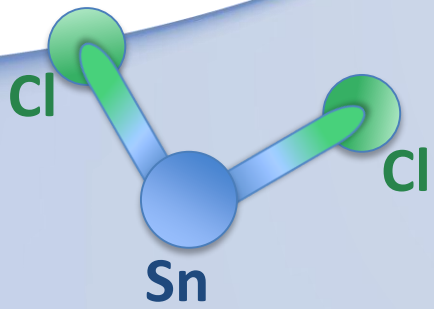
Drinking Water Chromium-6 (Cr6) Update

WESTCAS Annual Conference
San Diego, California
June 21, 2018

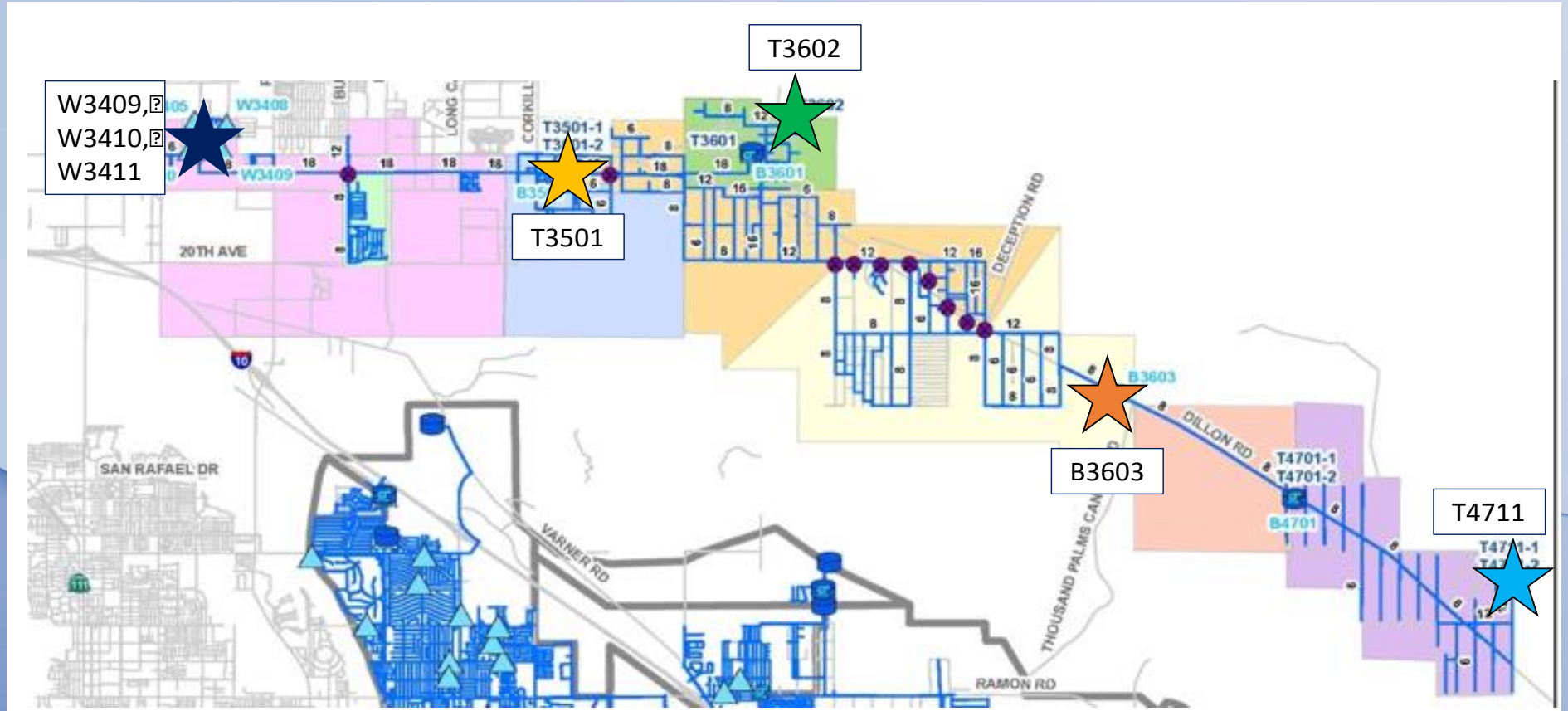
Summary of Stannous Chloride ($SnCl_2$) Bench Results



- Salt made of tin & chloride (SnCl2)
- Approved additive (corrosion inhibitor)
- Rapid reduction of Cr6 to Cr3
- Re-oxidation (Cr3 to Cr6) by chlorine is quick & limited
- Re-oxidation is inversely correlated with Sn dose
- Sn >0.3 mg/L achieved water quality goals independent of chlorine dose

Full-scale Demonstration

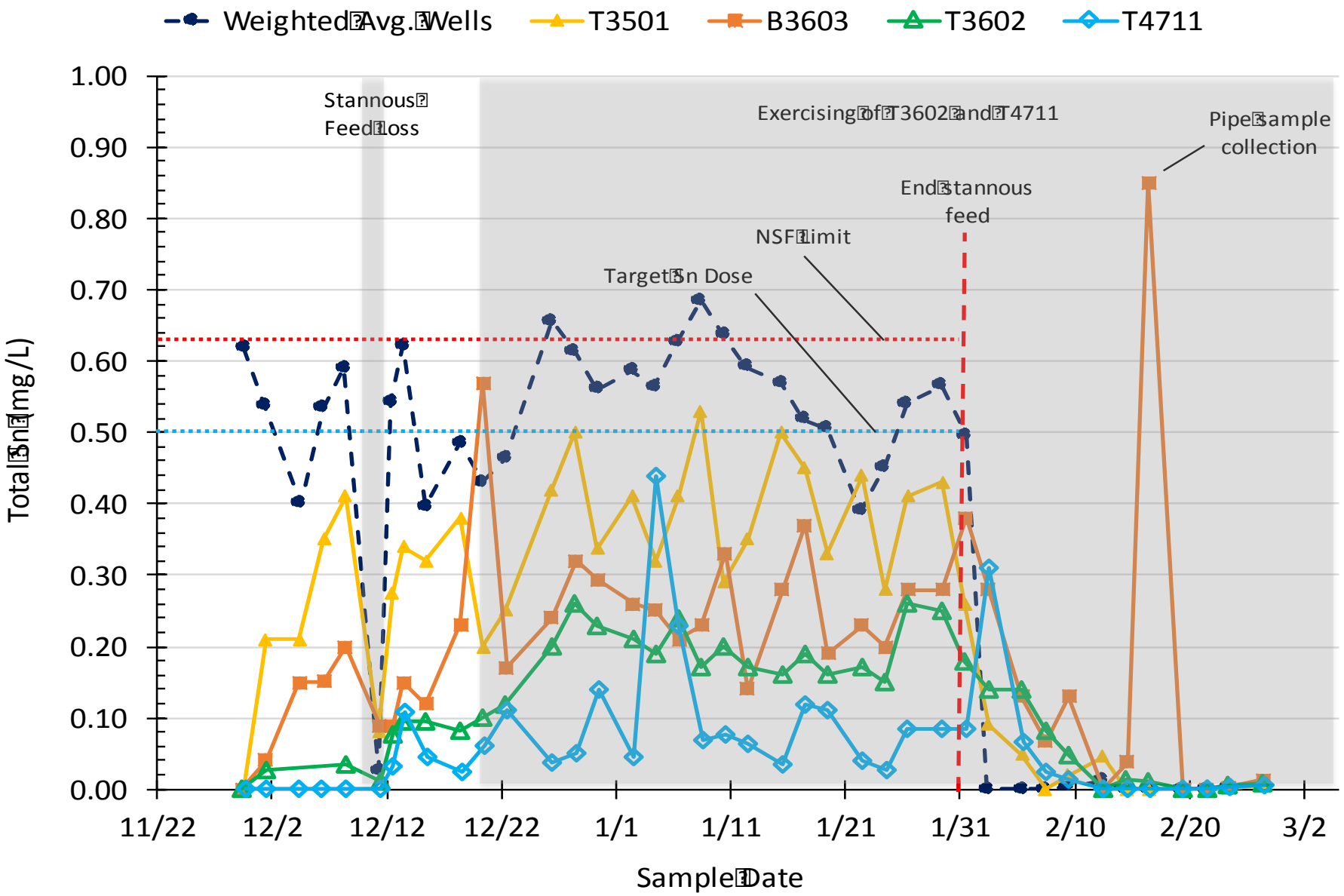
- Sky Valley (ID-8) Water System
  - Sufficient Cr6 levels (16-20 ppb)
  - Extended water system (longer MRT)
  - Continuous residual chlorine (averages 0.3 mg/L)



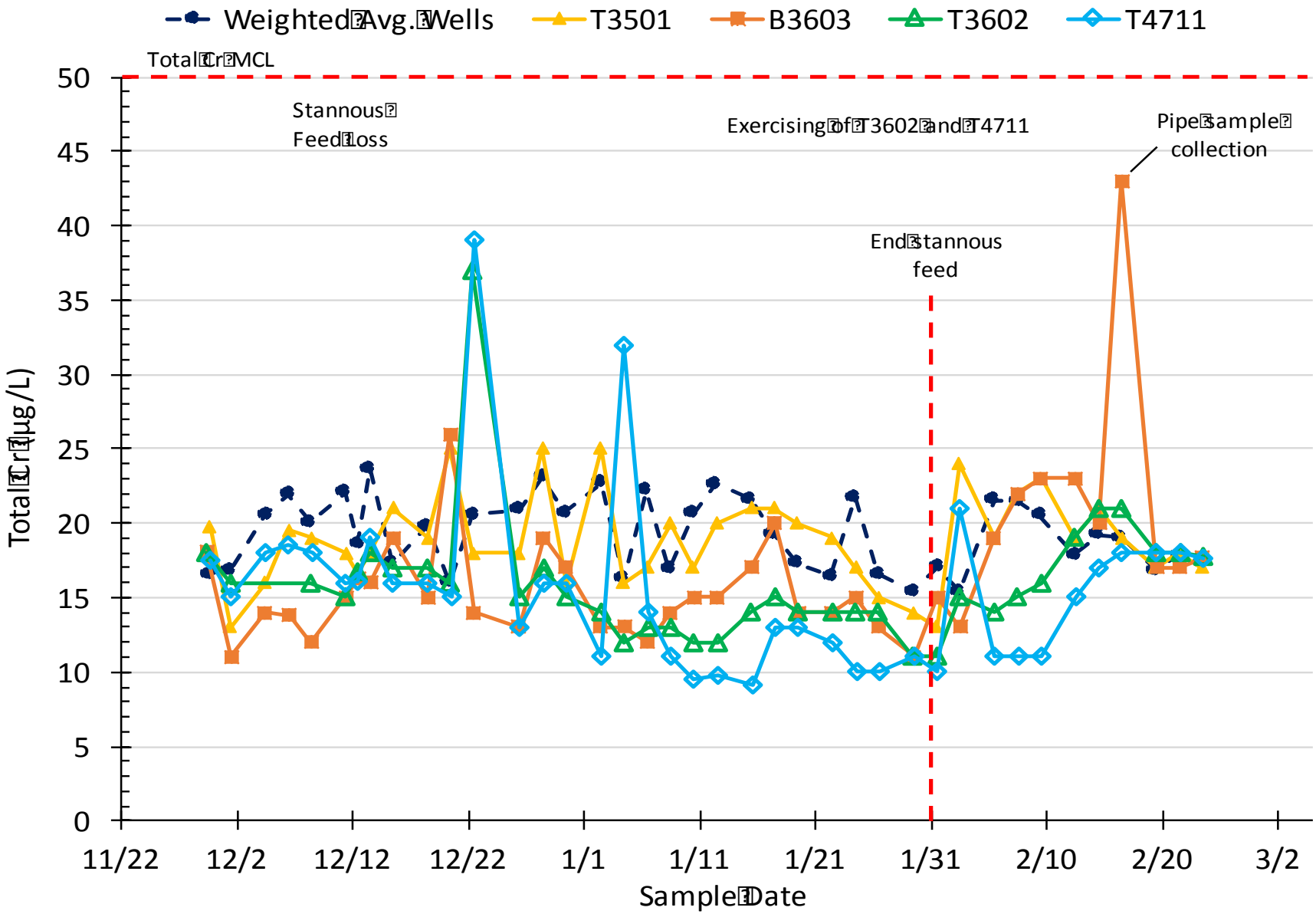
Objectives & Water Quality Goals

- Full-scale efficacy of $SnCl_2$
- Sn, Cr, Cr6 fate in system
- Stock Sn solution stability
- Achieve Cr6 levels below 10 ppb at entry point
- Maintain Cr6 levels below 10 ppb in chlorinated system
- Meet turbidity SMCL of 5 NTU
- Maintain consumer acceptance

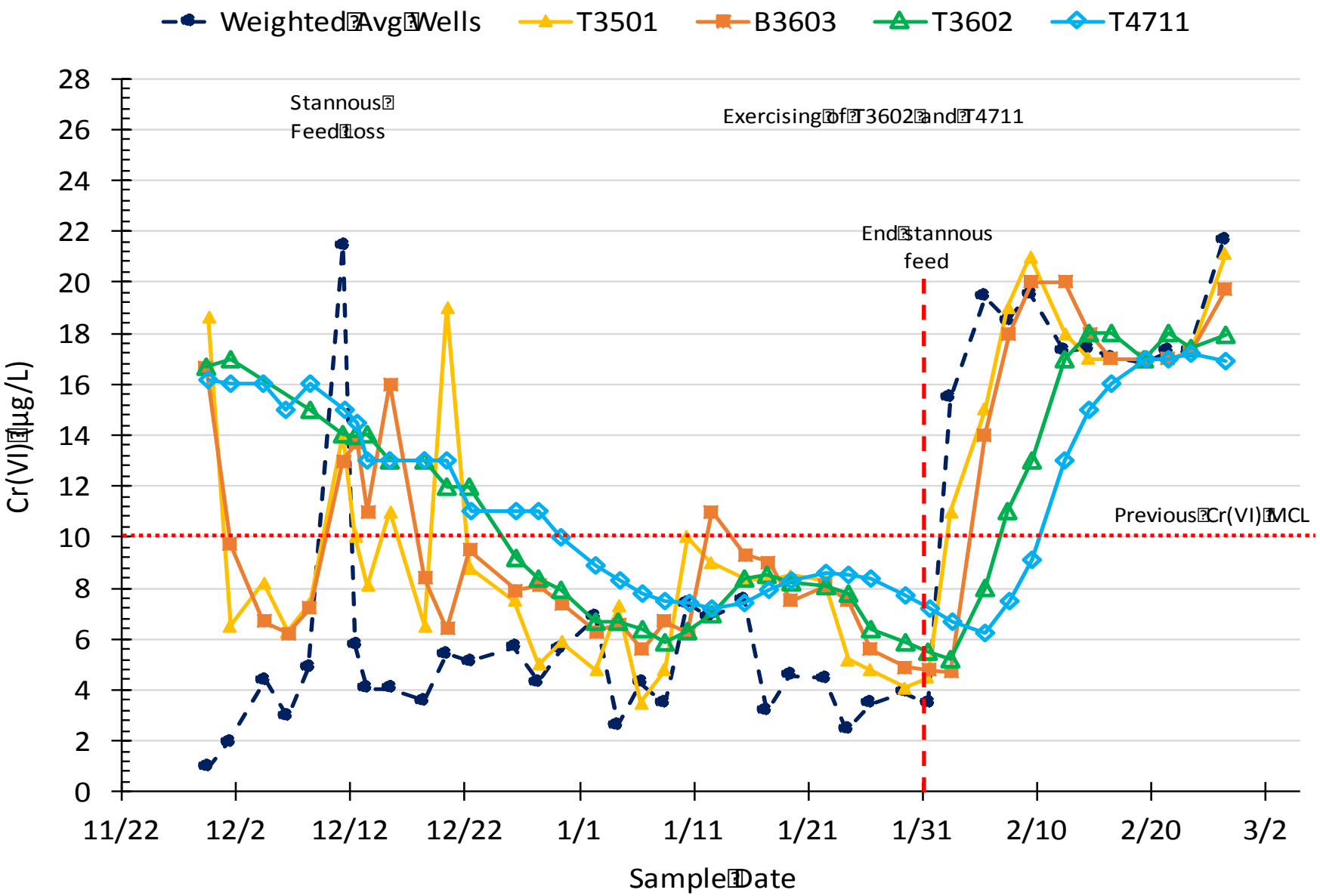
Total Sn


Weighted Avg. Wells
T3501
B3603
T3602
T4711
Stannous Feed Loss
Exercising of T3602 and T4711
Pipe sample collection
End stannous feed
NSF Limit
Target Sn Dose
Total Sn (mg/L)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
11/22
12/2
12/12
12/22
1/1
1/11
1/21
1/31
2/10
2/20
3/2
Sample Date

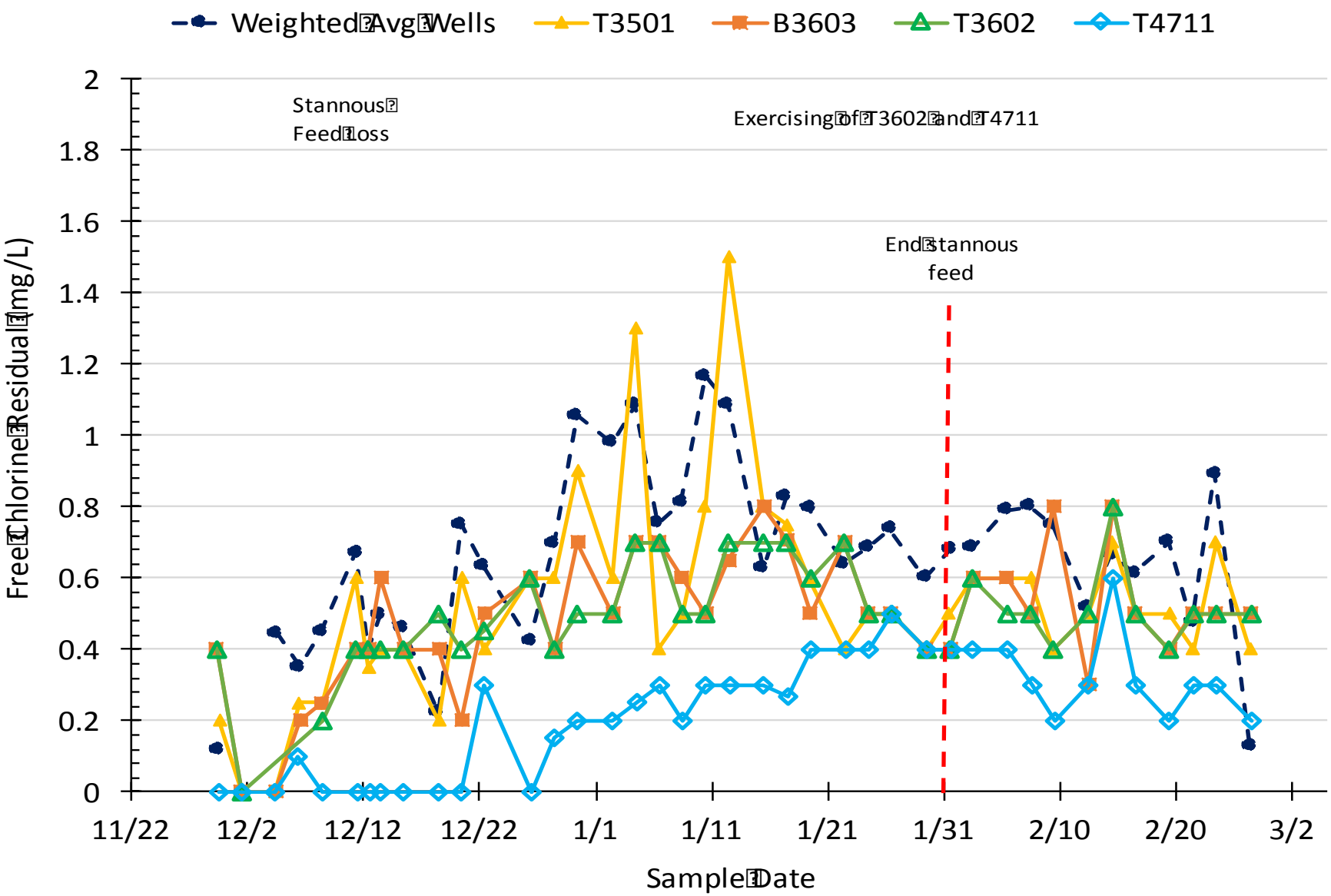
Total Chromium



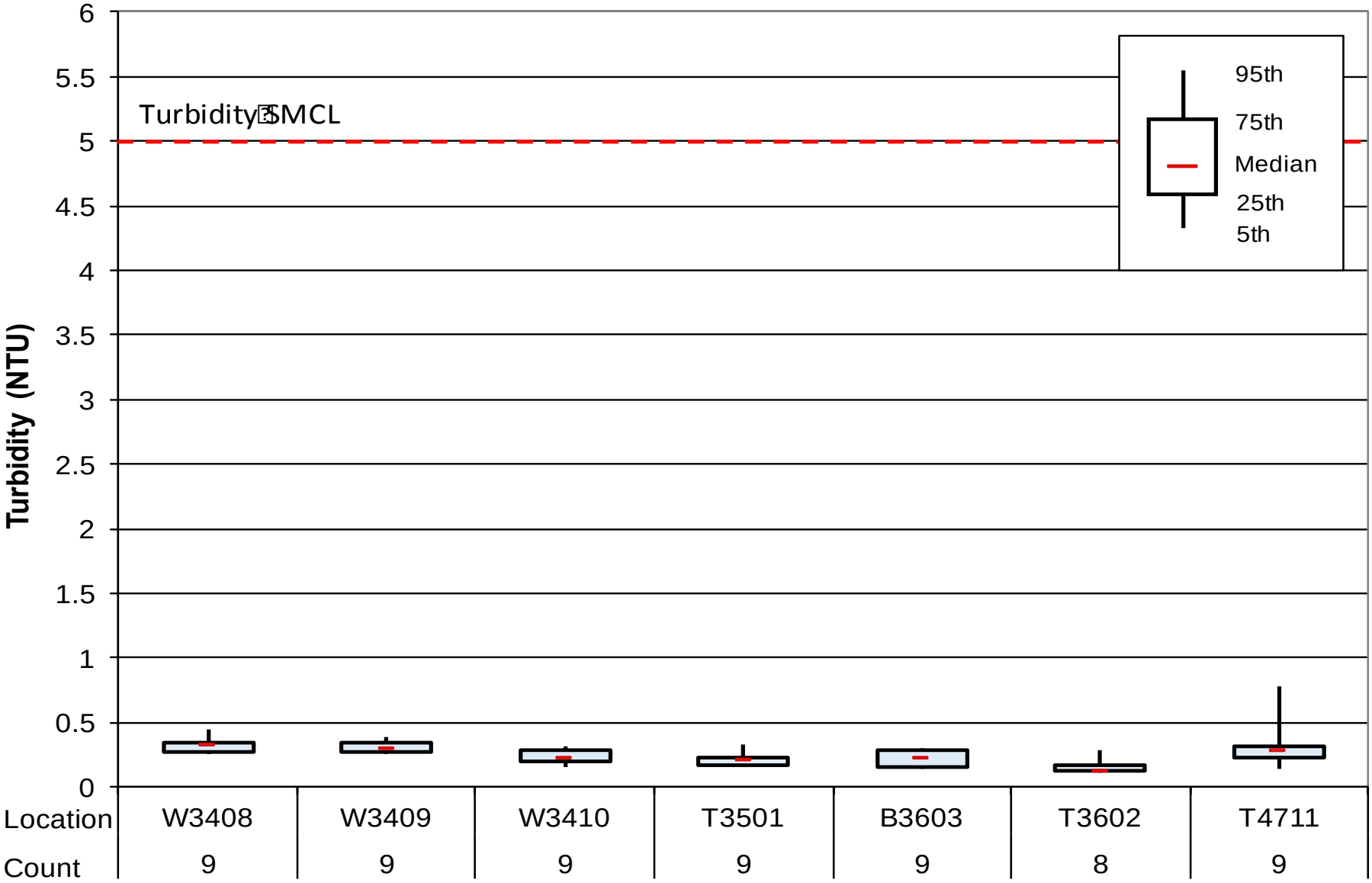
Chromium-6


Weighted Avg Wells
T3501
B3603
T3602
T4711
Stannous Feed Loss
Exercising of T3602 and T4711
End Stannous feed
Previous Cr(VI) MCL
Cr(VI) (µg/L)
Sample Date
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
11/22
12/2
12/12
12/22
1/1
1/11
1/21
1/31
2/10
2/20
3/2

Chlorine Residual



Turbidity – With Sn Feed

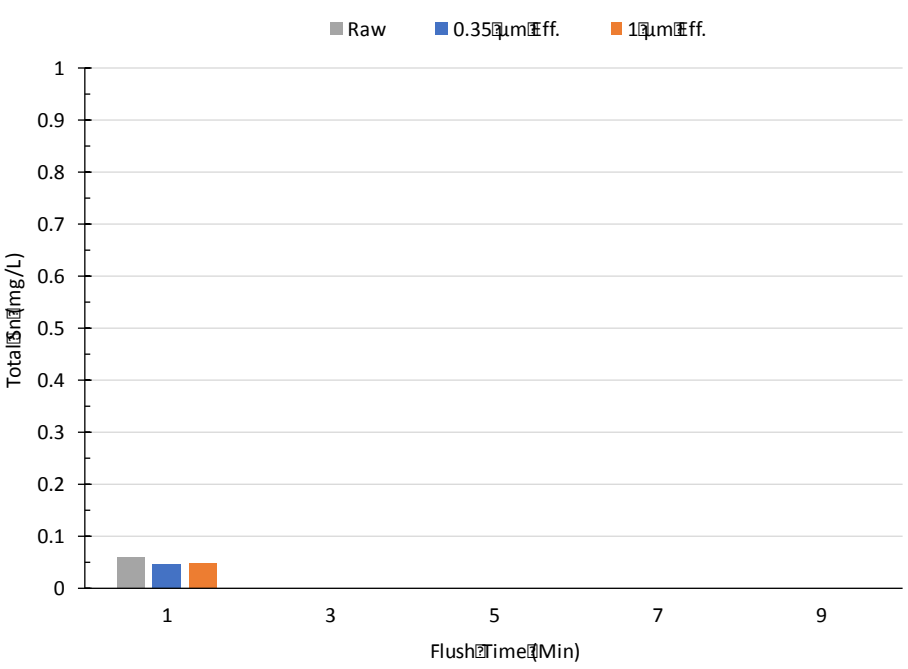


Hydrant Flushing Test

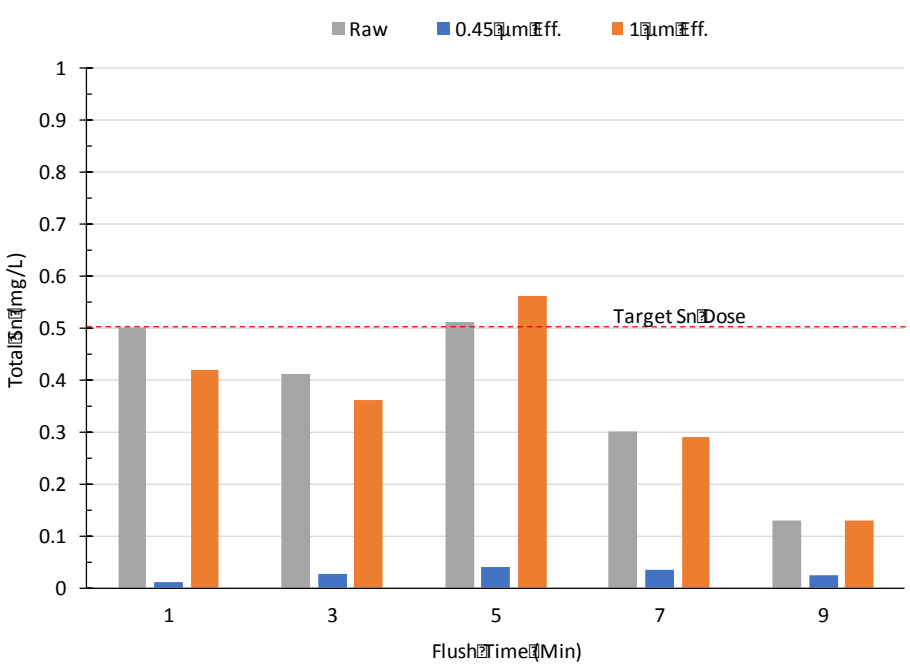
- 10-minute flush performed at hydrant near MRT tank site
- Compared flush water conditions before & after SnCl2 demonstration
- Compared unfiltered and filtered flush water (0.35-1 µm)
- Tests included turbidity, total Sn, total Cr, Cr6

Flushing Test Results - Sn

Baseline Flush

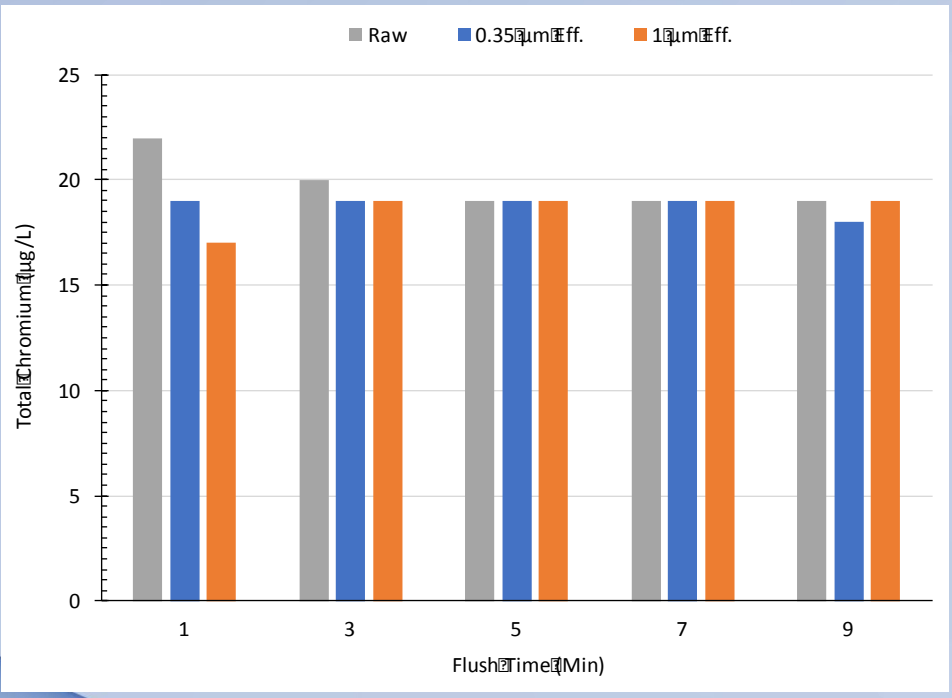


With-Sn Flush

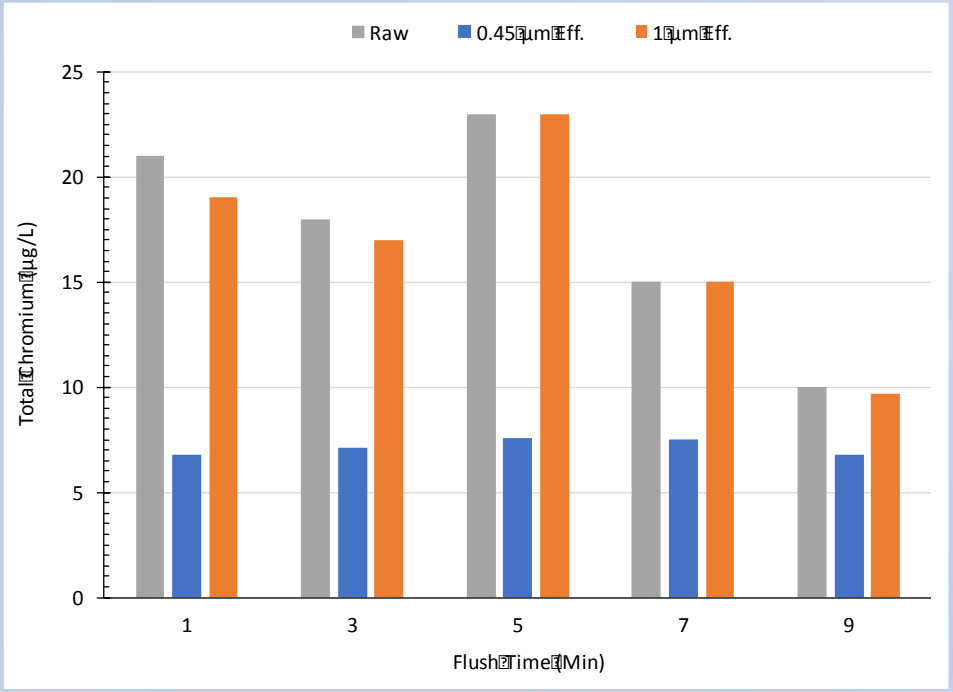


Flushing Test Results – Total Cr

Baseline Flush

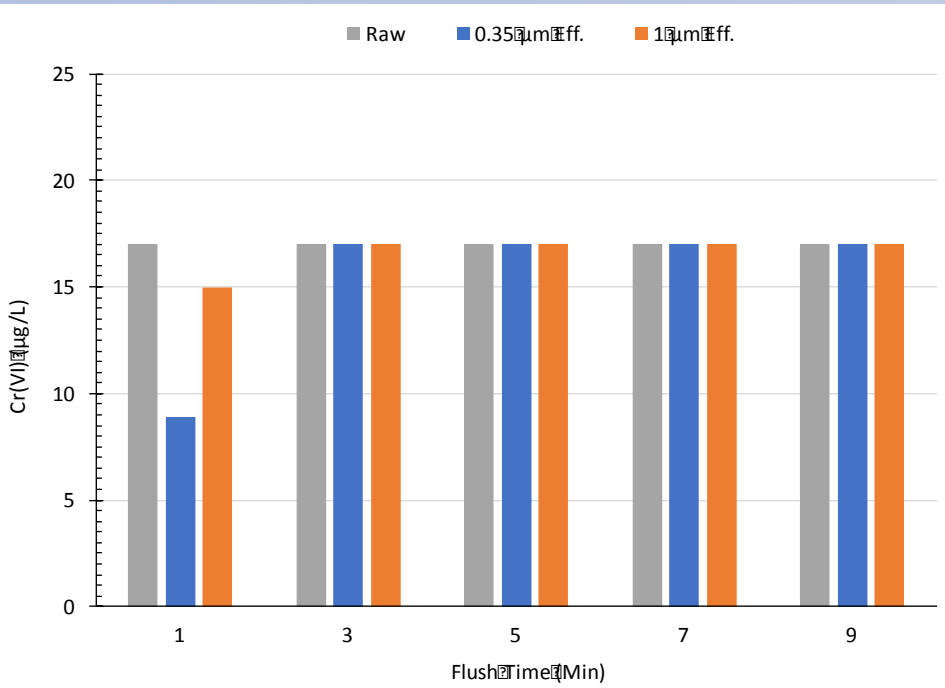


With-Sn Flush

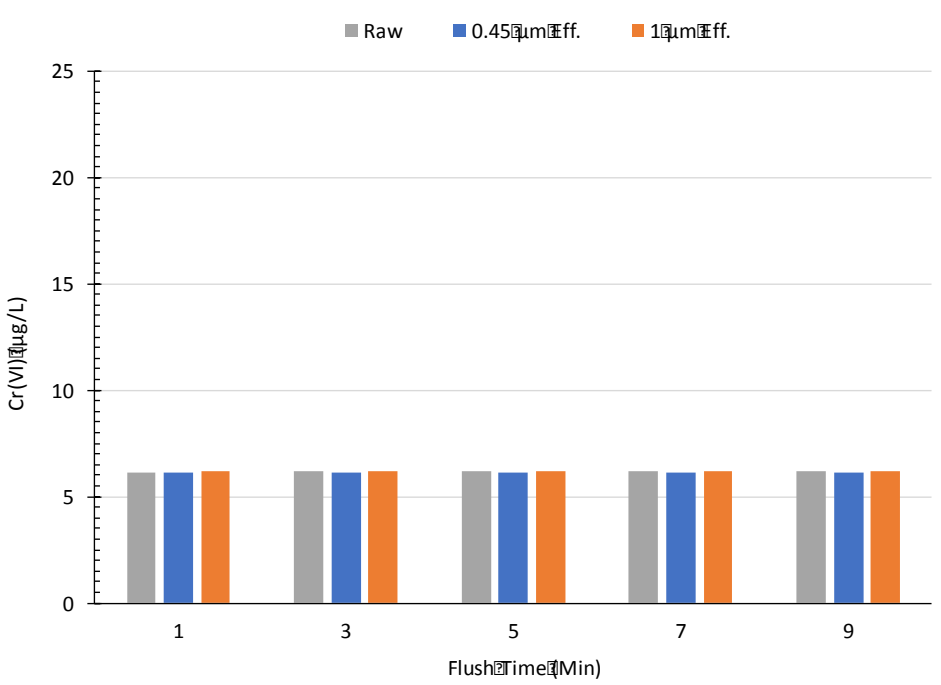


Flushing Test Results – Cr6

Baseline Flush

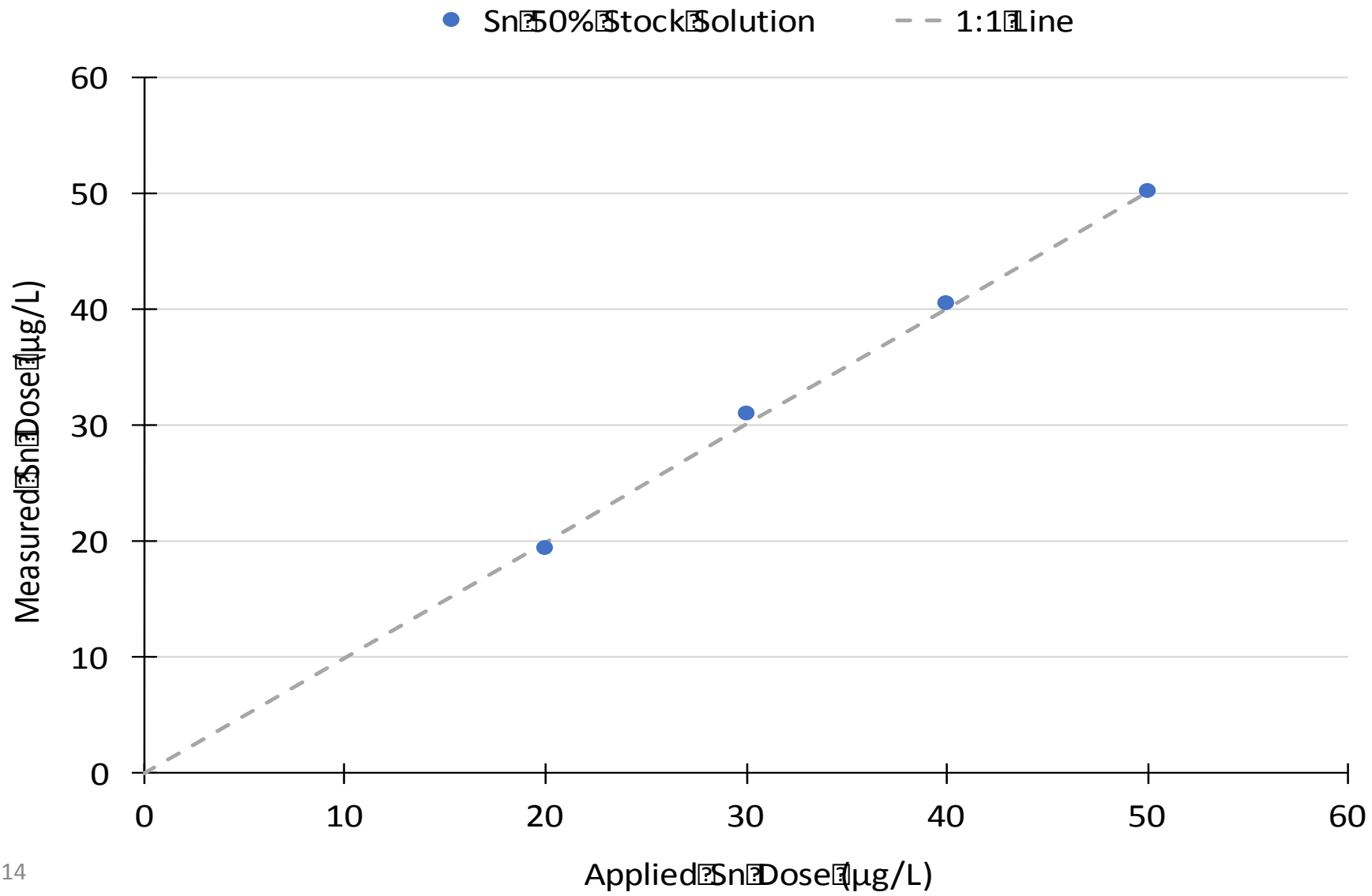


With-Sn Flush



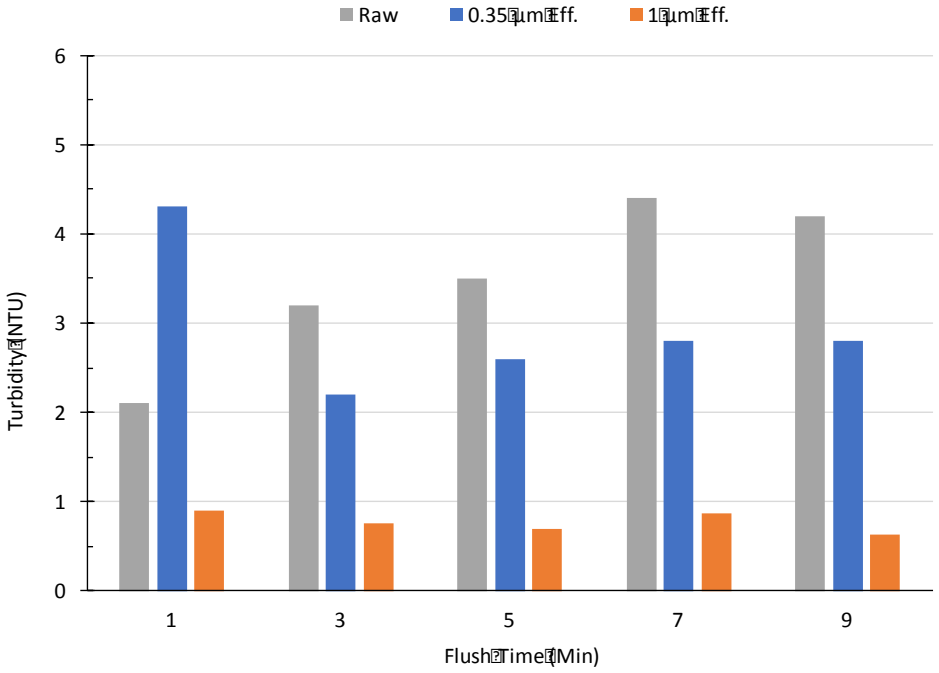
Stannous Stock Efficacy

March 2, 2018

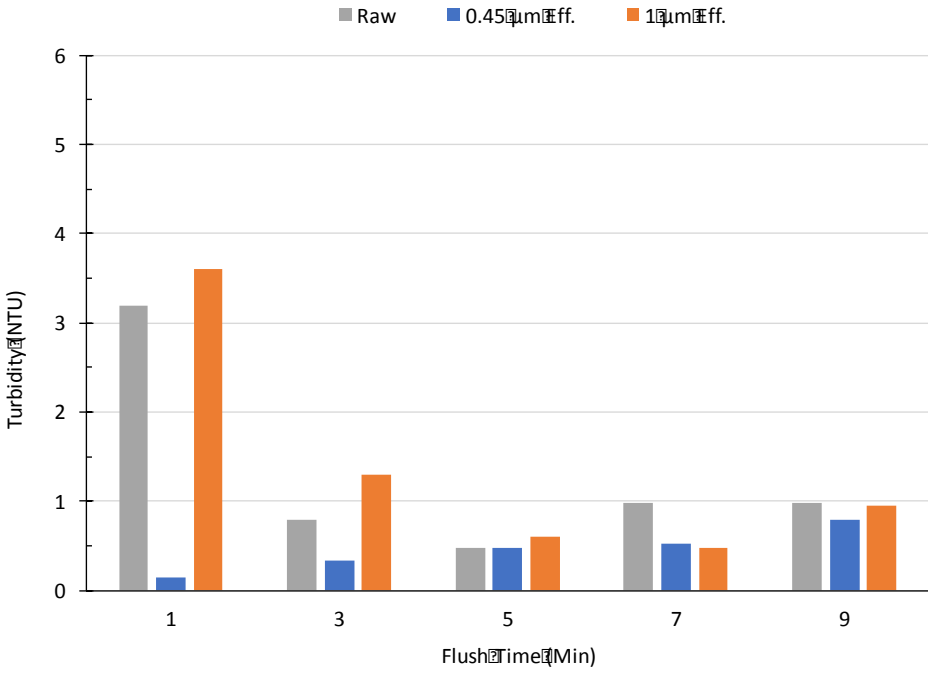


Flushing Test Results - Turbidity

Baseline Flush



With Sn Flush

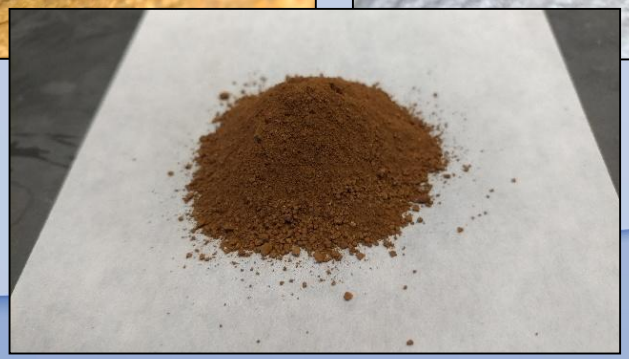


Distribution System Pipe Sample

- Final results are pending Pipe sample collected for ICP-MS, X-ray diffraction (XRD), and Scanning Electron Microscopy (SEM) at UC Riverside

Interior of pipe sample

Outer layer pipe scales



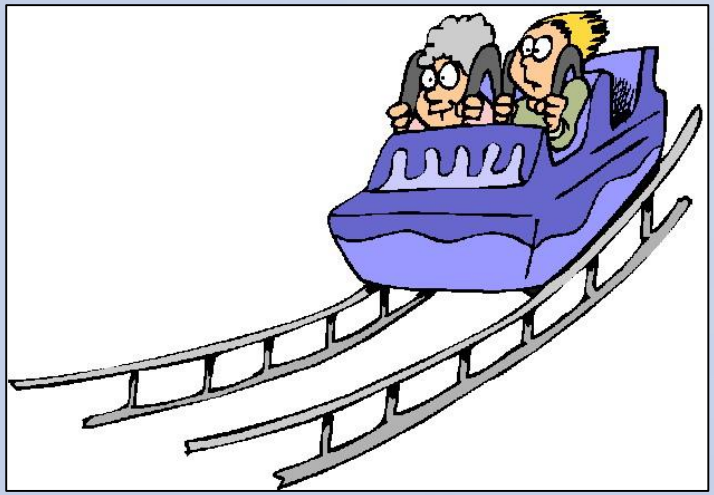
Prepared scale sample

Full-scale Demonstration Results

- ✓ Confirmed full-scale efficacy of stannous application followed by chlorination to achieve water quality goals
- ✓ Informed fate of Sn, Cr6, and Cr in water system
- ✓ Confirmed stannous solution stability
- ✓ Confirmed applied stannous dose
- ✓ Satisfied customers (benefits & outreach)

Cr6 MCL 2.0

- Cal EPA has no schedule for completing the Cr6 PHG review started in 2016
- SWRCB 2018 Drinking Water Regulation Priority List (11 items)
  - Evaluation of Economic Feasibility (#1)
  - Begin work on new Cr6 MCL (#2)
- Federal (USEPA) – Draft risk assessment still at starting line



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