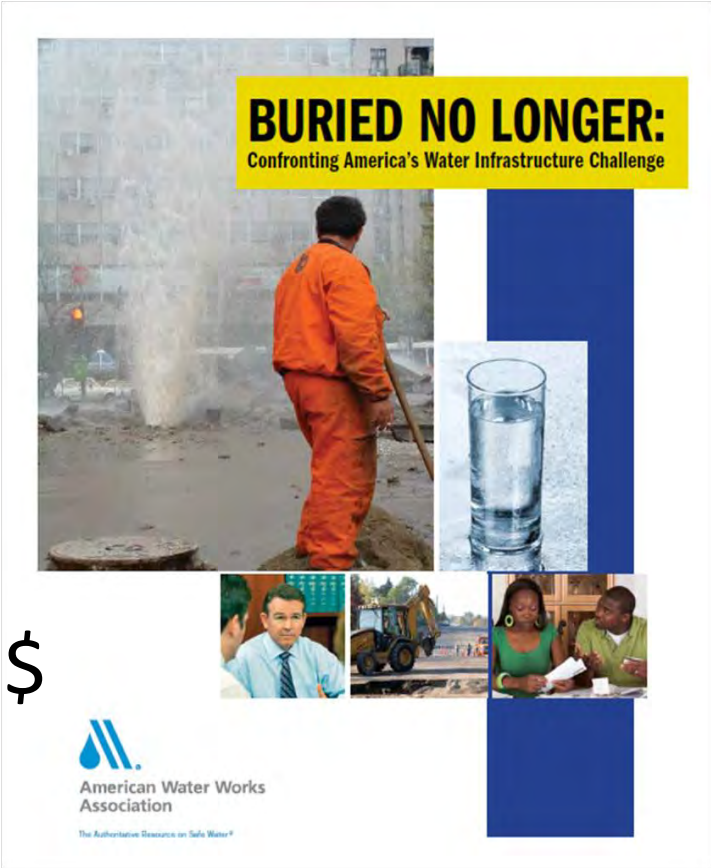
"The dawn of an era in which the assets will need to be replaced puts a growing stress on communities that will continue to increase for decades to come."

An Integrated Approach to Asset Management



An Integrated Approach to Asset Management

- Increases Efficiency & Effectiveness
- Prepares for “Replacement Wave”
- Focuses Scarce & Limited $$$
- One Step Toward the Daunting Task Ahead



Thank You!

WachsWater SERVICES
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