When it Breaks, it Pours

Large diameter pipeline breaks - planning, maintenance, and condition assessment activities that can help prevent these high profile pipeline failures.

Howard County History

- Howard County is located in the central part of Maryland, between Baltimore and Washington, D.C. It is considered part of the Baltimore-Washington Metropolitan Area.

Howard County
MARYLAND

History

- Howard County began providing water to its residents in 1931, under special agreement with Baltimore City.
- The expansion was to serve the Elkridge area in order to relieve water shortages.
- At that time, Howard County's population was approximately 45,000 people.

History

- In 1965, Howard County went through a tremendous growth spurt with the birth of Columbia.

- As growth continued, between 1968 and 1976, Howard County cost shared, with Baltimore City, the construction of 20 miles of Prestressed Concrete Cylinder Pipe (PCCP).

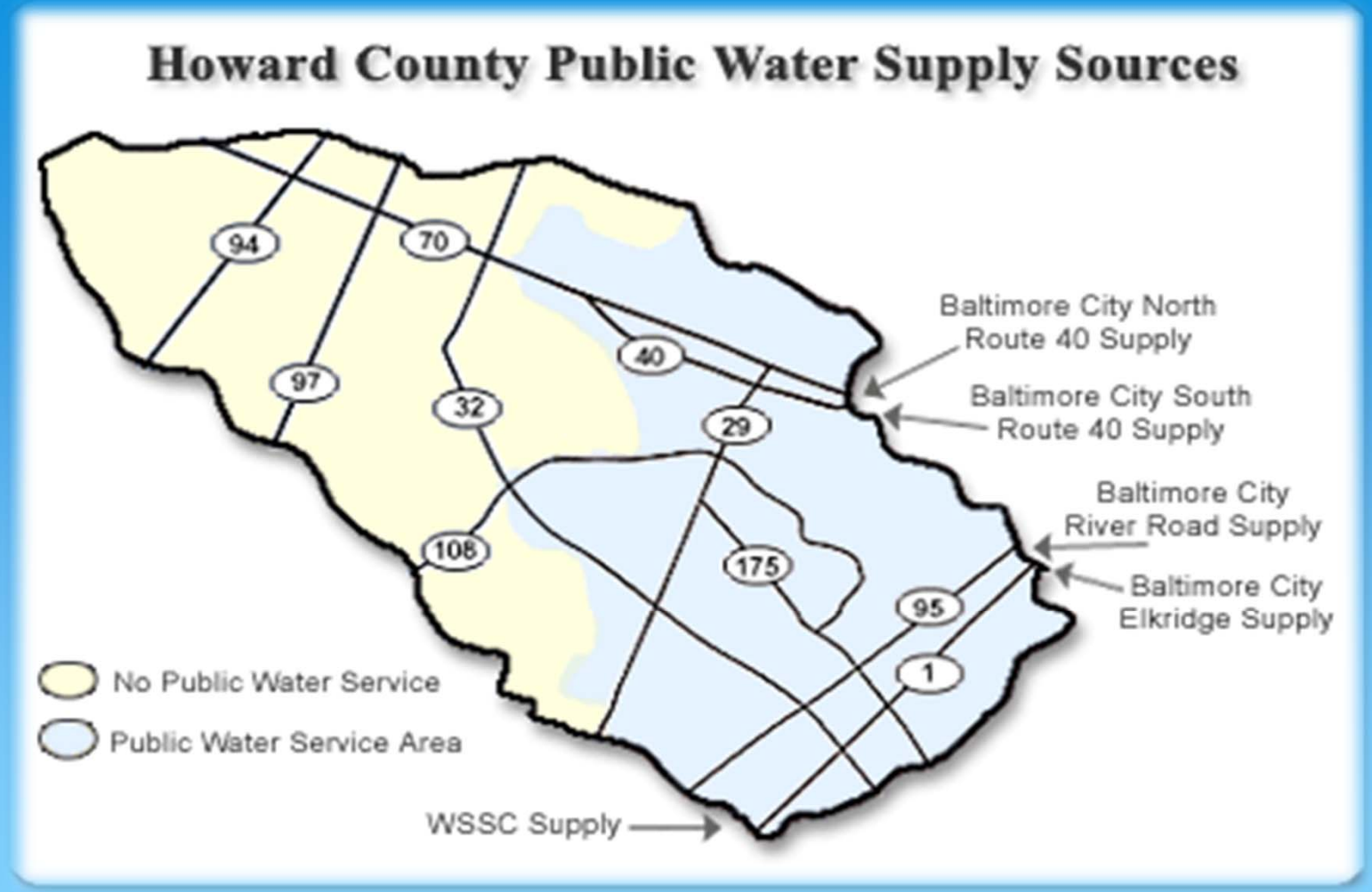
History

- During this period, an additional 18 miles of Prestressed Concrete Cylinder Pipe were constructed within Howard County.

- The diameters of the transmission mains range from 24-inches to 48-inches and serve as the backbone of the County water system.

History

- Today, Howard County's population is about 300,000 people.
- The current water distribution system consists of 1000 miles of pipe, both large and small diameter.
- 95% of Howard County's water is provided from Baltimore City through 20 miles of large diameter PCCP transmission mains.


Howard County Public Water Supply Sources
94
70
97
32
40
29
108
175
95
1
Baltimore City North
Route 40 Supply
Baltimore City South
Route 40 Supply
Baltimore City
River Road Supply
Baltimore City
Elkridge Supply
No Public Water Service
Public Water Service Area
WSSC Supply

PCCP Monitoring and Inspection

- In 1979, Howard County experienced its first catastrophic failure of Prestressed Concrete Cylinder Pipe.

Monitoring

- Over the next 11 Years, two leaks and five more catastrophic failures were experienced in the 36 inch Elkridge Transmission Main.

- In 1990, a consultant was hired to investigate the failures and it was concluded that the failures were a result of poor quality mortar coating, defective prestressed wires, and incorrect grade steel cylinders.

Monitoring

- Between 1990 and 2000, Howard County decided to conduct a more complete investigation of its Prestressed Concrete Cylinder Pipe.

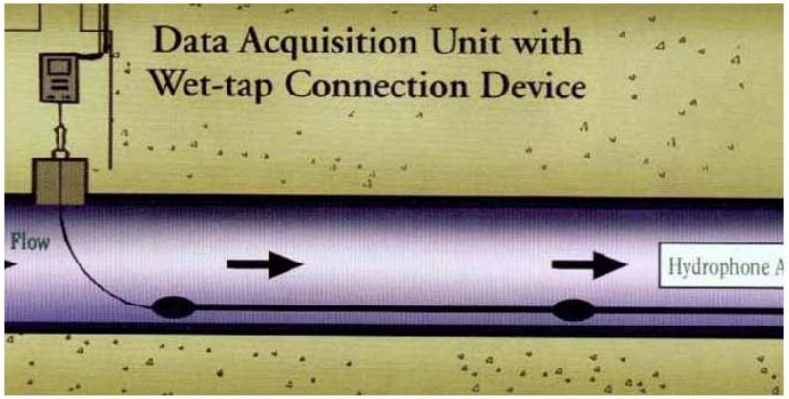
- The Howard County Bureau of Engineering and Bureau of Utilities developed a plan for inspection and monitoring of its Prestressed Concrete Cylinder Pipe.

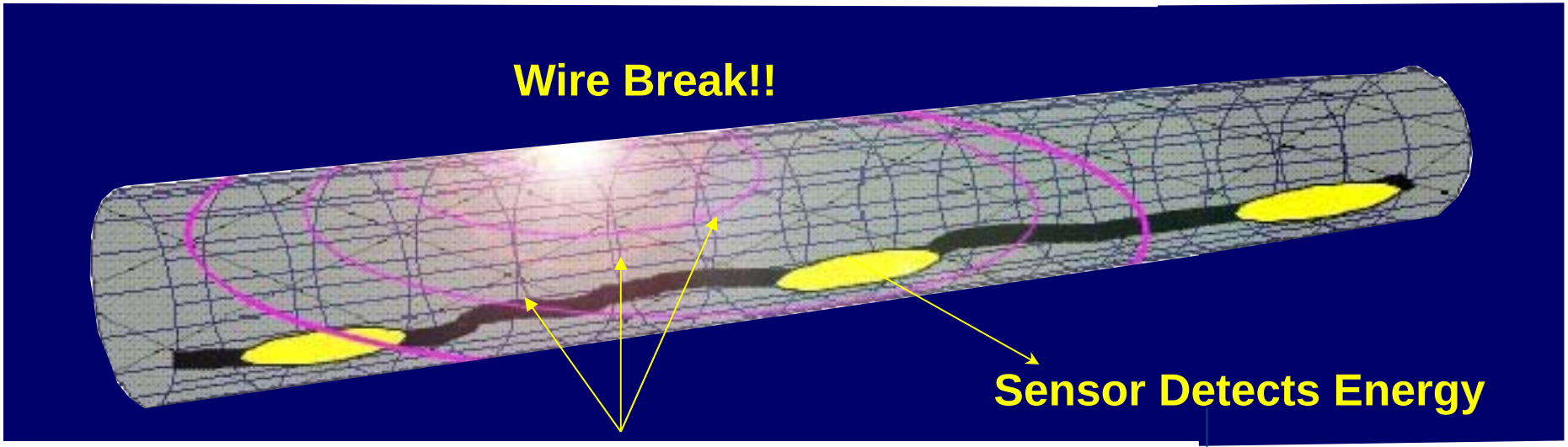
Monitoring

- Howard County would systematically shutdown the mains to perform visual analysis, sounding tests, and corrosion evaluations.

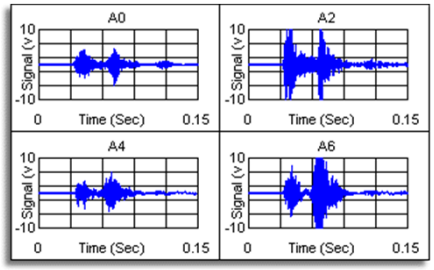
Monitoring

- In 1999,Howard County became aware of the work Pure Technologies was doing with Hydrophones and entered into a contract with Pure to monitor portions of Precast Concrete Cylinder Pipe.





Energy Release into pipe



Break Located:
Based on calculation from arrival time of signals at each sensor

Data sent to acquisition system

Internet Data Transmission

Centralized Data Processing, Reporting & Storage

Monitoring

- The arrays would be installed in one mile sections of the main for a 3-month period then moved to the next location.

- In the summer of 2000, Pure Technologies, informed us of a “very active” pipe section located in a portion of main that they were monitoring.

Monitoring

Pure pinpointed the location and the Bureau of Utilities mobilized to excavate the pipe section.

We Became Believers.

Program Implementation

- In 2005, CSX Railroad contacted Howard County and informed us of their plans to expand and construct a railroad over 3,000 feet of the Southwest Transmission Main.
- This main provides 1/3 of Howard County's Water.

Program

- In order to avoid any catastrophic failures to the railroad and to keep water service to the County a monitoring program was initiated while plans to permanently relocate the Southwest Transmission Main were developed.

- A capital project was funded to address this issue and eventually became the standard for the Howard County PCCP assessment program.

Four Phase Program

- Phase I – Inspection
- Phase II – Failure Risk Analysis
- Phase III – Repair or Replace
- Phase IV – Monitor

Program

Phase I - Visual analysis, sounding tests, and Electromagnetic Inspections.

- Establishes a baseline of the current condition of transmission main.

Program

Phase II - A failure risk analysis is performed on each section of pipe that exhibits broken prestressing wires to determine the probability of failure.

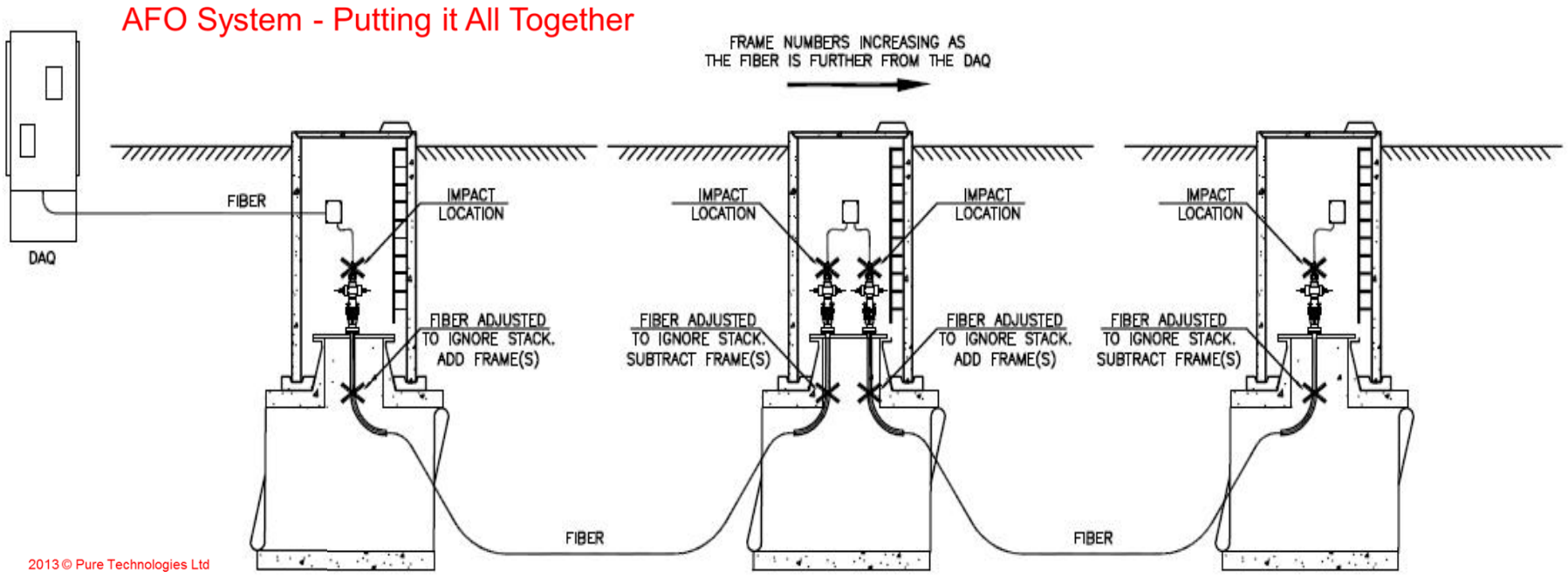
- Identifies any areas in urgent need of repair.
- Provides the approximate remaining life of the pipe section.

Program

Phase III - Address pipes damaged beyond a minimum threshold, repair using carbon fiber reinforcement or replace.

Program

Phase IV - Install an Acoustic Fiber Optic (AFO) cable in the pipeline and place the water main back into service.



Program

- The acoustic fiber optic cable is able to “hear” and locate prestressing wire breaks in the pipeline as they occur.
- Each wire break is recorded for that specific pipe and uploaded onto a database each day.
- This allows Howard County to estimate the total number of wire breaks in any piece of PCCP.

Program

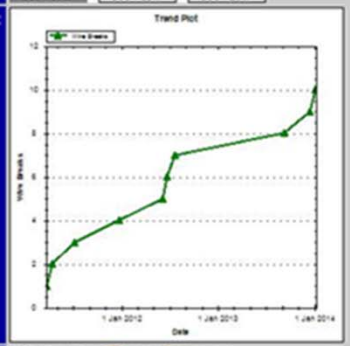
- By entering the SoundPrint™ Website, the wire break information can be accessed for any specific piece of pipe.

Event Data	
Site:	HCAFO
Date / Time:	Jan 03, 2014 07:32:06 Eastern Standard Time
Event Classification:	Wire Break
Location:	36 Southwest Howard County Station # 108+07
Pipe Data	
Pipe Diameter:	36 "
Pipe Class:	625-W-B
Repaired:	No
Replaced:	No
Inspected (Electromagnetic):	Jun 22, 2007
Charts and Maps	

Pipe Chart:

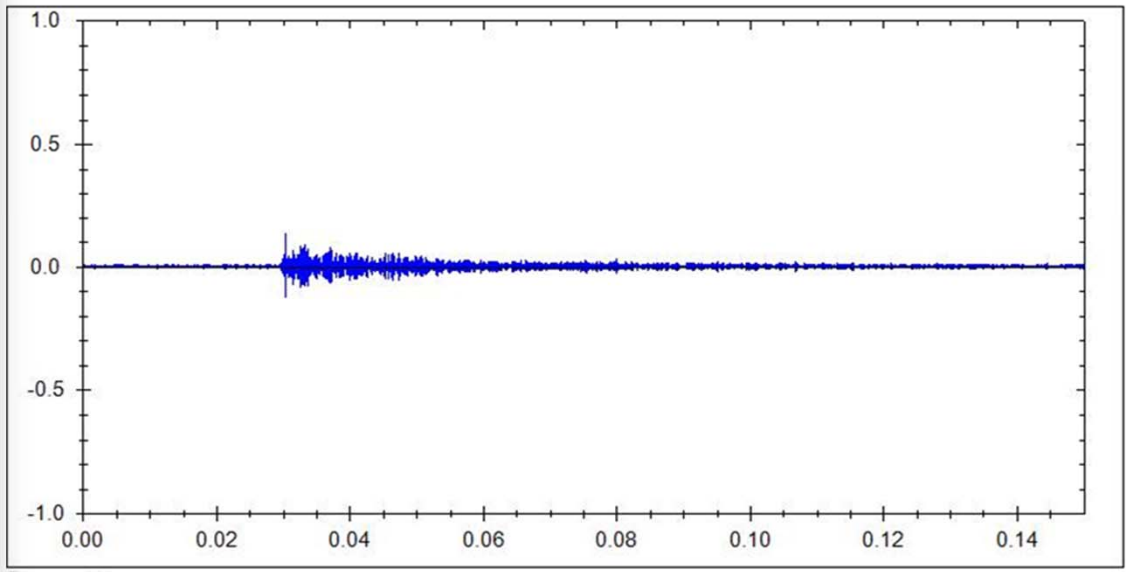
21-122	21-123	21-124
CFR	625-W-B	625-W-B
X+16=31	15+10=25	0+0=0
16	10	0
107+97.7	108+13.7	108+29.7

Trend Plot:



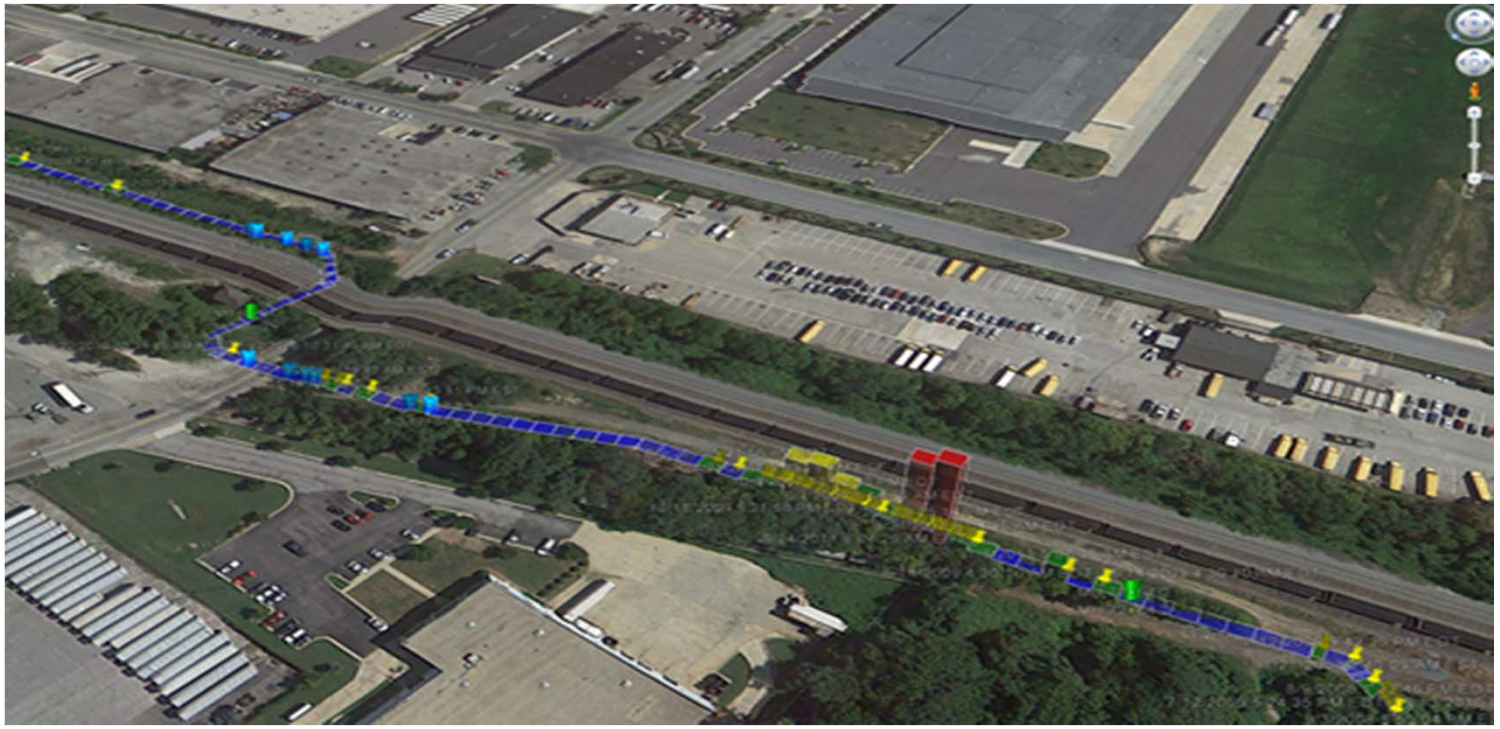
SoundPrint® Pipeline Management

Acoustic event recorded on 12/24/2011 6:37:30 PM EST



Program

- Each piece of pipe, along with its wire break history, is overlaid onto the mapping system provided by Google Earth.



Program

- By overlaying the pipeline onto the aerial photography, we can identify critical areas such as schools, hospitals, and major road interchanges where catastrophic water main breaks can impact property, life, and safety.

Program

- As the prestressed wires continue to break, the sections are re-analyzed and priorities can be adjusted to replace those sections that are near failure or that are in critical areas.

- This allows capital expenditures to be programmed for major replacement efforts.

- By selectively addressing critical sections, risk and cost can be balanced while maximizing the life of the investment.

What is next for Howard County?

- We are currently working on a pilot project with Pure Technologies to test an integrated asset management program called PureNET™.

- PureNET™ helps utilities streamline planning and decision making by establishing maintenance priorities, budgets, and planning of future projects, as well as providing information on the condition and useful life of a utility's infrastructure.

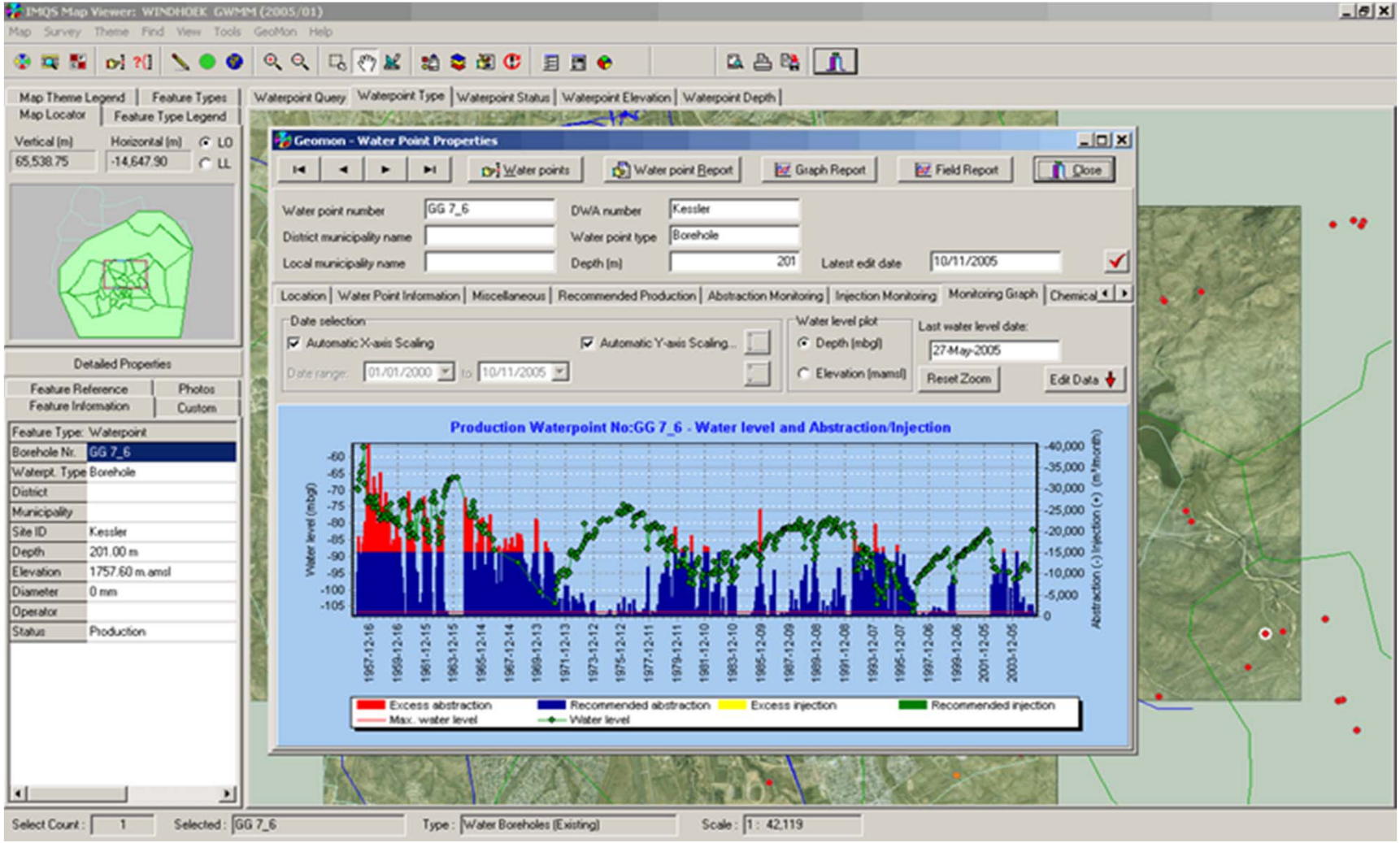
Future

Services

- Hydraulic analysis & capacity assessment
- Master planning
- Risk management
- Pipe integrity inspections
- Non-revenue and water loss analysis
- Asset accounting
- Long-term financial planning
- Optimized decision making
- Revenue management
- Customized software development

Future

Dashboard



Conclusion

Howard County has had One* catastrophic failure on its transmission mains since 1990, when we first began inspecting and monitoring PCCP.

Howard County continues to build the PCCP monitoring program and is piloting new technologies such as PureNET™.

Howard County is working toward its goal of permanently monitoring all of the PCCP installed.

Questions?