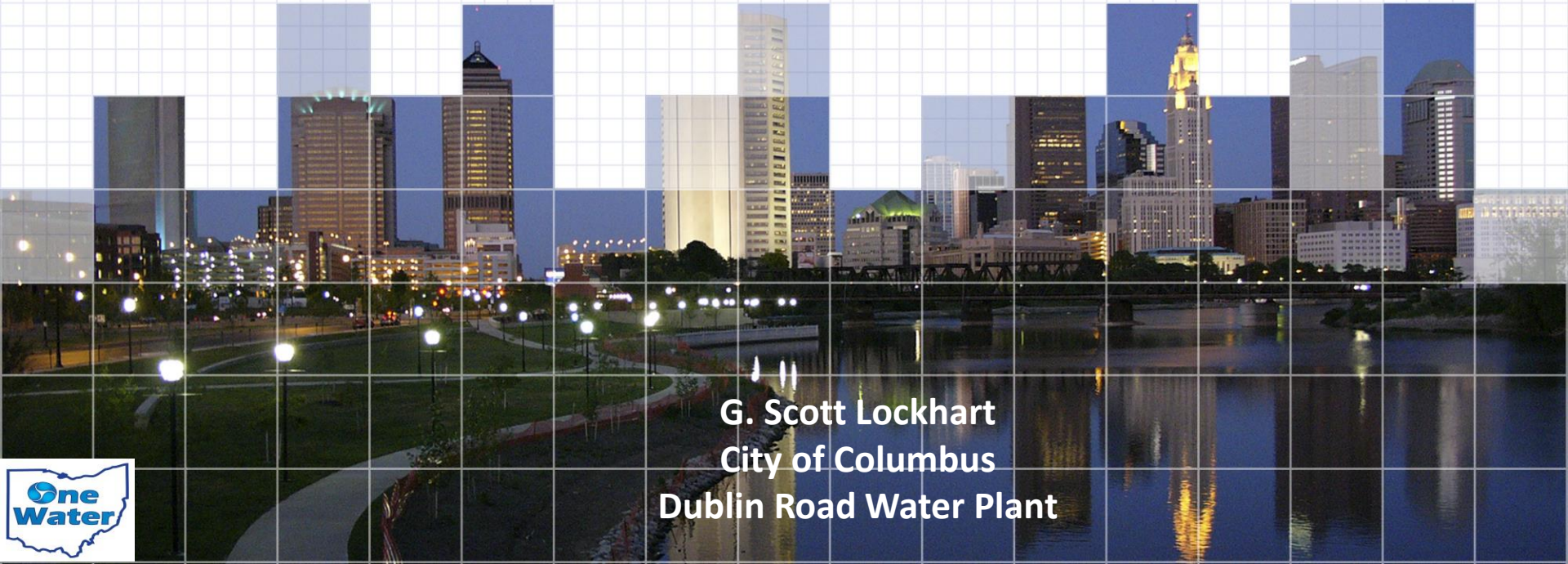
DUBLIN ROAD WATER PLANT

DESIGN, BENCH AND FULL SCALE TESTING OF FILTER AND COAGULANT AID POLYMER

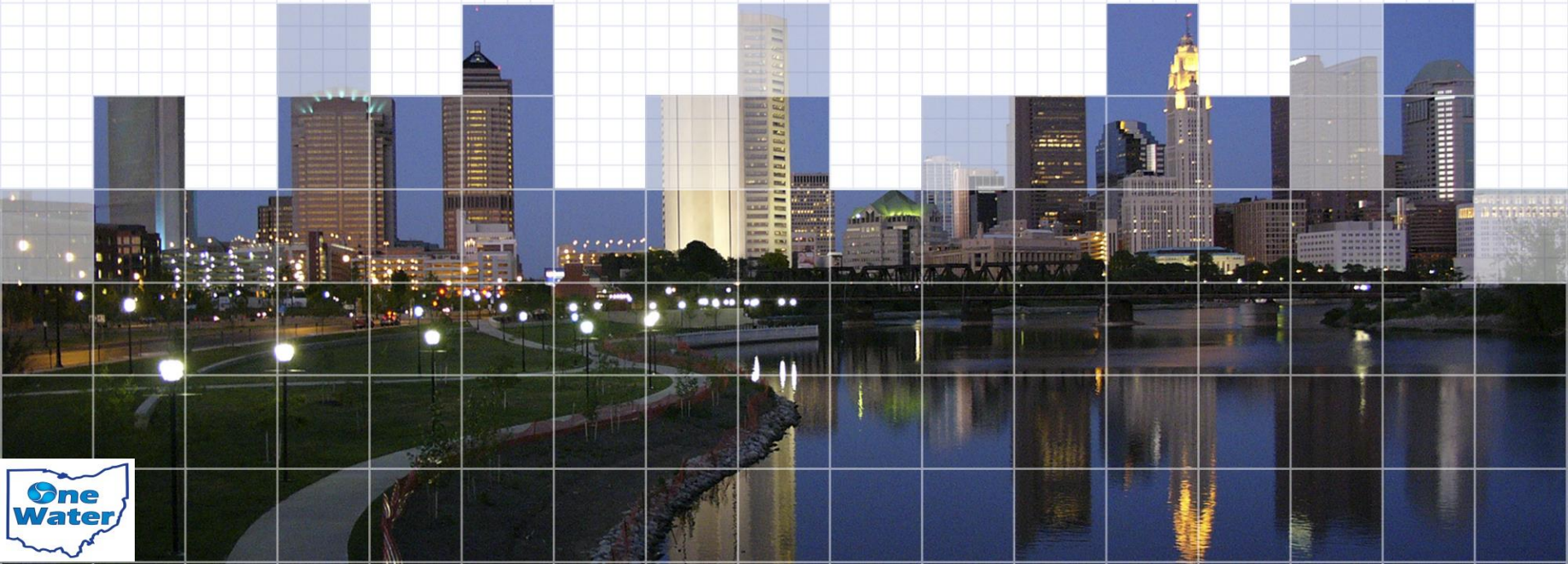


G. Scott Lockhart
City of Columbus
Dublin Road Water Plant

Presentation Topics

- Dublin Road Water Plant
- Project Background/Goals
- Approach
- Methods
- Results

DUBLIN ROAD WATER PLANT



DRWP Watershed

- *Scioto River*
- *Headwaters 80 Miles North of Columbus*
- *Over 1000 sq. mi. of watershed*
  - *primarily rural/agricultural*
- *Griggs & O'Shaughnessy Reservoirs*
  - *6.1 BG storage capacity*
- *Upground Reservoir*
  - *9.5 BG storage capacity*

Existing Site Plan

Plant Treatment Goals

- Total Hardness: 120 mg/L to 125 mg/L as $CaCO_3$
- Alkalinity: >35 mg/L as $CaCO_3$
- Total Organic Carbon (TOC): <2.0 mg/L
- Nitrate: < 10 mg/L as N
- Atrazine: <2.5 ppb (MCL= 3.0 ppb)
- Stage 2 DBP Compliance:
  - Target 80% of Location Running Annual Average (LRAA) and Operational Evaluation Level
- Comply with all primary drinking water regulations
- Taste and Odor

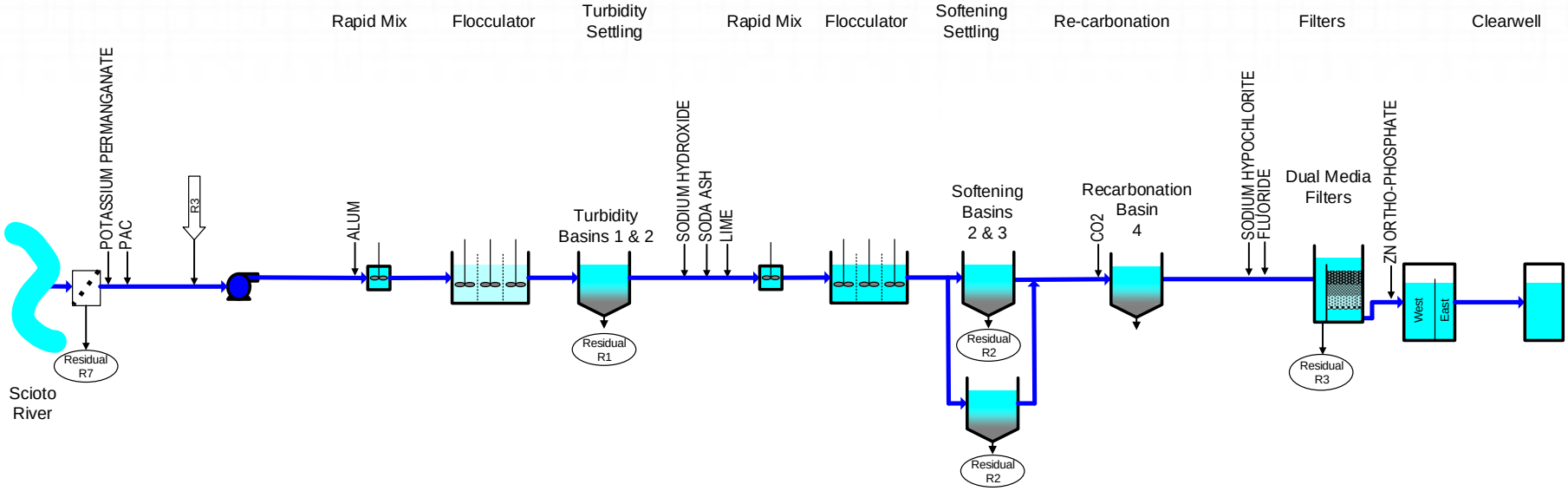
DRWP RAW WATER PARAMETERS

	MINIMUM	MAXIMUM	AVERAGE	MEDIAN
TEMPERATURE	31	86	57	57
HARDNESS	76	384	243	250
ALKALINITY	52	248	149	151
TURBIDITY	1	747	44	20
TOC	2	14	7	6

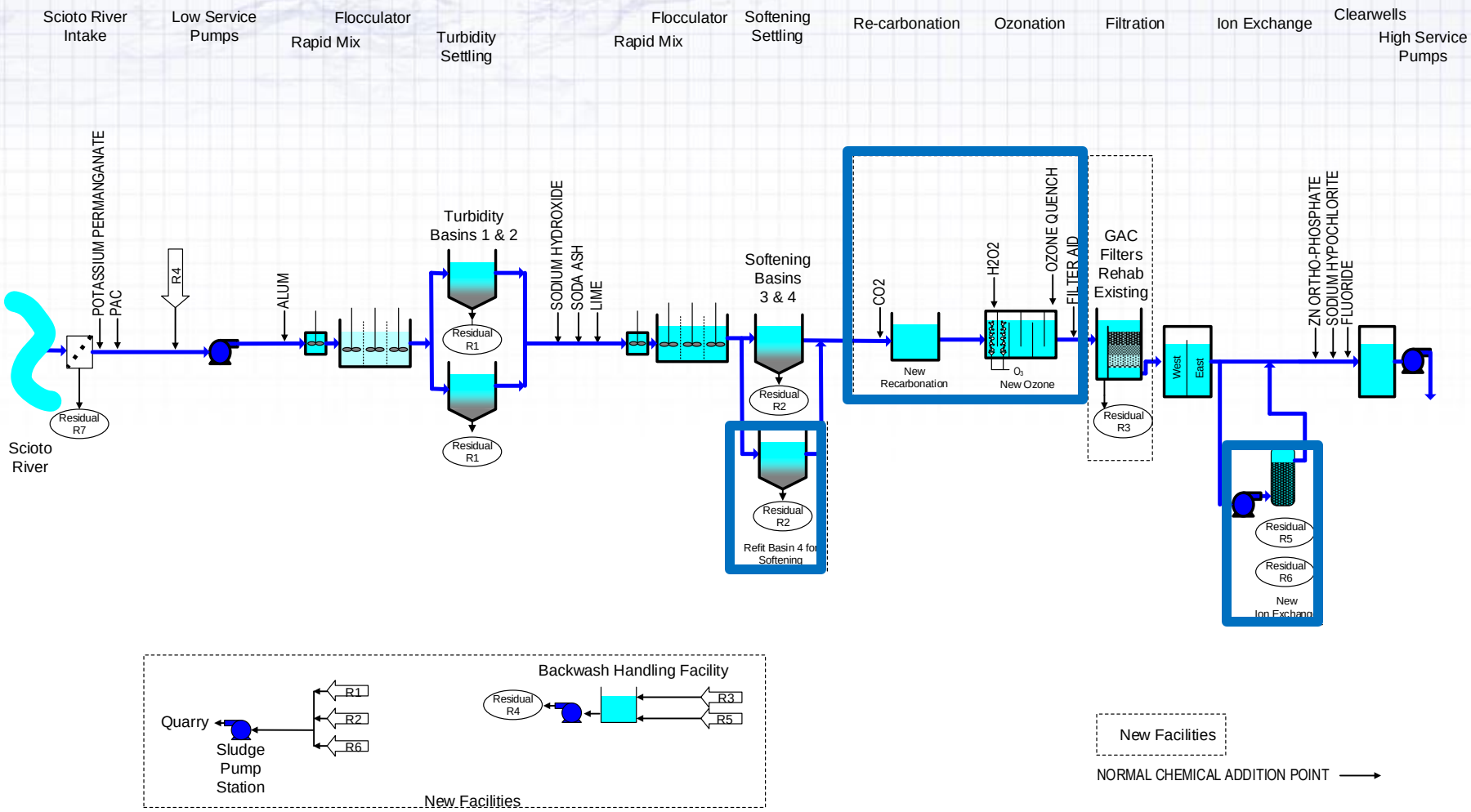
8.5 Years of Data

Existing Treatment Plant

- Scioto River
- Conventional Lime Softening Plant
- 65 MGD Capacity



DRWP Revised Process Flow Diagram



5/15/2013

PROJECT BACKGROUND/GOALS

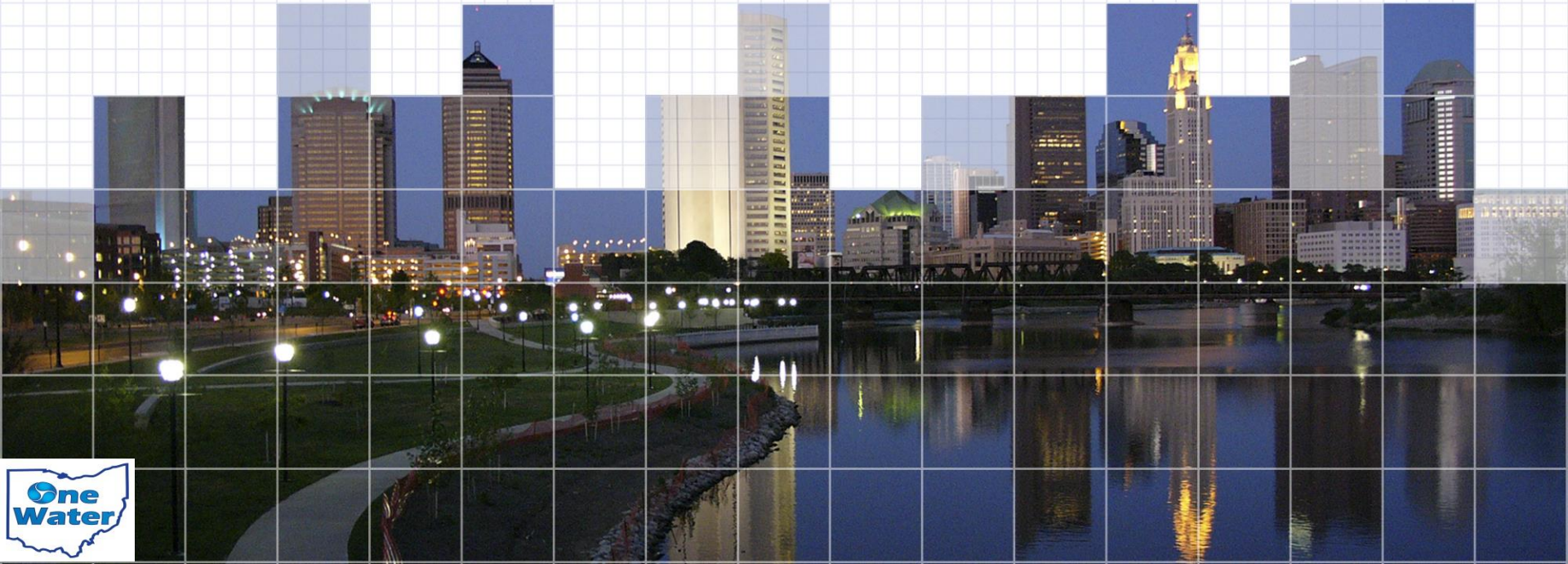


Figure B: Coagulated & Clarified Water Quality for 2/22/07-3/31/07

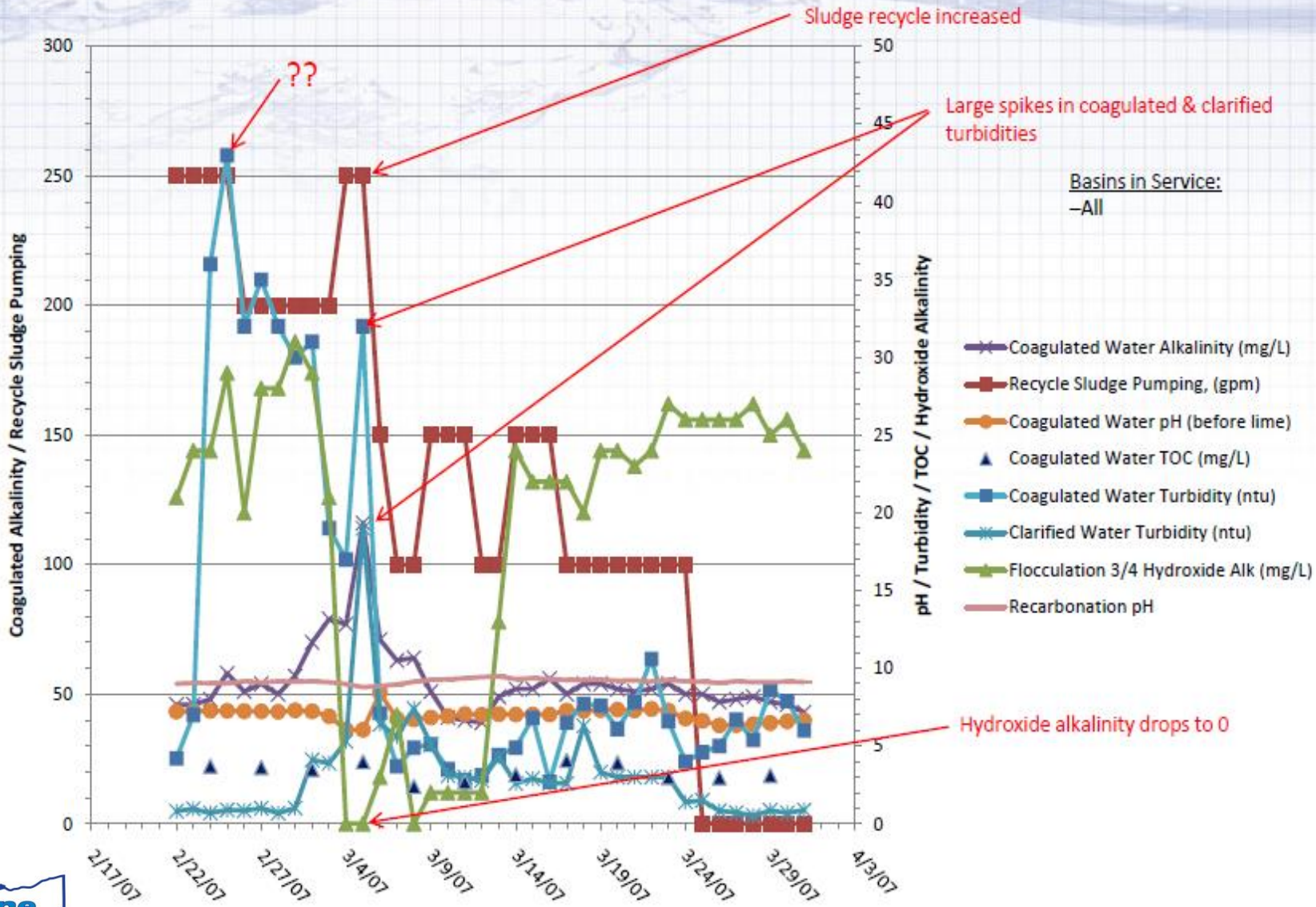
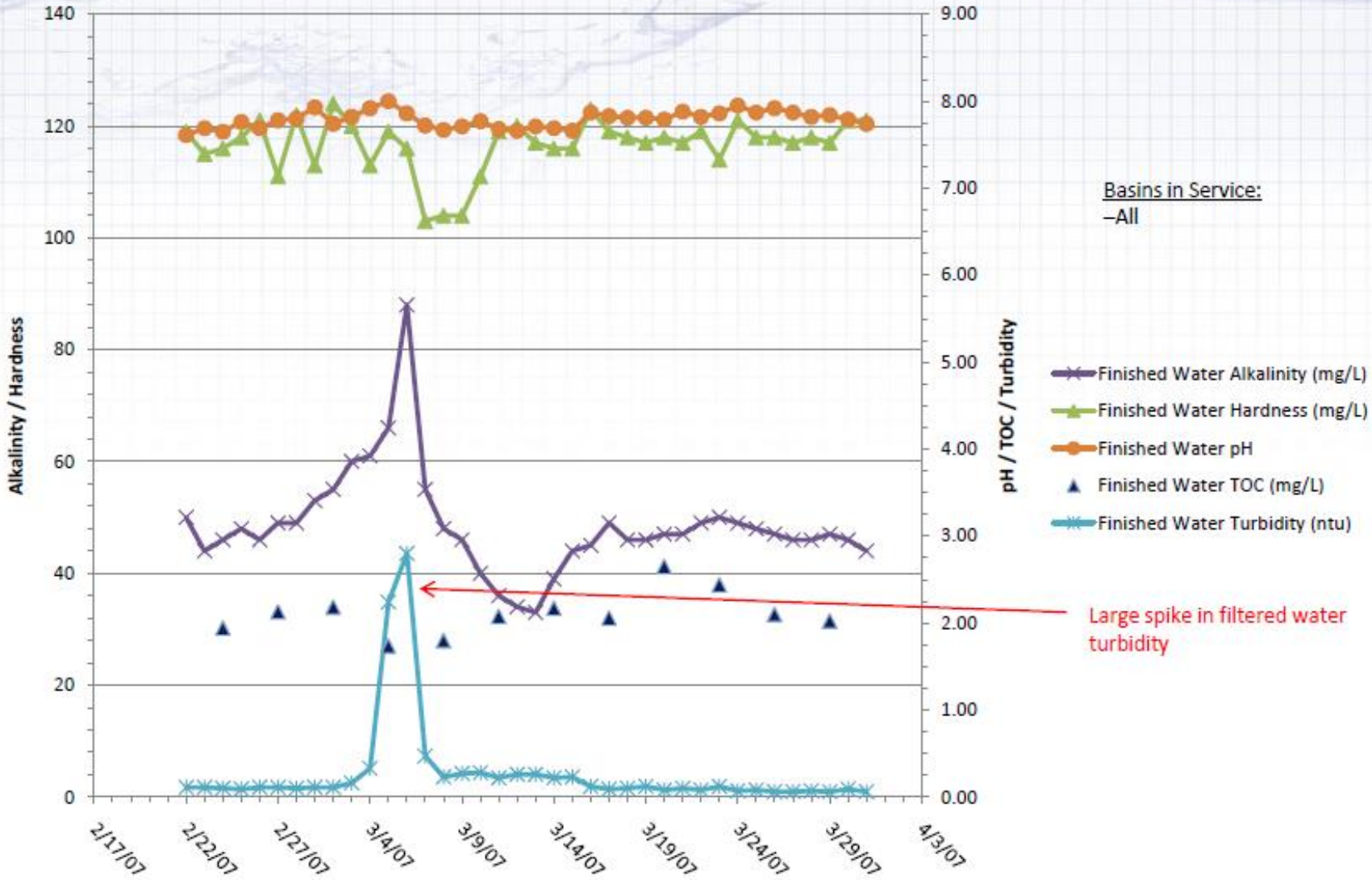


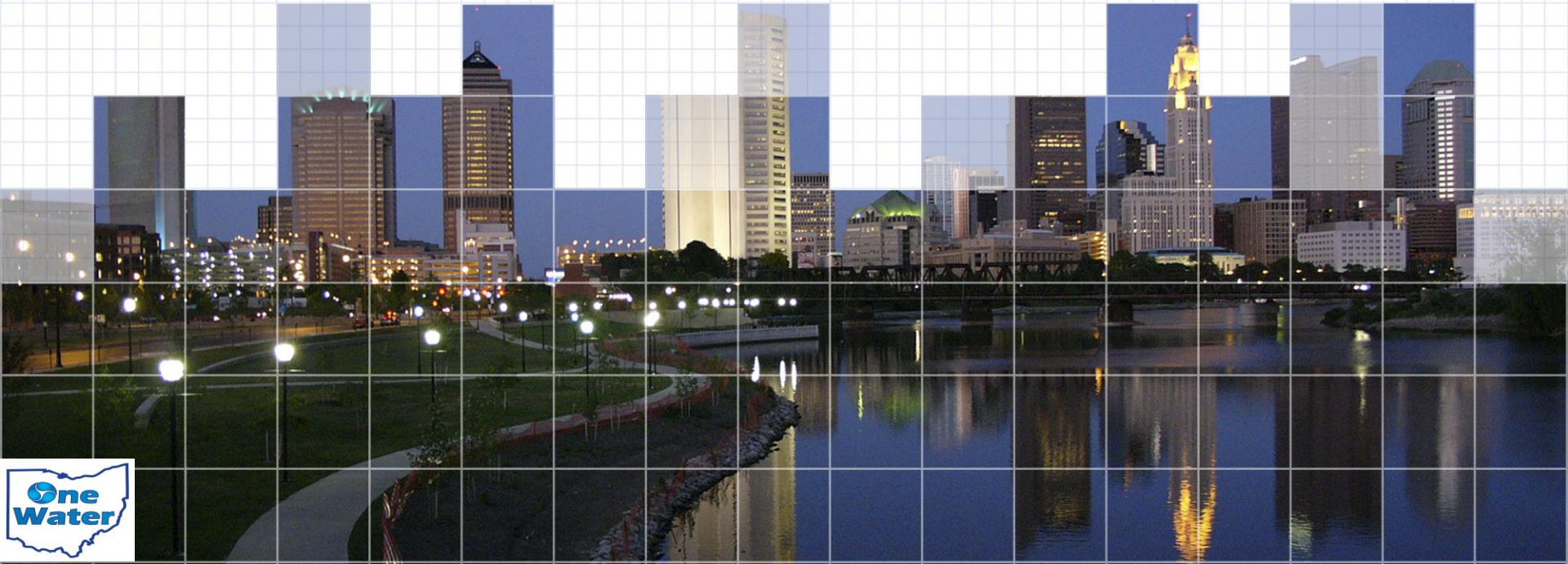
Figure D: Finished Water Quality for 2/22/07-3/31/07



Project Goals and Objectives

- Provide Operations Staff with Tools Required
  - Cold Water Concern
  - Rapid Changes in Raw Water Quality
- Additional Tools Considered
  - *Filter Aid Polymer*
  - *Coagulant Aid Polymer*
- Critical Issues to be Considered
  - Costs
  - Ease of Operations
  - Full time operations **NOT** required

FILTER AID POLYMER



Bench Scale

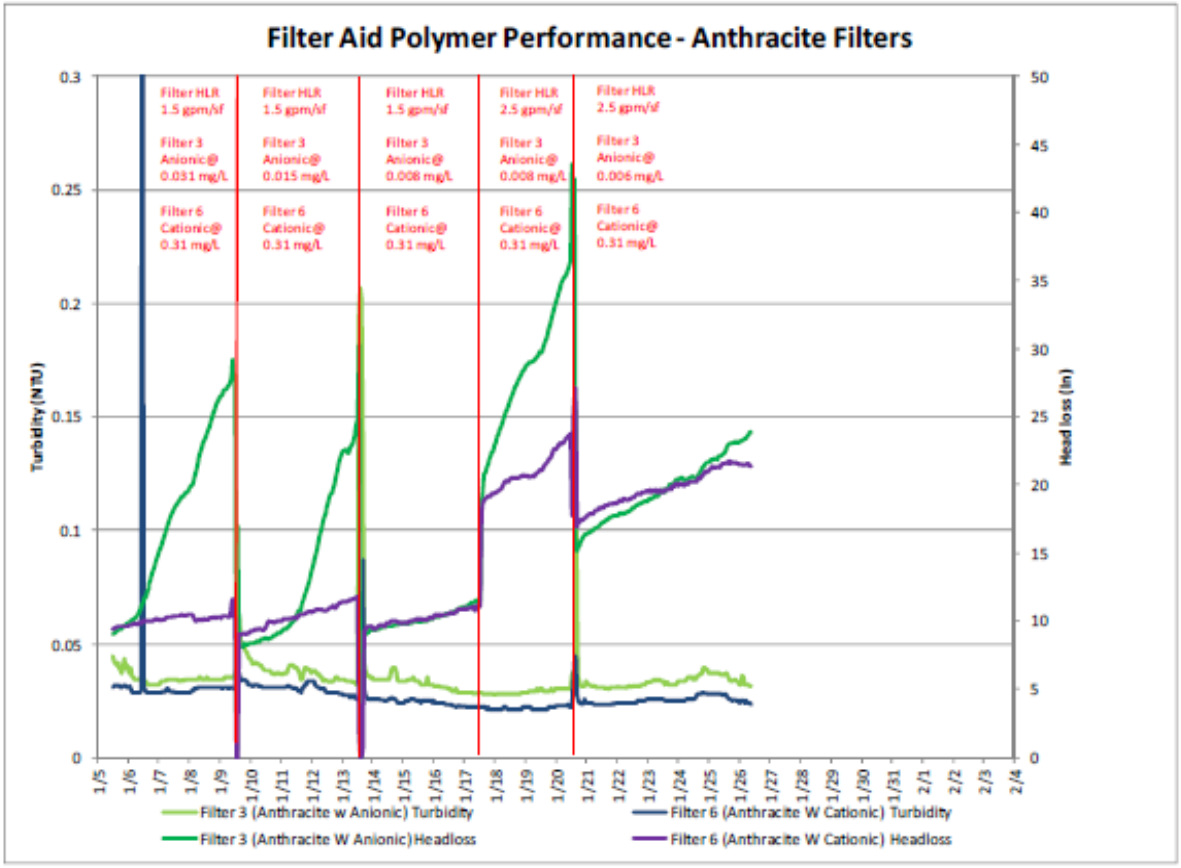
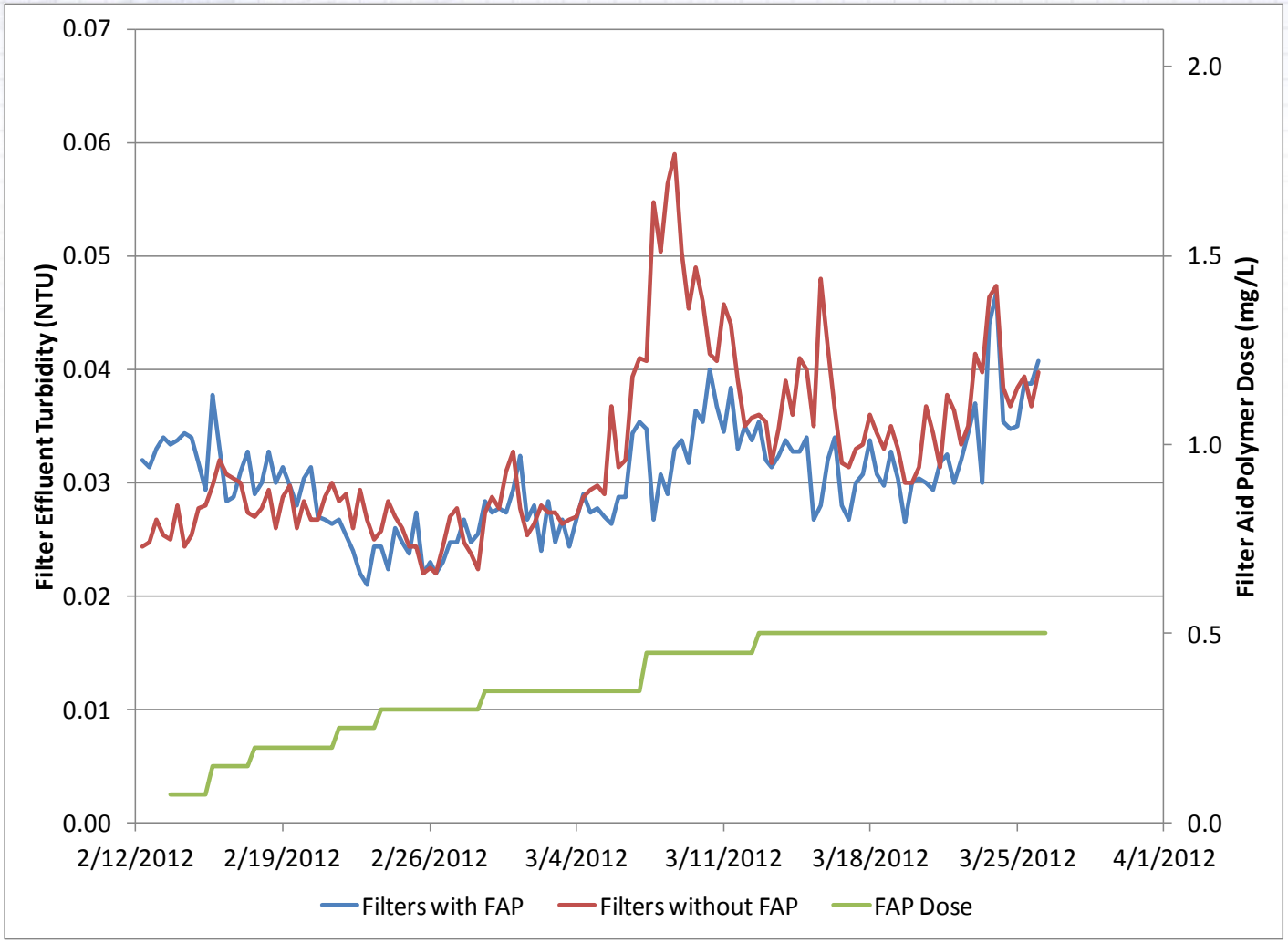
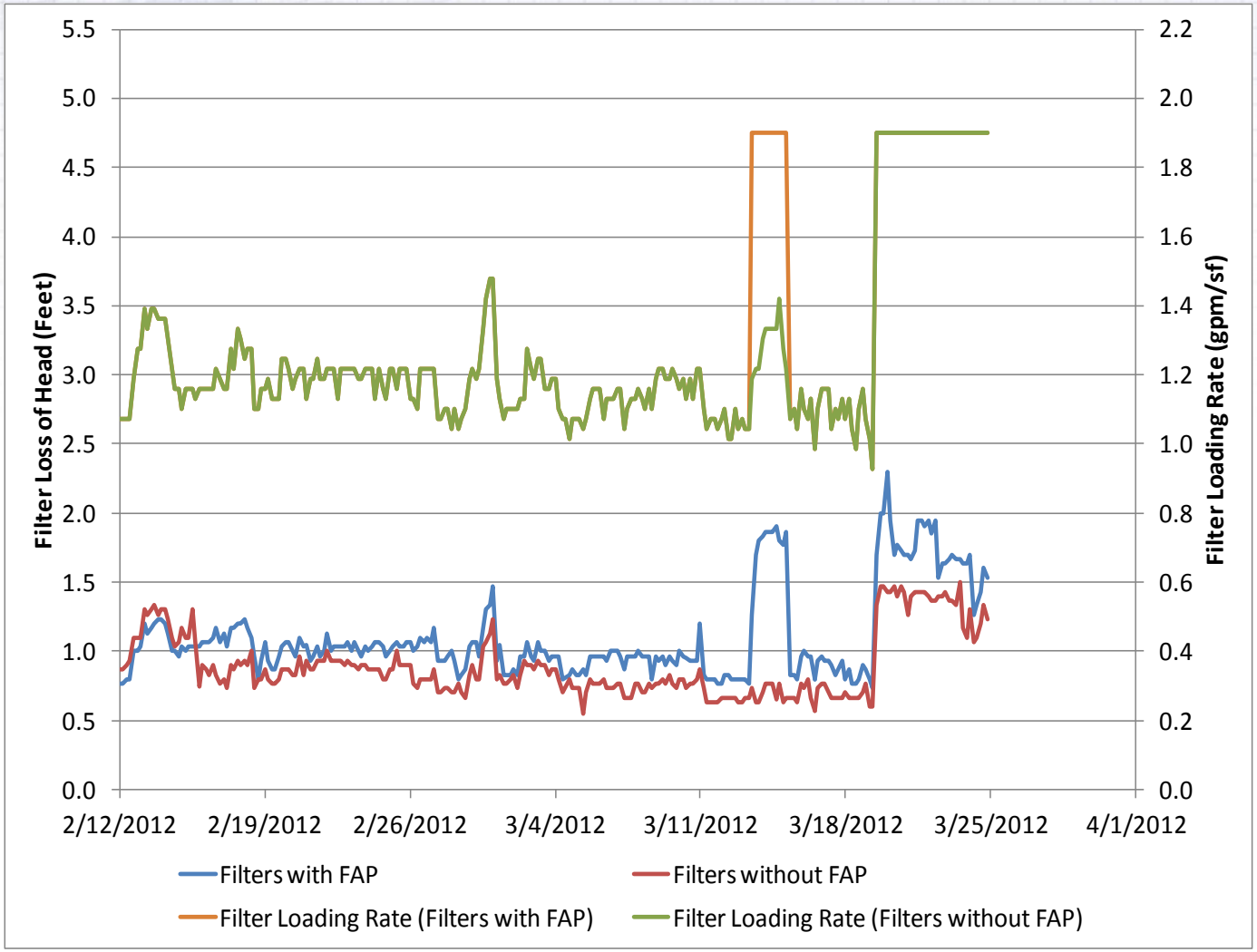


FIGURE 1

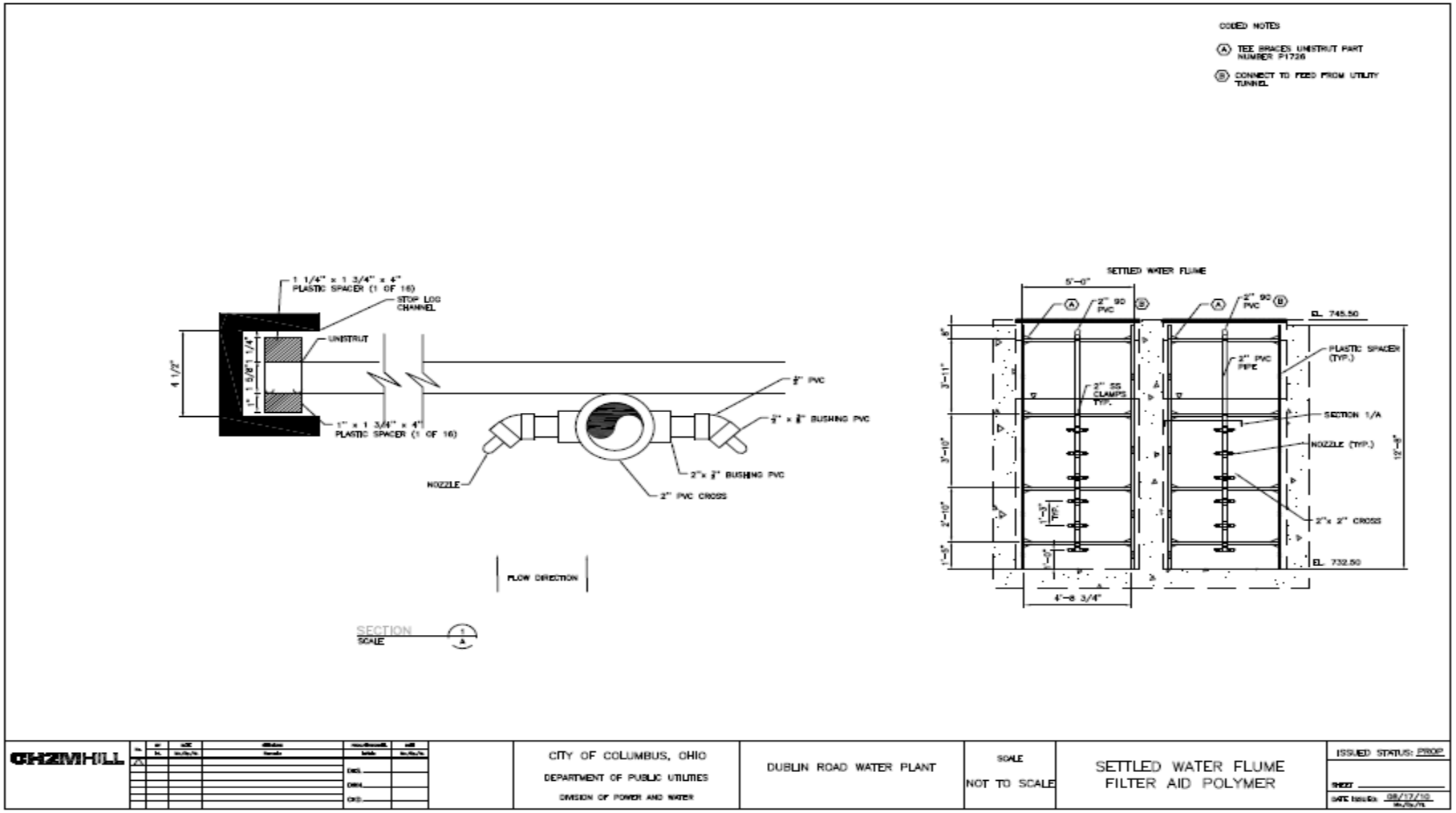
Full Scale Testing



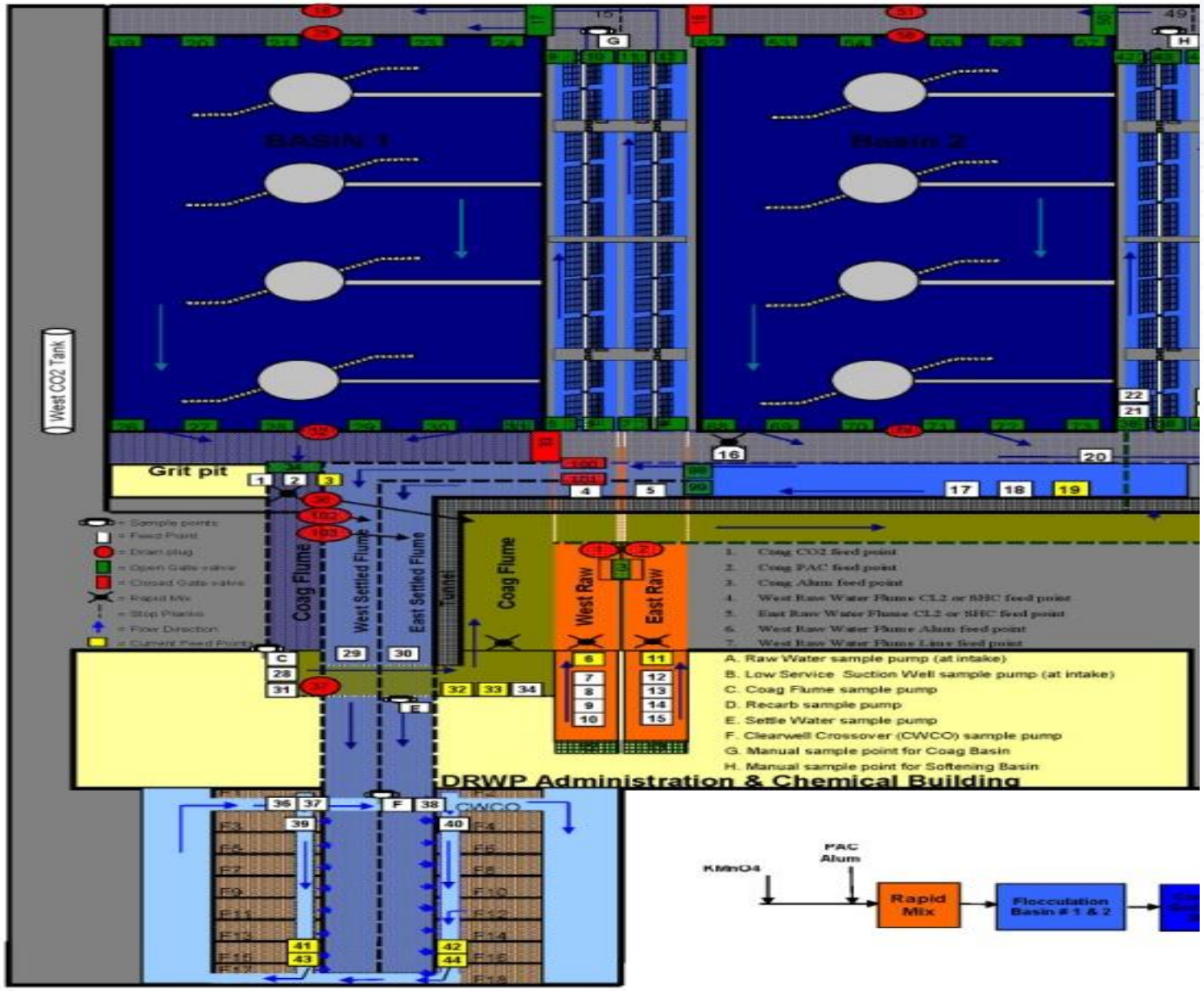
DRWP Full Scale Filter Aid Test – Filter Loss of Head and Filter Rate



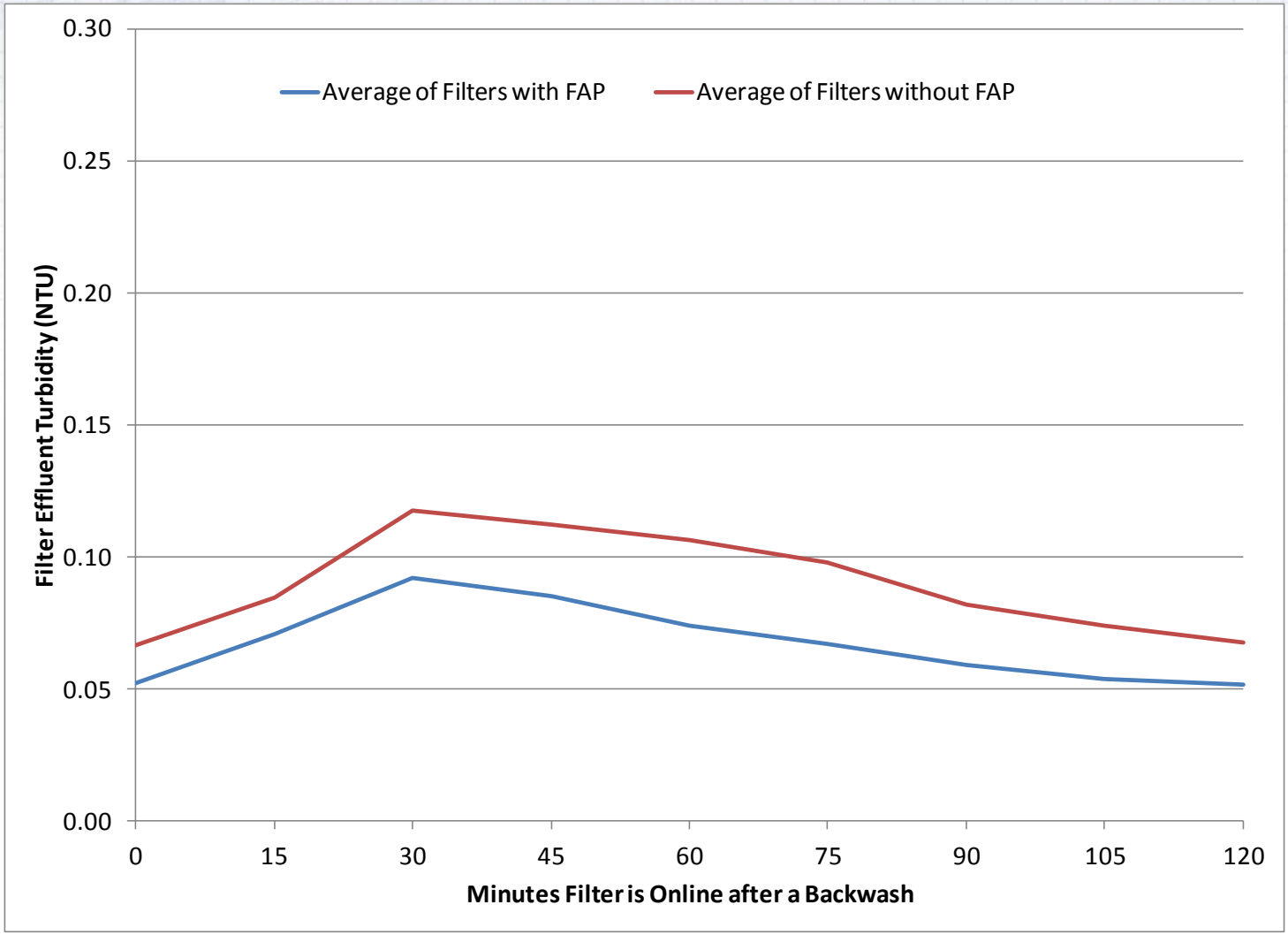
Diffuser Layout



Filter Full Scale Testing Layout

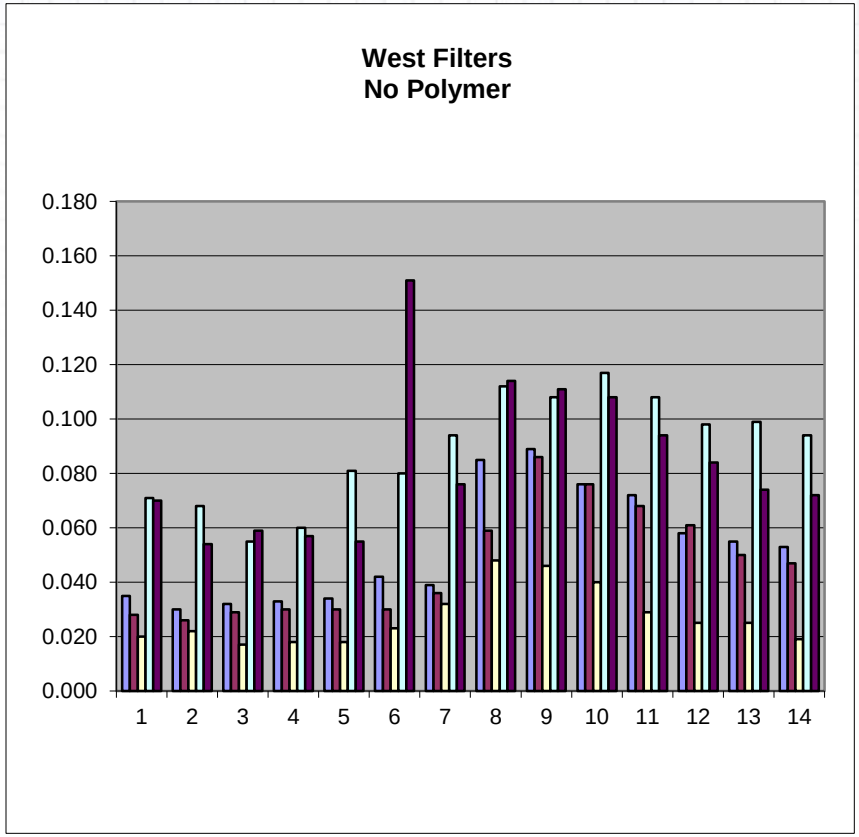


DRWP Full Scale Filter Aid Test – Filter Turbidity after Backwash (Start of Filter Run)

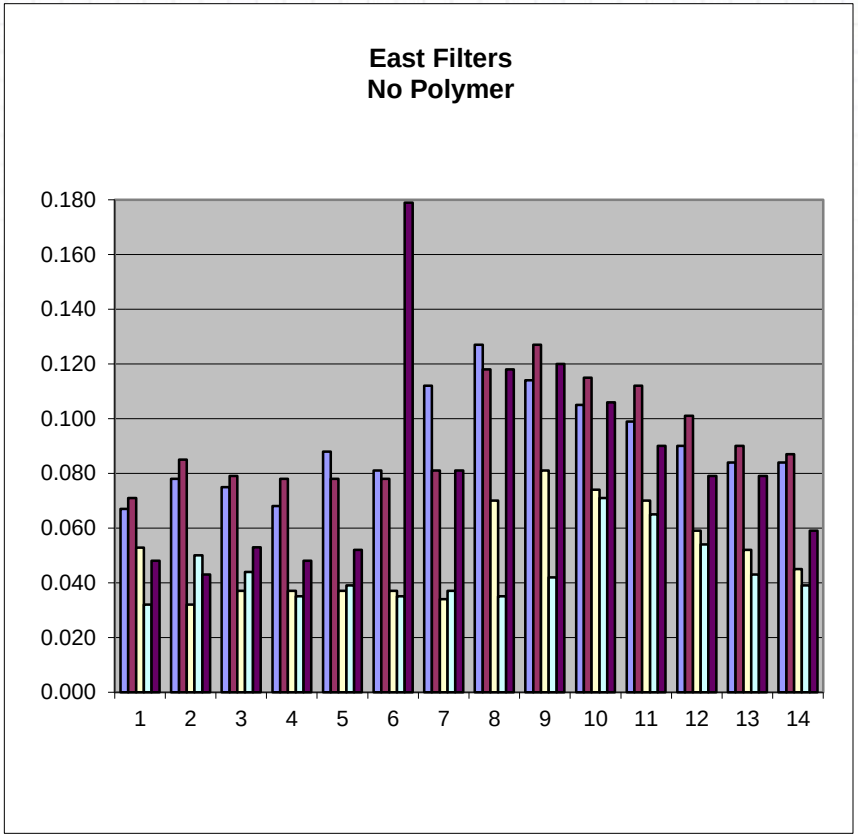


Filter Ripening – 2 Hrs. after backwash

West Filters - No Polymer

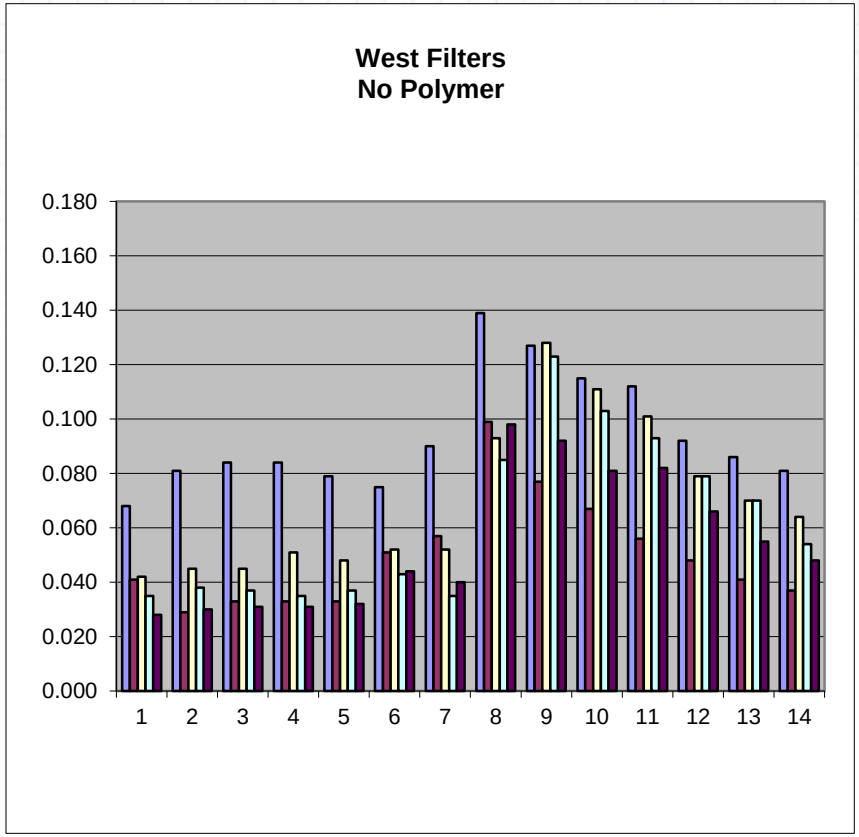


East Filters – No Polymer

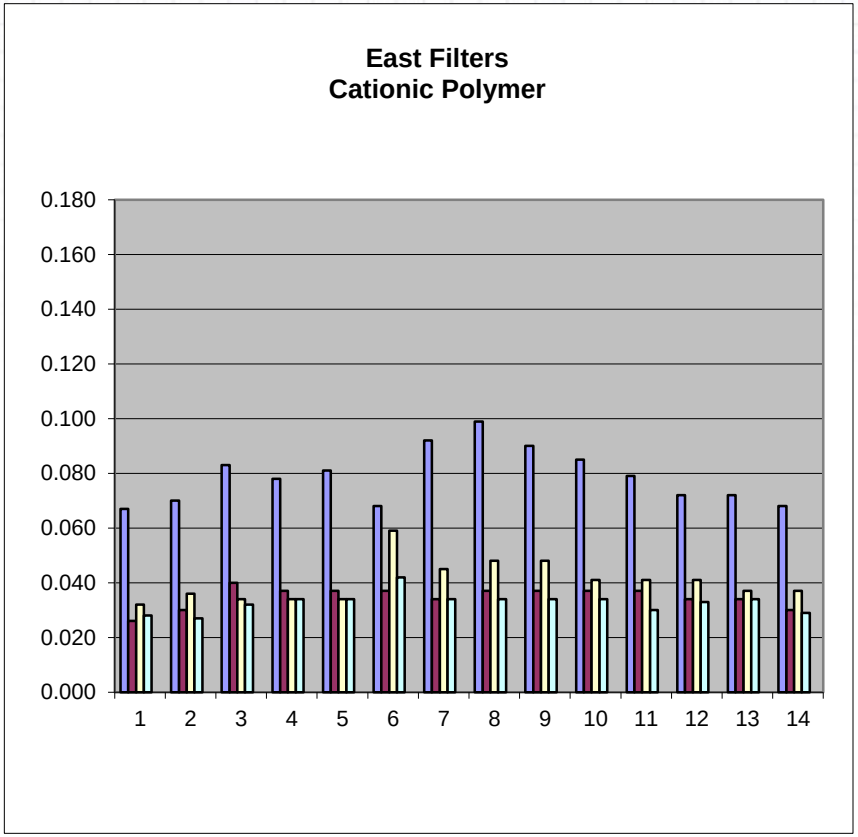


Filter Ripening – 2 Hrs. after backwash

West Filters - No Polymer



East Filters – Cationic Polymer

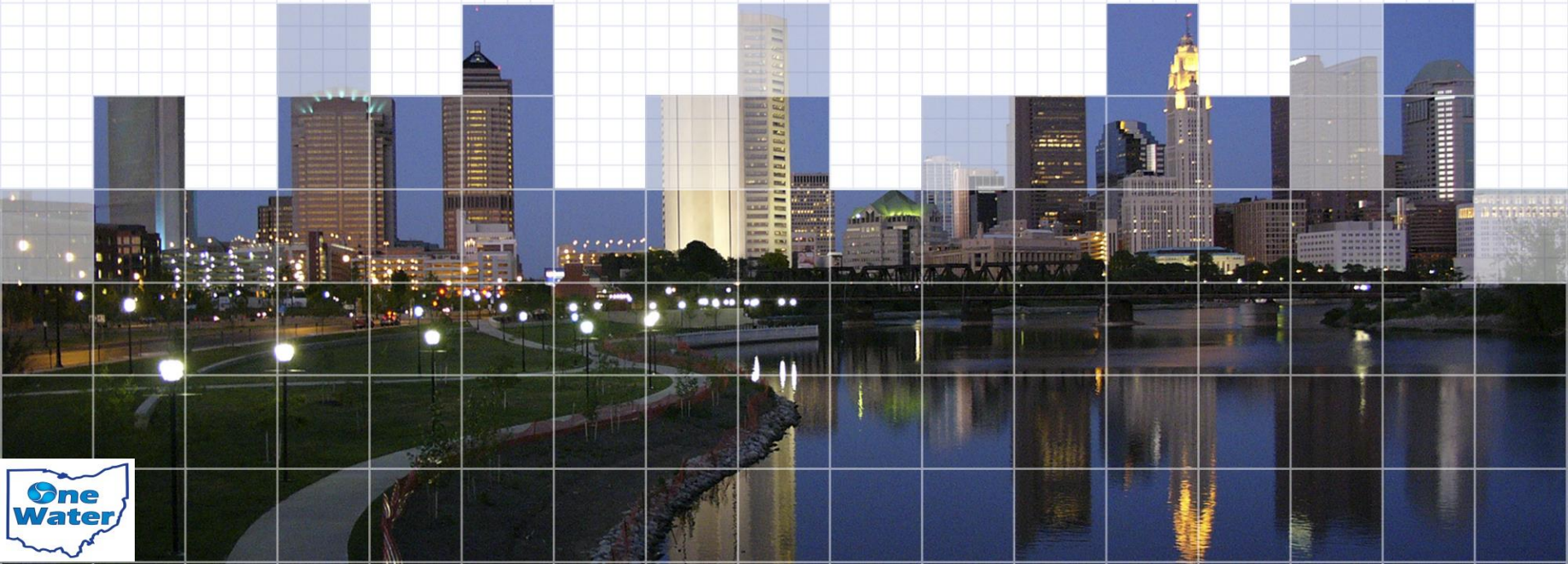


CONCLUSIONS

- Improvements in filtered water turbidity with the addition of polymer
- Filter headloss increase with polymer addition
- Anionic, Cationic or Nonionic polymers?

FULL SCALE TEST EQUIPMENT

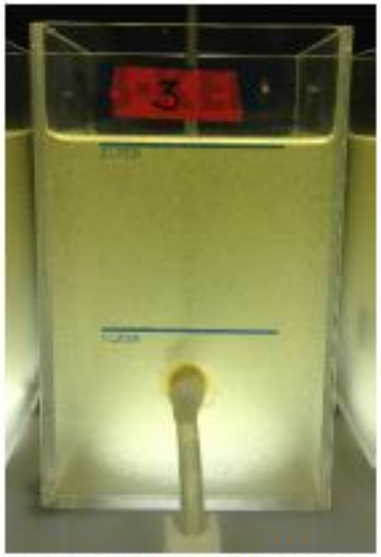
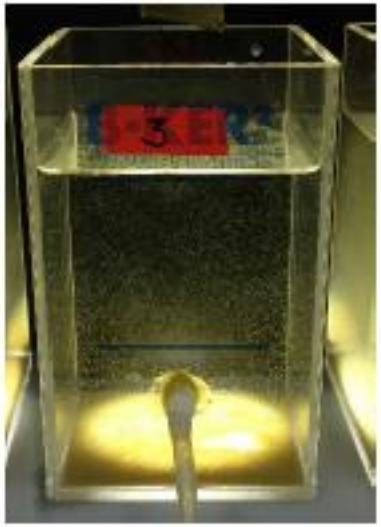
COAGULANT AID POLYMER

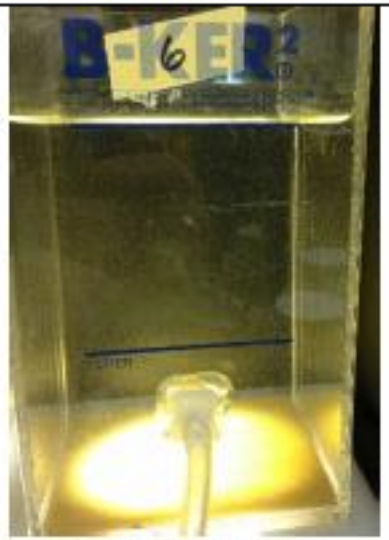


Jar Test Mixing Speeds

Mix Segment	Duration*	Speed 1
Rapid Mix	15 Seconds	300 RPM
Raw Water Flume (Rapid Mix to Floc 1&2)	4 minutes 15 seconds	150 RPM
Floc 1&2	55 minutes 30 seconds	38 RPM

Durations calculated based upon plant flow of 53 mgd

	@2.0 mg/L (Nalco 8102 Plus) *Jar Test 4-6*	Polymer @0.75 mg/L (Polydyne A-6340) *Jar Test 12-6*	@0.75 mg/L (Polydyne A-6320) *Jar Test 12-2*	@0.5 mg/L (Nalco 8181) *Jar Test 11-3*	@0 (Kemi Jar
tion	 End of Flocculation	 End of Flocculation	 End of Flocculation	 End of Flocculation	End of F
	 minutes into	 8 minutes into	 8 minutes into	 8 minutes into	8 minut

	Cationic Polymer @2.0 mg/L (Nalco 8102 Plus) *Jar Test 4-6*	High Charge Anionic Polymer @0.75 mg/L (Polydyne A-6340) *Jar Test 12-6*	Very Low Charge Anionic Polymer @0.75 mg/L (Polydyne A-6320) *Jar Test 12-2*	Nonionic Polymer @0.5 mg/L (Nalco 8181) *Jar Test 11-3*	Nonio @ (Kem *Jar*
	 30 minutes into settling period	 30 minutes into settling period	 30 minutes into settling period	 30 minutes into settling period	 30 minu settling
	 0 minutes into settling period	 60 minutes into settling period	 60 minutes into settling period	 60 minutes into settling period	 60 minu settling

Bench Scale Testing Results

POLYMER	EXPECTED POYMER DOSE	pH	Turbidity (NTU)	Partical Counts (Per 100 mL)	UVT (%/cm)	TOC (mg/L)	TOC Removal %	Color Units
Alum without polymer	NA	6.75	2.7	5171	77.8%	3.99	51.2	21
(1) Nonionic polymer	0.25 mg/L	6.76	0.27	97	80.2%	3.74	54.3	9
(2) Nonionic polymer	0.5 mg/L	6.76	0.70	194	79.6%	4.03	50.7	11
Anionic	0.75 mg/L	6.77	0.89	789	79.6%	3.75	54.2	11

Chemical Consumption and Cost

	Polymer	Expected Dose	Average Daily	Average Annual	Average Annual
			Consumption @ 67 mgd	Consumtion	Chemical Cost
			(ppd)	(lbs)	($)
	(1) Nonionic polymer	0.25 mg/L	140	51,100	$66,000
	(2) Nonionic polymer	0.50 mg/L	280	102,200	$203,000
	Anionic polymer	0.75 mg/L	420	153,300	$153,000

FILTER / COAGULANT AID POLYMER FEED SYSTEM

CONCLUSIONS

- Jar Testing setup crucial for accurate results.
- Selecting polymers for full scale testing.
- Results versus Cost.

Questions?

Thank You