

WATER QUALITY UPDATE

August 28, 2014

Presented by:

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Outline

- ▶ **Health Assessment**
- ▶ **Distribution System Water Quality**
- ▶ **Water Main Replacements**
- ▶ **Dissolved Oxygen Trials**
- ▶ **Silica Evaporation Trials**
- ▶ **Conclusions**
- ▶ **Recommendations and Options**



Health Assessment

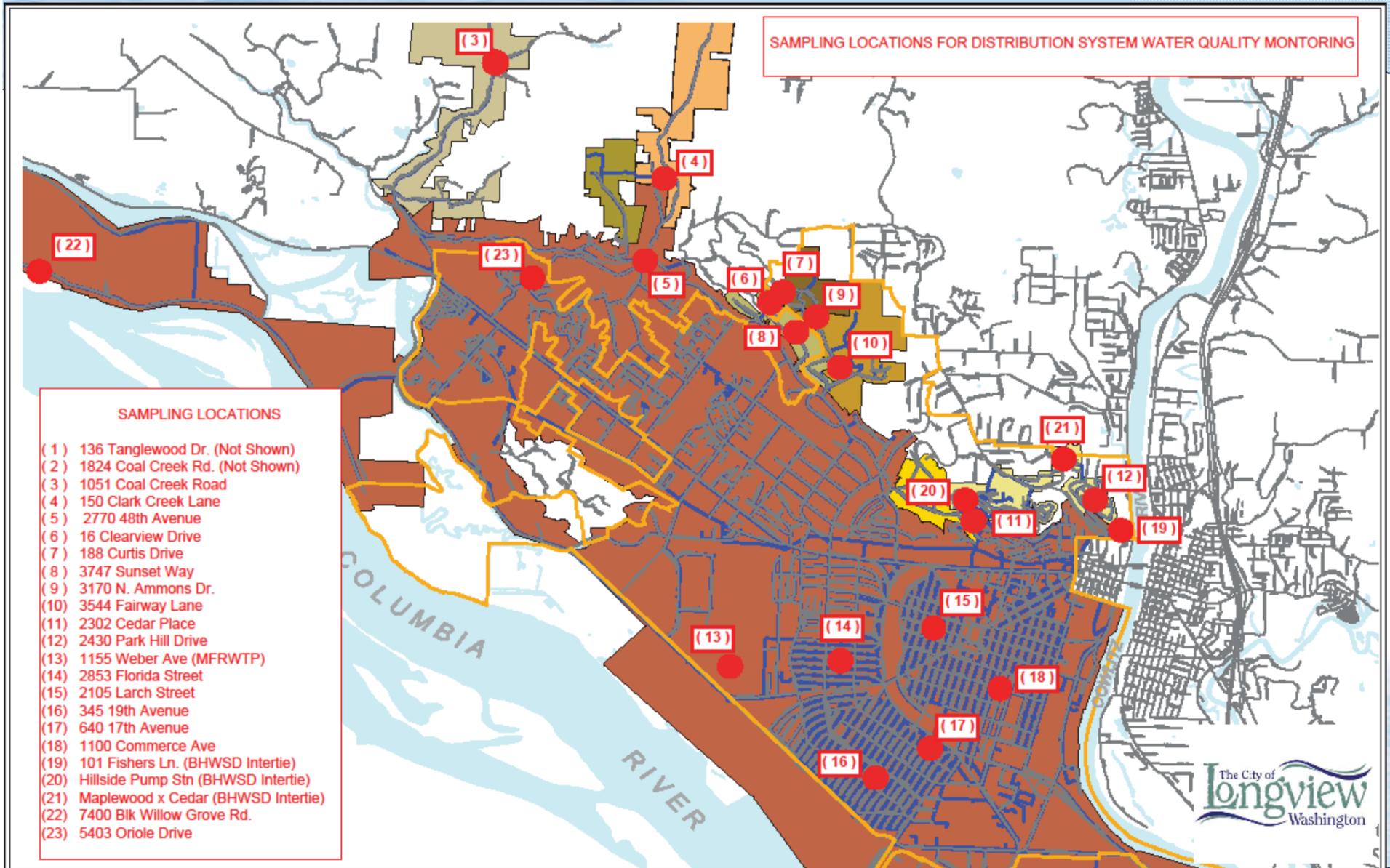
- ▶ **Water quality fact sheets developed by Intertox, an independent team of health science experts**
- ▶ **Assessed possible health impacts related to groundwater and distribution system water quality**
 - **Hard Water**
 - **Iron**
 - **Manganese**
 - **Silica**
- ▶ **No adverse health affects are expected, even at the highest concentrations measured**

Distribution System Water Quality

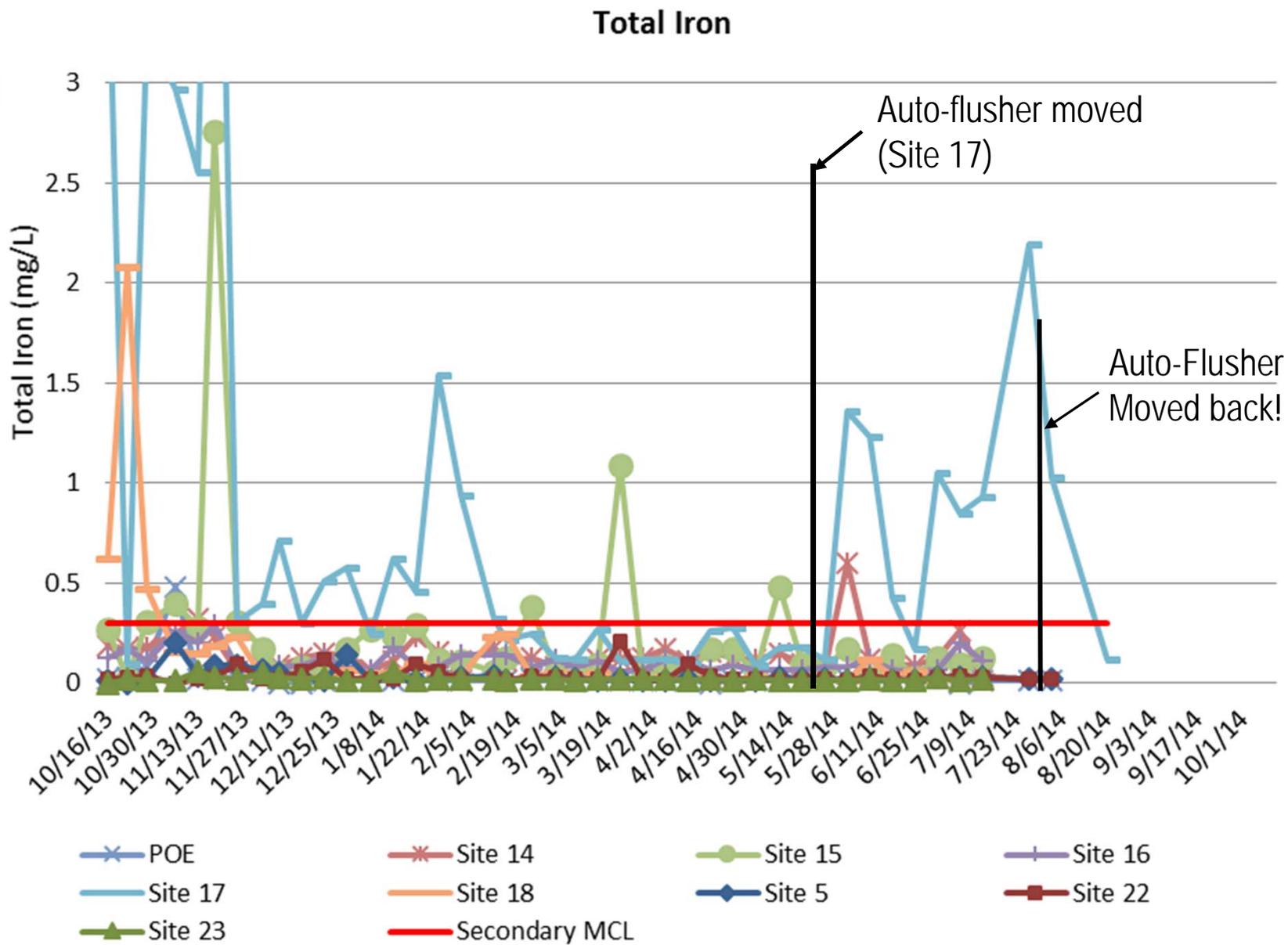
- ▶ **Ongoing distribution system sampling at 9 sites**
 - **Obtained one year of detailed data to diagnose issues and determine controlling factors**
 - **Sampling program scaled back in July 2014**
 - **Continuing monitoring to track conditions and identify changes**
- ▶ **Distribution system continues to improve**
 - **Acceptable chlorine level at all areas except Site 17**
 - **Acceptable iron level at all areas except Site 17**
 - **Acceptable manganese levels at all areas**



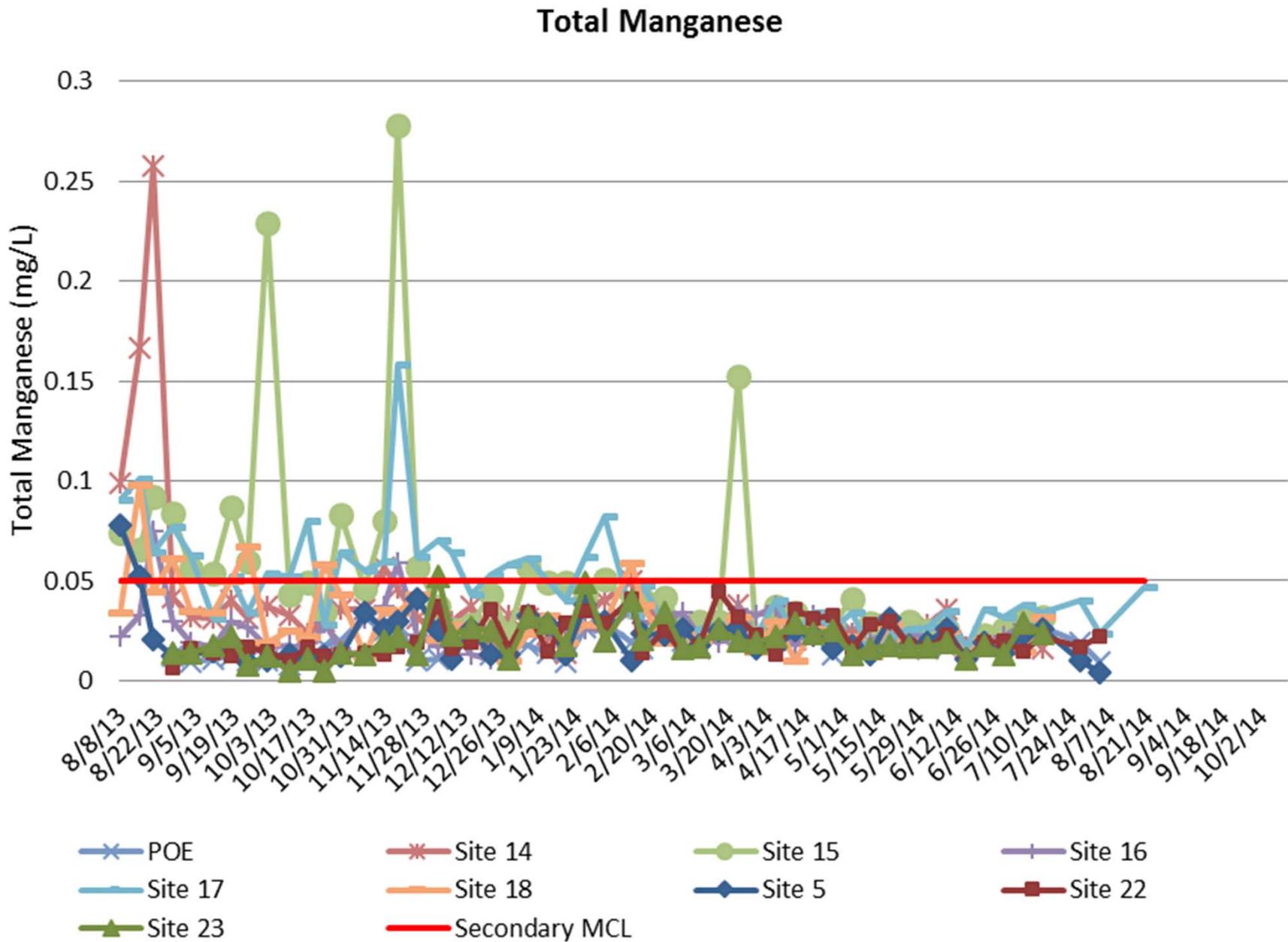
Distribution System Water Quality Testing Sites



Distribution System Water Quality - Iron



Distribution System Water Quality - Manganese



Distribution System Water Quality - Conclusions

- ▶ **Water quality vastly improved since last year**
- ▶ **Causes of de-stabilization have been identified**
 - **Increased water age due to hydraulic changes**
 - **Chemical response due to reduced ORP**
- ▶ **Methods of controlling destabilization were identified**
 - **Increase ORP**
 - **Stabilized free chlorine residual at water treatment plant**
 - **Evaluated dissolved oxygen injection**
 - **Auto-flushers used to increase turnover**
 - **Gentle flushing to avoid destabilizing delicate pipe scales**
 - **Main replacements to remove accumulated pipe scale**

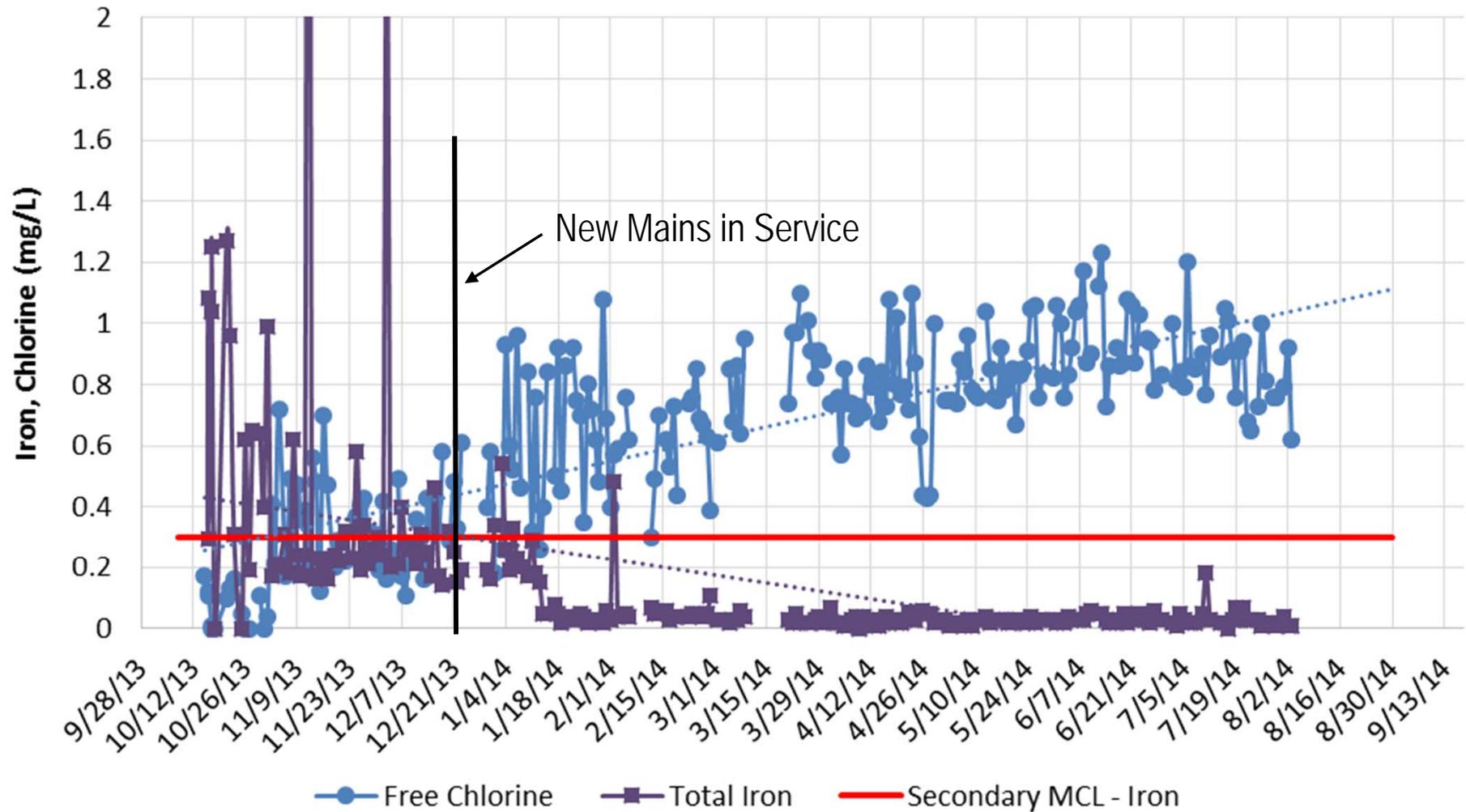


Water Main Replacements - Overview

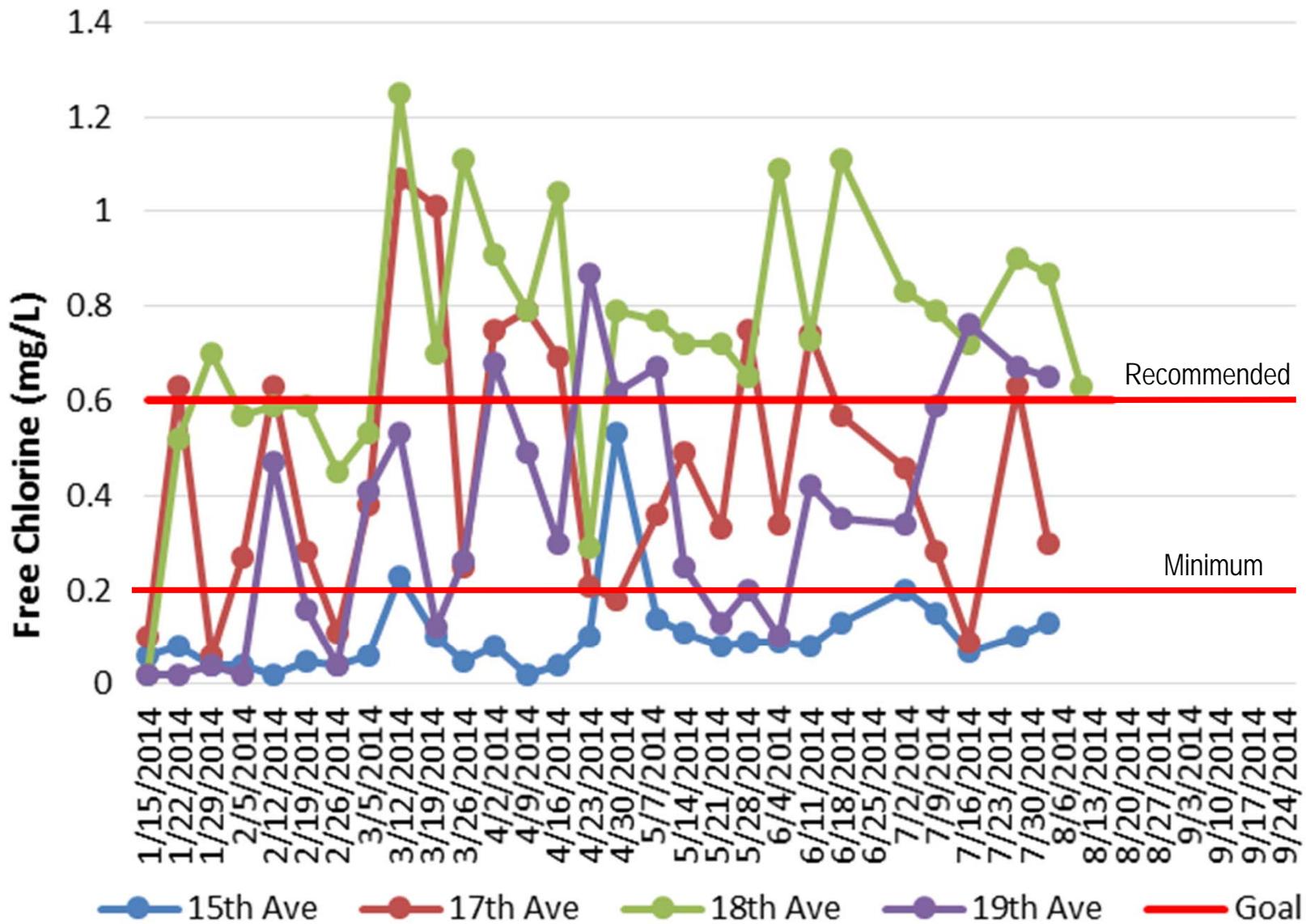
- ▶ **Enhanced city-wide main replacement program needed to address leaks, undersized pipe, inadequate flow and poor water quality**
- ▶ **High priority given to water quality**
- ▶ **Expanded water quality monitoring in Baltimore Area to identify extent and degree of issues after emergency main replacement**
- ▶ **Topographic surveys completed for several alleys**
- ▶ **Design 30% complete for selected main replacement**



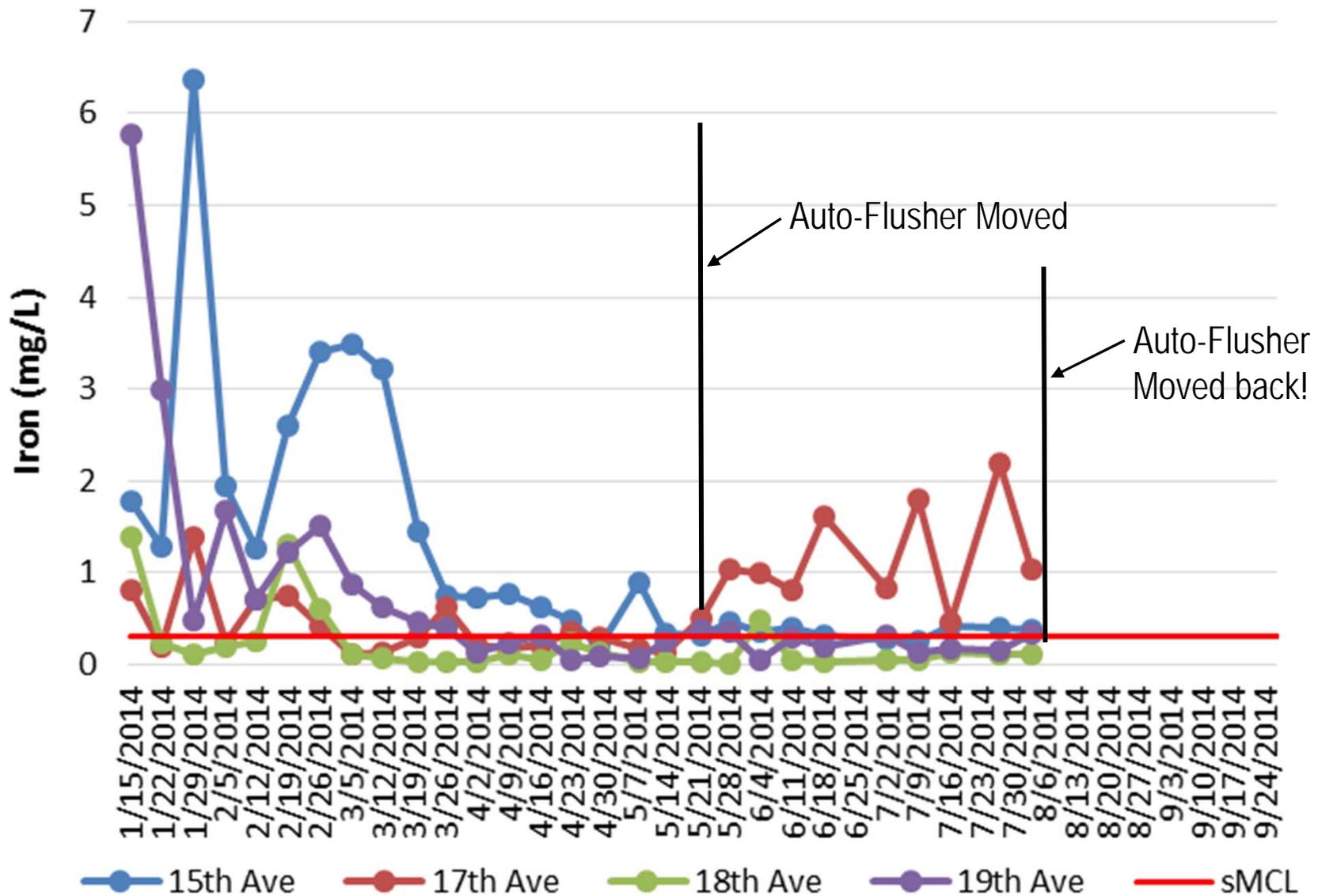
Emergency Water Main Replacement - 16th / 17th Ave Alley



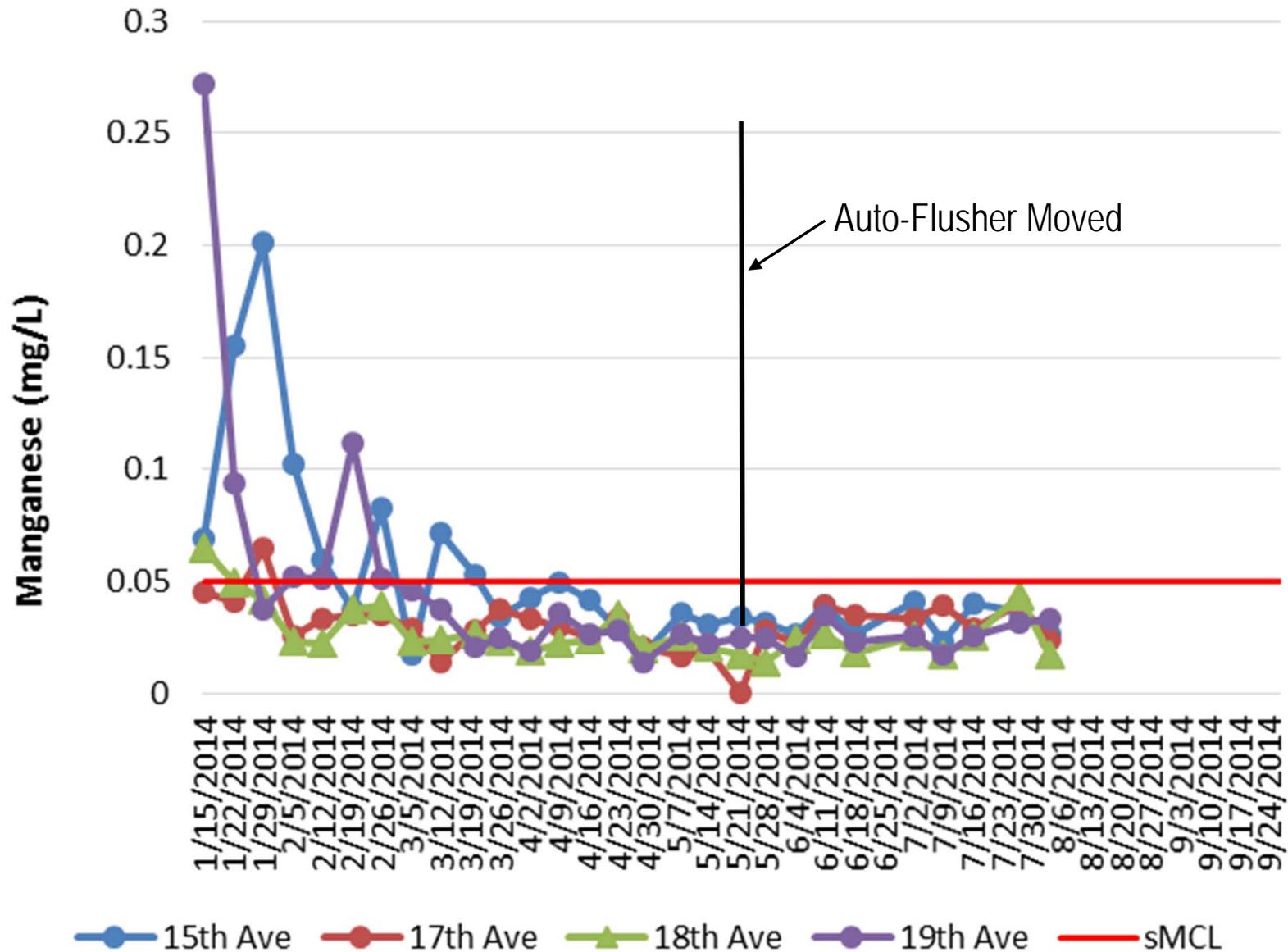
Water Main Replacement Planning – 600 Block Water Quality



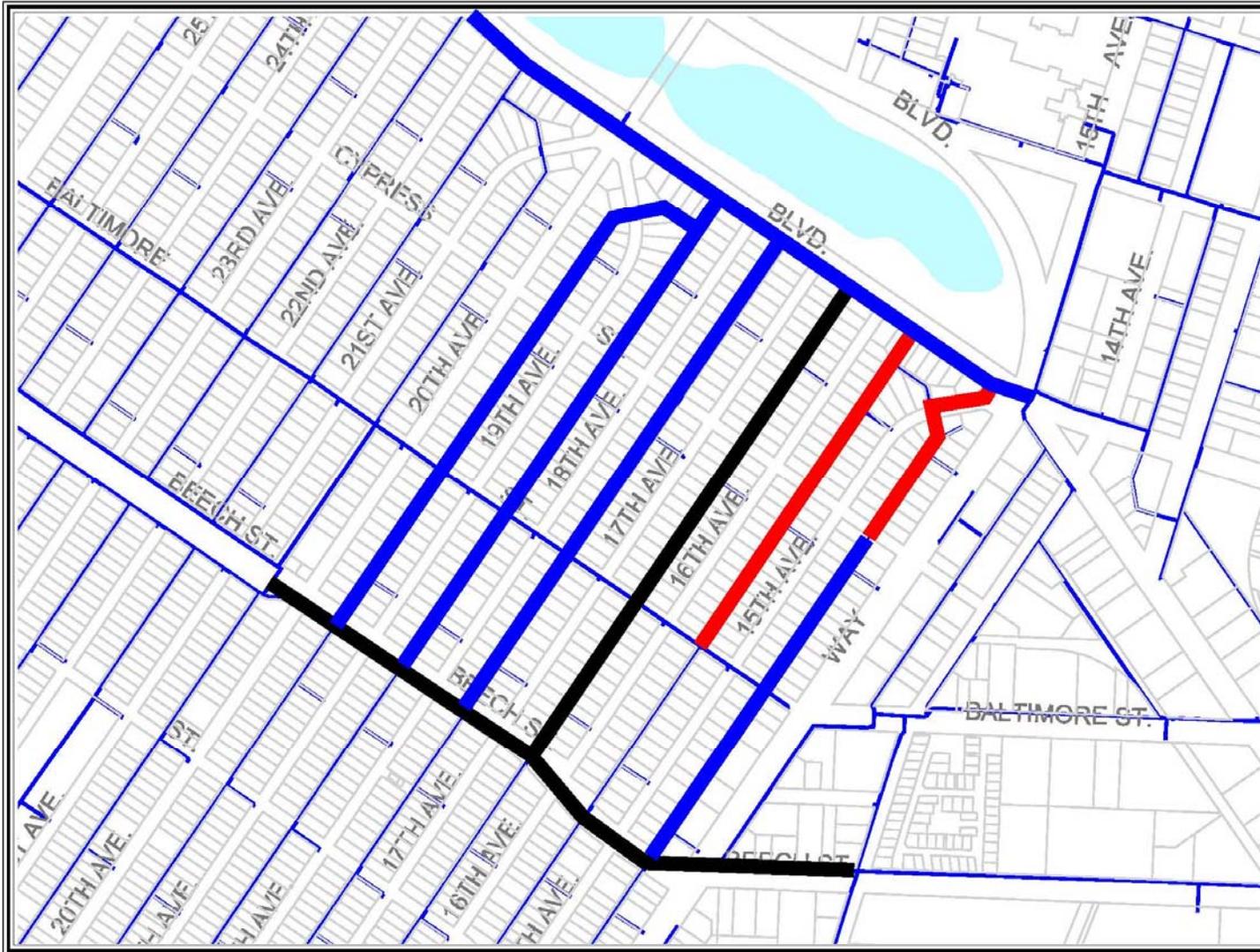
Water Main Replacement Planning – 600 Block Water Quality



Water Main Replacement Planning – 600 Block Water Quality



Water Main Replacement Planning



- ▶ Replaced (5,000 LF)
- ▶ In Design (2,500 LF)
- ▶ Future

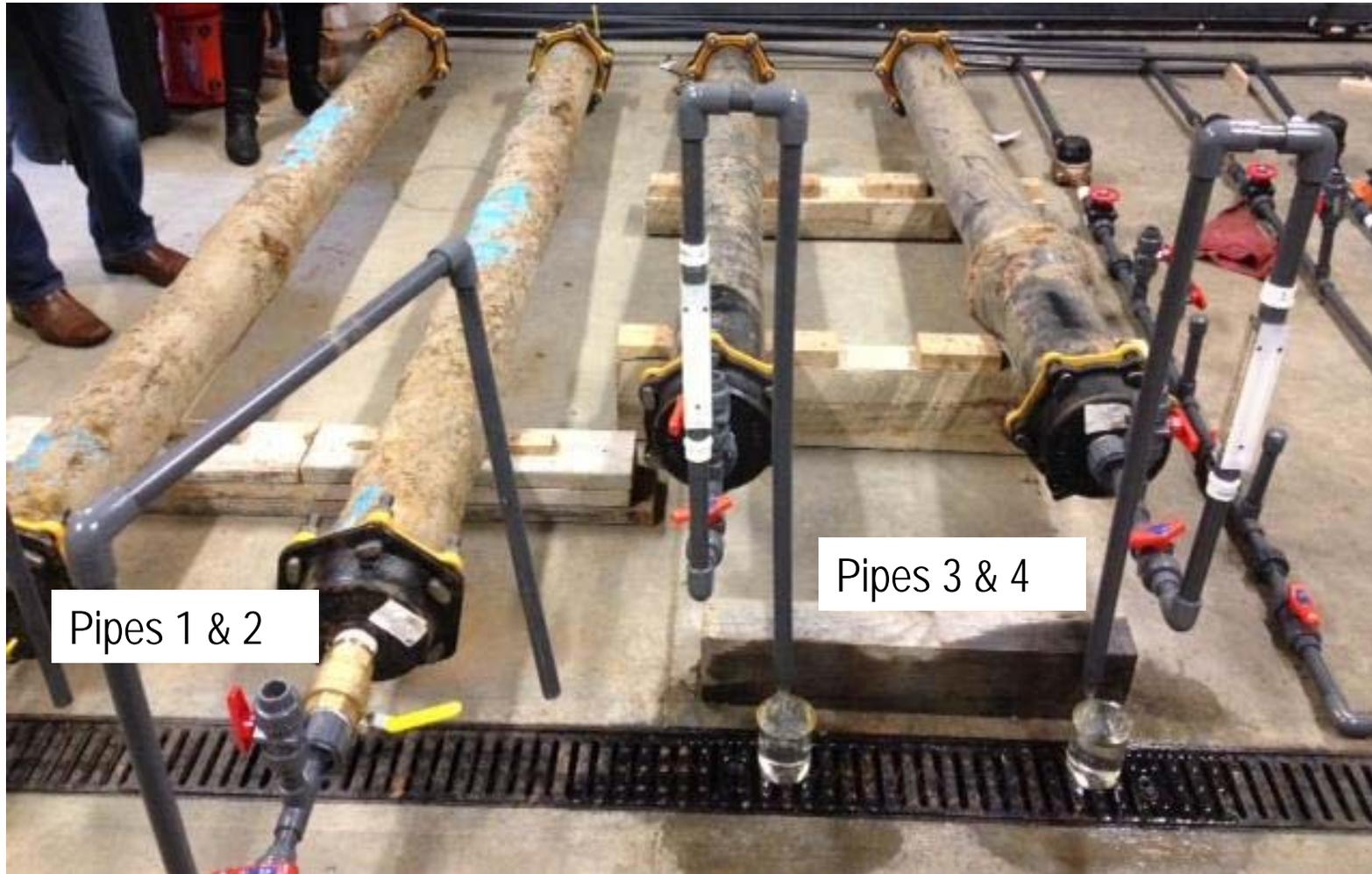


Dissolved Oxygen Trials - Overview

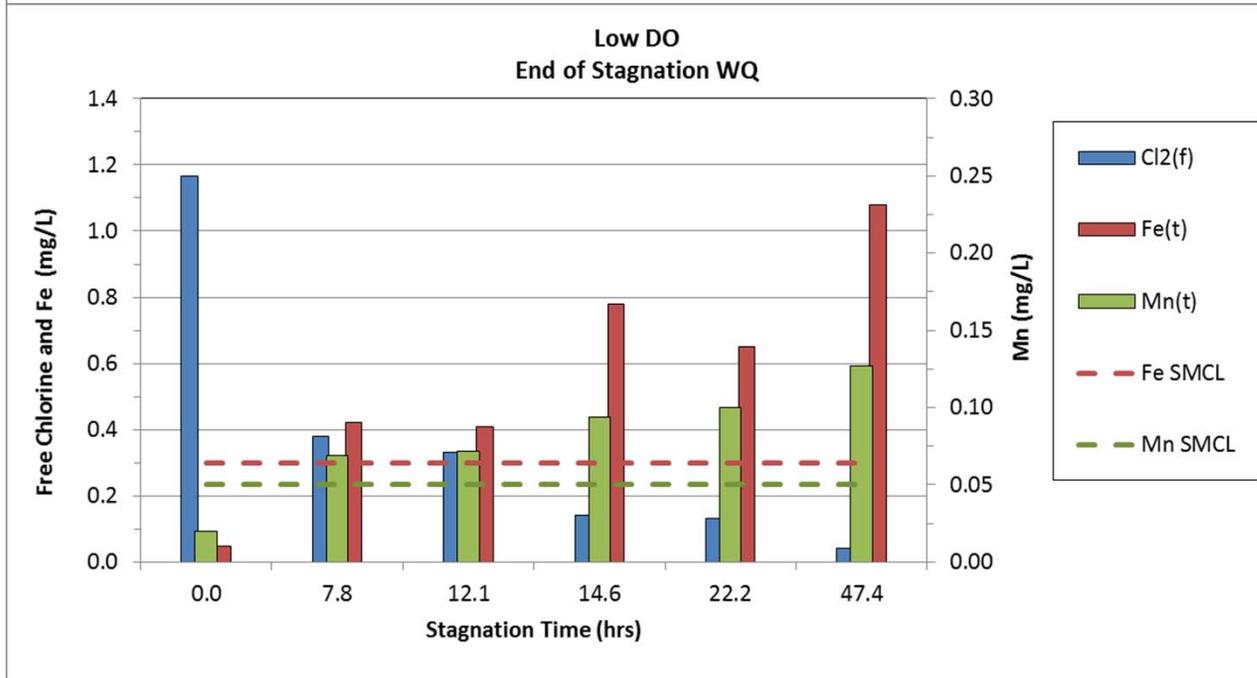
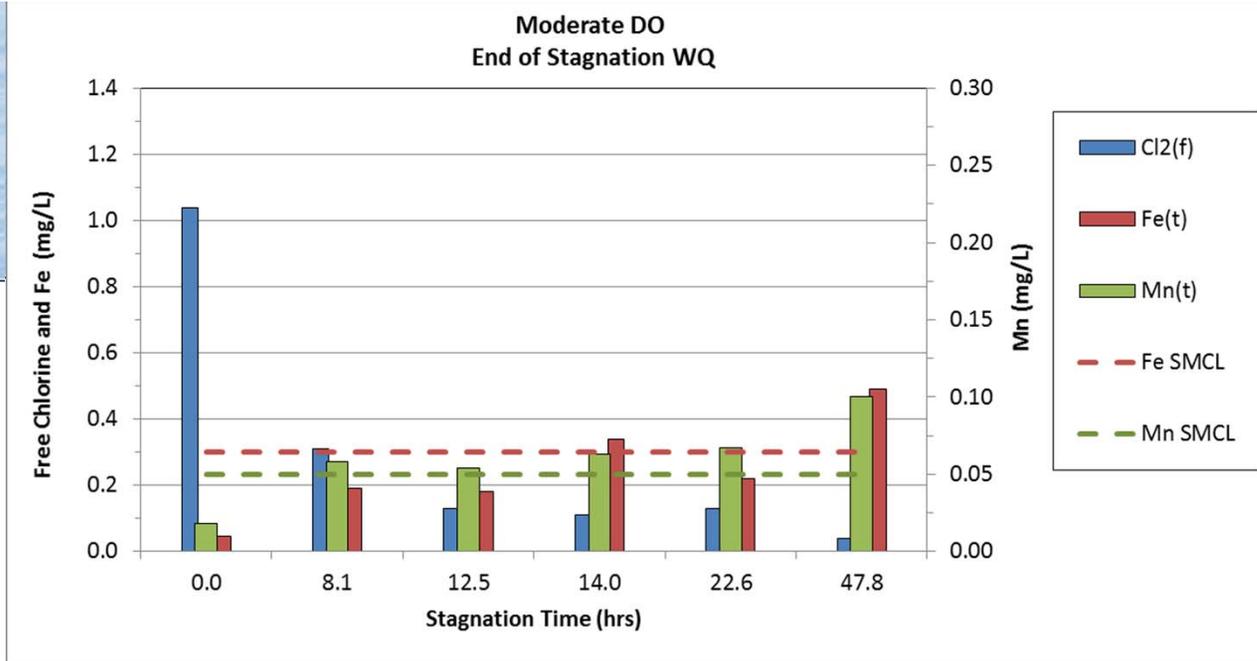
- ▶ **Used pipe rigs to assess impact of increased DO levels on water quality**
 - **Assembled from existing pipes removed from the system**
 - **Ocean Beach Hwy (Pipes 1 and 2)**
 - **Alley between 16th and 17th (Pipes 3 and 4)**
- ▶ **Conditions Studied**
 - **Low DO - Did not modify current DO levels in treated water (< 1 mg/L); tested in Pipes 2 and 3**
 - **Moderate DO - Injected moderate levels of DO into treated water (5-7 mg/L); tested in Pipes 1 and 4**
 - **Different stagnation times were studied (0 – 48 hours)**



Dissolved Oxygen Trials - Pipe Rigs

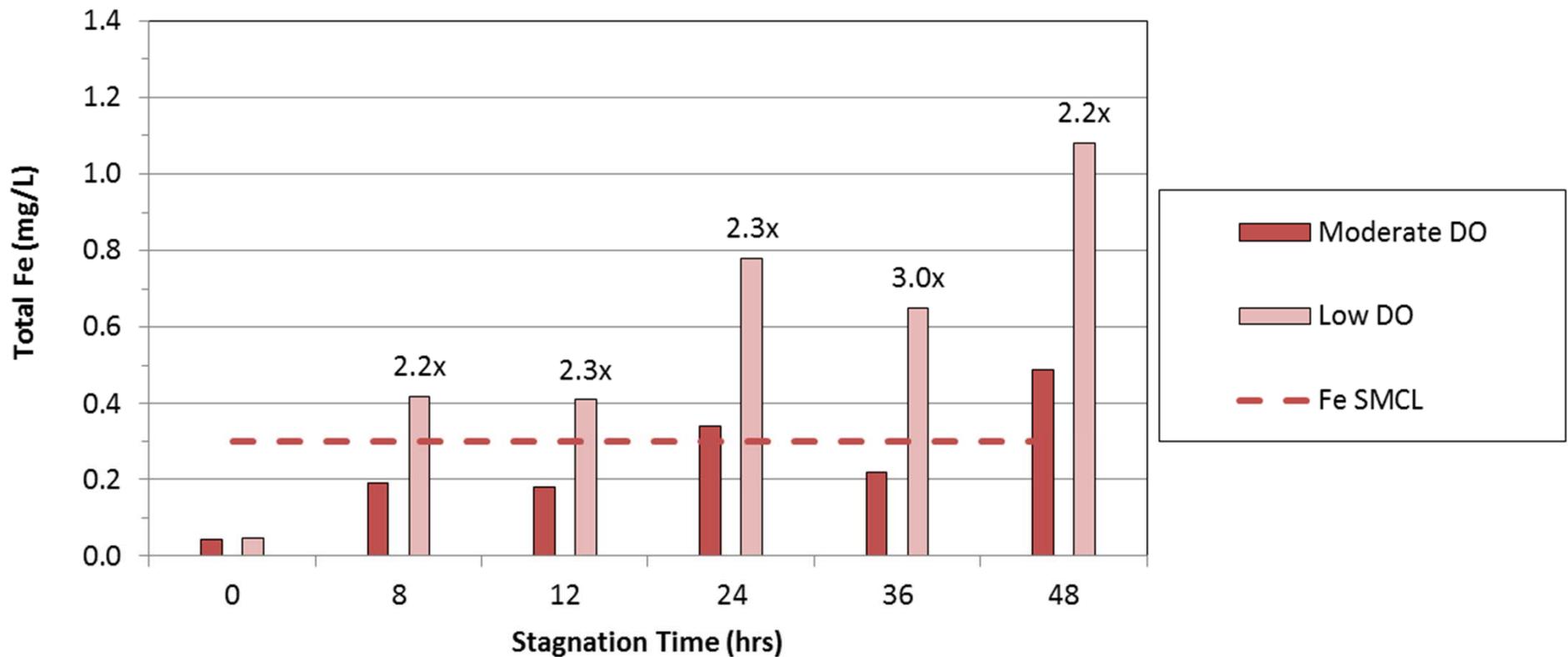


DO Trials Summary of Findings

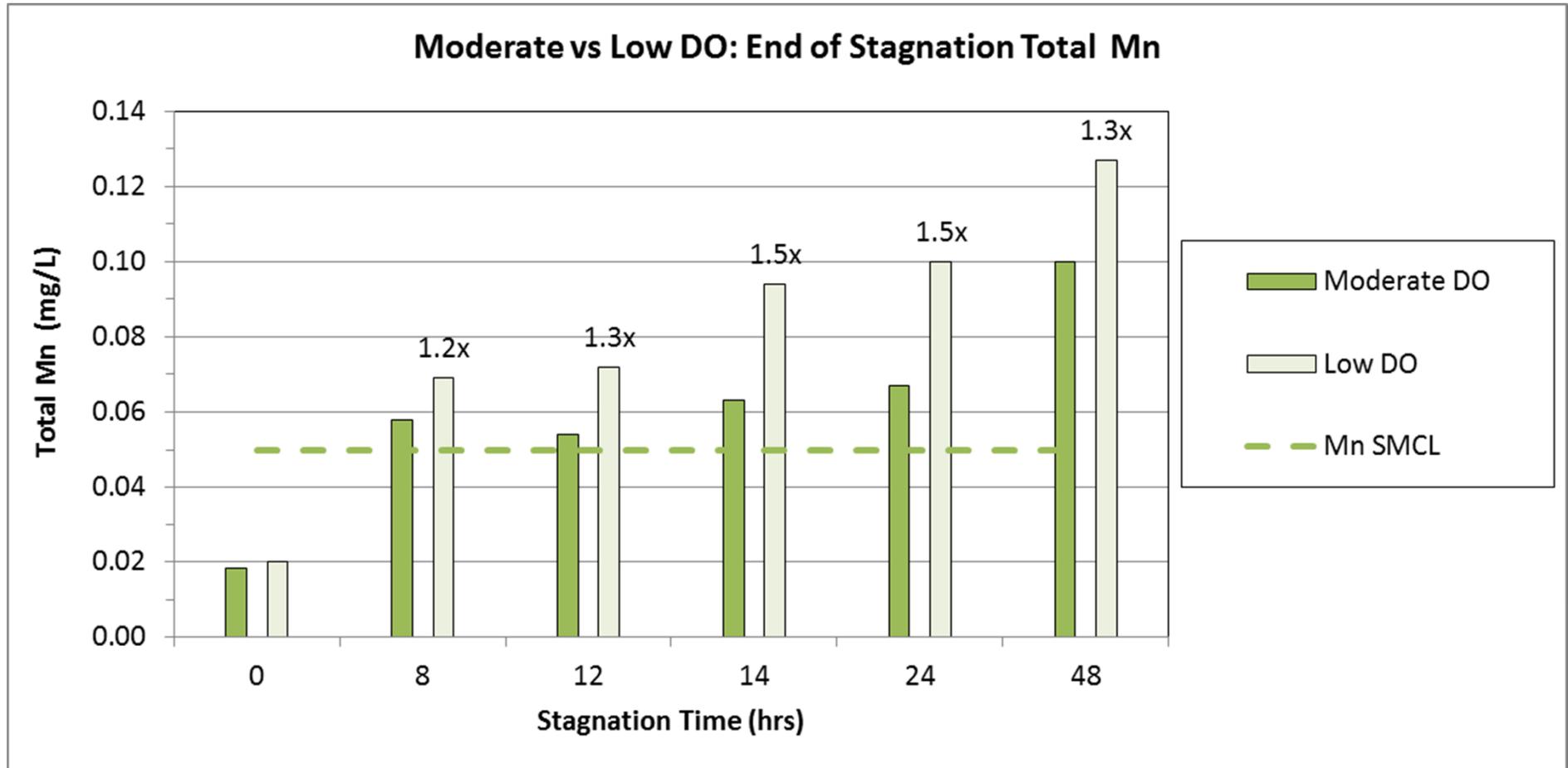


Dissolved Oxygen Trials - Iron Comparison

Moderate vs Low DO: End of Stagnation Total Fe

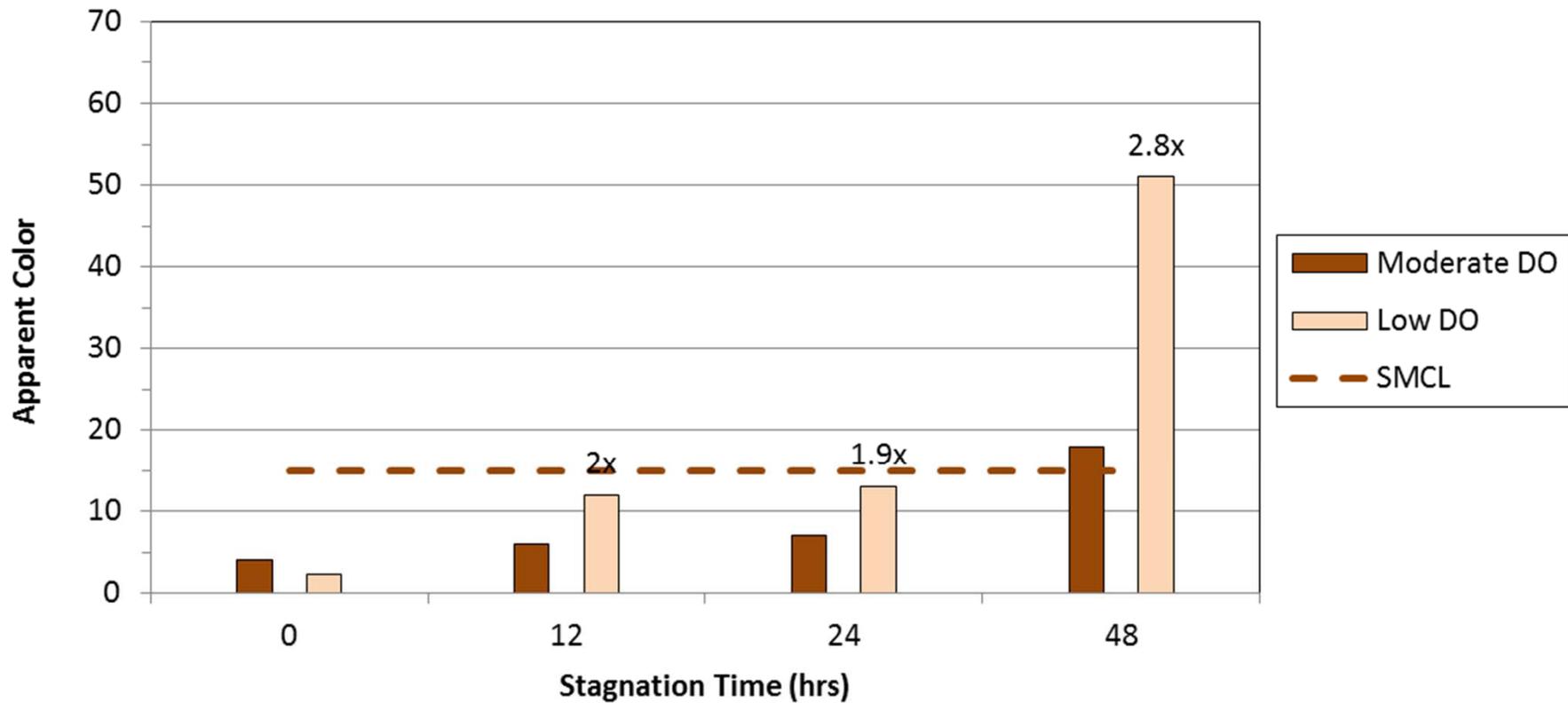


Dissolved Oxygen Trials - Manganese Comparison

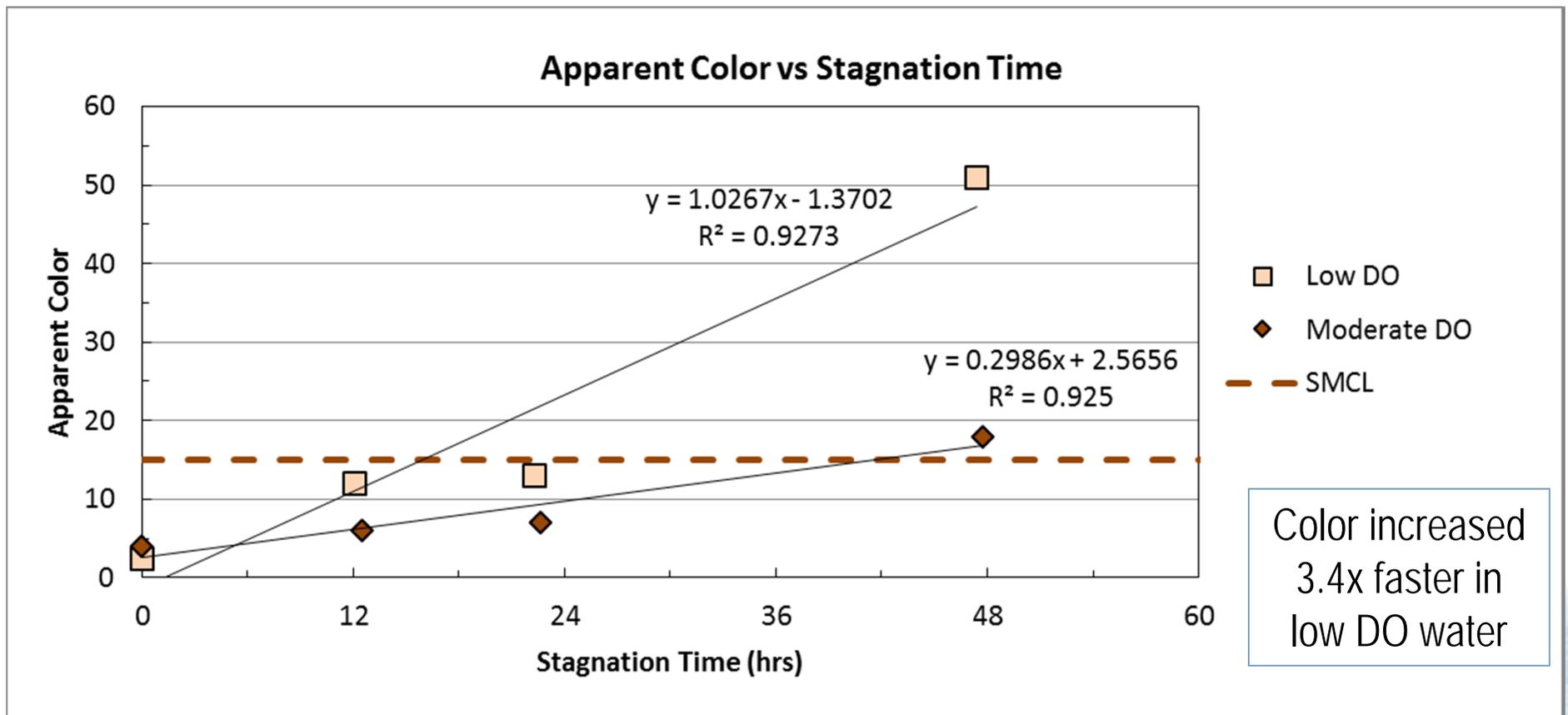


Dissolved Oxygen Trials - Color Comparison

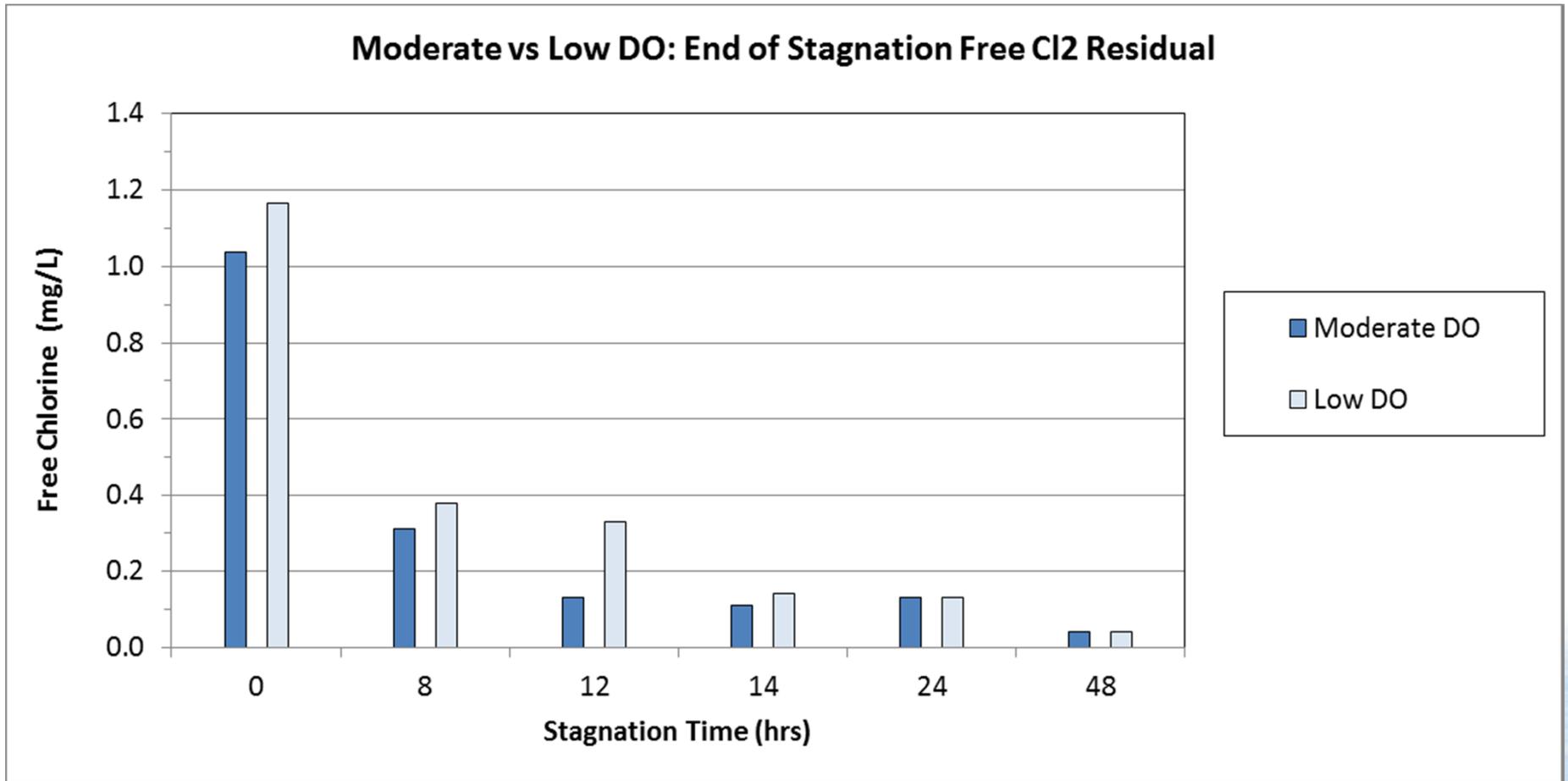
Moderate vs Low DO: End of Stagnation Apparent Color



Dissolved Oxygen Trials – Rate of Change Comparison



Dissolved Oxygen Trials - Chlorine Comparison



Dissolved Oxygen Trials - Conclusions

- ▶ **Moderate levels of DO:**
 - **Significantly improve aesthetic water quality conditions**
 - Iron
 - Manganese
 - Apparent Color
 - **Help to meet SMCLs for longer period of stagnation time**
 - **Reduces dependency on maintaining specific chlorine residual**
 - **Does not appear to affect rate of chlorine decay**
 - **Multiple constituents in pipe scales impacting decay rate**
 - **Benefit of DO injection on chlorine decay rate may improve over time**

Dissolved Oxygen Trials - Recommendations

- ▶ **Implement DO injection at treatment plant**
 - **Significantly improves aesthetic water quality conditions**
 - **Reduces dependency on maintaining specific chlorine residual**
- ▶ **Monitor distribution system to verify no unintended consequences**
- ▶ **DO injection will be a long-term commitment**
- ▶ **DO injection is cost effective alternative to accelerated City wide main replacement program**
 - **Estimated DO Costs:**

Capital:	\$400,000
Operating:	\$ 30,000/YR
- ▶ **Baltimore Area main replacements should remain high priority**

Silica Evaporation Trials - Background

- ▶ **What is causing the white spotting?**
 - **Hardness?**
 - **Silica?**
 - **Other evaporative solids?**
- ▶ **Previous tests used tile spotting to evaluate several treatment approaches**
 - ~~Phosphates?~~ **(Not effective)**
 - **Softening (Calcium and magnesium removal)**
 - **Silica removal – significant improvement with >50% reduction in silica**



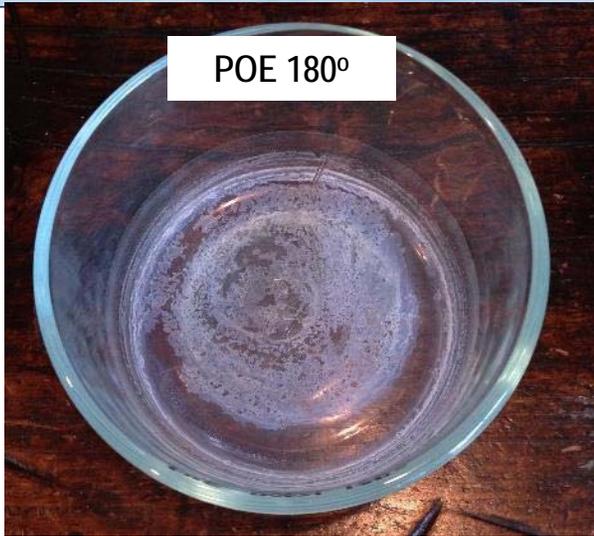
Silica Evaporation Trials - Overview

- ▶ **Additional softening trials conducted to:**
 - Confirm visual appearance using larger volumes of water (100 mL versus 0.1 mL on tiles)
 - Assess impact of softening on ease of cleaning
 - Silica levels remained constant in all tested waters
- ▶ **Three waters prepared, evaporated, and cleaned:**
 - Point of Entry water (POE)
 - Ion Exchange water (IX)
 - 100% hardness removed
 - Representative of what a homeowner could install
 - 50% Softened
 - Representative of a pellet softening system at the treatment plant



Silica Evaporation Trials

100 mL in an 180°F Oven

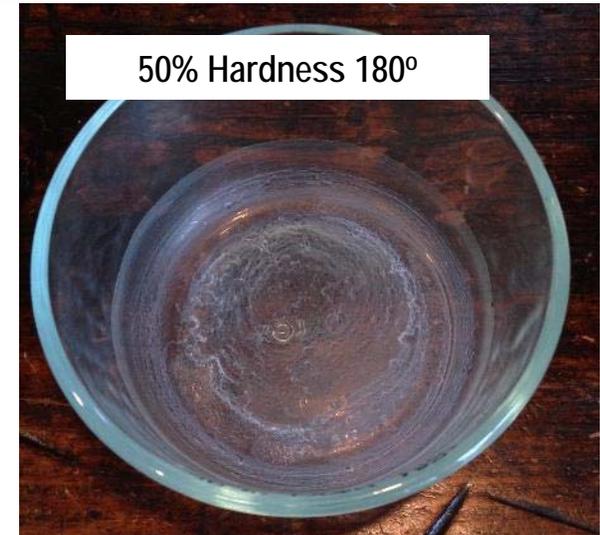
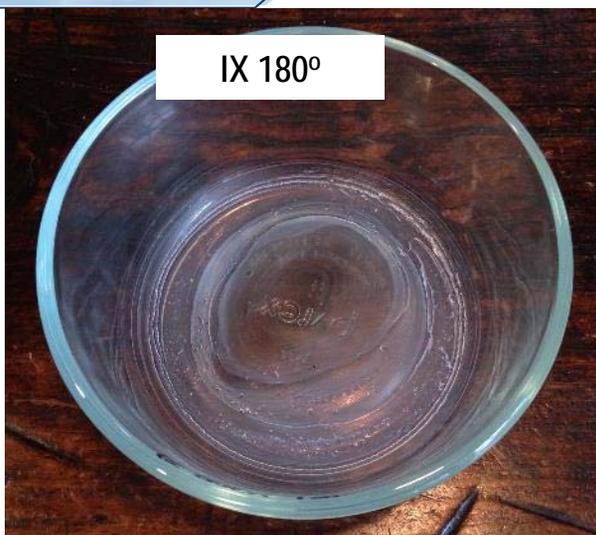
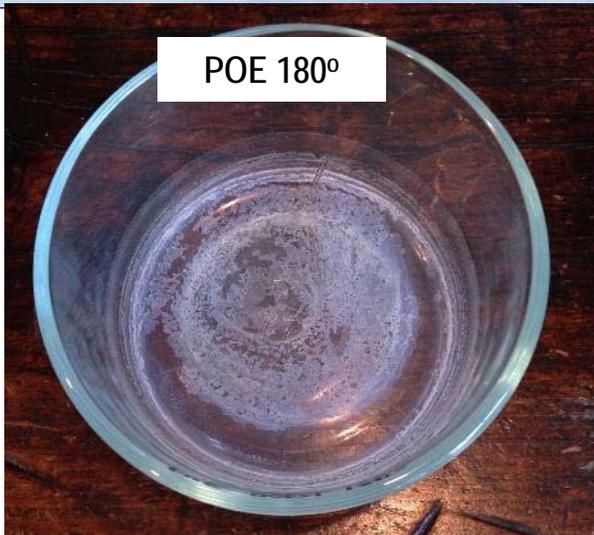


- ▶ **Testing on stainless steel cookware and pans yielded evaporation and cleaning results similar to glass cookware**



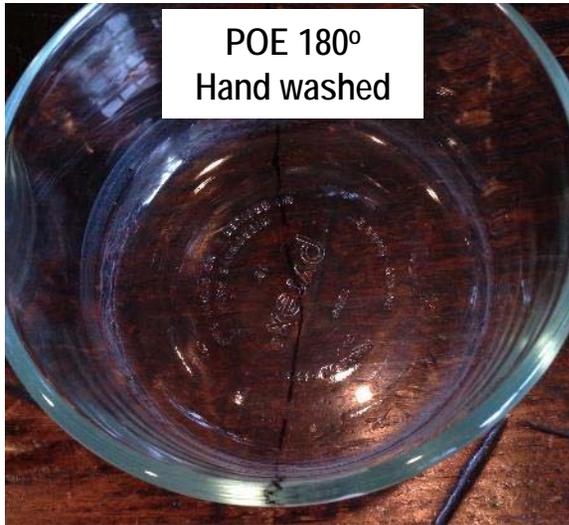
Silica Evaporation Trials

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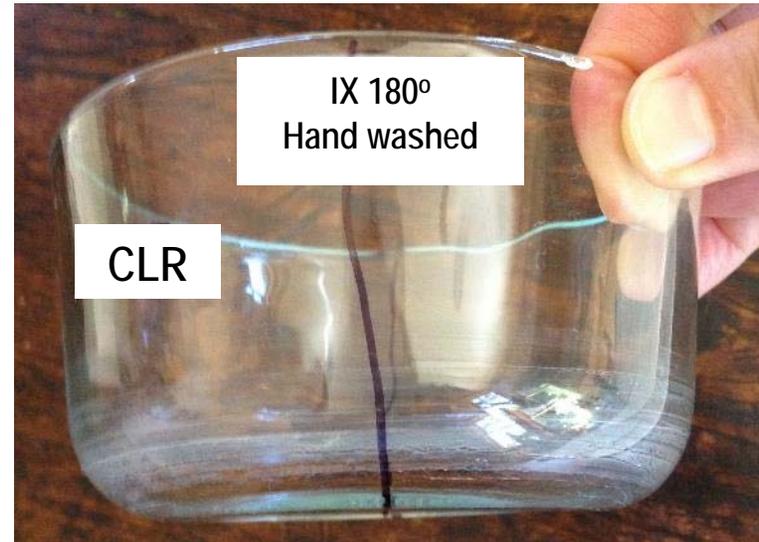
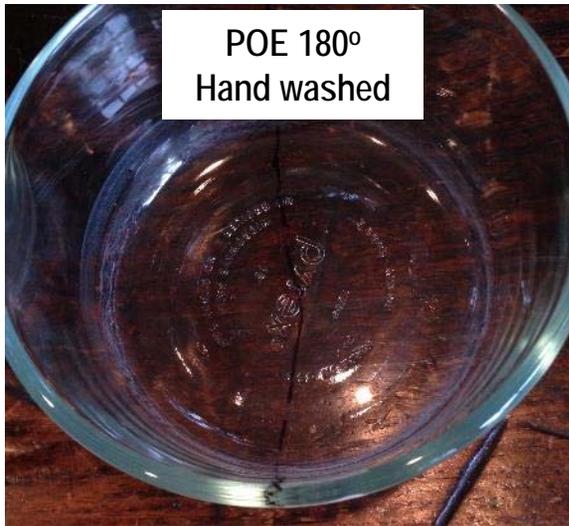
Silica Evaporation Trials

Effectiveness of Cleaning Methods



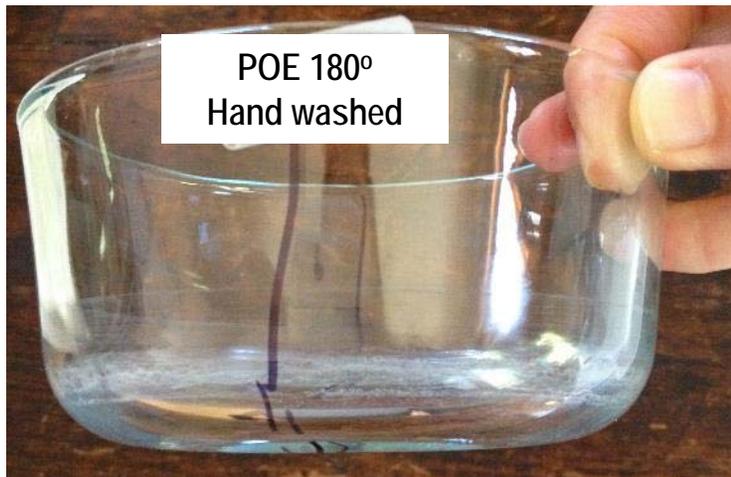
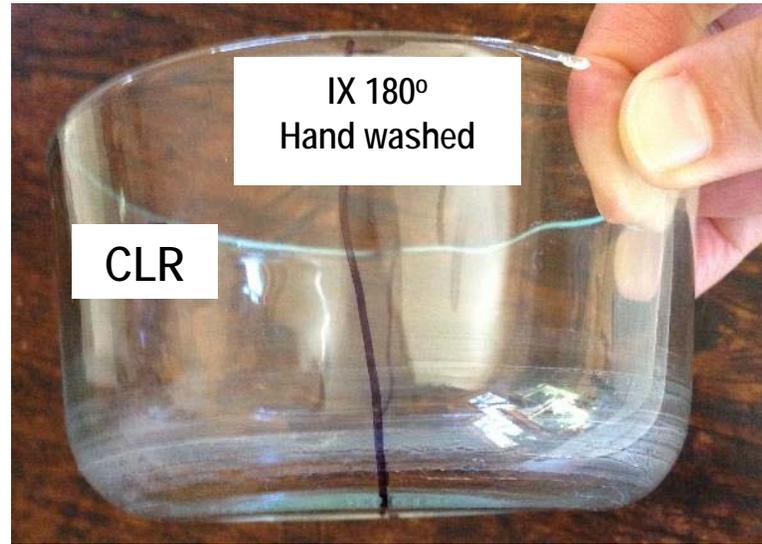
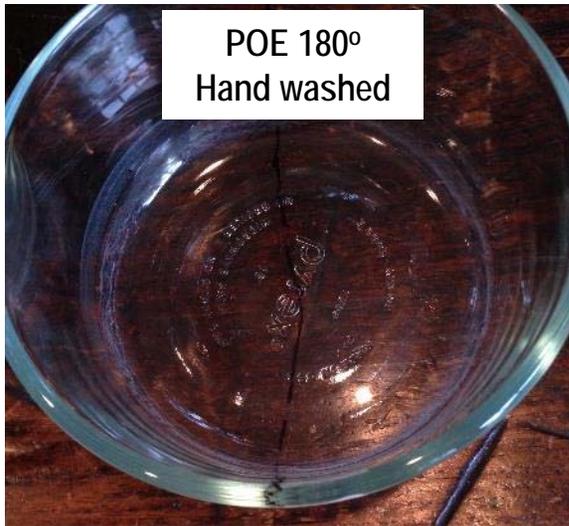
Silica Evaporation Trials

Effectiveness of Cleaning Methods



Silica Evaporation Trials

Effectiveness of Cleaning Methods



Silica Evaporation Trials

Causes of Glassware Film/Etching

▶ *Dishwasher Manufacturer A:*

- Silica film and etching appear permanent; no success at removal.
- Both result from a water/chemical reaction with certain types of glassware.
- Caused by some combination of: soft or softened water, alkaline washing solution, insufficient rinsing, dishwasher overloading, heat of drying, long/hot cycles.

▶ *Dishwasher Manufacturer B:*

- Generally, everyday glasses and inexpensive crystal are made of ingredients that will show signs of etching over time.
- Once the etching process has begun, it can not be reversed.
- Etching is aided by pre-rinsing the dishes, insufficient water volume, too soft water, too hot water and not using rinse-aid.



Silica Evaporation Trials

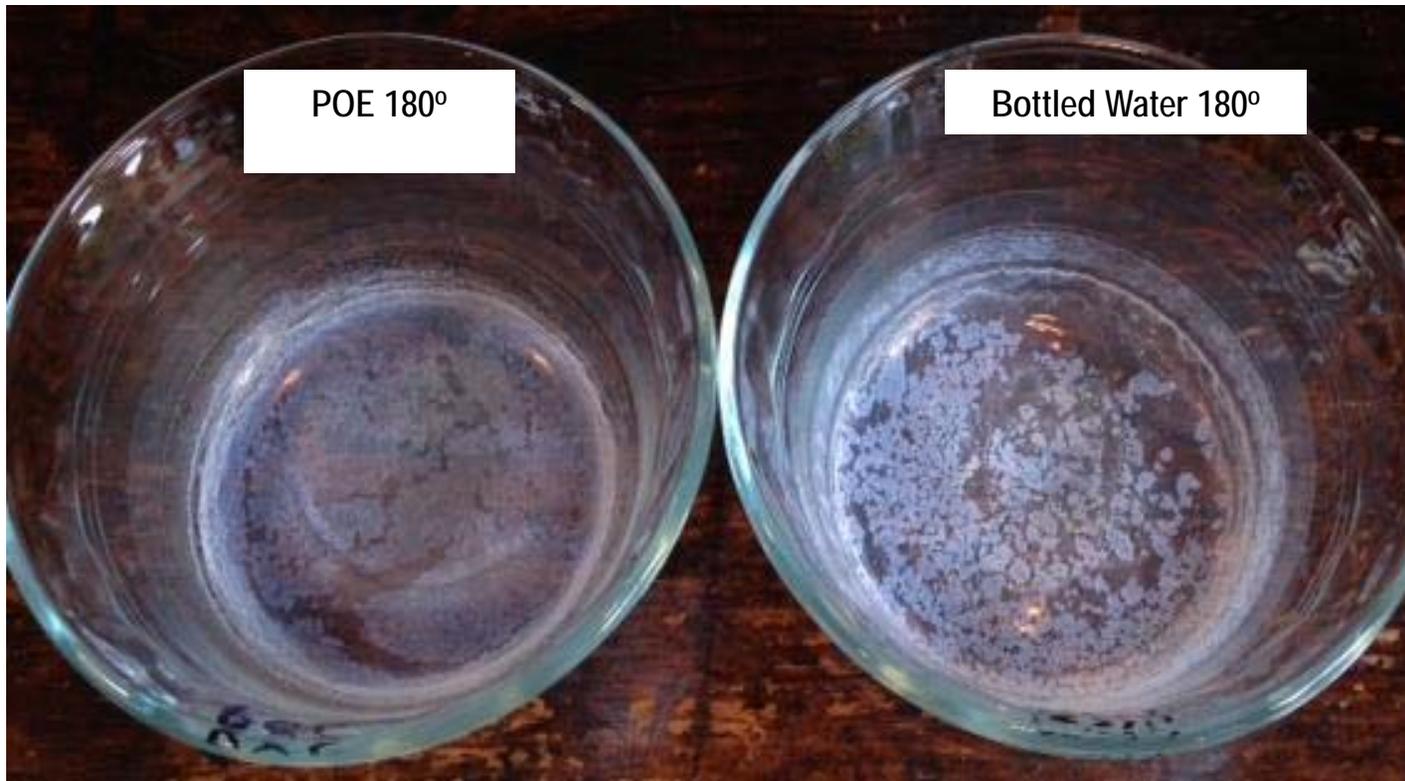
Comparison of Longview Water to a Retail Bottled Water

- ▶ Both contain naturally occurring minerals, including moderate hardness and high silica content
- ▶ Assess visual appearance of FDA regulated bottled water (approx. \$7/gal)

	Silica		Total Hardness (mg/L CaCO ₃)	Alkalinity (mg/L CaCO ₃)	Total Dissolved Solids (mg/L)
	Total (mg/L SiO ₂)	Dissolved (mg/L SiO ₂)			
Longview Water	54.9	54.2	111	105	222
Bottled Water	84.9	82.6	104	130	224

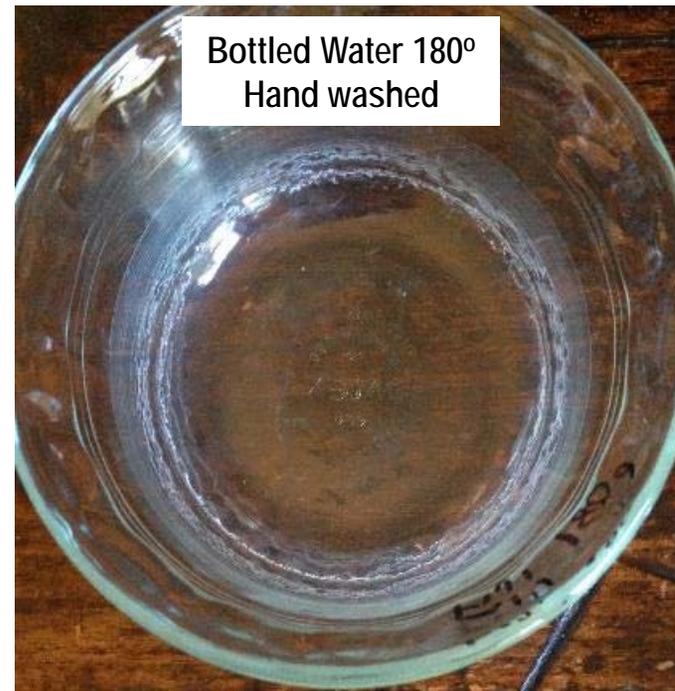
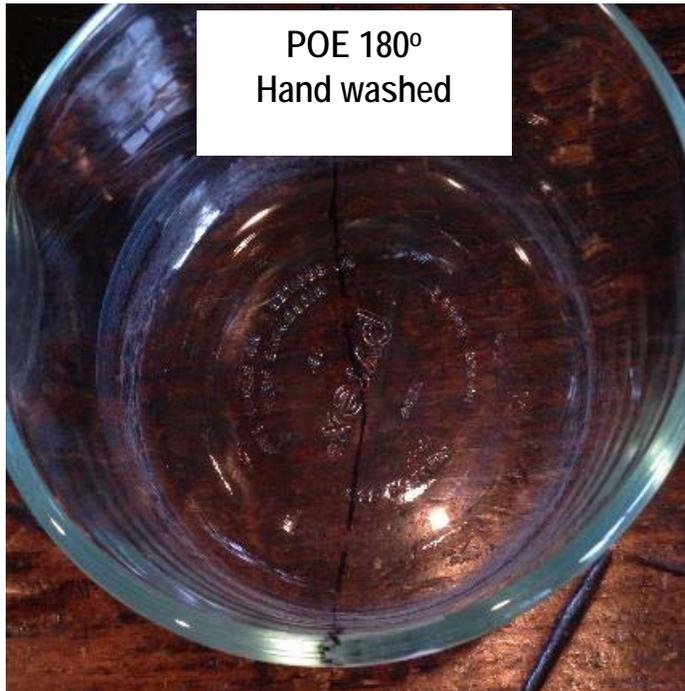
Silica Evaporation Trials

Comparison of Longview Water to a Retail Bottled Water



Silica Evaporation Trials

Comparison of Longview Water to a Retail Bottled Water



Conclusions – Silica

- ▶ **Primary cause of spotting is naturally-occurring silica**
 - Silica appears to “etch” surfaces if allowed to evaporate
- ▶ **Aesthetic issue not experienced equally by all customers; varies with:**
 - Type and age of glassware/surface
 - Amount of handwashing and hand drying
 - Dishwasher use and settings, detergent type and rinse aids
 - Evaporation plus heat is most problematic
- ▶ **Softening not likely to make significant improvement**
 - No change in visual appearance or ease of cleaning
- ▶ **Longview water and bottled water are both safe to drink**
 - Longview Water meets all EPA and DOH Safe Drinking Water Act regulations
 - Retail bottled Water meets FDA regulations



Conclusions - Distribution System

- ▶ **Water quality was vastly improved without additional treatment or significant chemical addition**
 - **Causative factors and solutions at the plant and within the distribution system have been identified**
 - **Several mitigation strategies have been implemented**
 - **Others mitigation strategies underway**
- ▶ **Water quality monitoring and management is ongoing**



Options & Recommendations - Silica

Customer

- ▶ Hand-dry or squeegee surfaces after use
- ▶ Use rinse-aids
- ▶ Install point of use or household filtration systems (RO)

City

- ✓ Public Outreach
- ✓ Investigate cause and avoid unnecessary cost of softening
- ✓ Investigate treatment options to remove silica
- ▶ Evaluate source water options and associated costs



Options & Recommendations - Distribution System

Chlorine Residual (ORP)

- ✓ Stabilized at MFRWTP
- ✓ Trim/boost after filters (90% design stage)
- ✓ Optimize MFRWTP operations (on-going)
- ✓ Investigate another chemical to raise ORP (Dissolved oxygen)
- ▶ Boost residuals within distribution system

Water Age

- ✓ Continue auto-flushing
- ✓ Continue regular water flushing program
- ▶ Hydraulic modeling to verify flow paths
- ▶ Pipeline re-routing

Distribution System Solids

- ✓ Continue uni-directional flushing program
- ✓ Ice-pigging
- ✓ Main replacements
- ✓ Hydro-Jet cleaning
- ▶ Swabbing of cement lined/plastic pipes
- ▶ Clean and/or line unlined cast iron pipes that are structurally sound
- ▶ Main replacements



DISCUSSION

