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Aging Water Infrastructure Research Program SAB Consultation

Infrastructure Condition Assessment

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Condition Assessment

Goals:

- To generate the science and engineering to improve and evaluate promising innovative technologies and techniques.
- To enable utilities to make technically sound asset management judgments based on the condition of their assets.

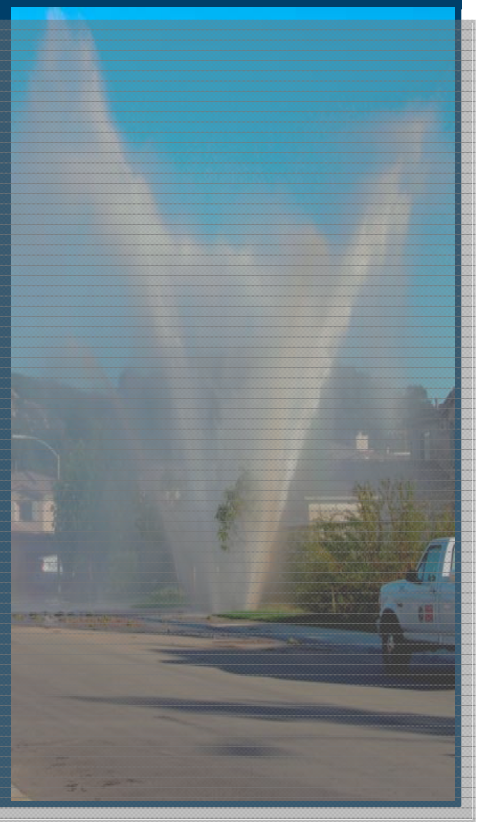
Components:

- Collection of data and information through direct inspection, observation, investigation, in-direct monitoring and reporting.
- Analysis of data and information to make a determination of the structural, operational and performance status of capital infrastructure assets.
- Failure analysis, which seeks to determine the causes of infrastructure failures in order to estimate remaining useful life and to prevent future failures.

Condition Assessment

Key Projects

- National/regional infrastructure assessments
  - Example: Climate change adaptation
- Condition assessment of wastewater collection systems
  - Example: SSOAP
- Condition assessment of drinking water distribution systems
  - Example: Leak detection technology development
- Controlled condition testing facility



National and Regional Infrastructure Assessment

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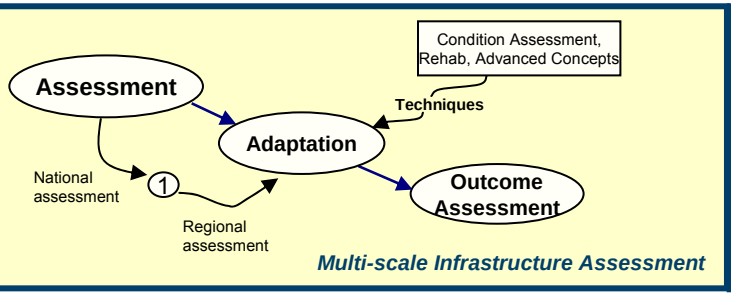
Multi-Scale Infrastructure Assessment



Multi-scale Infrastructure Assessment

- Assessing infrastructure sustainability and adaptability on national and then regional levels
- Develop/suggest adaptations to meet the needs of the region
- Assess the outcomes of the adaptations

Major Components of Assessment

Prediction Uncertainty Management

Developing ways to manage the impact of model uncertainties in infrastructure decisions.

Water Availability

Assessing the impacts of climate changes and land use developments in terms of water availability.

Water Conservation

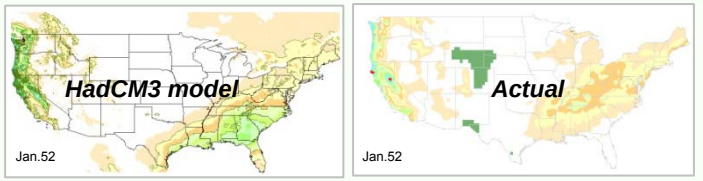
Developing and applying advanced techniques and technologies to reduce water loss and water quality deterioration during distribution.

Water Reuse

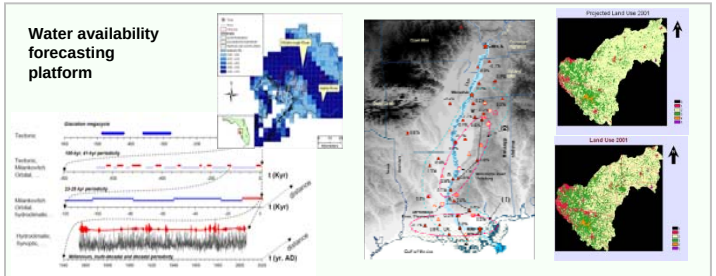
Identifying regions and technologies to amend water resource availability under future climatic and global conditions.

Water Resources in Energy Production

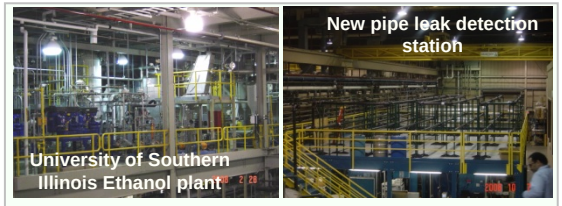
Assessing and developing water conservation policies and infrastructure for sustainable energy productions.



Prediction Uncertainty Management



Water Availability; Tool Boxes, and Regional Studies



Water Conservation and water reuse

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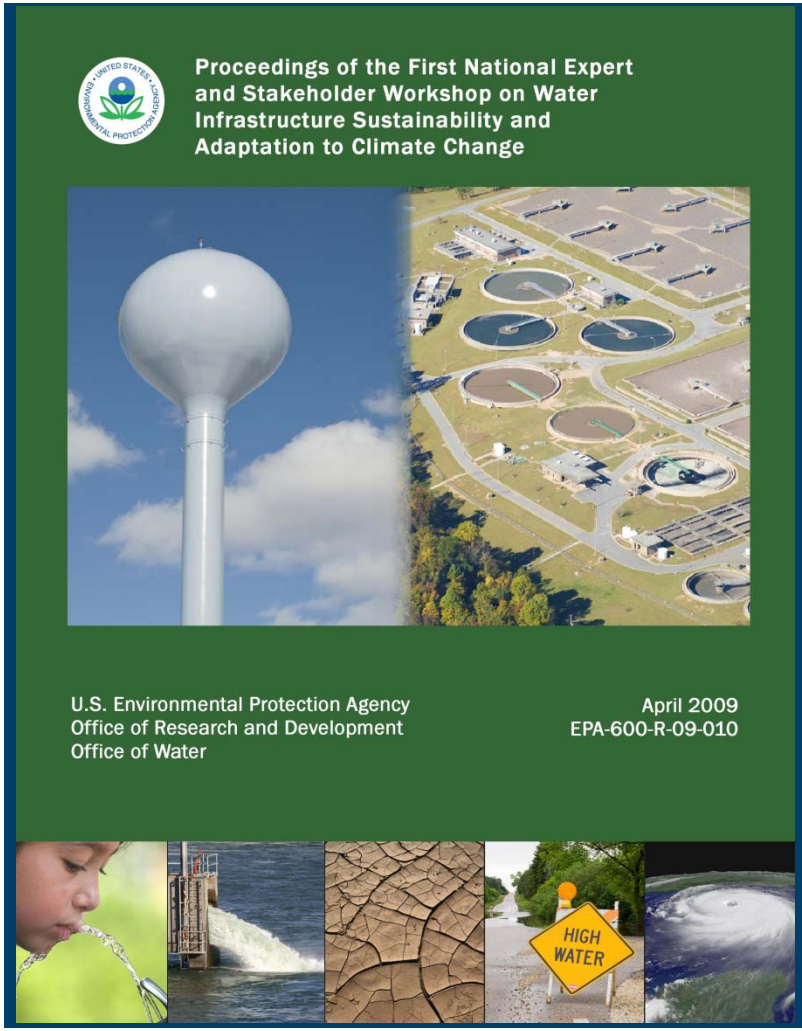


Infrastructure Adaptation to Climate Change

EPA Stakeholder Workshop

Condition Assessment of Wastewater Collection Systems

Objectives:

- Evaluate current and innovative condition assessment technologies and assess the state of the technology
- Prepare for and conduct field demonstrations of selected innovative technologies to provide third-party cost and performance data

Major Tasks:

- Establish stakeholder group
- Assess and report on State of the Technology
  - International technology forum
- Develop protocols and metrics for technology demonstrations
- Develop site selection criteria for technology demonstrations
- Conduct field demonstrations

Schedule

- **Initiated in December 2007**
- **Estimated Completion in December 2010**

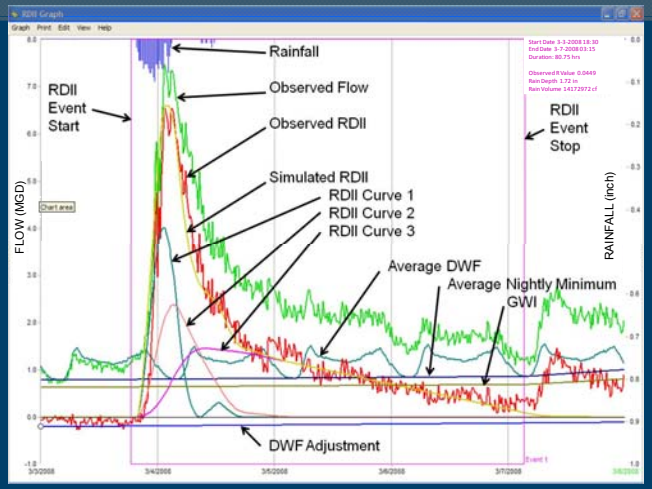
Research Partners

- **Cadmus Group**
- **Louis Berger Group**
- **ADS Environmental Services**
- **Redzone Robotics**

Sanitary Sewer Overflow Analysis and Planning Toolbox (SSOAP)

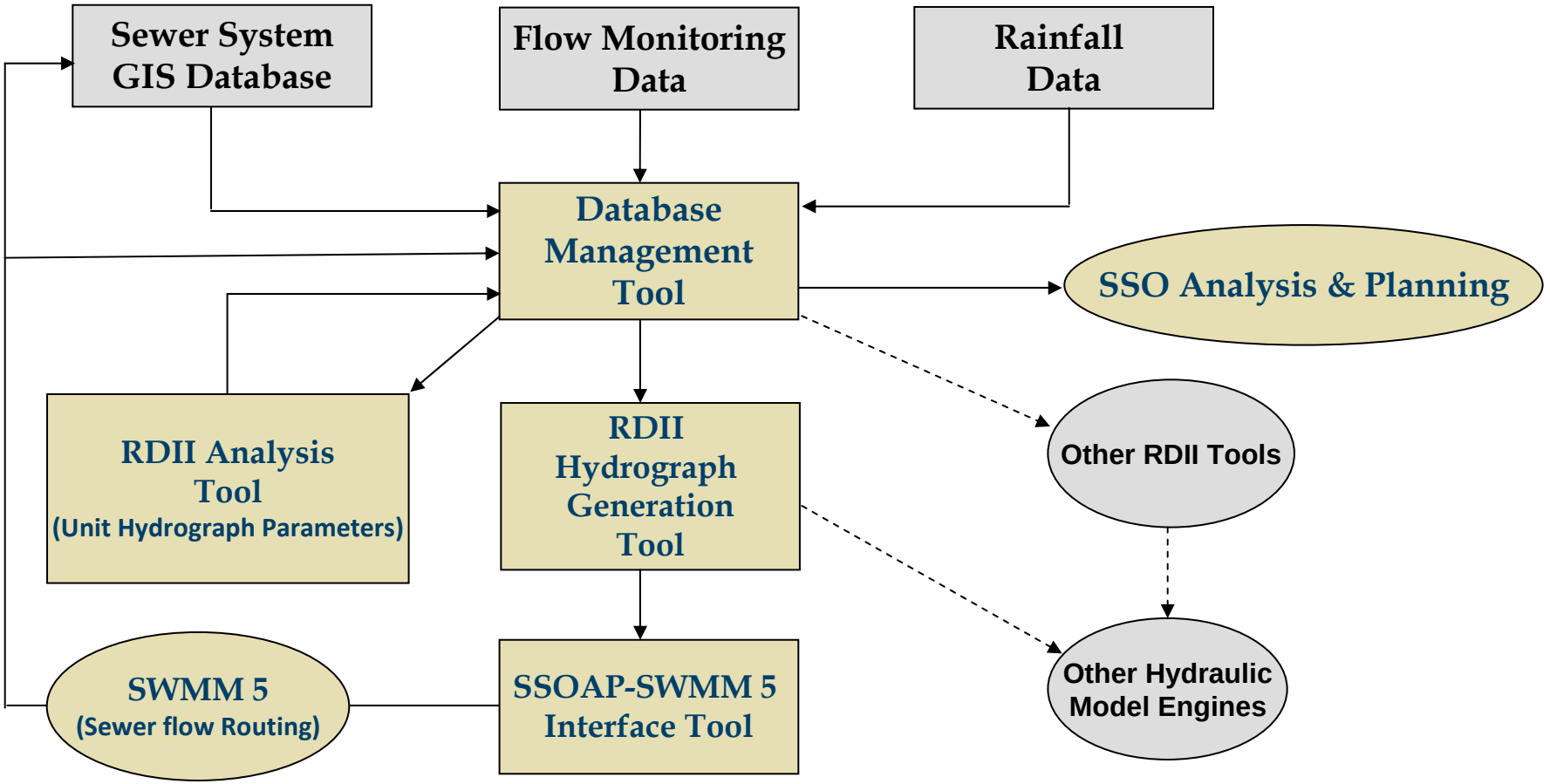
- Condition assessment toolbox using flow monitoring data.
- Analyze sewer flow data to determine characteristics and infiltration and inflow rates.
  - –Prioritize collection system subareas for inspection and condition assessment
  - –Conduct performance assessment of rehabilitation activities

- SSOAP was developed under a cooperative research and development agreement (CRADA) with CDM
- Two reports published
- Three one-day workshops conducted
- Two-day hands-on training conducted in March 2009 for 10 beta testers in VA
- Public release of SSOAP expected August 2009



RDII Graph

SSOAP Toolbox



Condition Assessment of Drinking Water Distribution Systems

Objectives:

- Evaluate current and innovative condition assessment technologies and assess the state of the technology.
- Prepare for and conduct field demonstrations of selected innovative technologies to provide third-party cost and performance data.

Major Tasks:

- Stakeholder group
- State of the Technology (SOT) assessment
  - International technology forum – SOT Report on condition assessment of ferrous mains
  - Predictability/preventability indices feasibility
  - Pipe condition curves SOT
  - Inspection technology usage
  - Federal research technology transfer opportunities
  - Critical research review
- **Technology Field Demonstrations** – Louisville, KY

Research Partners

- **Battelle Institute**
- **Jason Consultants**
- **Virginia Tech**
- **National Research Council of Canada**
- **PARS (Picatinny Arsenal Research Services) Environmental Services**

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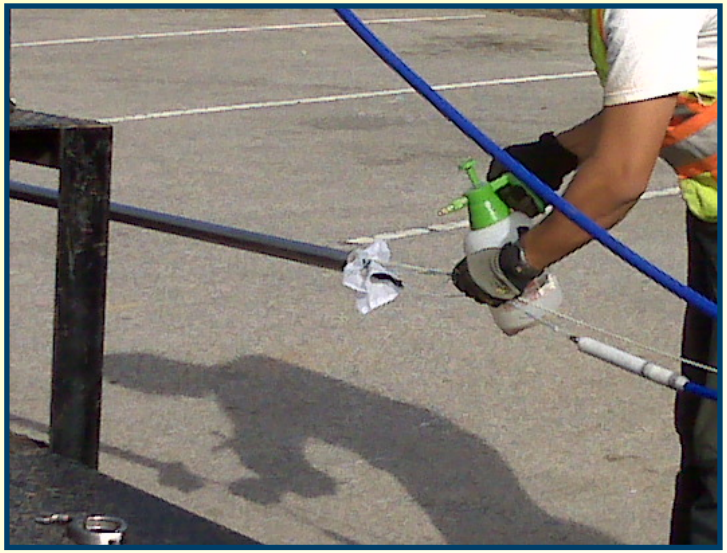
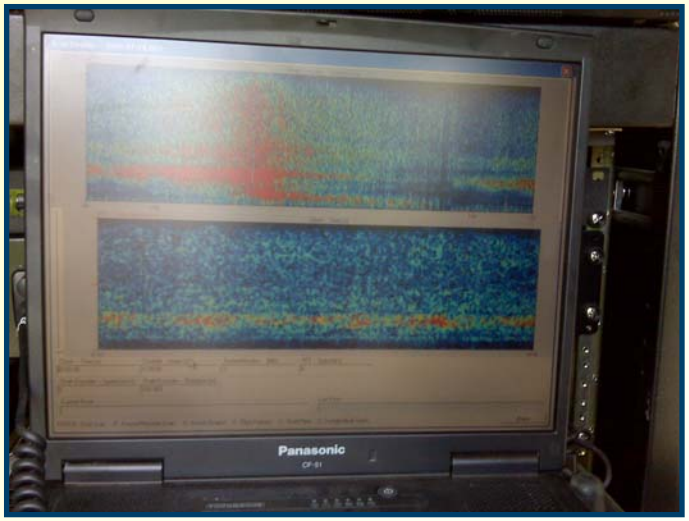
Condition Assessment Technology Demonstration Louisville, KY

Demonstration Hosted by Louisville Water Company

- 2500-ft, 24-inch, cement-lined, ductile iron pipe, 76-yr old
- Recent breaks, reduced flow; seven previous leaks found
- Demonstration period: July 6th – August 21st
- Pipe will be replaced and upsized to 30-inch in September
- Demonstration in progress
  - 13 technologies; 6 vendors
    - 7 developmental and 6 commercial
    - Leak detection and external & internal inspection
- Post-demonstration pipe extraction and condition confirmation – August 21st - September 15th

Condition Assessment Technology Demonstration
Louisville, KY





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Water Pipe Leak Detection Experimental Station

Goal: Locate leaks to within a few centimeters with significantly reduced false identifications.

- Research the application of acoustic/noise logger technology using state of the technology “leak noise correlation” techniques.
- Leak noise correlation techniques in development have the potential to improve detection accuracy in noisy field operations.

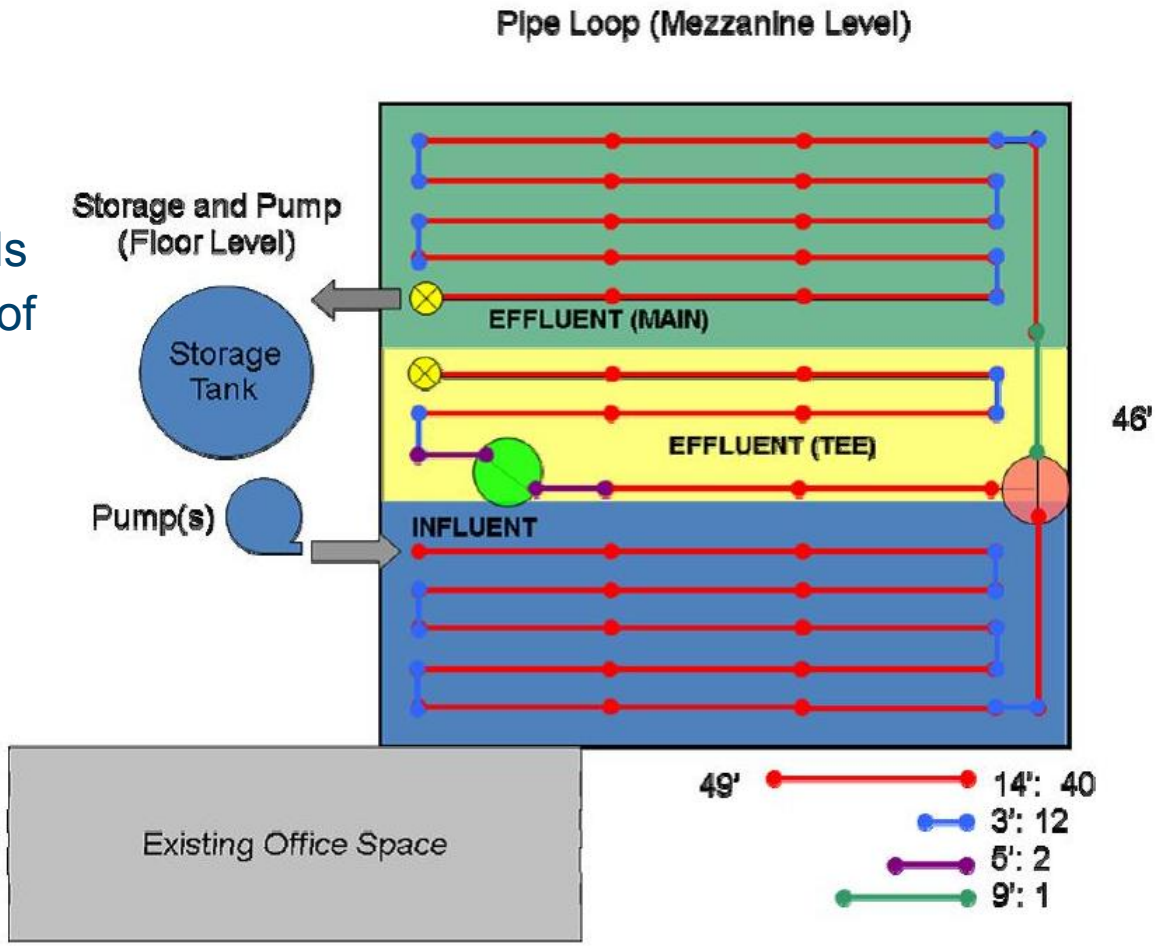
Leak Detection Test Pipe Loop

Test Loop Design

- Provide long runs without bends
- Provide option for adding tees of various angles
- Provide option to test leaks of various geometries

Pipe Materials

- PVC
- Unlined ductile iron
- Cement lined ductile iron



Controlled Condition Research

Goal: Evaluate controlled condition testing needs for innovative technologies for aging water infrastructure, and develop preliminary designs for upgrading Edison Pipeline Test Facility.

Highest Rank Data Needs

- Assessment of Ferrous Potable Water Pipe (>18")
- Assessment of Ferrous Sewer Force Main (>18")
- Examination of Bedding Conditions of Buried Piping
- Assessment of Ferrous Sewer Force Main (<18")
- Assessment of Non-Ferrous Sewer Force Main (>18")
- Leak Detection in Sewer Force Mains

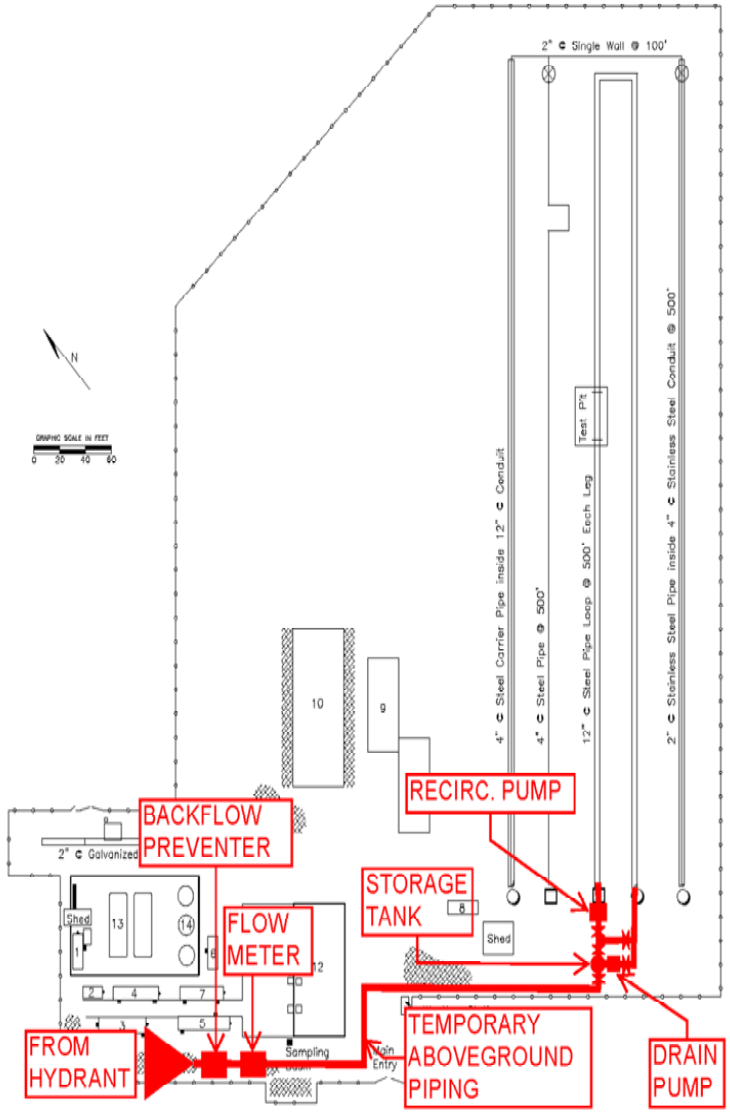
Next Steps (through FY10)

- Revised Report & Preliminary Designs
- Select Priority Needs
- Generate final design
- Implement improvements
- Initiate testing

Research Partners

- **Research Triangle Institute**
- **CDM**

Proposed Initial Upgrades Edison Pipeline Test Facility



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Future Program Areas of Interest and Activity

- Infrastructure failure analysis and modeling
  - Forensics/failure cause evaluation
  - Factors/warning signs of failure
  - Standardized data collection
  - Failure prediction/useful life assessment
- Cooperative Agreement
  - 4-year agreement
  - Team of nationally recognized research foundations and university research centers
- Asset Management Decision-Support Tools

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Questions?