

Collection and Analysis of Soil Corrosion Information and Lessons Learned on Cathodically Protected Pipe Installations

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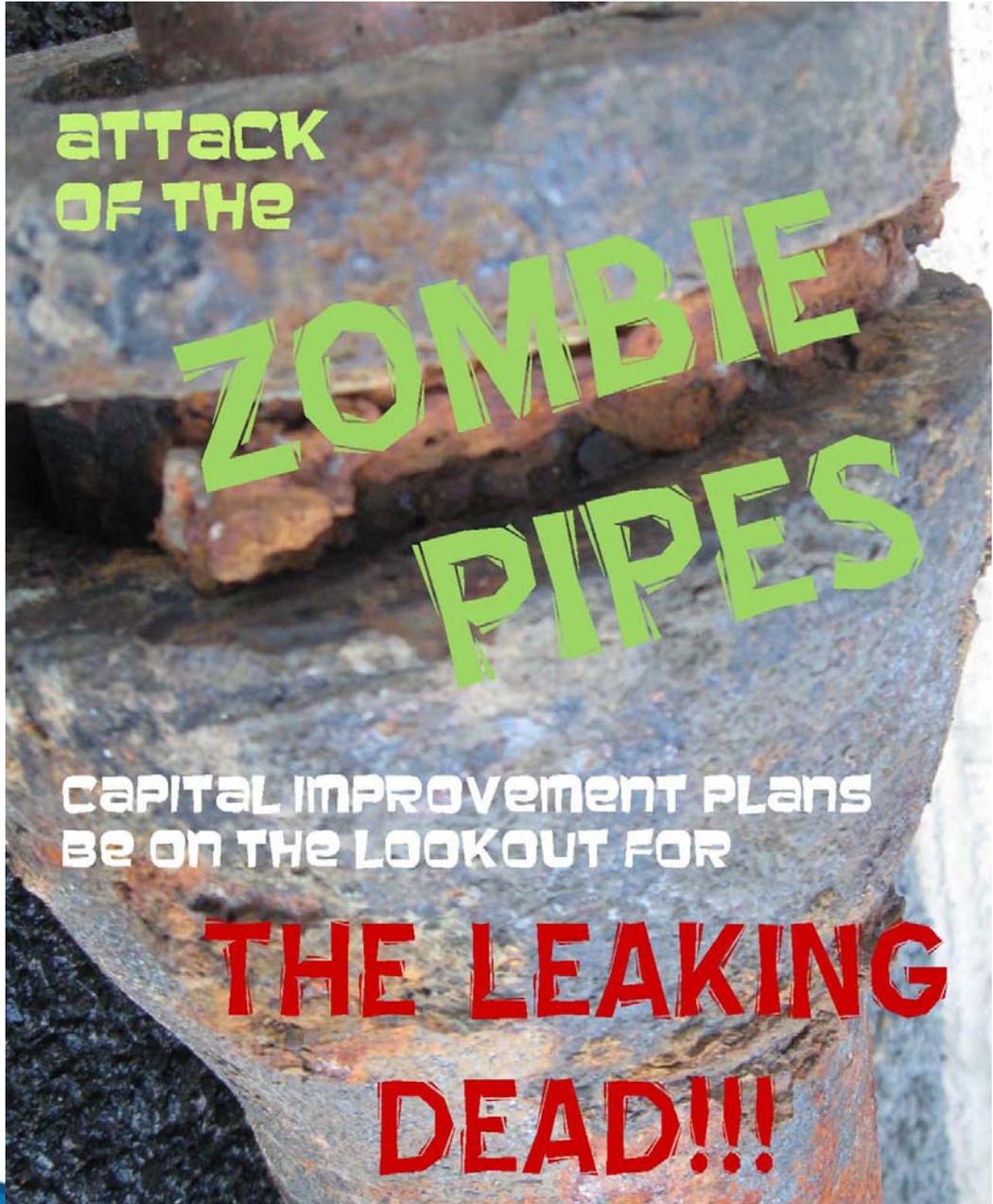
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Tualatin Valley Water District

Tualatin Valley Water District





**ATTACK
OF THE**

ZOMBIE PIPES

**CAPITAL IMPROVEMENT PLANS
BE ON THE LOOKOUT FOR**

**THE LEAKING
DEAD!!!**





ROTTEN PIPE

Ferrous material returning to its natural state



Pipe Corrosivity at TVWD

Key factors:

Soil Corrosivity

Dissimilar metals

Installation method

10-pin testing throughout district

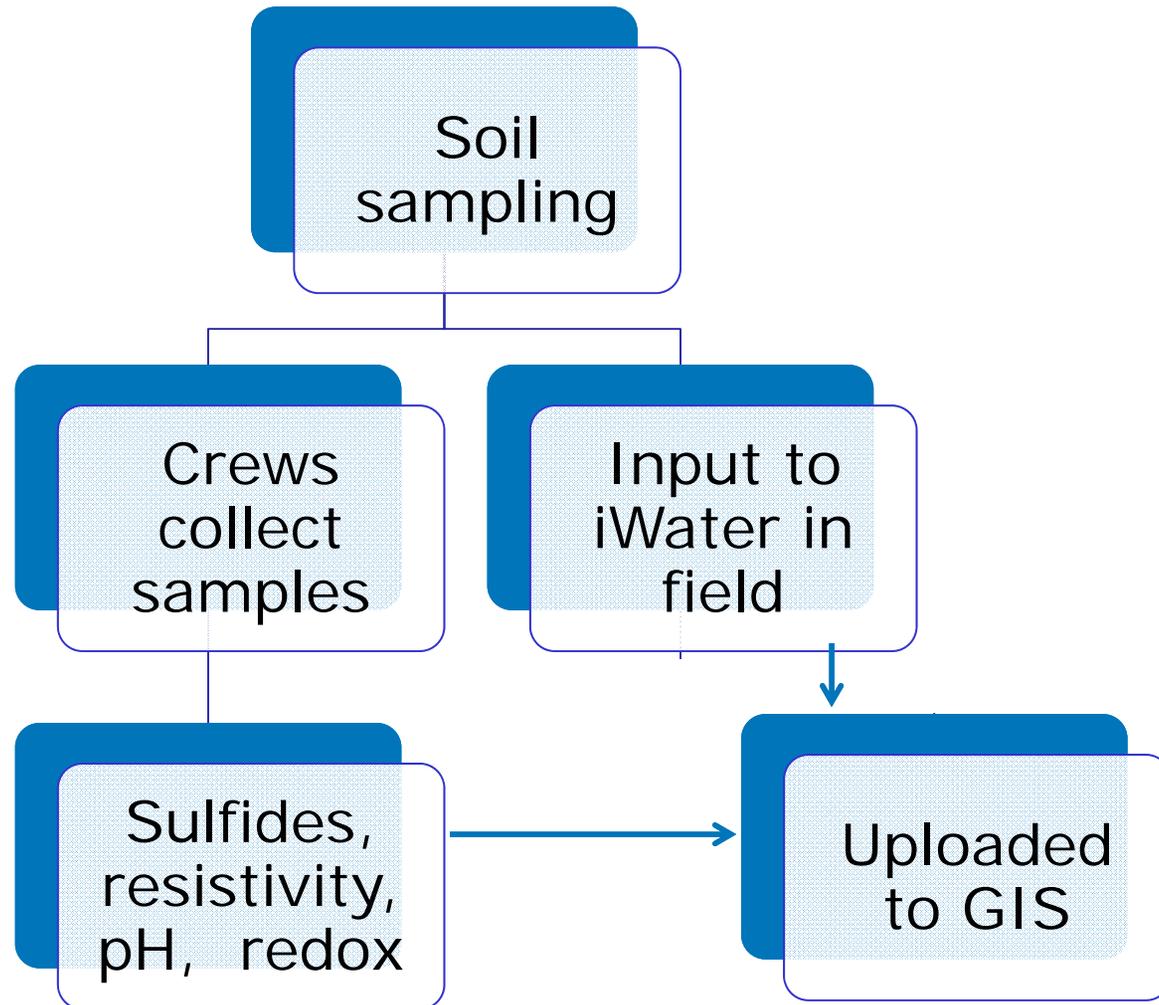
Upon request – for certain projects ~200-ft

Soil sampling

Copper services connected to DI mains

Bedding

Pipe Corrosivity at TVWD



Condition Assessment of System

- Breaks due to corrosion (GIS)
- Condition identified during maintenance activities
 - Crews inform engineering- best line of defense are the field crews.
- Exposing and testing pipe
 - Soil testing
 - Wall thickness gauge & graphitization of pipe
 - Scientific “hammer” test
 - Needle scaler
 - Sand blasting



Condition Assessment of System



Condition Assessment of System



Condition Assessment of System



Condition Assessment of System



Corrosivity in Pipelines

- Potholing-
 - Not always accurate due to limited exposure. If top is bad, bottom is usually worse.
 - For good results, expose entire pipe.
 - Samples of pipe
 - Unsure of thickness class in a large system with “inherited” districts. Could have thin walled pipe



Corrosivity in Pipelines

- CP testing
 - Regular testing on existing pipelines with CP. Have systems at light-rail and on large transmission mains.
 - Protect new installations
 - Protecting entire system



Corrosivity in Pipelines

- Prioritize replacements

Rank	Pipe Location	Pipe Condition	Critical Infrastructure	Business Impacts	Cost (TVWD)	Critical Customers	High Flow Customers	Type of Service Area	Proximity to Critical Pipe	Traffic Impacts	System Capacity	Project Coordination	Installation Method	Leakage	TOTAL SCOR	Project #
1	Melody/Damascus 113th	Very Poor	Single Feed to Neighborhood	N/A	N/A	N/A	No	Residential	Far Proximity	Low Traffic	Undersized	Paving Overlays	N/A	N/A	14	31
2	Parkview/Arcadia/179th	Very Poor	Non-Critical	N/A	High Cost	N/A	No	Residential	Far Proximity	Moderate Traffic	N/A	N/A	Native Backfill	N/A	12	28
3	NW 159th Pl	Poor	Single Feed to Neighborhood	N/A	N/A	N/A	No	Residential	Near Proximity	Low Traffic	N/A	N/A	N/A	N/A	10	40
4	Rosa (185th/Farmington)	Moderate	Single Feed to Neighborhood	N/A	N/A	N/A	No	Residential	Near Proximity	Low Traffic	N/A	N/A	N/A	N/A	8	20
4	195th/Sandra	Very Poor	Single Feed to Neighborhood	N/A	N/A	N/A	No	Residential	Far Proximity	Low Traffic	N/A	N/A	N/A	N/A	8	3
6	Turin/207th	Very Poor	Single Feed to Neighborhood	N/A	N/A	N/A	No	Residential	Far Proximity	N/A	N/A	N/A	N/A	N/A	7	7
6	Oak St	Very Poor	Single Feed to Neighborhood	N/A	N/A	N/A	No	Residential	Far Proximity	N/A	N/A	N/A	N/A	N/A	7	4
6	Rosa Pl/170th	Poor	Non-Critical	N/A	N/A	N/A	No	Residential	Near Proximity	N/A	N/A	N/A	N/A	N/A	7	5
9	121st/Taylor	Poor	Single Feed to Neighborhood	N/A	N/A	N/A	No	Residential	Far Proximity	N/A	N/A	N/A	N/A	N/A	6	38



Cathodic Protection of DIP

- Joint bonding
- Anodes
- Poly wrap
- Tightly bonded coating
- Coating exposed surfaces
- Impressed current

Prevent this from
happening



Joint Bonding- Lessons learned

Method 1: CAD welding

- Advantages:
 - Forgiving
 - Less investment
 - Easier to make better bond
- Disadvantages:
 - Time consuming
 - Done on horizontal surface
 - Weather sensitive
 - Safety considerations (open flame, smoke)
 - Difficult to install on small fittings (megalugs)
 - Various welders for different pipe and wire sizes



Joint Bonding- Lessons learned

Method 2: Pin brazing

- Advantages:
 - Fast
 - Done on vertical and horizontal surfaces
 - Not much smoke
 - Less safety concerns (oozing material)
 - One size fits all
- Disadvantages:
 - Welding surface needs to be really clean
 - Welder is temperamental, sometimes hard to get a good bond
 - Requires more finesse
 - Sensitive to condition of batteries
 - Expensive, dependent on type of pin brazing tool
 - Need space for grounding magnet (grind off coating)
 - Difficulty making a good ground



Joint Bonding- Lessons learned

- Performing joint bonding
 - Dual bonds on 4-inch pipe is difficult due to size
 - Bonding to megalugs and valves- best done prior to installation
 - Use handicaps to cover
 - Have also used wax tape- works well if wrapped around entire pipe.

What not to do!



Polywrap- Lessons learned

Pipe materials / coatings

- Polywrap
 - 4 or 8 mil?
 - Difficult to find a good manufacturer.
 - Recommend inspection, and testing of bags prior to install.
 - Contractor to obtain certificate for bags. Needs to be done as an early submittal to not hold up construction.
 - V-bio- have not used but looks promising for our use.
 - 100% virgin material (include in specs)



Nuts and Bolts – Lessons learned

Pipe materials / coatings

- Tightly bonded coating
 - Hold back or remove from spigot ends for insertion. Depending on material, different options worked best for removal (scraping, grinder, impact chisel)
 - If coating is inside, must be NSF-61 approved
 - Needs to be removed for joint bonding
 - Consider inhalation hazards for removal- not good to try to burn off
 - DIP is more difficult to coat than steel (not many manufacturers provide DIP with extra coating)



Coatings- Lessons learned

Pipe materials / coatings

- Tightly bonded coating
- Repair anything removed.
- If held back, ensure exposed areas are protected
 - Tape wrap (good)
 - Shrink wrap sleeve with filler (better)- DIP systems are not bottle-tight so may have issues with shrink wrap
 - Use wax tape plus filler material (best)
 - Potential corrosion issue with bare material and oxygenated water.



Nuts and Bolts – Lessons learned

Bolts, Fittings, Valves

- Exposed bolts, nuts- Stainless with anti-seize, wrap in wax tape.
- Fluoropolymer coated T-bolts- check coating – may need to wrap.
- Valves & fittings- epoxy coating is for aesthetic purposes. Need to wrap in wax tape or PE bags



TVWD Standards– Lessons learned

CP test stations

- Locate outside of travel lane
- Use standard valve can w/ "CP TEST" imprinted on lid (better for road projects)
- Prefer board type test panel for easy access



Cathodic Protection at TVWD

- Next Steps
 - Implementation in-house
 - Standards update
 - Capital Improvement Projects



Questions??

