

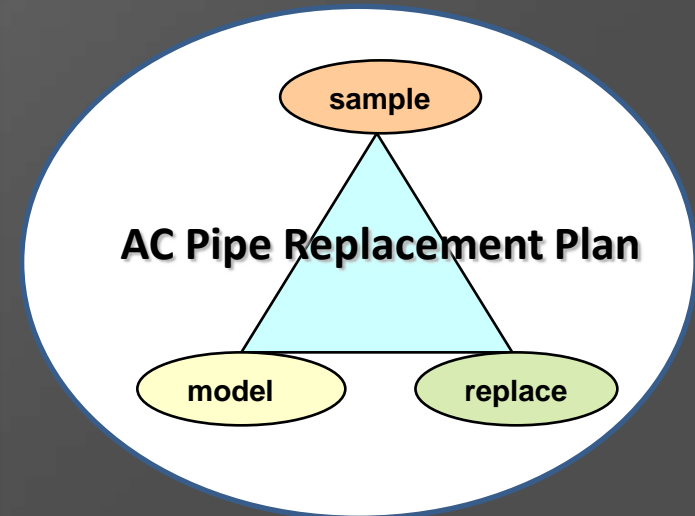


EAST BAY MUNICIPAL UTILITY DISTRICT

Asbestos Cement Pipe Study

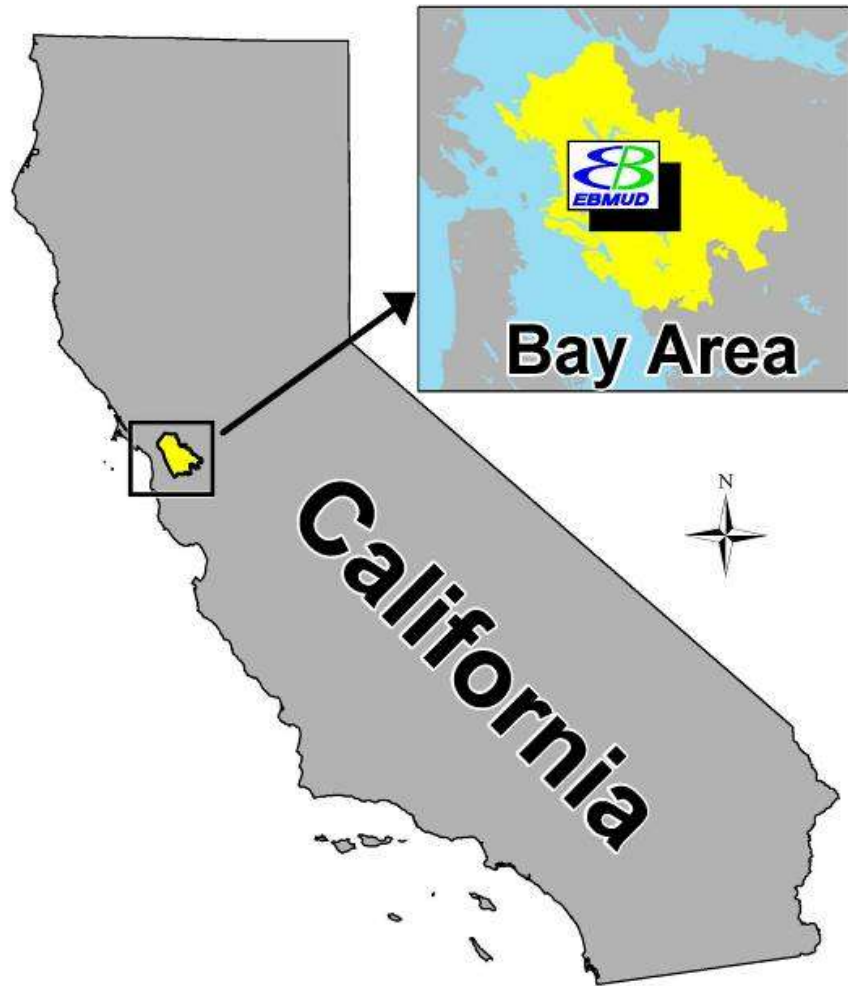
Outline

- EBMUD's Asbestos Pipe Inventory and Leak History
- Asbestos Pipe Corrosion Studies to date
- Identification of an AC Pipeline Replacement Plan



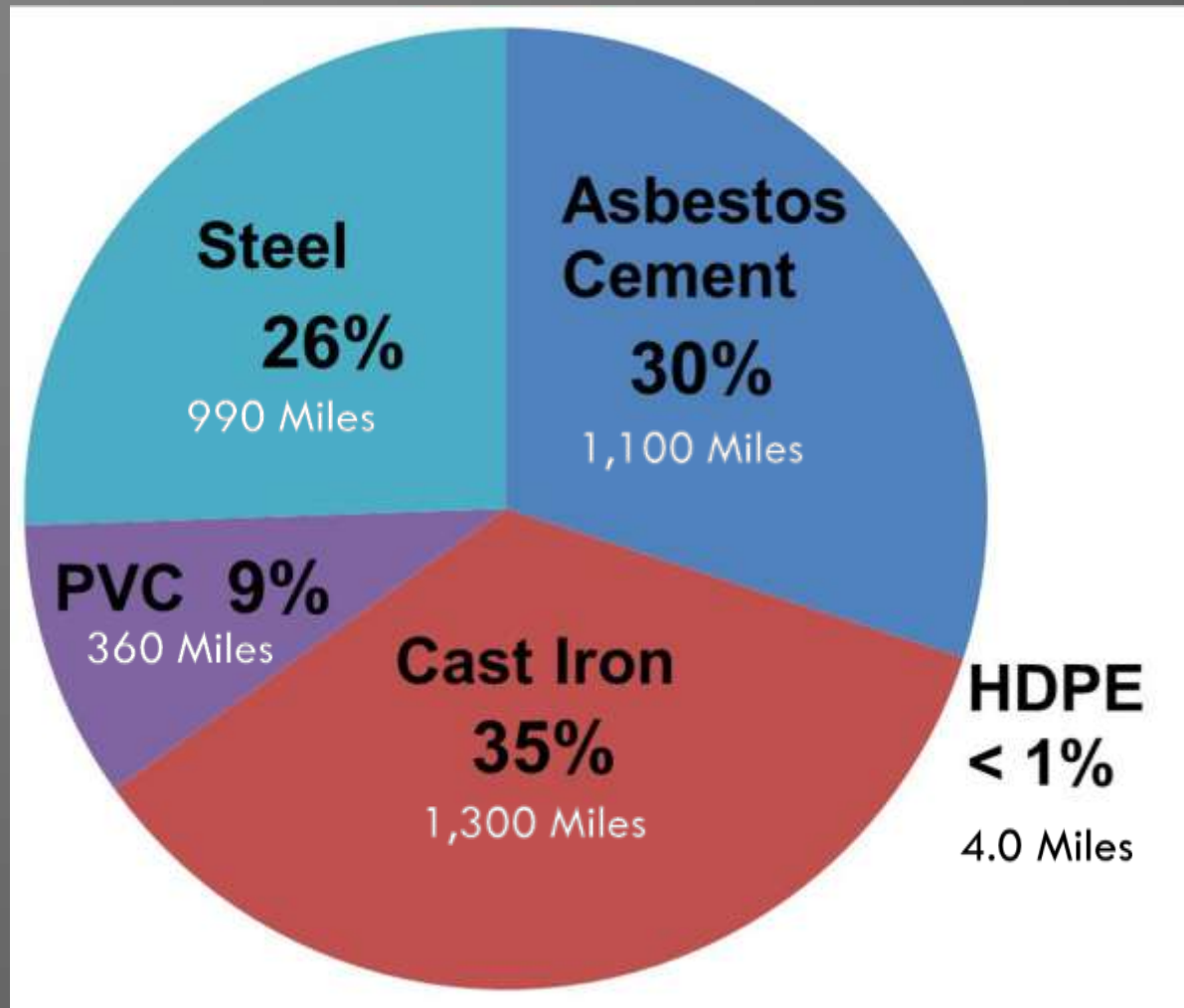
EBMUD:

East Bay Municipal Utility District

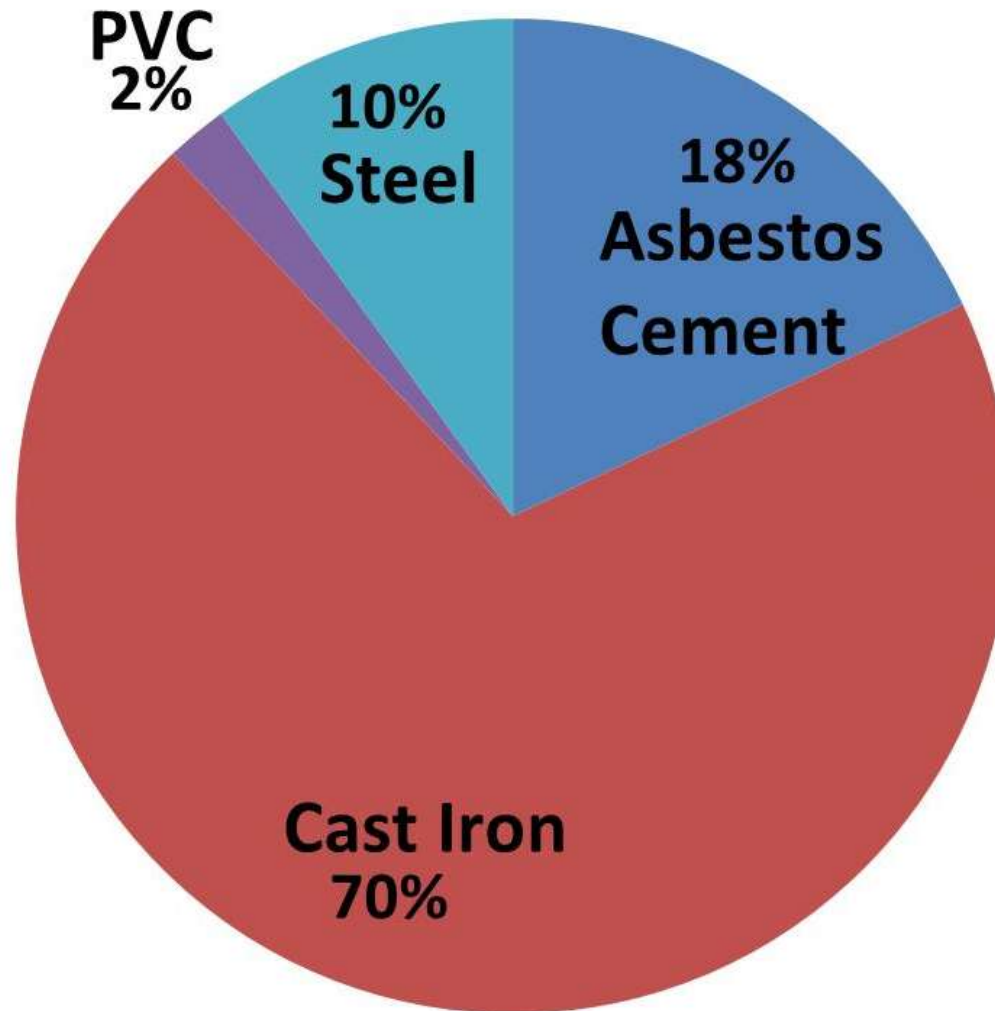


- 4,200 miles of pipe
- 1.3 million people
- 90% of water supply from Sierra foothills
- Alameda and Contra Costa Counties
- 331 square miles of service area

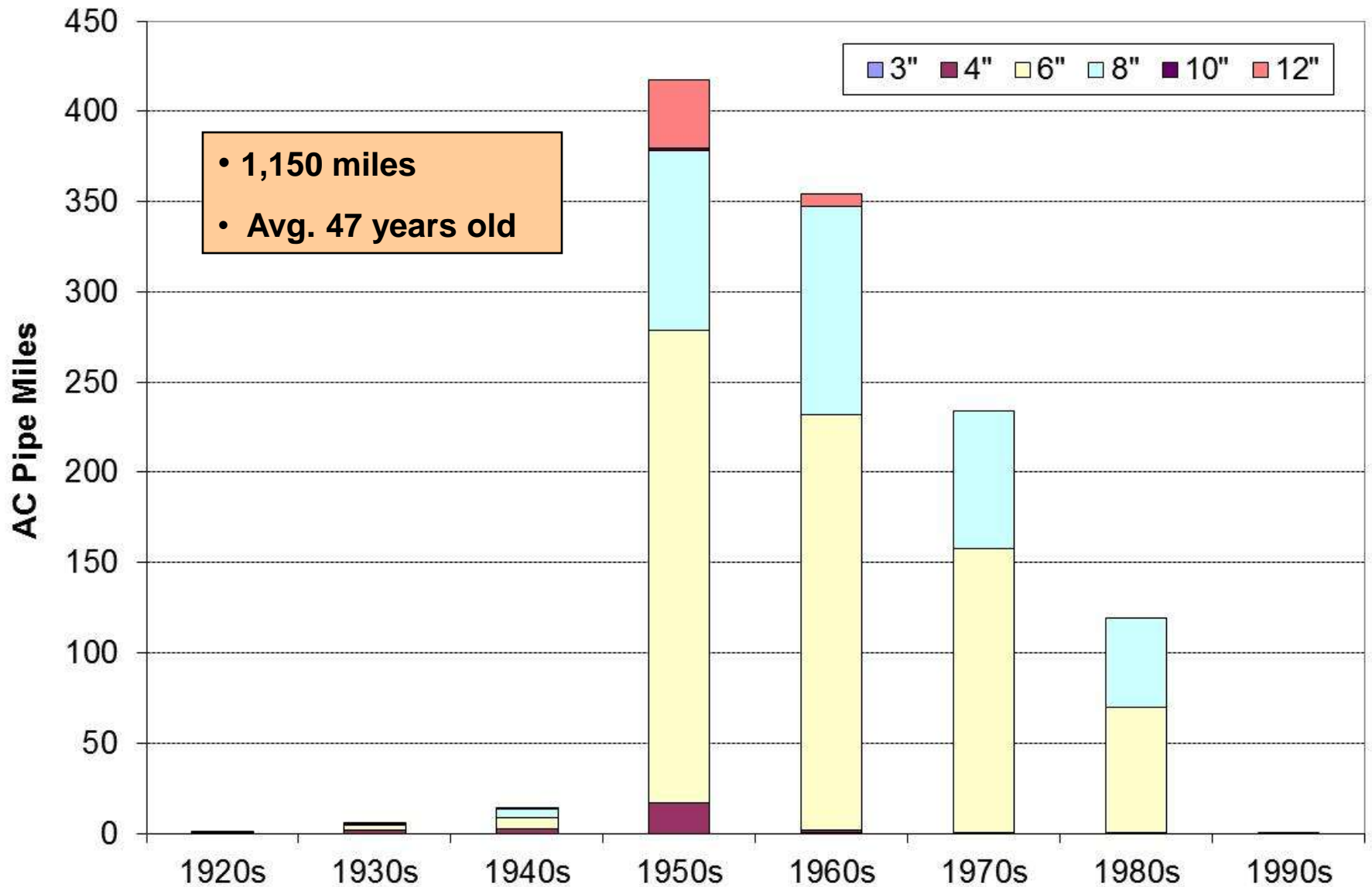
Distribution Pipeline Inventory

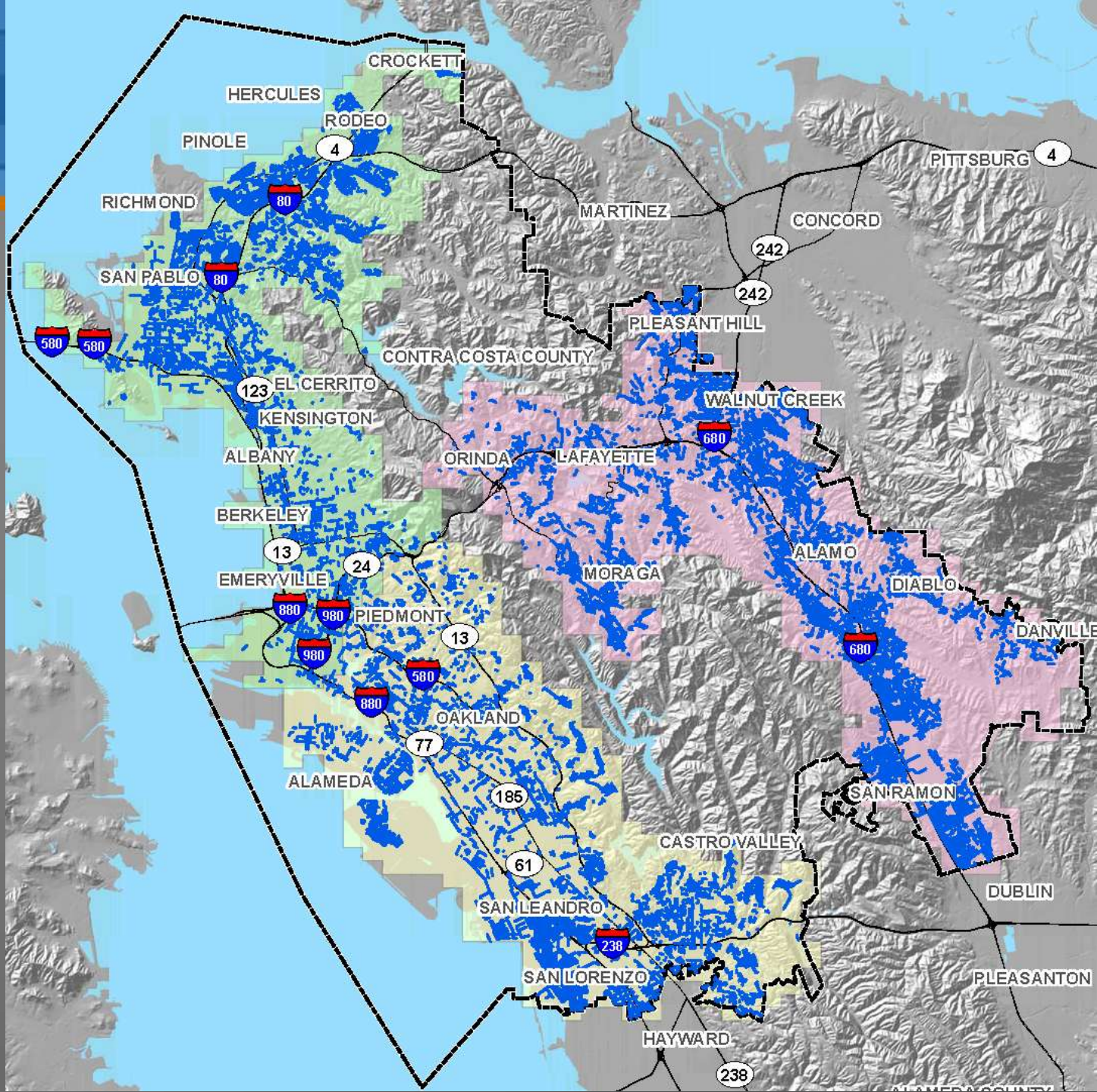


Leak Summary

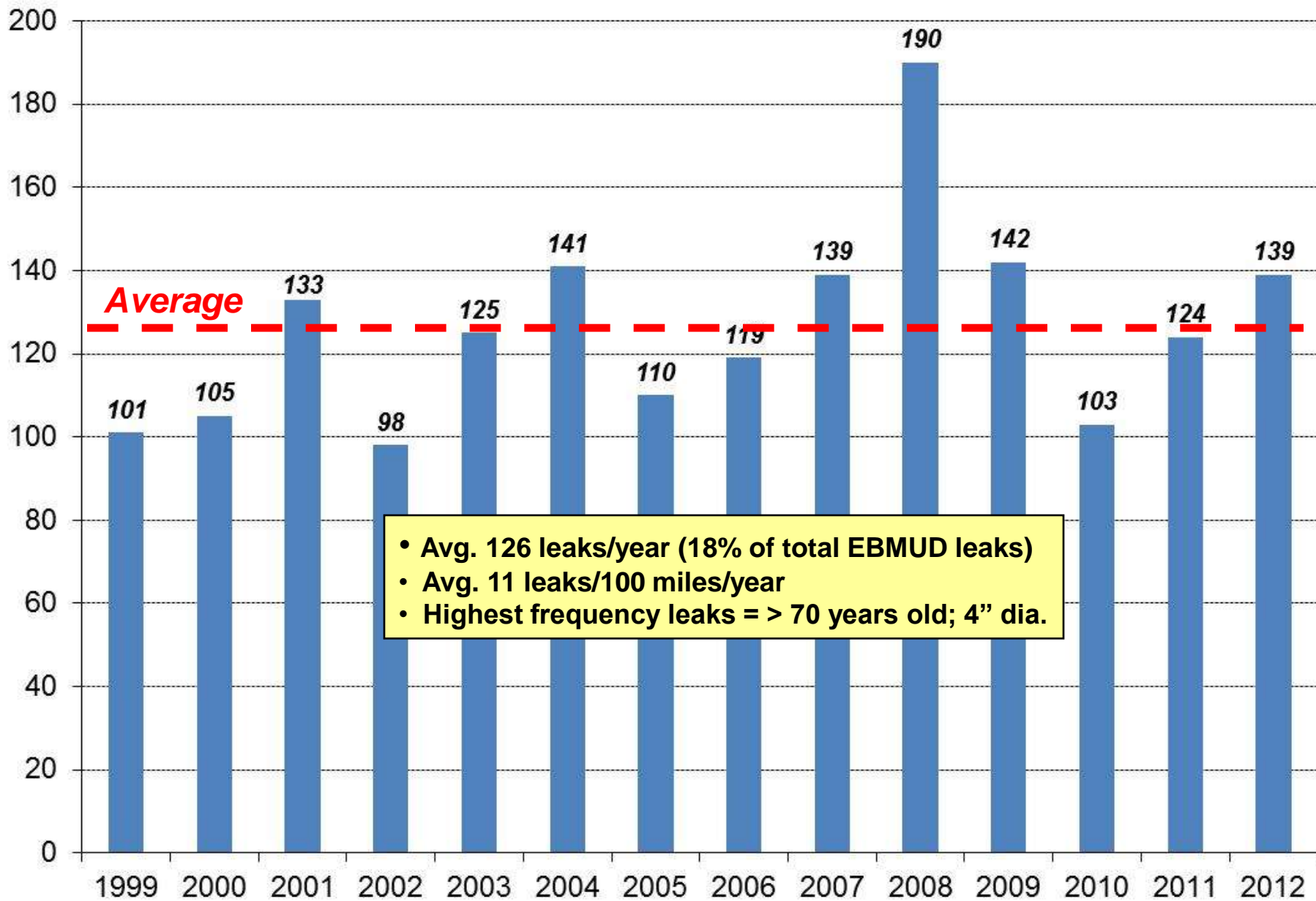


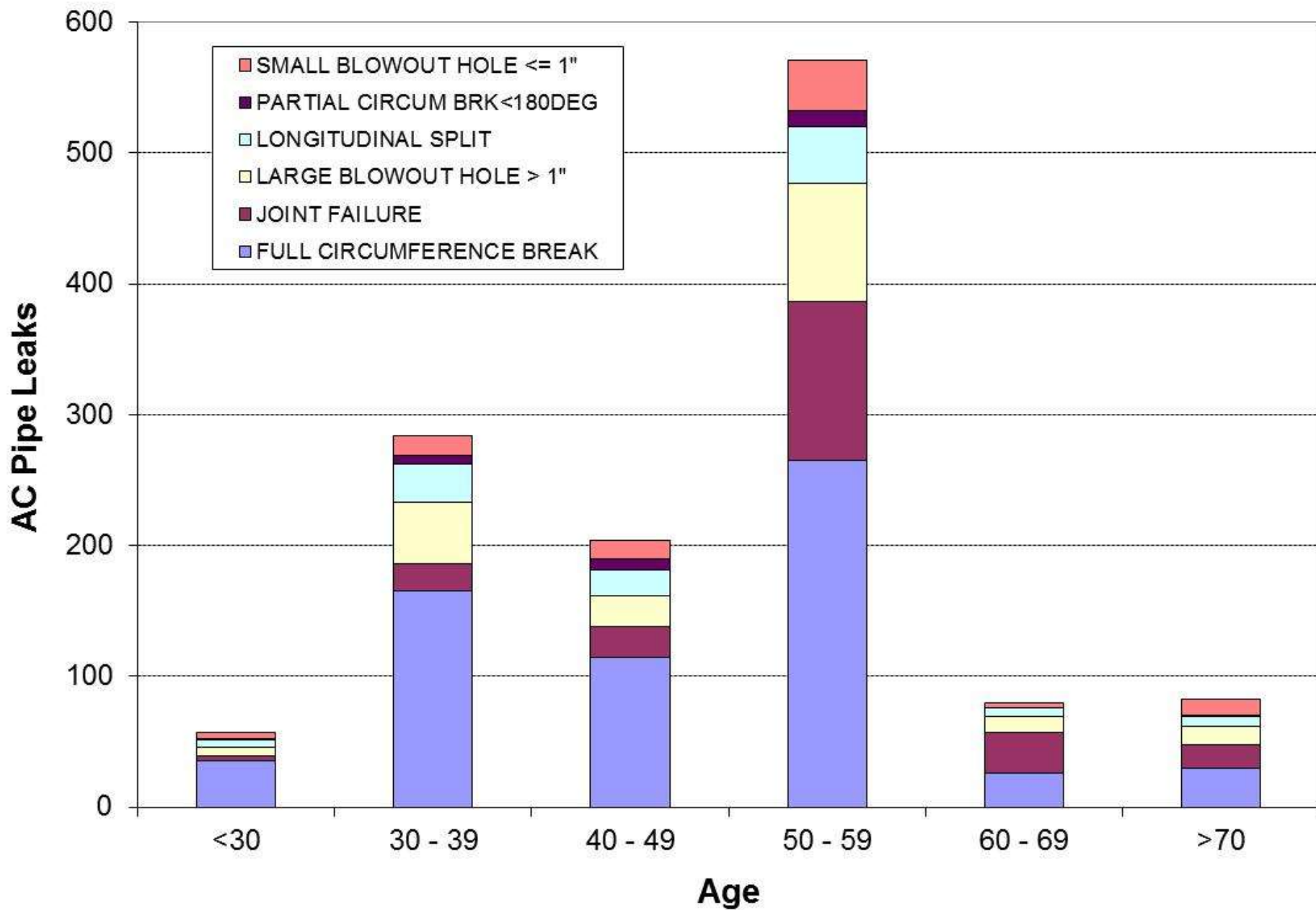
AC Pipe Inventory

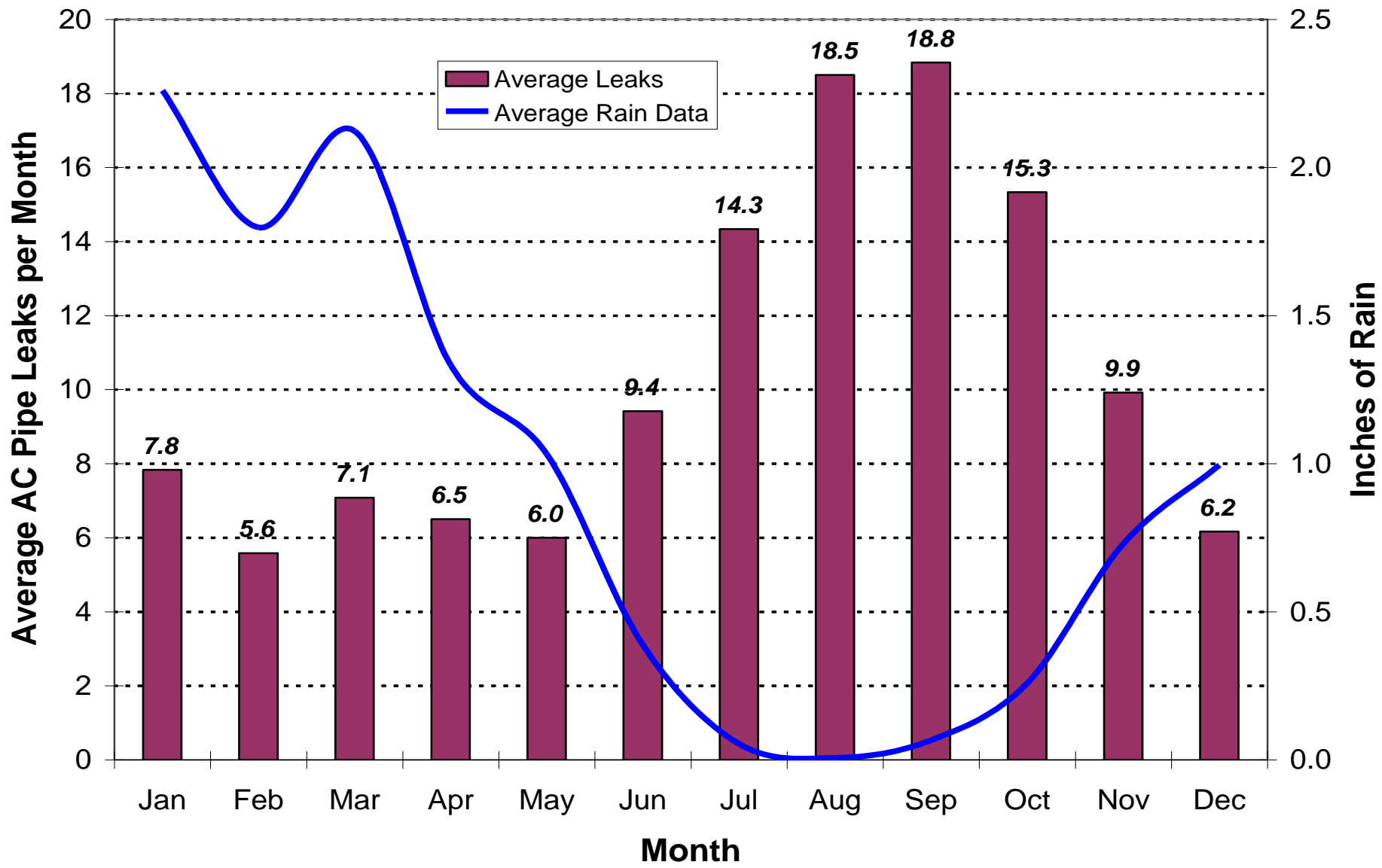




AC Pipe Leaks per Year







2009-2011 Collection & Testing

- 2009-2010: Collected 21 samples
- 2011: Collected 16 additional samples
- Size – various pipe lengths
- All on Failed Pipes



Phase 1 Asbestos Cement Pipe Corrosion Study

Technical Report



East Bay Municipal Utility District
Design and Pipeline Infrastructure Divisions
Engineering Department

July 2012



SAMPLE #13



SAMPLE #14



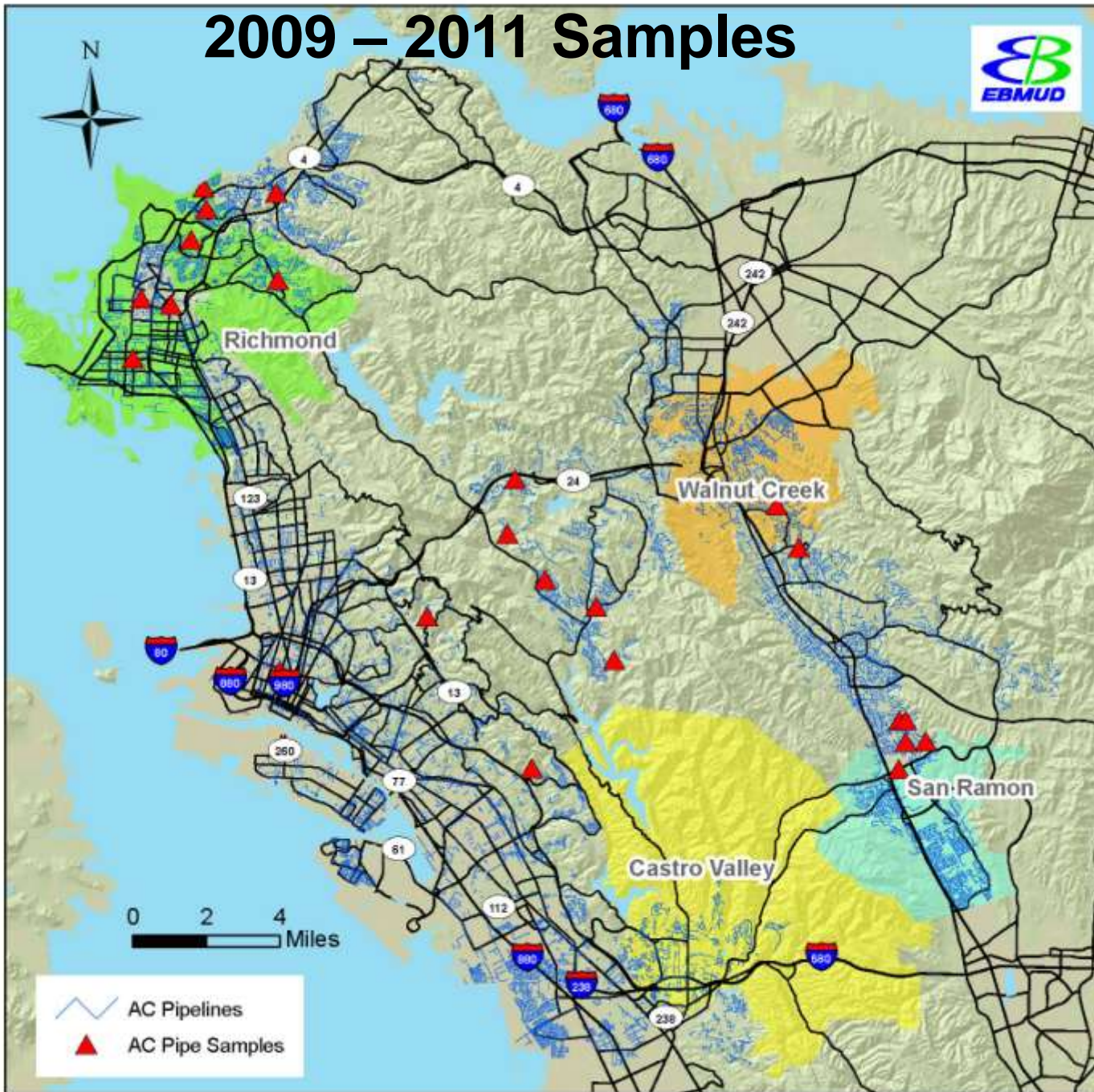
SAMPLE #15



SAMPLE #16



2009 – 2011 Samples



Current Sample Collection (2012-2013)



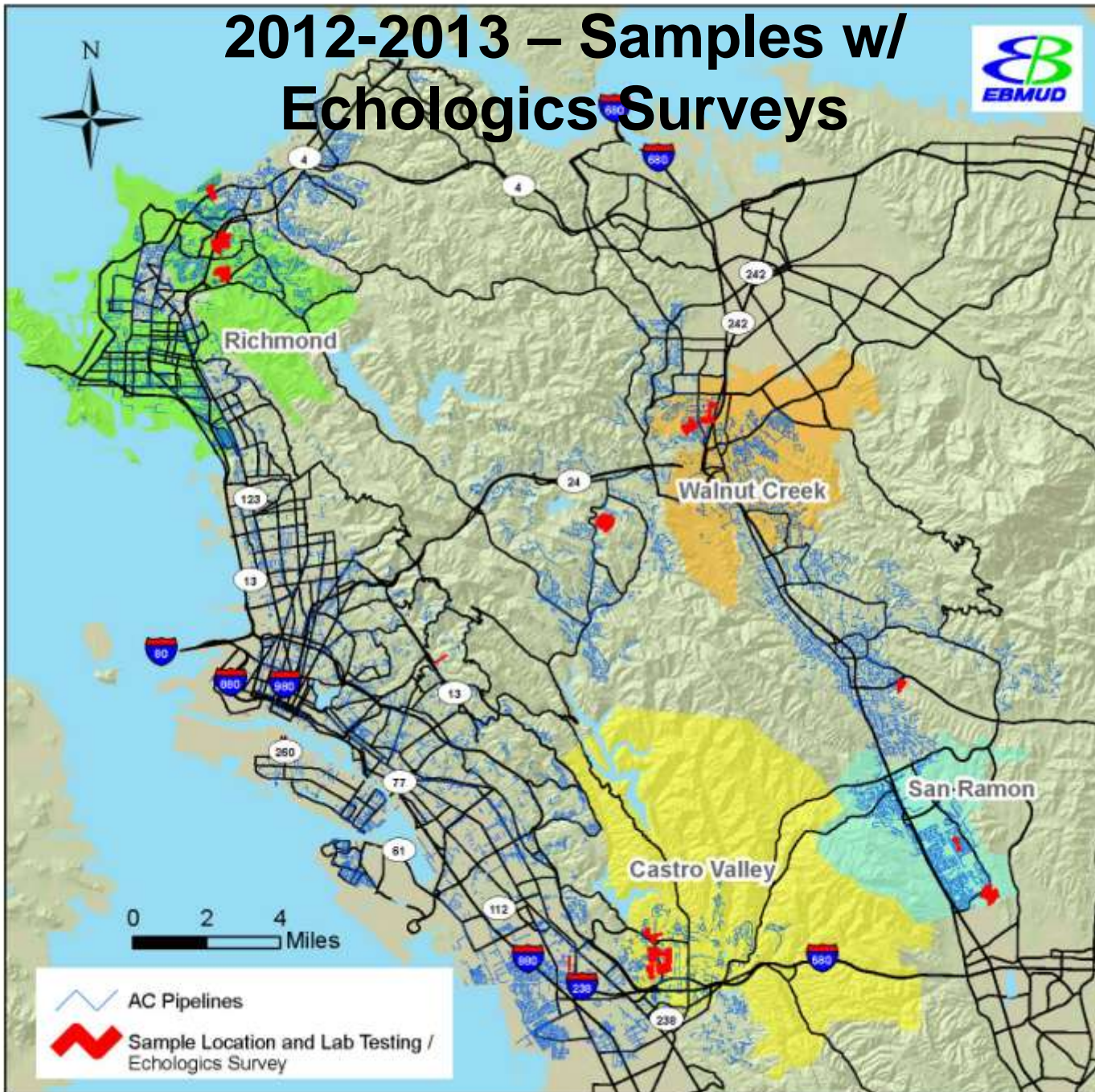
- Partnership with WRF
- Different Water Quality Zones
- 6" & 8" Diameters, Pre & Post 1970's
- Sizes: 3-in diameter coupons and 3-ft long sections
- 70 samples collected (to date), primarily from "live" pipes w/o leak history



Lab Testing and Acoustical Surveys

- JDH Corrosion: Laboratory Services
 - Contracted to test up to 100 Samples
 - Battery of tests conducted includes stain, crush, tensile, flexural, density, pH, Scanning Electron Microscope (SEM), petrographic
- Echologics: Pipeline Integrity Testing
 - Acoustical Pipeline Condition Surveys
 - Evaluated approx. 2 miles of pipe at 22 sites
- Stain tests conducted to correlate with Echologics survey results.

2012-2013 – Samples w/ Echologics Surveys



Danville – AC Pipe Replacement



Danville – AC Pipe Replacement



Danville – AC Pipe Replacement



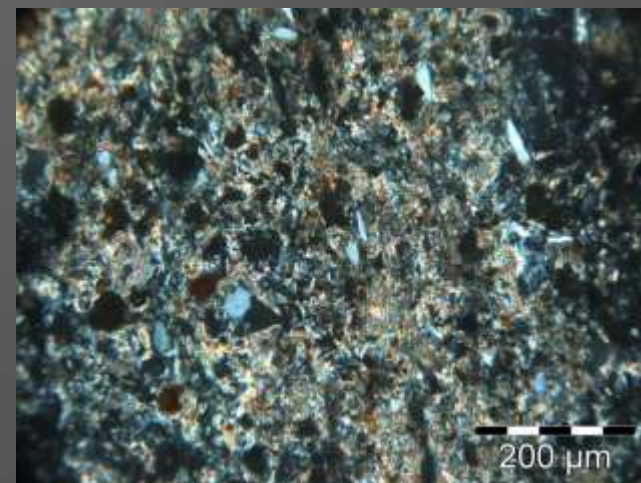
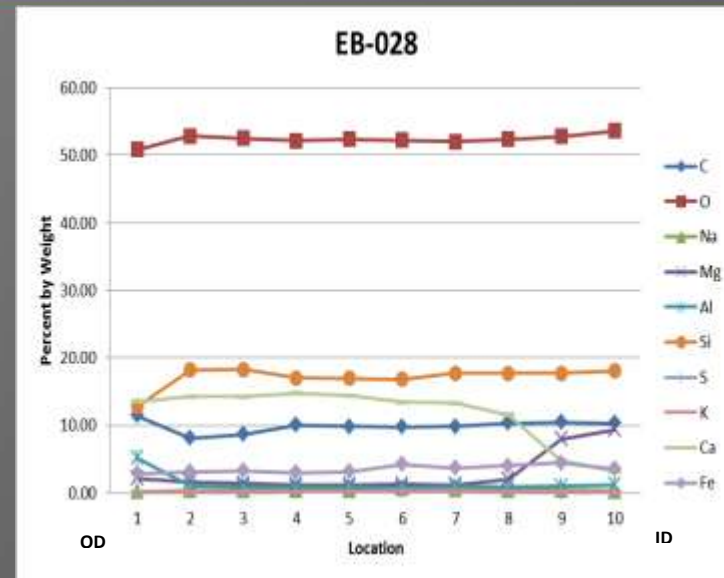
AC Pipe Corrosion Measurements



Outer Diameter (OD) Thickness

Inner Diameter (ID) Thickness

Stain Test and Elemental Composition



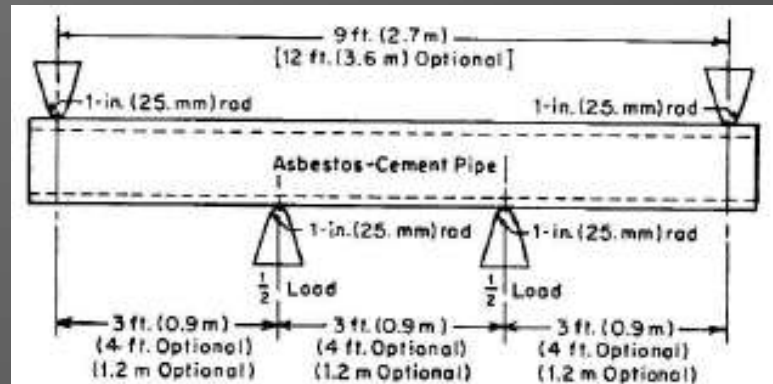
Crush Strength Test



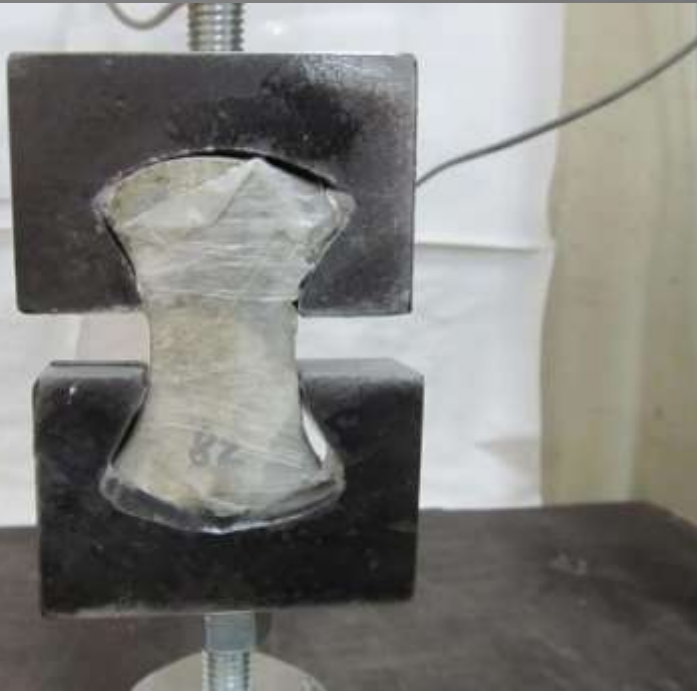
Crush strength tests conducted on the pipe samples indicated that all of the samples met the requirements of as-manufactured (new) pipe for Class 150 pipe



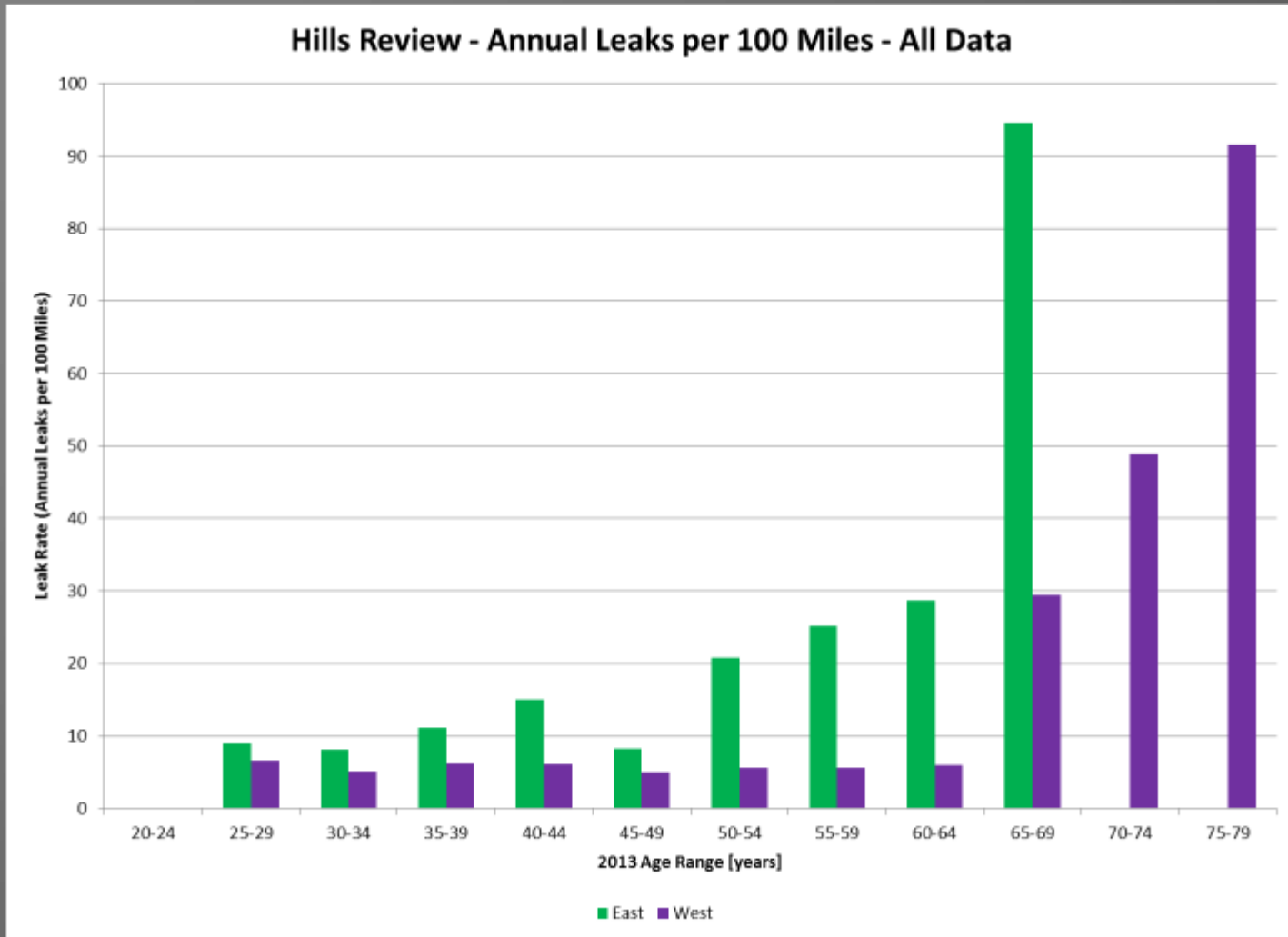
Flexural Testing



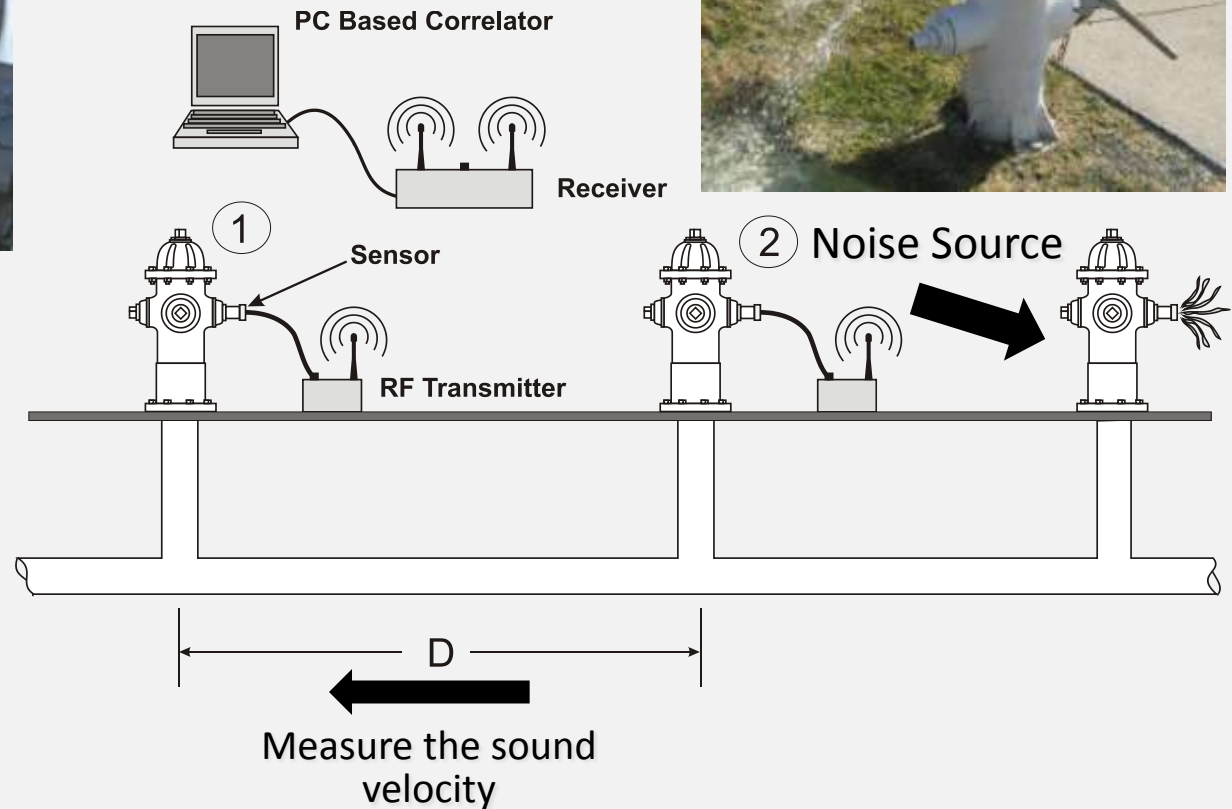
Tensile Test



EAST of HILLS versus West of Hills AC Pipe



Echologics Acoustic Surveys



Street Name	Location	Coupon or 3' Sample	Diameter	Year Installed	Echologics % Loss	Stain % Loss	Good Correlation Ech v Stain
Narcissus Court	Castro Valley	Coupon	6	1978	40%	0%	No
Todd Court	Castro Valley	Sample	6	1976	58%	48%	Yes
Lakeridge Road/La Costa Avenue	Castro Valley	Sample	6	1985	38%	48%	Yes
Nordell Avenue	Castro Valley	Coupon	6	1953	60%	29%	No
Wisteria Street	Castro Valley	Coupon	8	1963	21%	21%	Yes
Greenway Drive	Richmond	Coupon	8	1977	11%	27%	No
Park Central Court	Richmond	Coupon	6	1978	15%	18%	Yes
Raton Court	Richmond	Coupon	6	1959	57%	38%	No
Dublin Drive	Richmond	Sample (Break)	6	1961	37%	84%	No
Encinal Drive	Walnut Creek	Coupon	6	1960	38%	48%	Yes
Montin Court	Walnut Creek	Coupon	6	1975	29%	33%	Yes
Leroy Lane	Walnut Creek	Coupon	8	1965	57%	19%	No
El Suyo Drive	San Ramon	Sample	8	1976	22%	23%	Yes
Tangerine Road	San Ramon	Sample	8	1964	28%	26%	Yes
Wyndale Drive	Castro Valley	Sample	6	1955	35%	74%	No
Carlwyn Drive	Castro Valley	Sample	8	1955	26%	58%	No

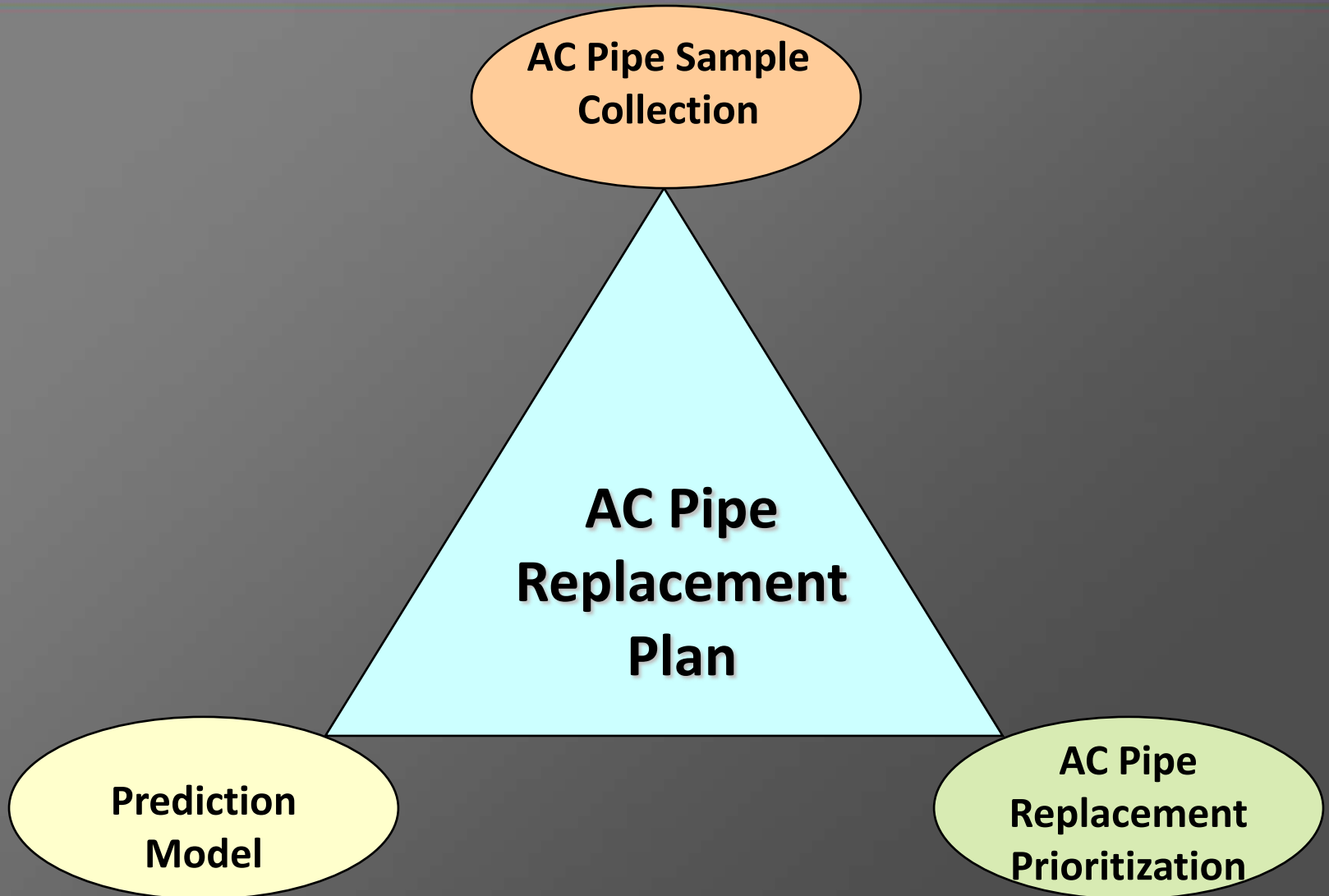
Stain Test results compared to Echologics Surveys.

4 out of 6 pipe samples (non-break) have good correlation

vs.

4 out of 9 for coupons

Pipe Replacement Plan

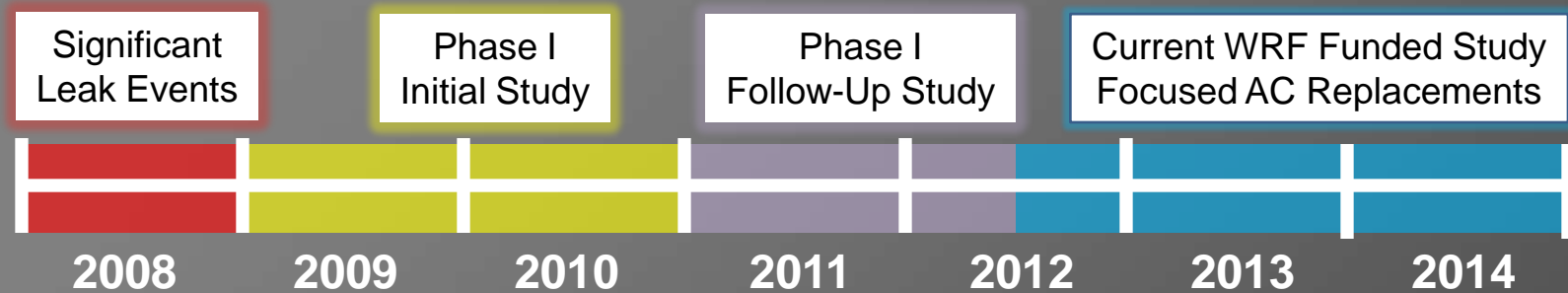


Prediction Model

Model Input Data:

1. AC Pipe Database – Installation Age Attribute
2. Agency-Specific Corrosion Rates for AC Pipe
3. Pipeline Class Safety Factor Tolerances

AC Pipe Study Timeline & Next Steps



- Ongoing thru 2013
 - Collect and Test AC Samples
 - Investigate Replacement/Rehab Methods
 - Investigate Water Quality Optimization
- 2014
 - Complete WRF/EBMUD AC Pipe Study
 - Pilot replacement/rehab method



Asbestos Cement Pipe Corrosion Study

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