Then & Now:

Changes in Tank Design and Operations to Maintain Chlorine Residuals

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1994 TANK RULES

1. Bigger is better
2. Single inlet/outlet
3. Keep the tank full

THE RULES HAVE CHANGED

Outline

1. Regulations
2. Understanding Water Quality
3. Understanding Tanks
4. What is the Problem?
5. Best Practices – AWWA M-68
6. Case Studies
7. What's Everyone Else Doing?

1. Regulations Then…

EPA 1974 Safe Drinking Water Act
1986 Amendment

PA DER
1971 Chapter 109 Safe Drinking Water Code
PA DEP wasn't established until 1995

PA DEP Requirements Now…

Currently:

SW/GUDI sources

Disinfectant residual in system: **0.02 mg/L**

Starting April 29, 2019:

New Disinfection Requirements Rule from Chapter 109

Disinfectant residual in system: **0.2 mg/L**

2. Water Quality

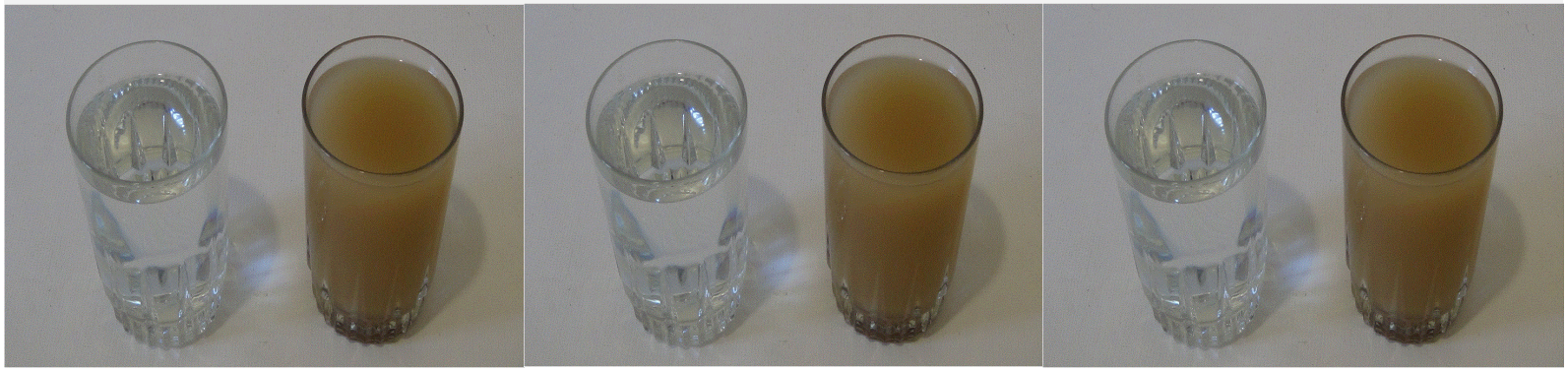
Three Determinants

1. Source Water
2. Treatment
3. Distribution System

Water Age

What is it?

- General indicator
- Average time from treatment facility to any point in the distribution system
- Water quality tends to deteriorate with increasing water age

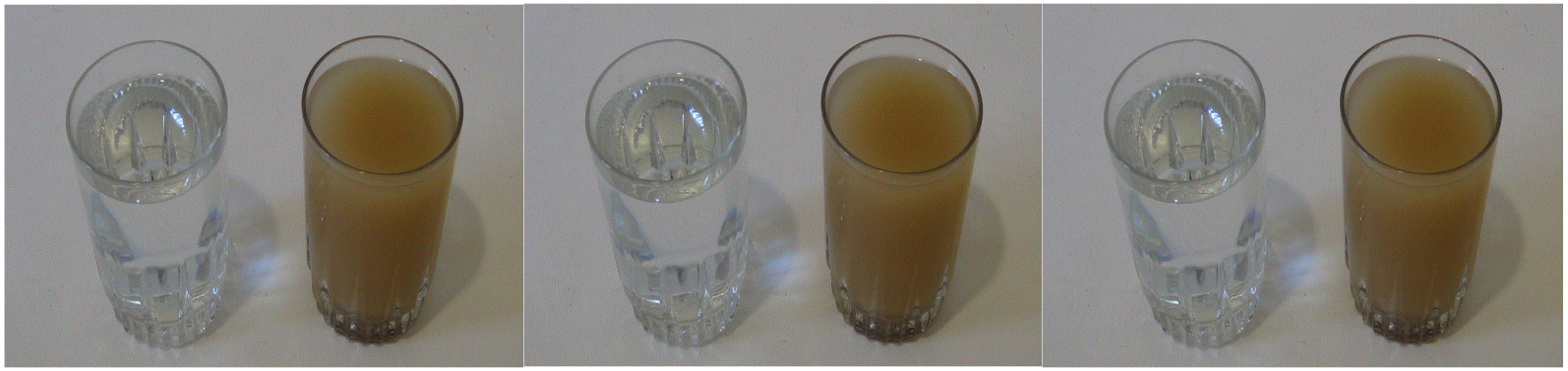


Water Age

What is ideal?

Depends on…

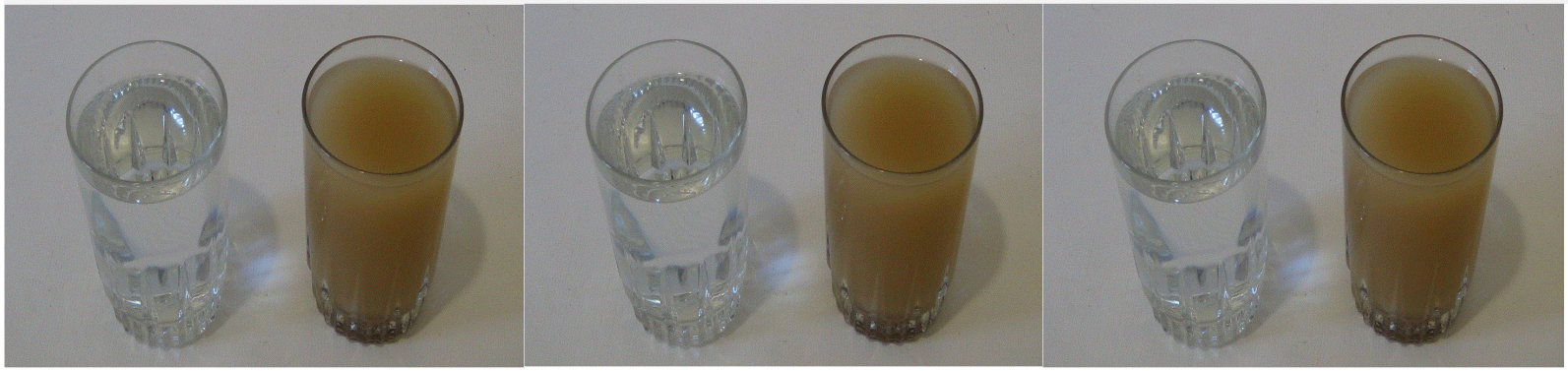
- Source, Treatment, Distribution System
- System Goals
- 5 days (120 hours)



Water Age

Can it be truly measured?

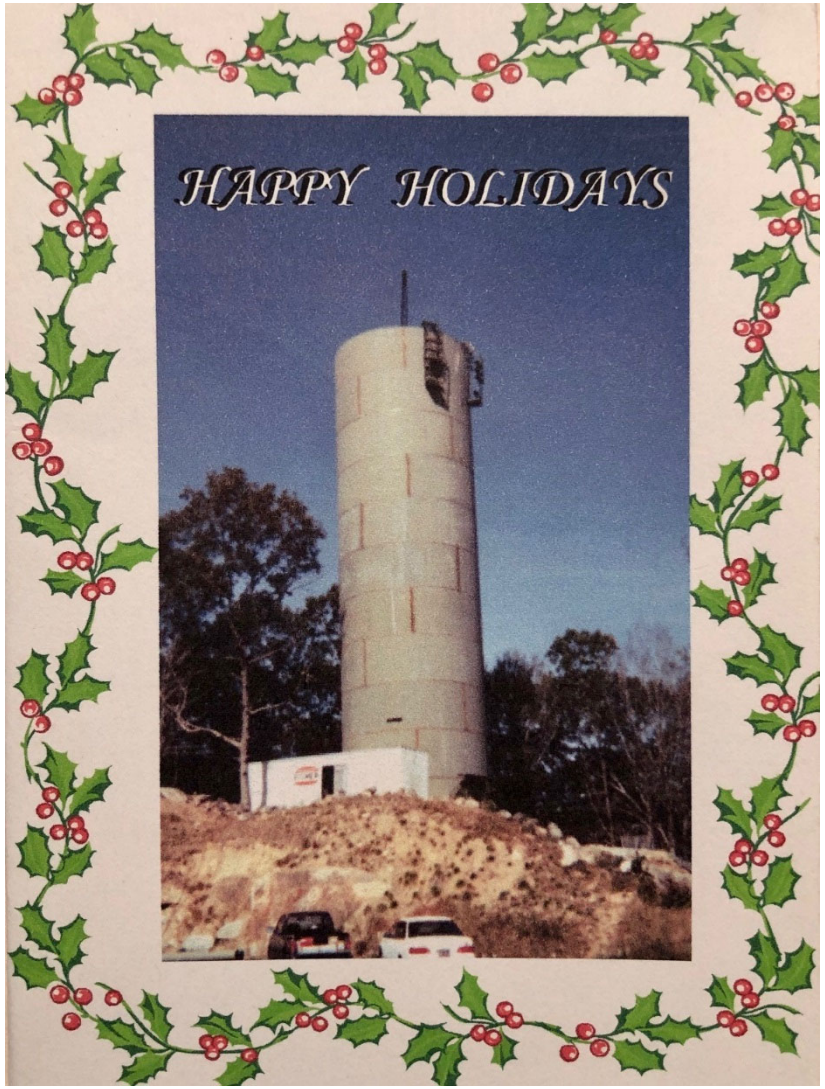
- No
- Can be approximated with varying degrees of accuracy
- Hydraulic Modeling, Tracer Studies, Measured Data



Reduce Water Age in System

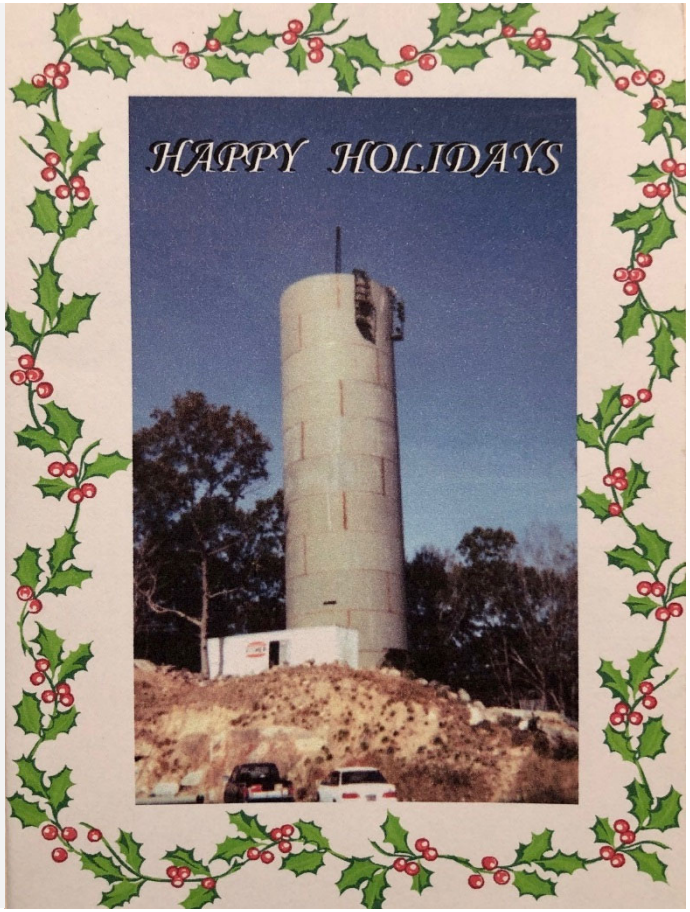
1. Increase demand (i.e. flushing)
2. Reduce volume in the system

3. Understanding Tanks



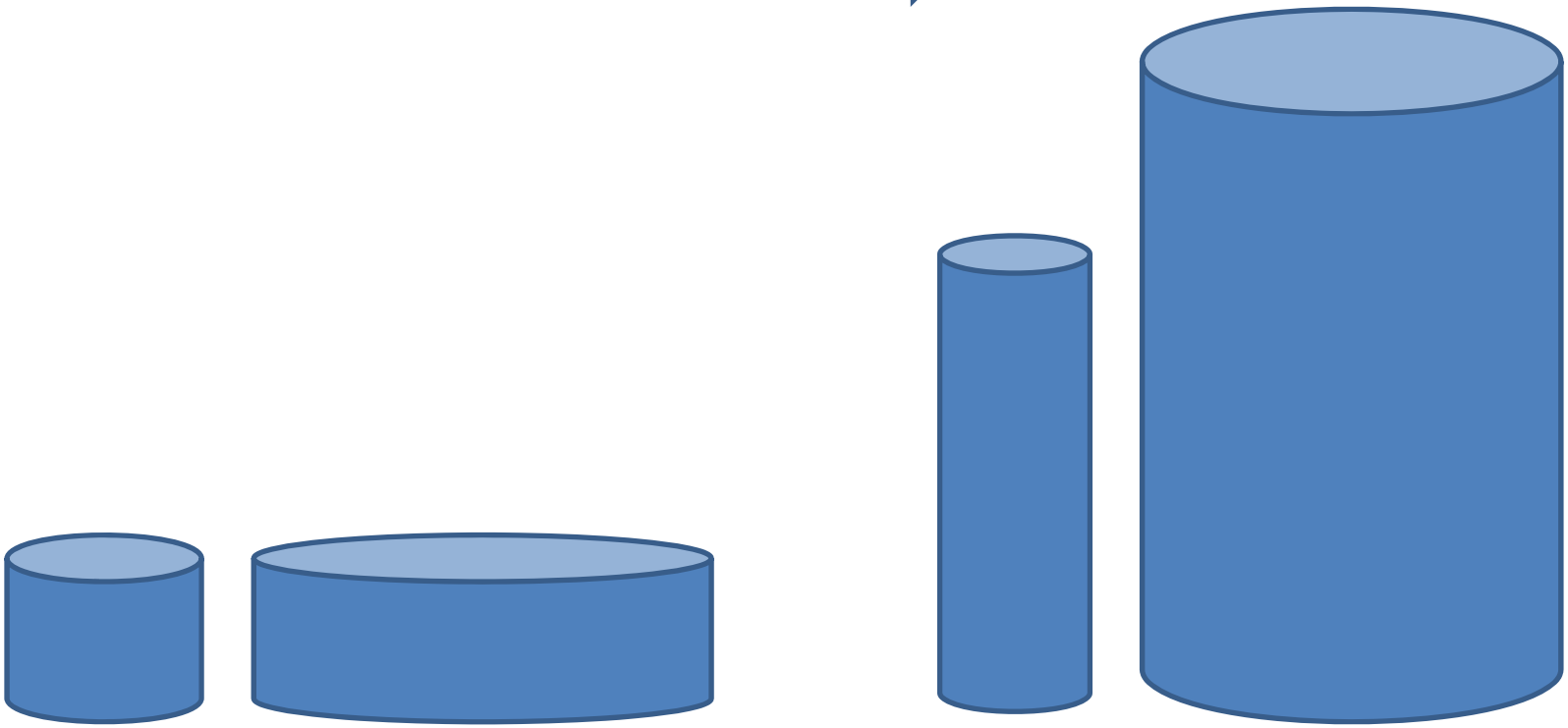
Tank Design Then…

- Hydraulic requirements
- Equalize pressure
- Balance water use during the day
- Emergency storage, fire protection
- Bigger is better
- Future growth

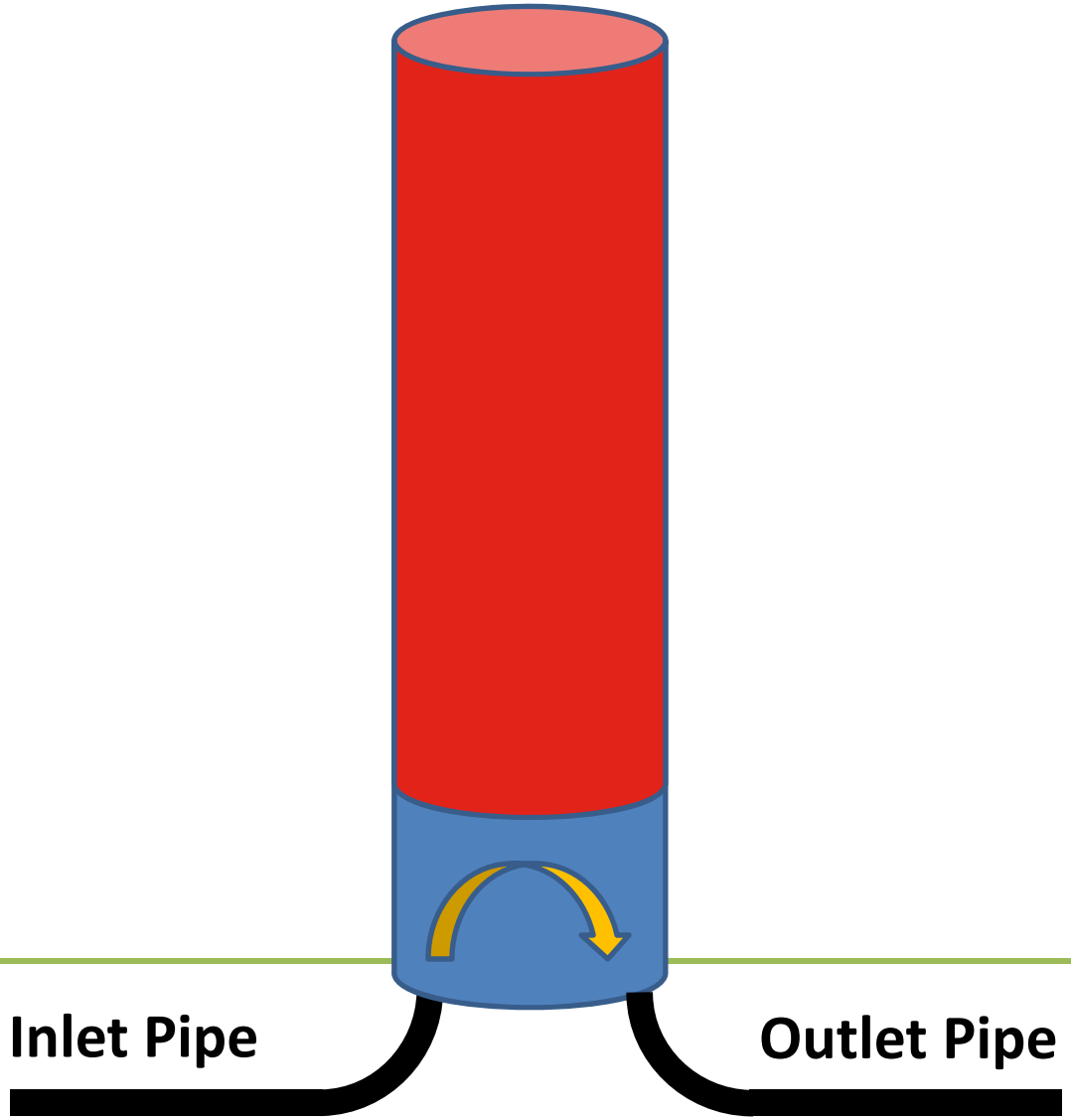


Tank Design Mixing

EASY → **HARD**



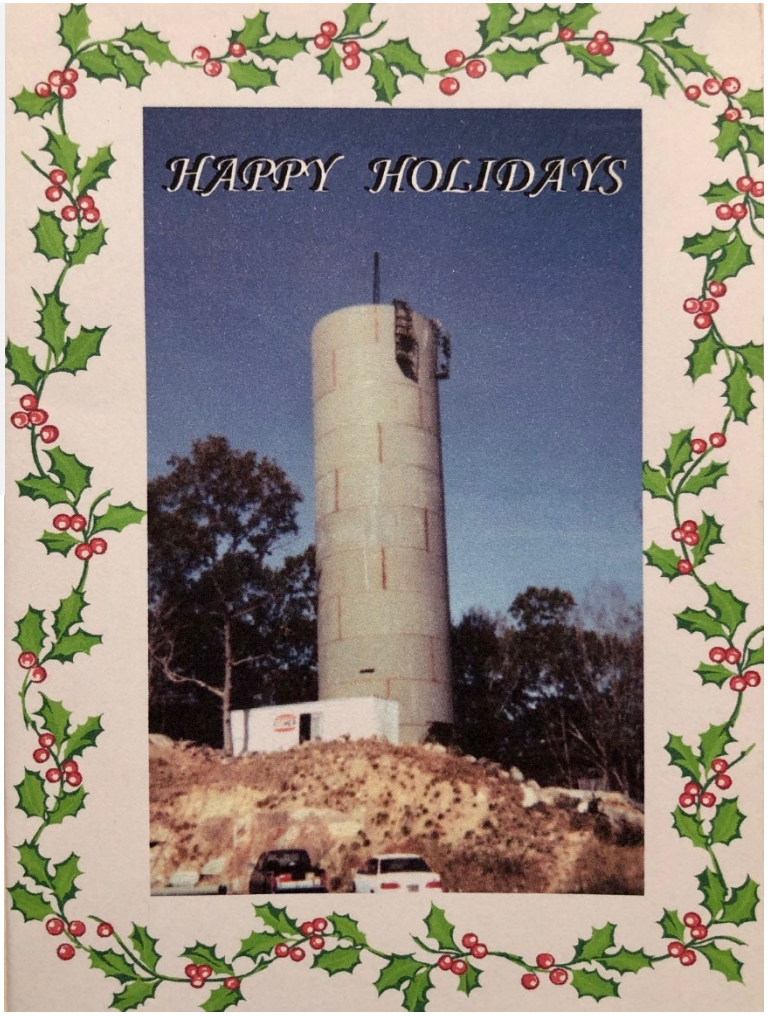
Reservoirs **Standpipes**



Standpipe

Tank Design Now…

- Hydraulic requirements
- Equalize pressure
- Balance water use during the day



Tank Design Now…

- Find alternate solutions for fire protection.
- Right sized is better
- Demo old tanks
- Elevated tanks, not standpipes
- Don’t build assuming future growth
- Usage still decreasing

Mixers Then…

Mixers What can they do?

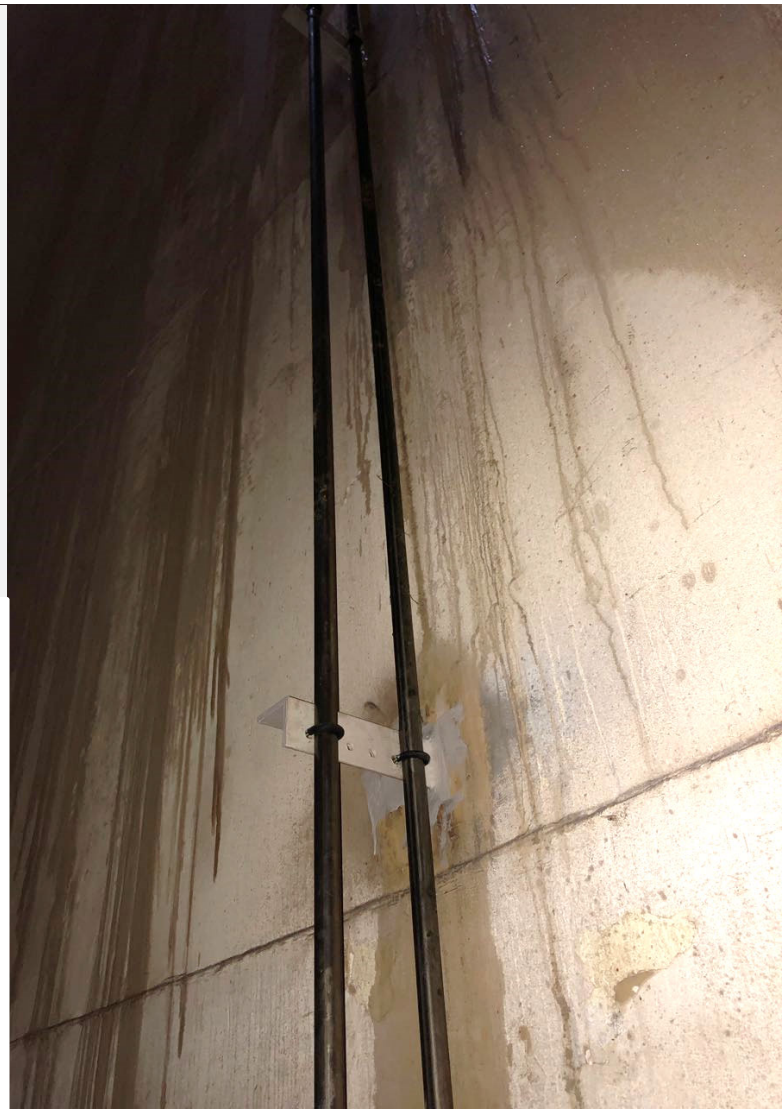
- ☑ Move water in the tank
- ☑ Inject chemicals
- ☑ Prevent or minimize freezing
- ☒ Reduce water age

Don’t Forget Your PA DEP Permits!!

- Permit for mixer
- New higher fees
- Permit for changes in treatment
- Delays in Permit review?

Mixers Now…

- Most tanks – old & new
- Passive and active
- Costs have gone down
- Options have grown*
- Still in its infancy



Operations Then…

- Keep the tanks full
- Keep them in service

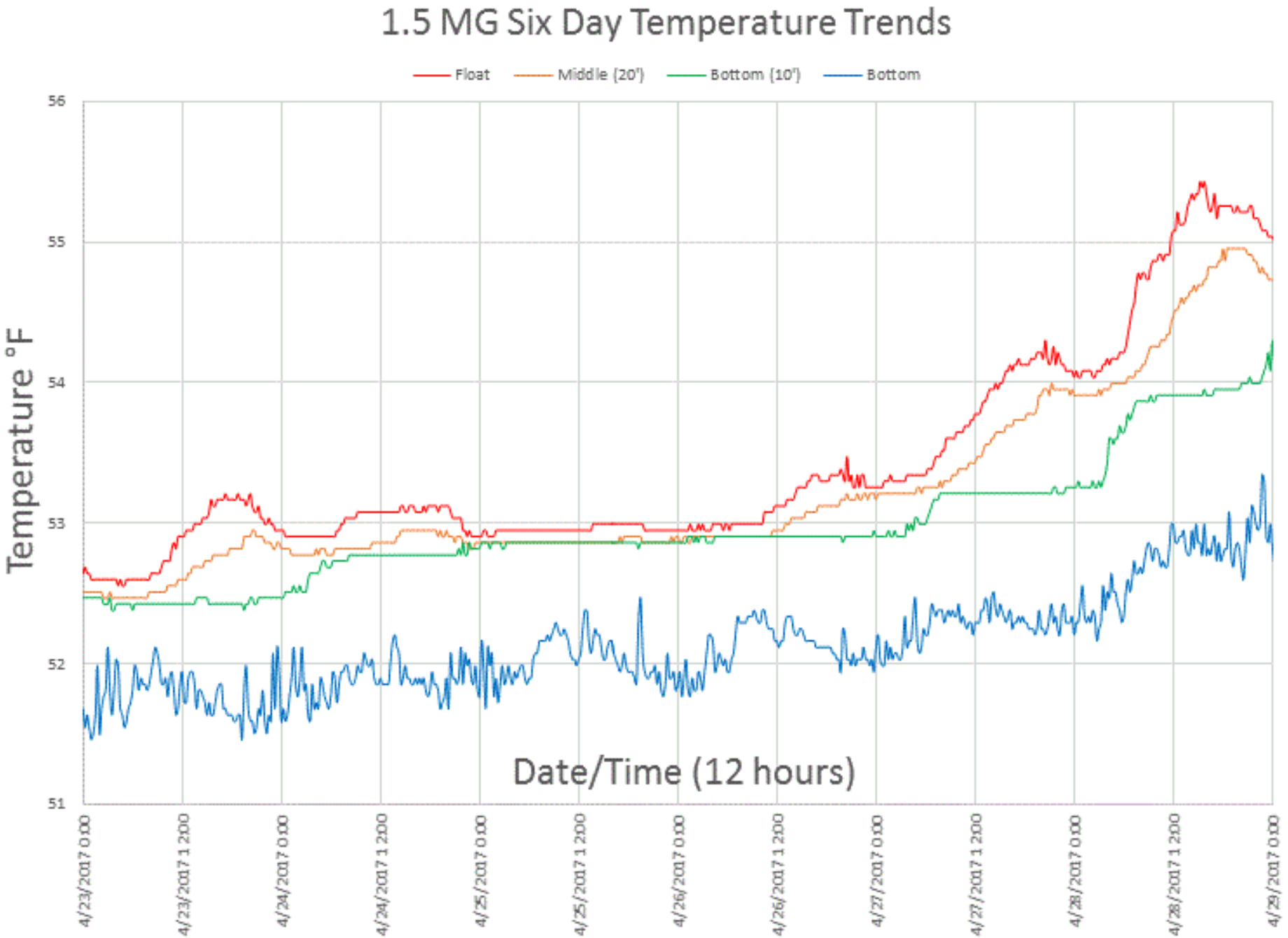
Operations Now…

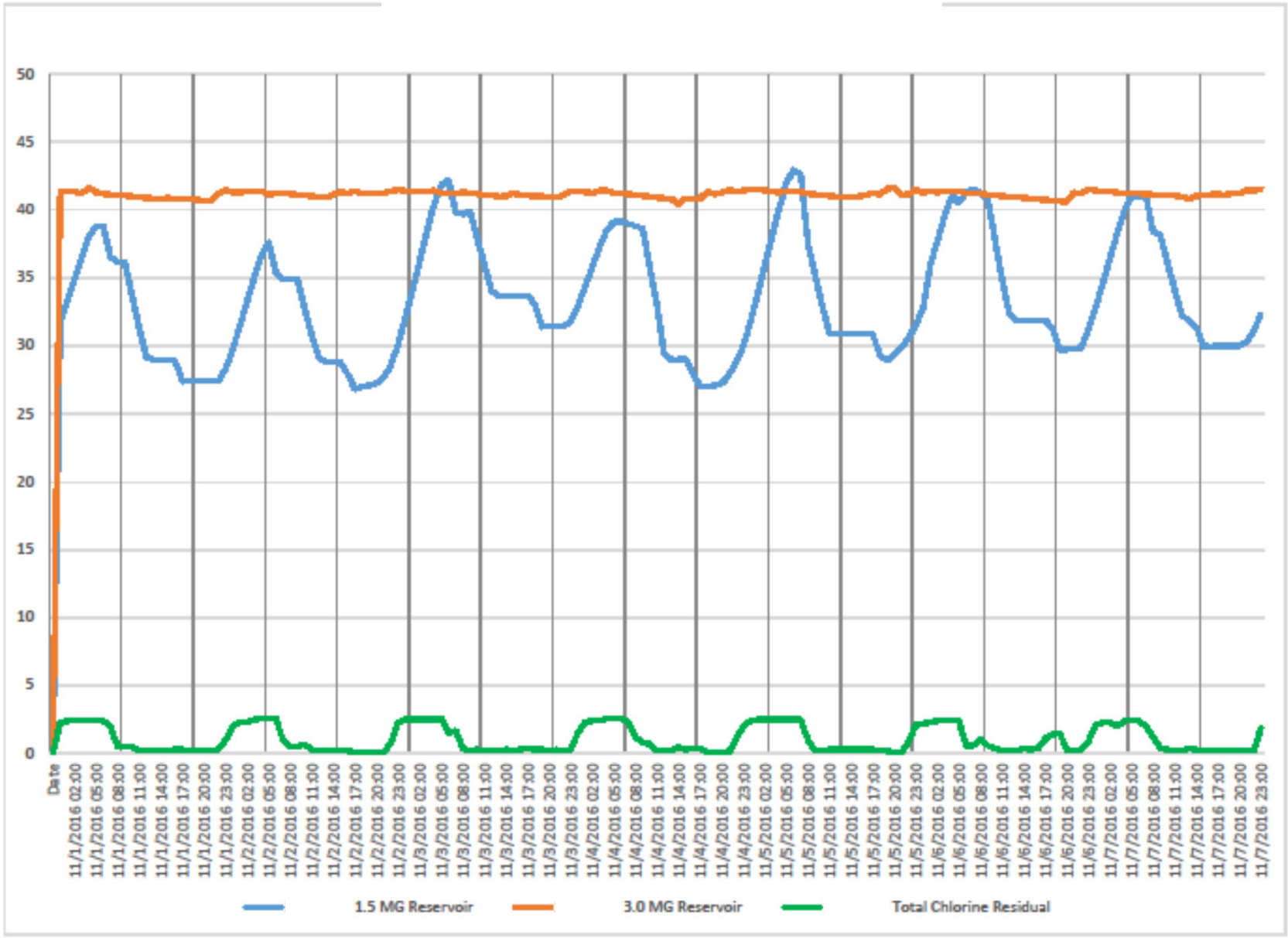
- DON’T keep the tanks full only
- Inspect tanks regularly, drain and clean out as needed
- Consider how and when pumps run to fill tanks

4. What is the Problem?

Data

- Need baseline measurements
- Accuracy – critical to modeling
- Over time


1.5 MG Six Day Temperature Trends
Float
Middle (20')
Bottom (10')
Bottom
Temperature °F
56
55
54
53
52
51
Date/Time (12 hours)
4/23/2017 0:00
4/23/2017 12:00
4/24/2017 0:00
4/24/2017 12:00
4/25/2017 0:00
4/25/2017 12:00
4/26/2017 0:00
4/26/2017 12:00
4/27/2017 0:00
4/27/2017 12:00
4/28/2017 0:00
4/28/2017 12:00
4/29/2017 0:00


50
45
40
35
30
25
20
15
10
5
0
Date
11/1/2016 02:00
11/1/2016 05:00
11/1/2016 08:00
11/1/2016 11:00
11/1/2016 14:00
11/1/2016 17:00
11/1/2016 20:00
11/1/2016 23:00
11/2/2016 02:00
11/2/2016 05:00
11/2/2016 08:00
11/2/2016 11:00
11/2/2016 14:00
11/2/2016 17:00
11/2/2016 20:00
11/2/2016 23:00
11/3/2016 02:00
11/3/2016 05:00
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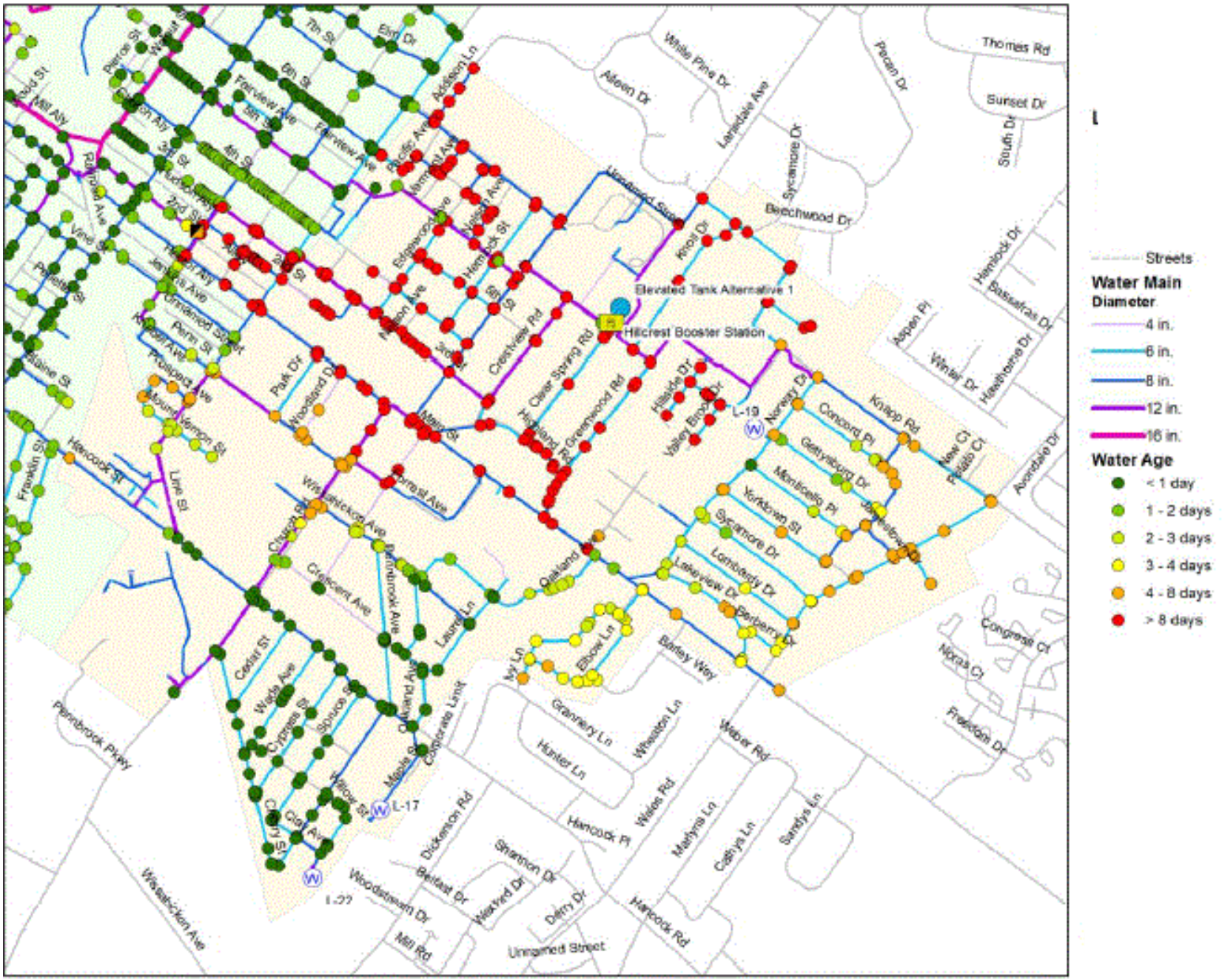
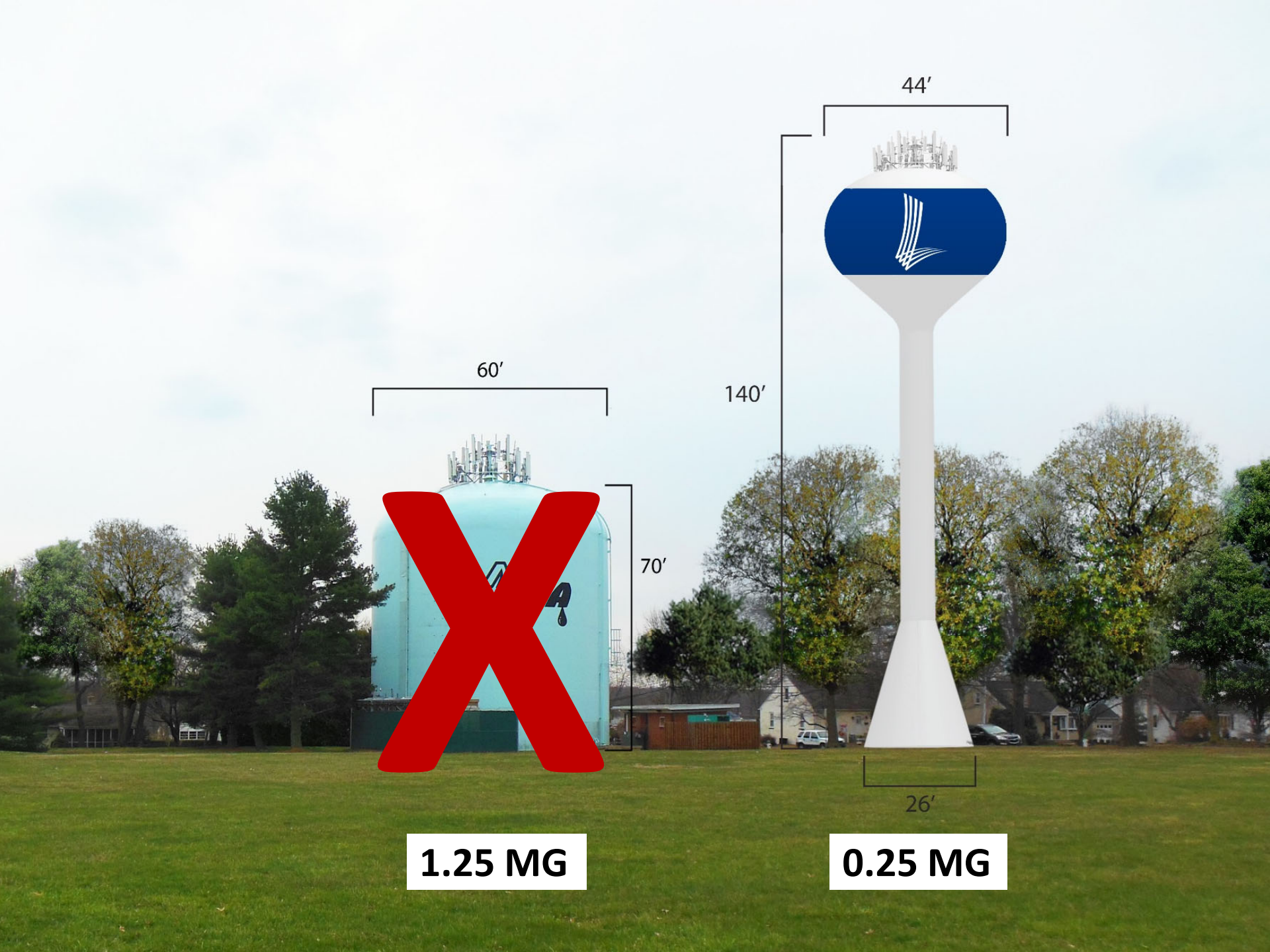
11/4/2016 20:00
11/4/2016 23:00
11/5/2016 02:00
11/5/2016 05:00
11/5/2016 08:00
11/5/2016 11:00
11/5/2016 14:00
11/5/2016 17:00
11/5/2016 20:00
11/5/2016 23:00
11/6/2016 02:00
11/6/2016 05:00
11/6/2016 08:00
11/6/2016 11:00
11/6/2016 14:00
11/6/2016 17:00
11/6/2016 20:00
11/6/2016 23:00
11/7/2016 02:00
11/7/2016 05:00
11/7/2016 08:00
11/7/2016 11:00
11/7/2016 14:00
11/7/2016 17:00
11/7/2016 20:00
11/7/2016 23:00
1.5 MG Reservoir
3.0 MG Reservoir
Total Chlorine Residual


NPWA
1.25 MG


Elevated Tank Alternative 1
Hillcrest Booster Station
L-19
L-17
L-22
Streets
Water Main
Diameter
4 in.
6 in.
8 in.
12 in.
16 in.
Water Age
< 1 day
1 - 2 days
2 - 3 days
3 - 4 days
4 - 8 days
> 8 days


44′
140′
60′
70′
26′
1.25 MG
0.25 MG

Help from the PA DEP

I'm serious!!

Justin Blashaw –

PA DEP Technical Assistance Program

Distribution System Optimization Program

- Assistance to systems to improve water quality
- Focus on operational changes and best management practices

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Tools

Storage Tank Assessment Spreadsheet

- Mixing performance and tank turnover
- Impact of operational strategies
- Basic BASIC analysis

Tools

Field Assistance

- In-tank water quality monitoring
- Temperature data loggers to assess thermal stratification
- Continuous disinfectant residual monitoring

What's the cost?

IT'S FREE!!!

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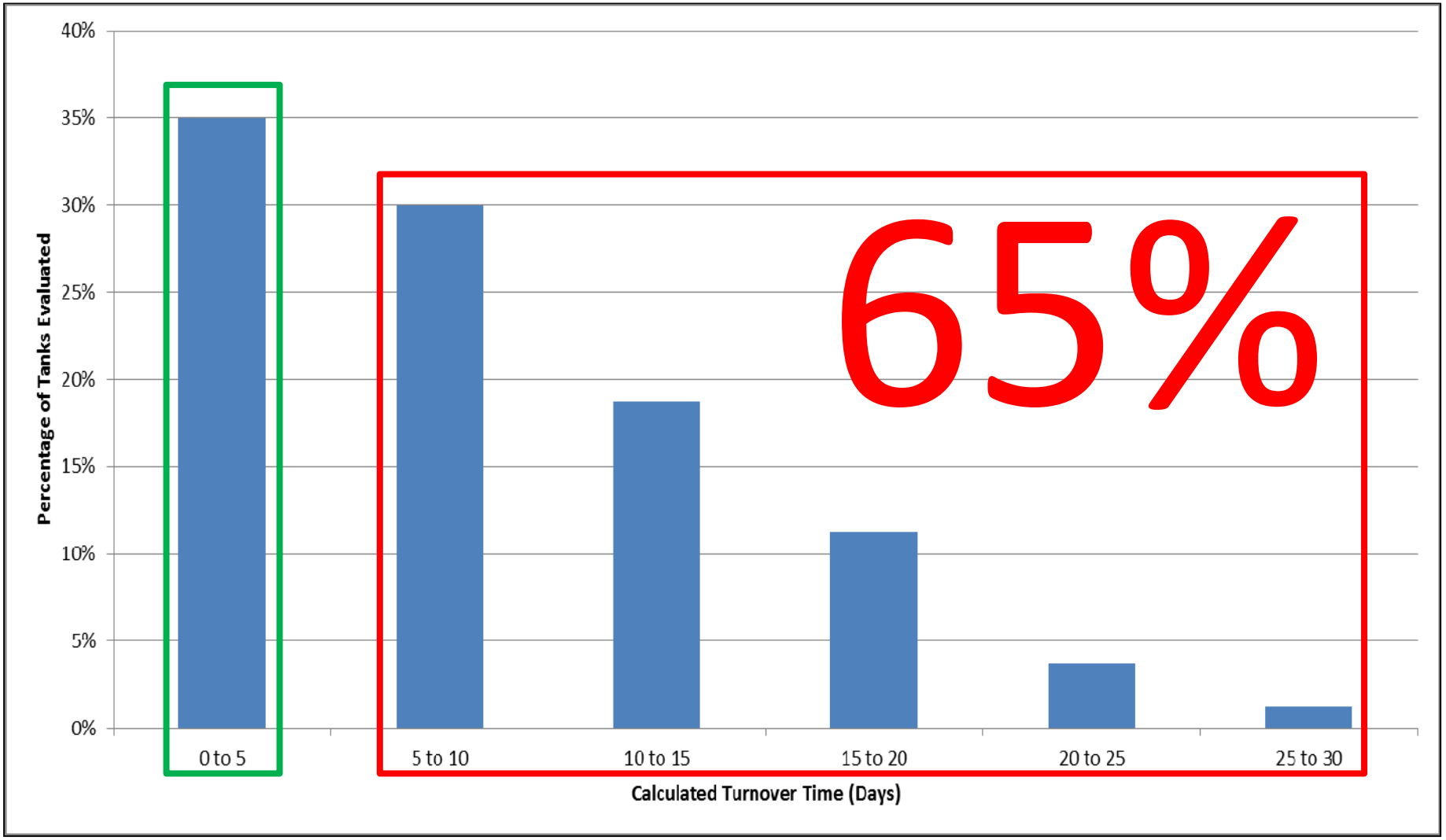
Tanks Assessed



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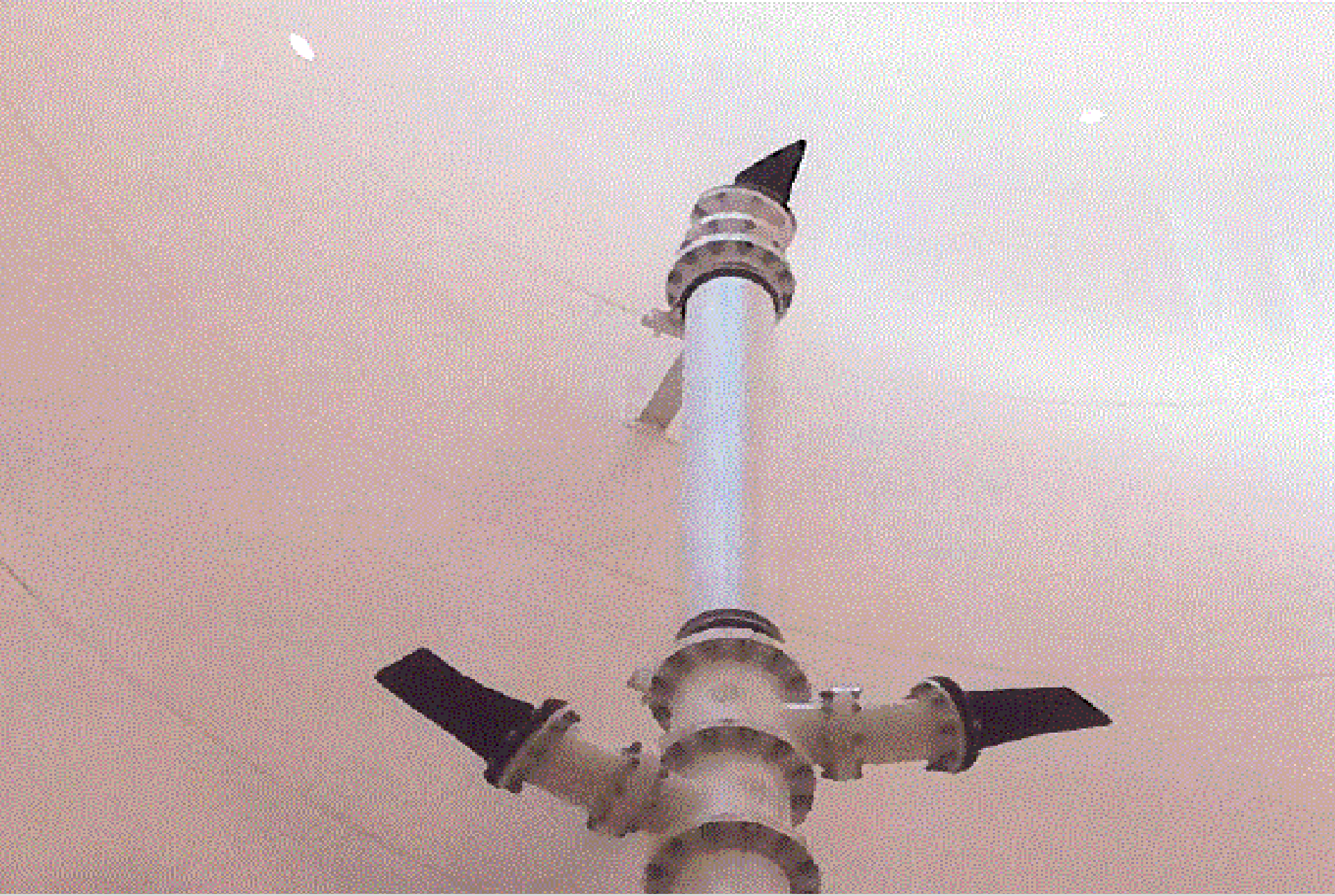
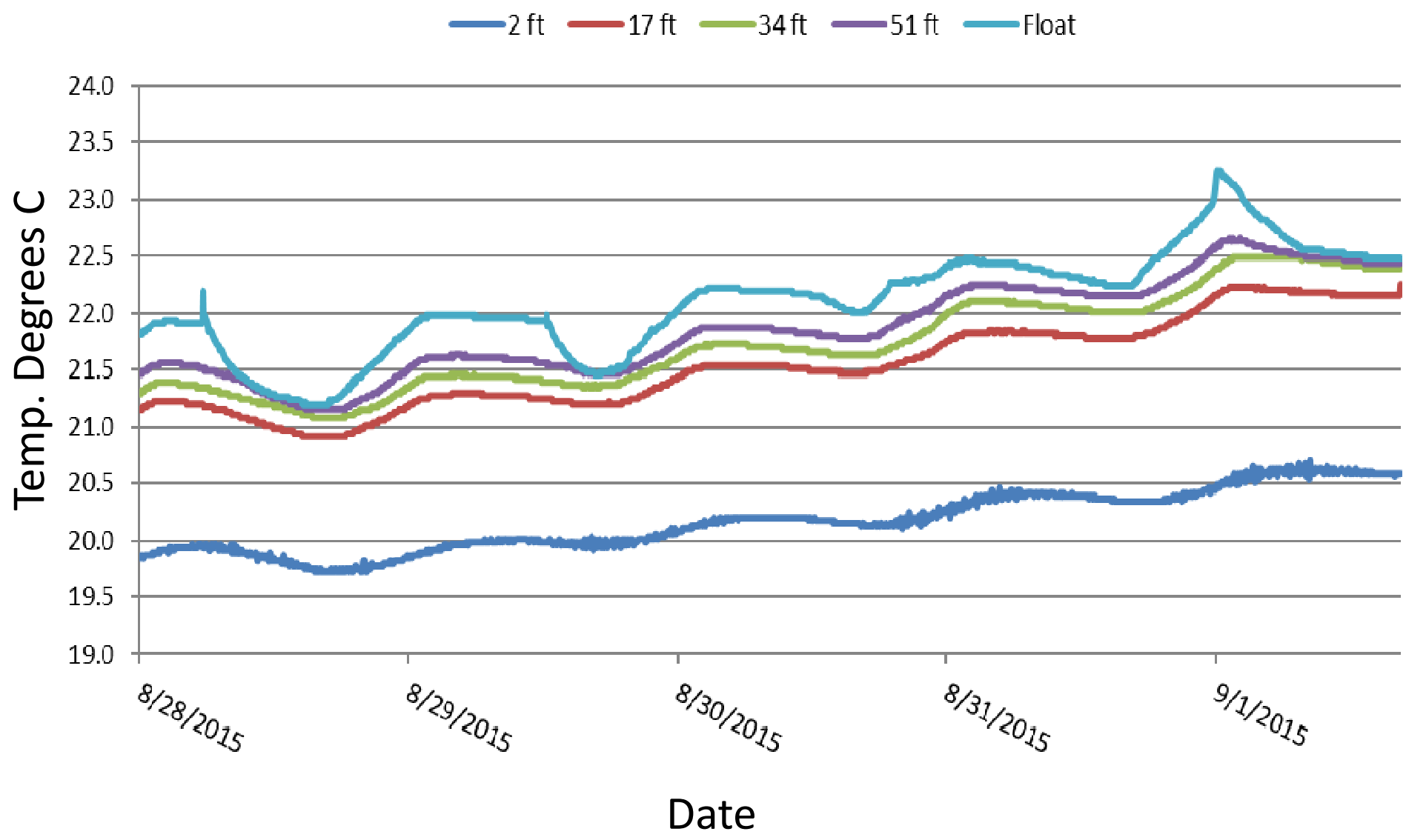
1.0 MG Gallon
No Mixer
0.25 MG Gallon
With Mixer



Entech Engineering was NOT the mixer designer.

0.25MG Temperature Trends




1.0 MG Gallon
No Mixer
0.25 MG Gallon
With Mixer
Pump: 350 gpm

What's Important? Mixer Design

- Select the Right Mixer for Your Tank
- Accurate Design Data
- Qualified Installer
- Qualified Inspection

Need Help?

PA DEP Technical Assistance Program

Justin Blashaw

(717) 783-3900

jblashaw@pa.gov

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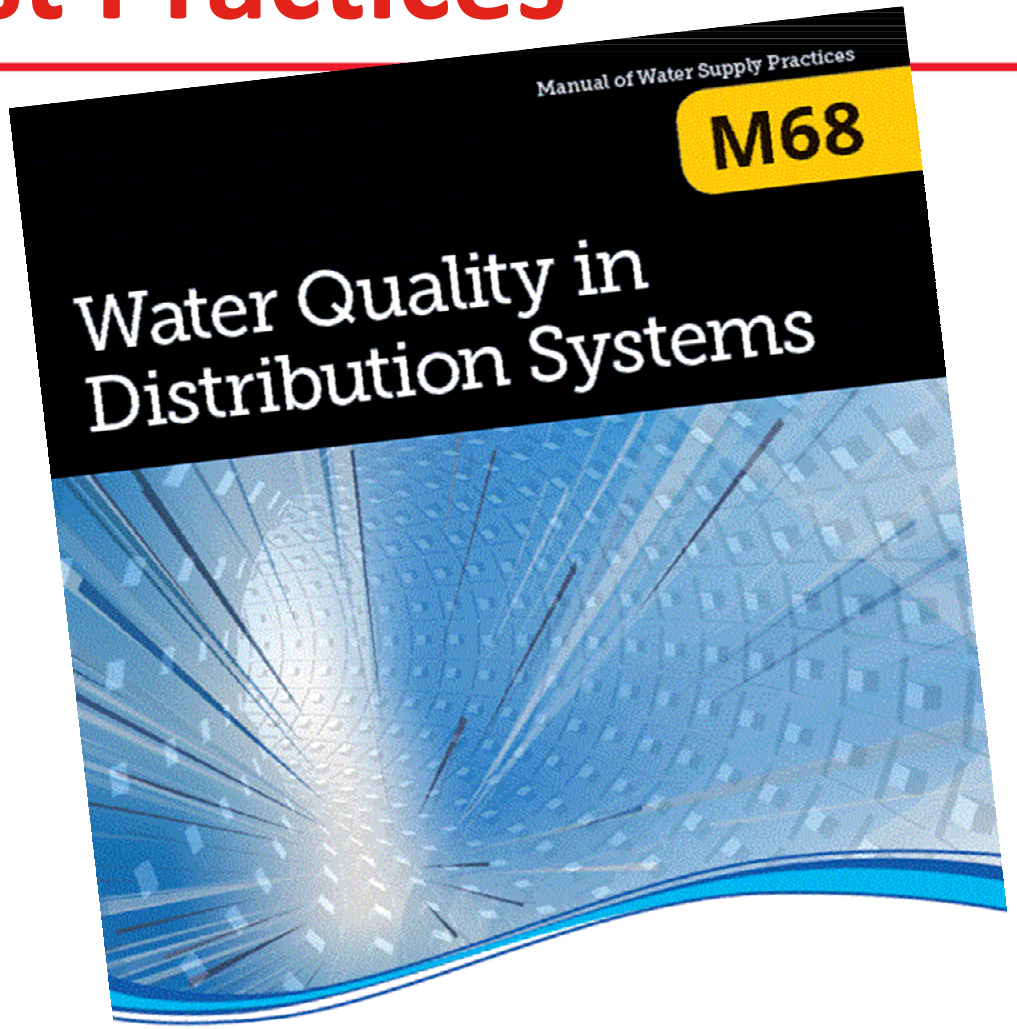
5. Best Practices



AWWA M-68

Who wrote it?

Our colleagues

What is it for?

Best Practices, as a first step

Who is it for?

Owners, Operators, Engineers

What components are included?

Pumps, tanks, mains, fittings

AWWA M-68 Chapters

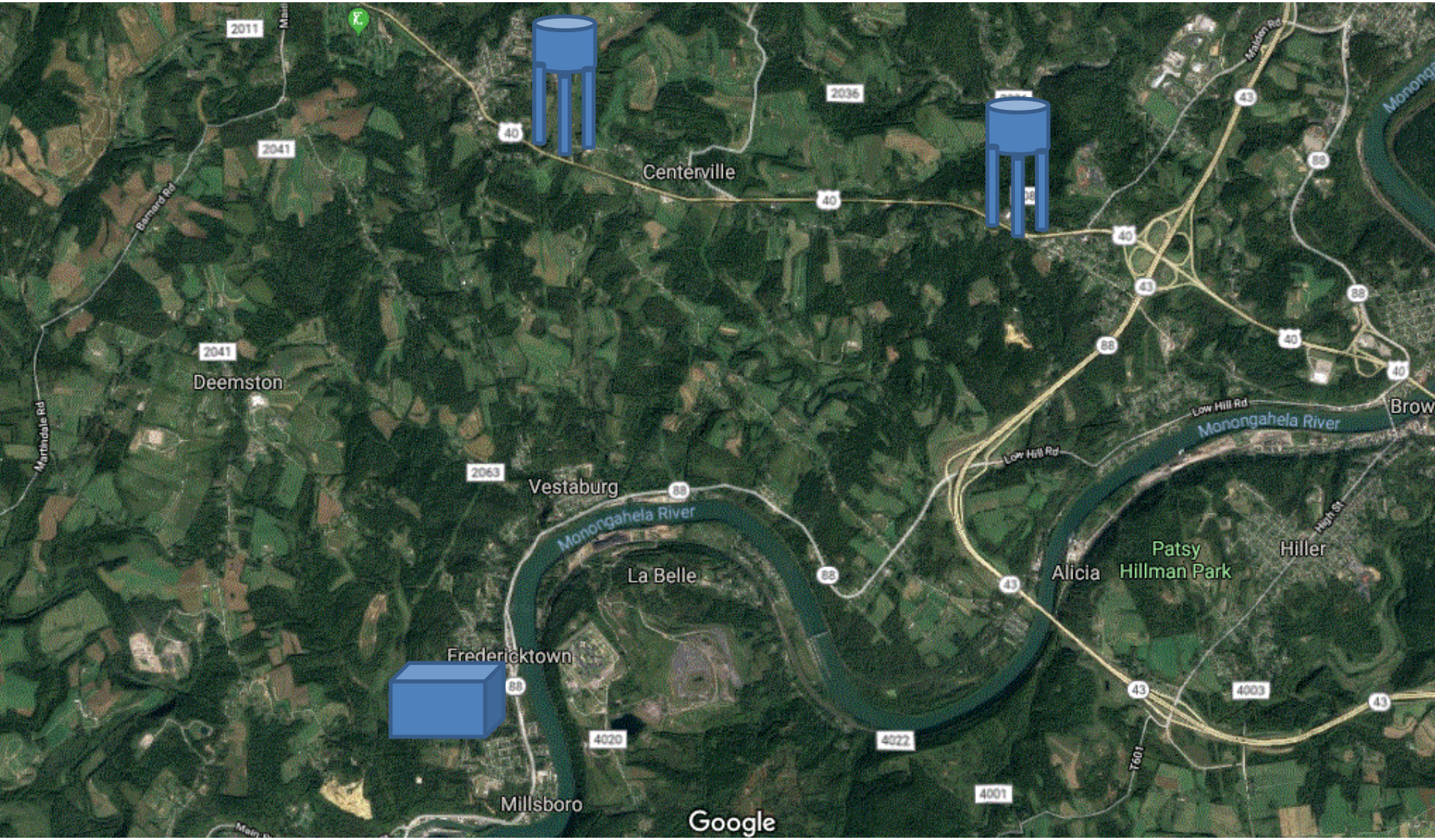
2. Capacity & Water Age
3. Understanding & Managing Biofilm, Coliform Occurrence, & the Microbial Community
6. Nitrification
7. Disinfection & Disinfection By-products

AWWA M-68 Chapter 2

Capacity & Water Age

- Determining Capacity
- Determining Water Age
- Ways to Balance Capacity and Water Age
- Best Practices
- Case Studies
- References

6. Case Studies



What Does the Owner Need?

- Both tanks rehabilitated?
- Both tanks torn down, and a new tank built?
- A combination?

Plan

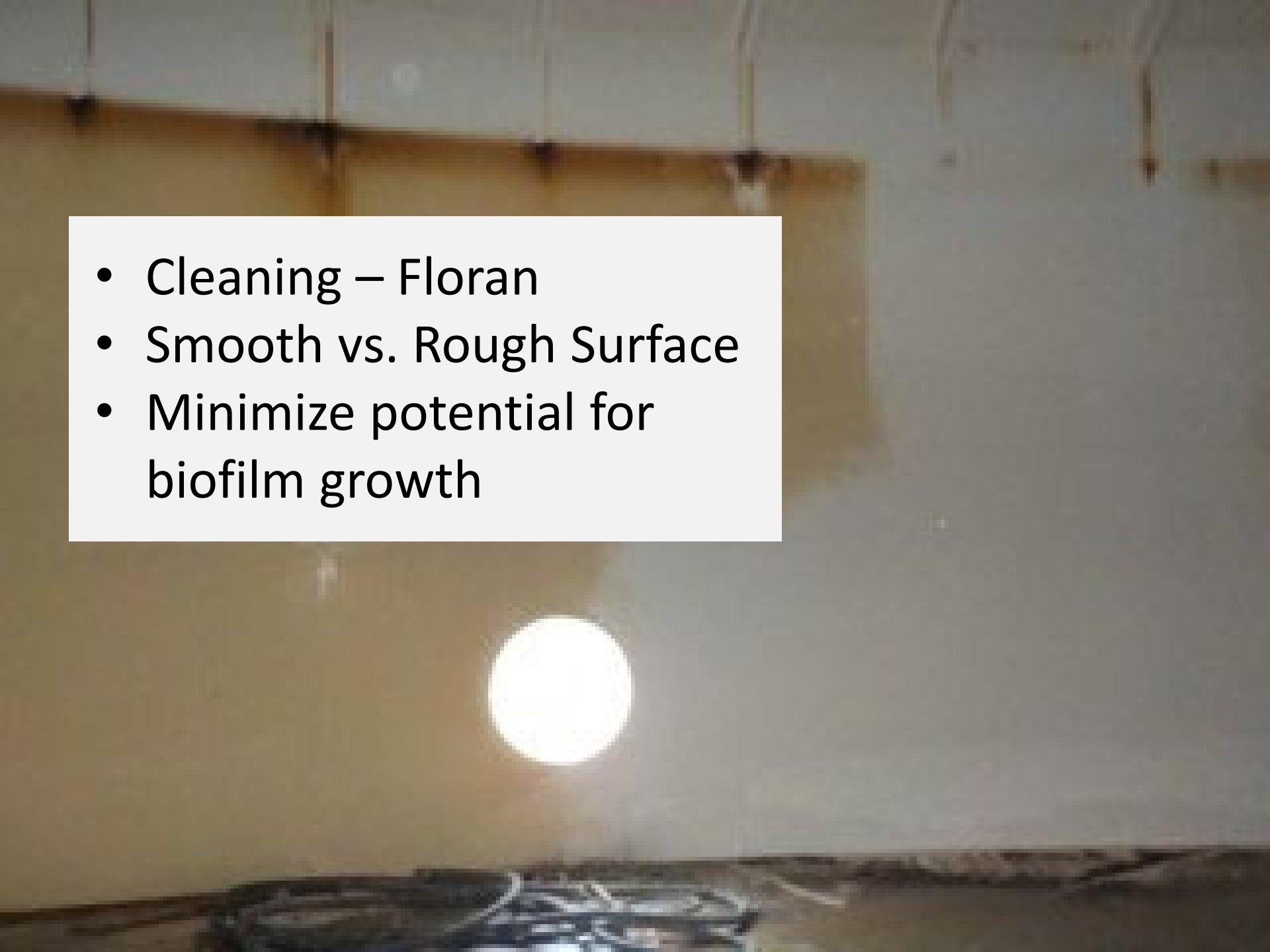
1. Obtain & Analyze Data
2. Hydraulic Modeling
3. Evaluate Water Quality Issues
4. Review Scenarios
5. Assess Costs
6. Formulate Long-Term Plan

Case Study #2

TTHM Issues

1. Obtain & Analyze Data
2. Hydraulic Modeling
3. Evaluate Water Quality Issues
4. GridBee mixers with spray aeration
5. Multiple Owners report seeing more than 60% reduction

Case Study #3



- Cleaning – Floran
- Smooth vs. Rough Surface
- Minimize potential for biofilm growth

Case Study #4

2.0 MG Reservoir

0.25 MG Spheroid

POTABLE WATER QUESTIONNAIRE

Please enter as much information as possible in the boxes below, then email this form to INFO@MEDORACO.COM, or fax to 701-225-0002.

SolarBee | GridBee
Medora Corporation

A. TANK LOCATION AND OWNER INFORMATION

RESERVOIR OR TANK OWNER, and CITY and STATE	North Penn Water Authority, Lansdale, PA	CONTACT NAME	Christine Gunsaullus
		ORGANIZATION	Entech Engineering

Accurate Data

B. CITY WATER SYSTEM OVERVIEW

TYPE OF DISINFECTANT BEING USED IN THIS WATER? (CHLORINE, OR CHLORAMINE, OR OTHER)	Chlorine
IS THE SOURCE WATER FROM SURFACE (RIVER AND IMPOUNDMENTS,) OR WELLS	River
EXISTING TANK, OR NEW TANK BEING CONSTRUCTED	Existing
THIS TANK'S MAIN FUNCTION, SUCH AS GENERAL STORAGE, CT TANK, CLEARWELL, OTHER	General Storage
EXISTING AND/OR EXPECTED WATER QUALITY PROBLEMS IN THIS TANK	Want to maintain chlorine levels; no TTHM problems
PROJECT OBJECTIVES: GENERAL MIXING, THM REMOVAL, CHLORINE BOOSTING, ICE PROTECTION	General mixing, ice protection
MOST STATES REQUIRE A PERMIT FOR MIXING OR THM REMOVAL IN A TANK, DOES YOURS	yes

C. TANK DESCRIPTION AND DIMENSIONS (PLEASE FILL OUT THE PERTINENT SECTION BELOW)

PUT "X" IN ONE:

Spheroid		RATED VOLUME, GALLONS		RISER DIAMETER , INCHES		ROOF SHAPE	
Hydropillar		TANK DIAMETER, FEET		WET RISER OR DRY RISER?		CONSTRUCTED OF	
Cylindrical		TANK HEIGHT, FEET		RISER HEIGHT, FEET			
Other		DISTANCE, TANK BOTTOM TO GROUN				'ERIOR OBSTRUCTIONS	
		HATCH: UNOBSTRUCTED L X W, INCHES				LOCATION OF HATCH(S)	

OR

PUT "X" IN ONE:

All Above Ground	X	RATED VOLUME, GALLONS	1,500,000
Part Underground			
		For round TANKS: DIAMETER, FEET	56'
		HEIGHT, FEET	80' HWL

>>> PUT "X" IN ONE:

Cylindrical Shape		Rectangular TANKS: LENGTH, FEET	
Rectangular Shape		WIDTH, FEET	
Irregular Shape		HEIGHT, FEET	
Standpipe			

ROOF SHAPE (FLAT, DOMED, OTHER)	domed w/ knuckle
CONSTRUCTED OF (STEEL, CONCRETE, OTHER)	steel
OBSTRUCTIONS (COLUMNS, BAFFLES, OTHER)	n/a
HATCH 1: UNOBSTRUCTED L X W, INCHES	24" x 24"
HATCH 2: UNOBSTRUCTED L X W, INCHES	Tank #2 only - 24" round
LOCATION OF HATCH(S)	partway up roof / TK#2 nr,ctr
APPROXIMATE YEAR TANK WAS BUILT	1971 / 1989
TANK MANUFACTURER	PDM / CB&I

D. FLOWS, OPERATING DEPTH, INLET-OUTLET, POWER

7. What's Everyone Else Doing?

Western I

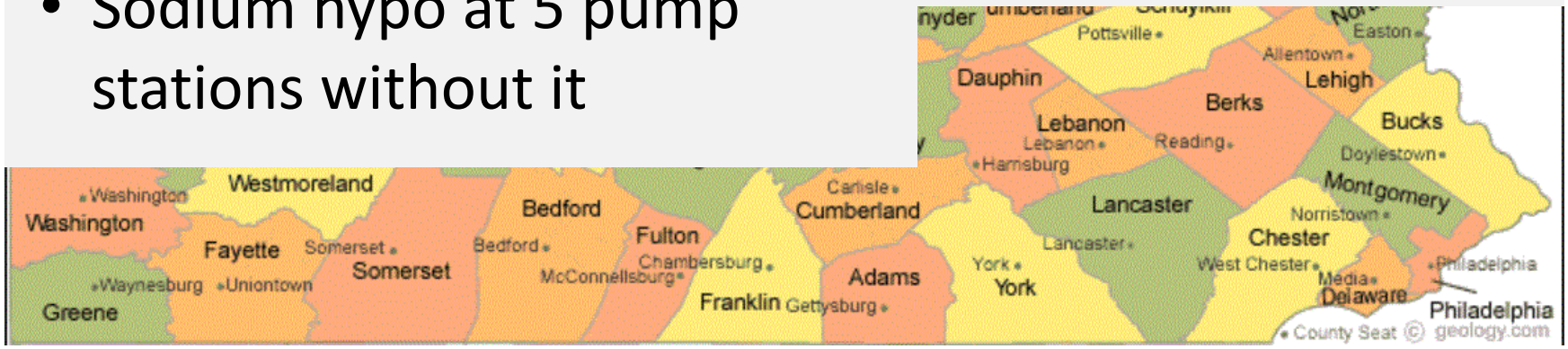
- Full-tim
  flusher
- Increme
  chlorine dose at key points
- Sodium hypo at 5 pump stations without it

Central PA

- Raised chlorine levels at plant a tiny bit; monitoring changes for at least a month

Discount

lsned several tanks



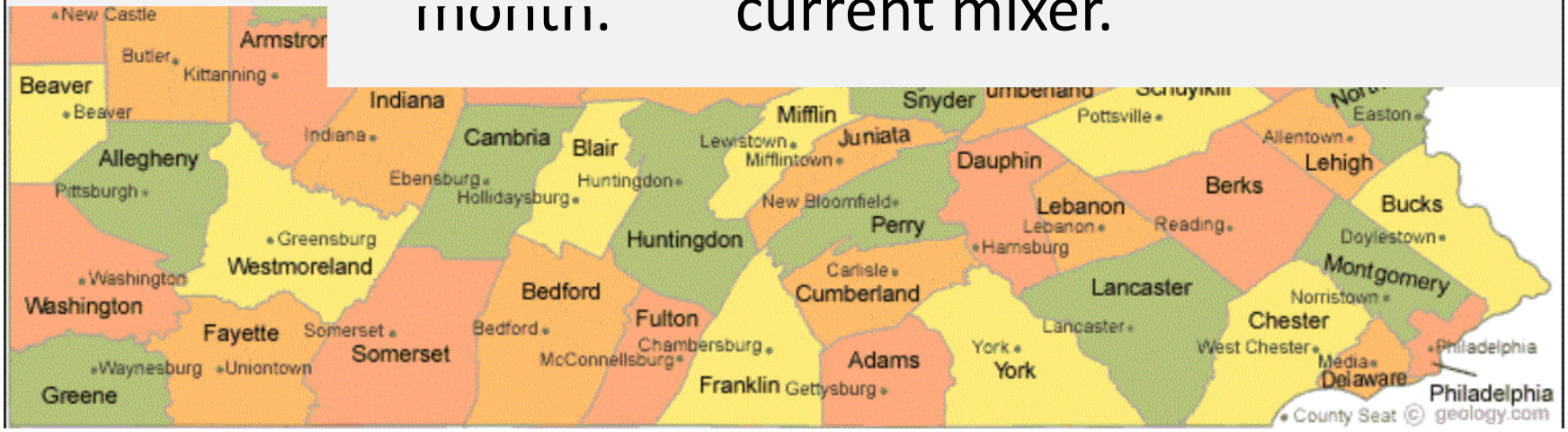
7. What's Everyone Else Doing?

Western PA

- Changed location of chemical injection, fi base to where mixer month.

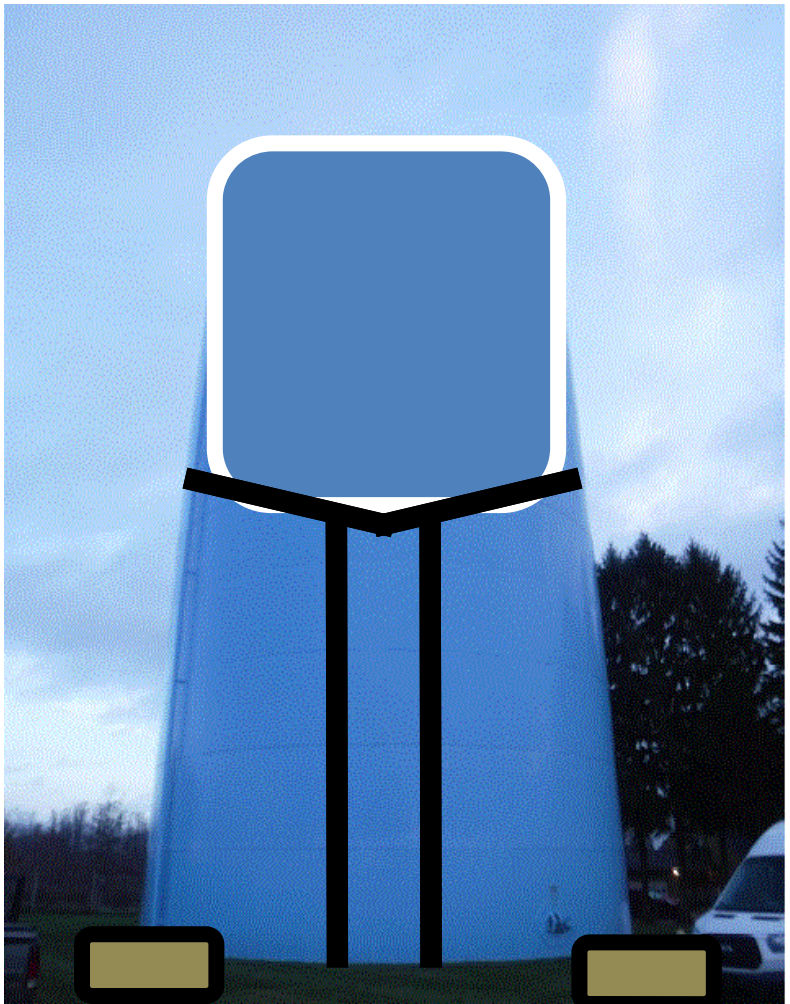
Eastern PA

- Dropping temperature probes into tank for a month to gauge effectiveness of current mixer.



What's Everyone Else Doing?

Turn a Standpipe Into an Elevated Tank



What Are YOU Doing?

Conclusions

- Can’t design or operate tanks like we did 25 years ago.
- Know what problem you are solving.
- Get accurate data.
- Mixers do not improve water age.
- Help is out there
  - PA DEP – Justin Blashaw
  - AWWA M-68
  - Your colleagues

Check out our website:
www.entecheng.com

Connect with me on LinkedIN

Christine Gunsaullus
Cell: 484-354-9201
cgunsaullus@entecheng.com

Questions?