Then & Now:

Changes in Tank Design and Operations to Maintain Chlorine Residuals

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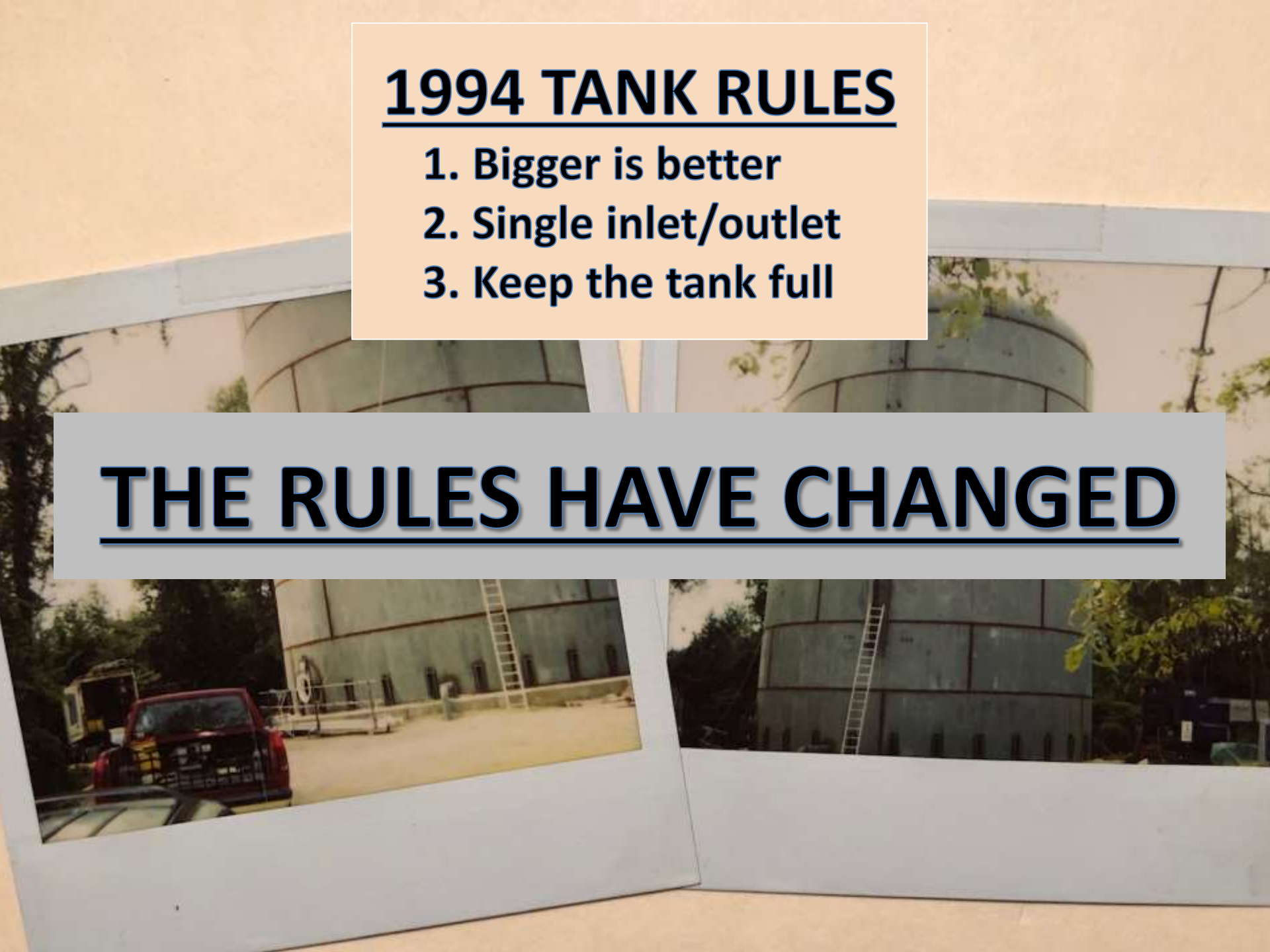
1994 TANK RULES

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

THE RULES HAVE CHANGED



Outline

1. Regulations
2. Water Quality
3. Understanding Tanks
4. What is the Problem?
5. Case Studies
6. What’s Everyone Else Doing?

1. Regulations

PA DEP Requirements

Currently:

SW/GUDI sources

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

Starting April 29, 2019:

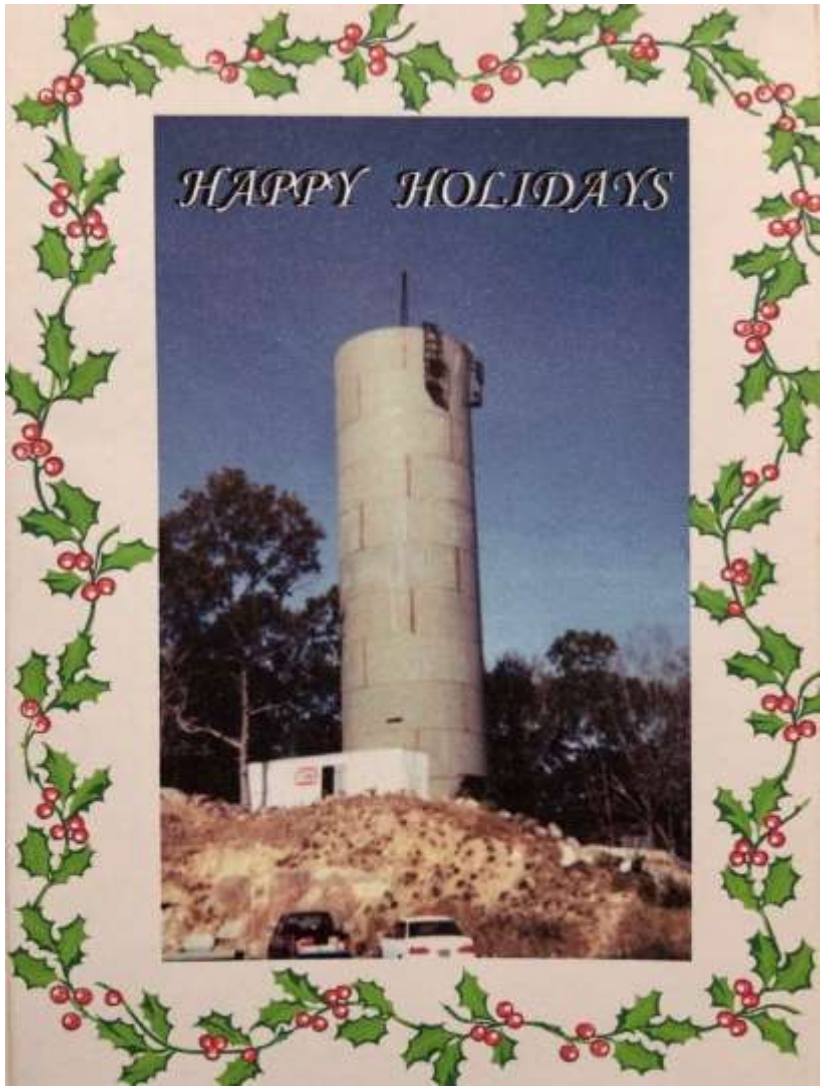
New Disinfection Requirements Rule from Chapter 109

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

2. Water Quality

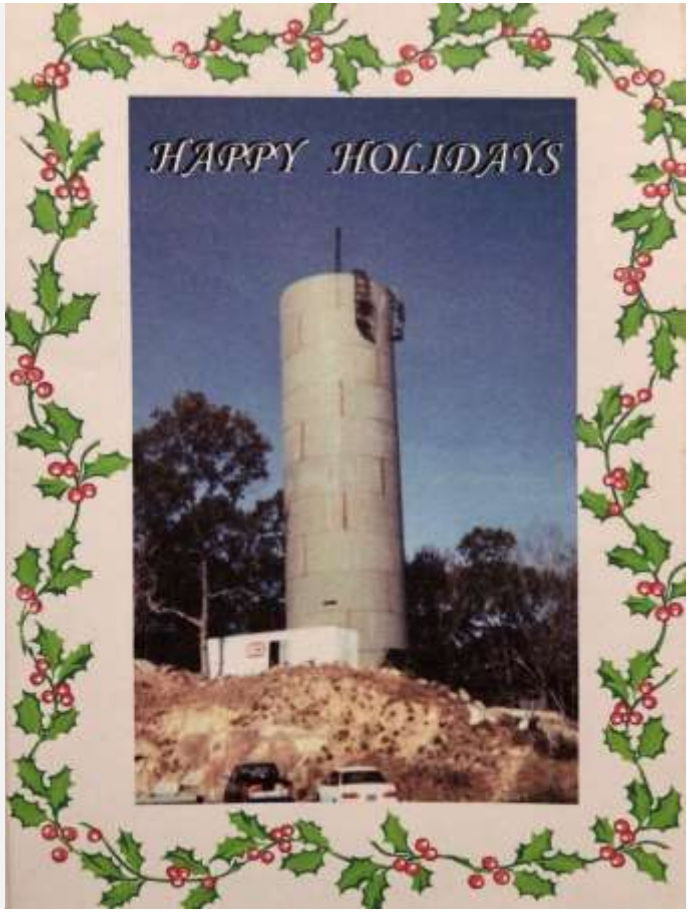
- Deteriorates with increasing water age
- Two ways to reduce water age:
  1. Increase demand (i.e. flushing)
  2. Reduce volume in the system

3. Understanding Tanks



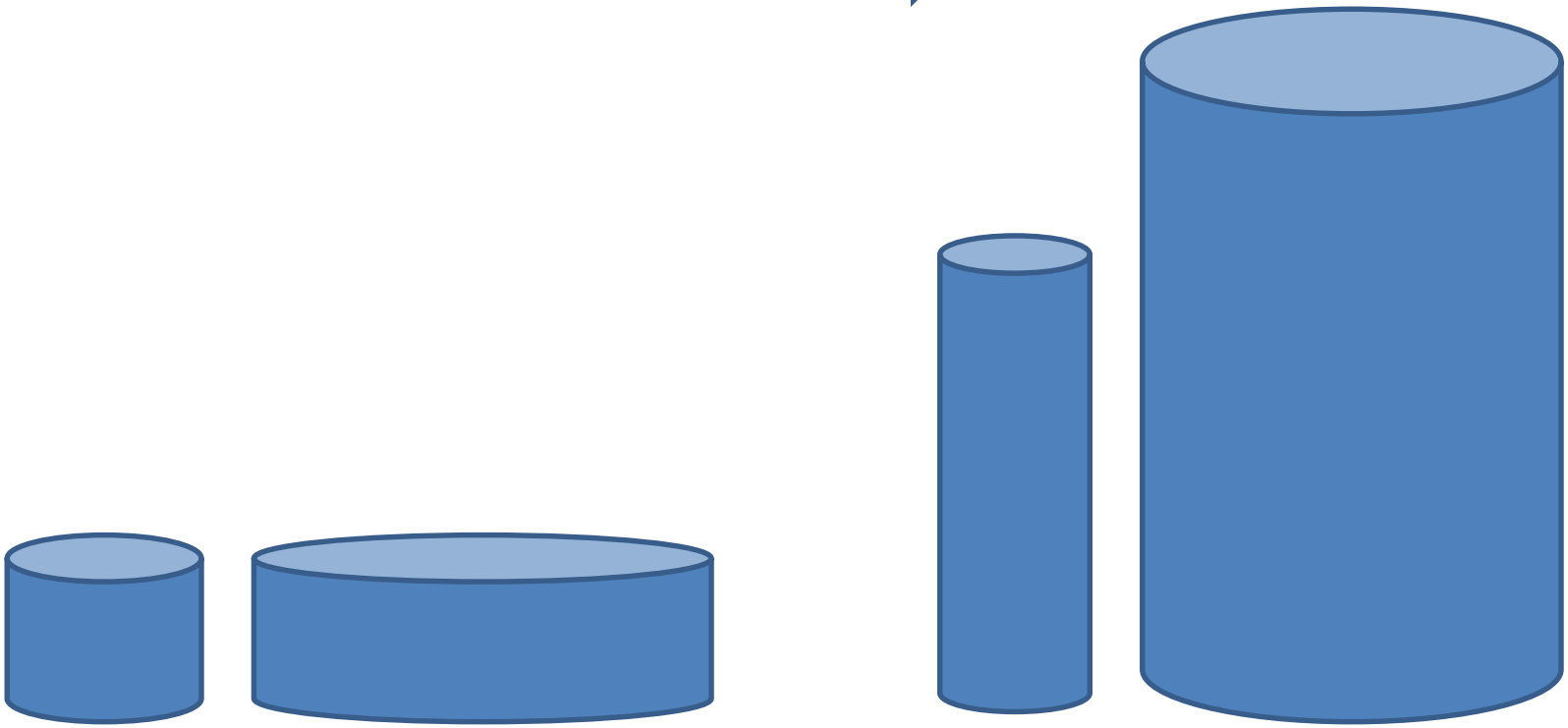
Tank Design Then…

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

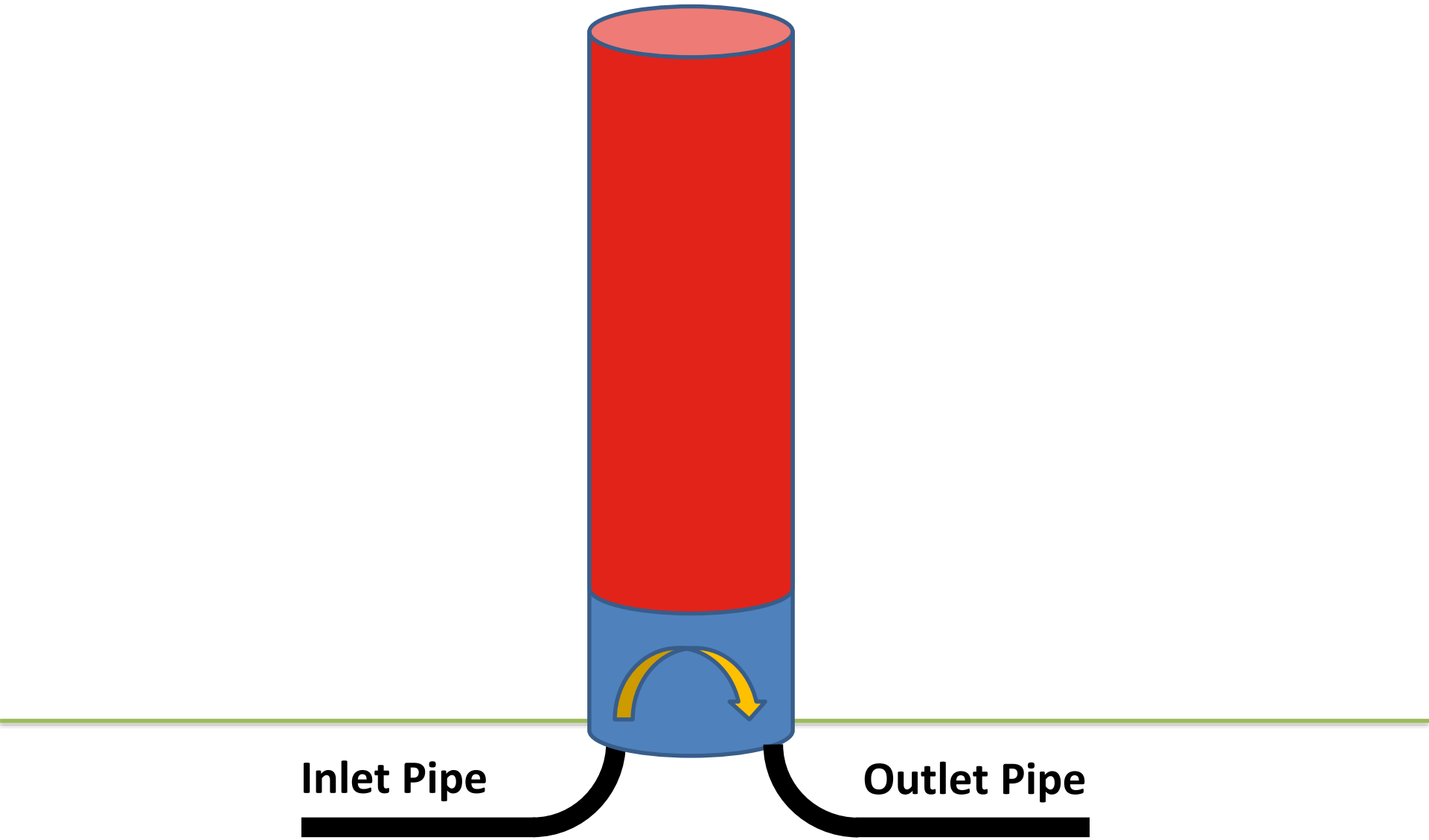


Tank Design Mixing

EASY → HARD



Reservoirs **Standpipes**



Standpipe

Tank Design Now…

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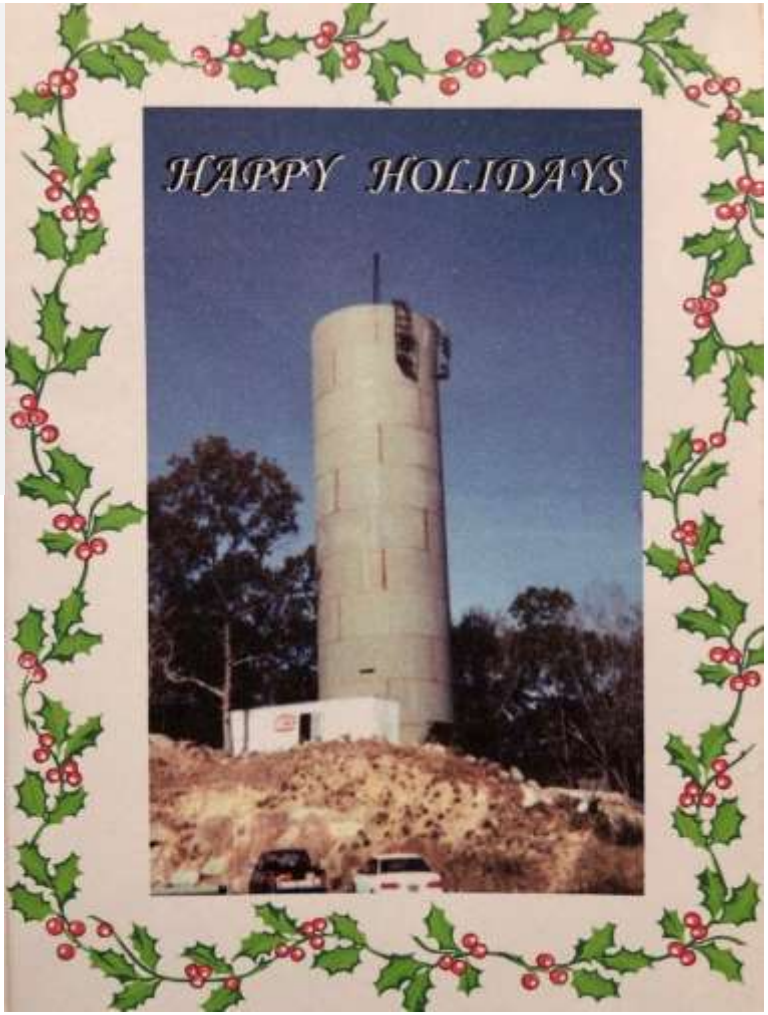
- Balance water use during the day



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 Permit!!

- Permit for mixer
- New higher fees
- Permit for changes in treatment

Mixers Now…

- In most tanks
- 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…

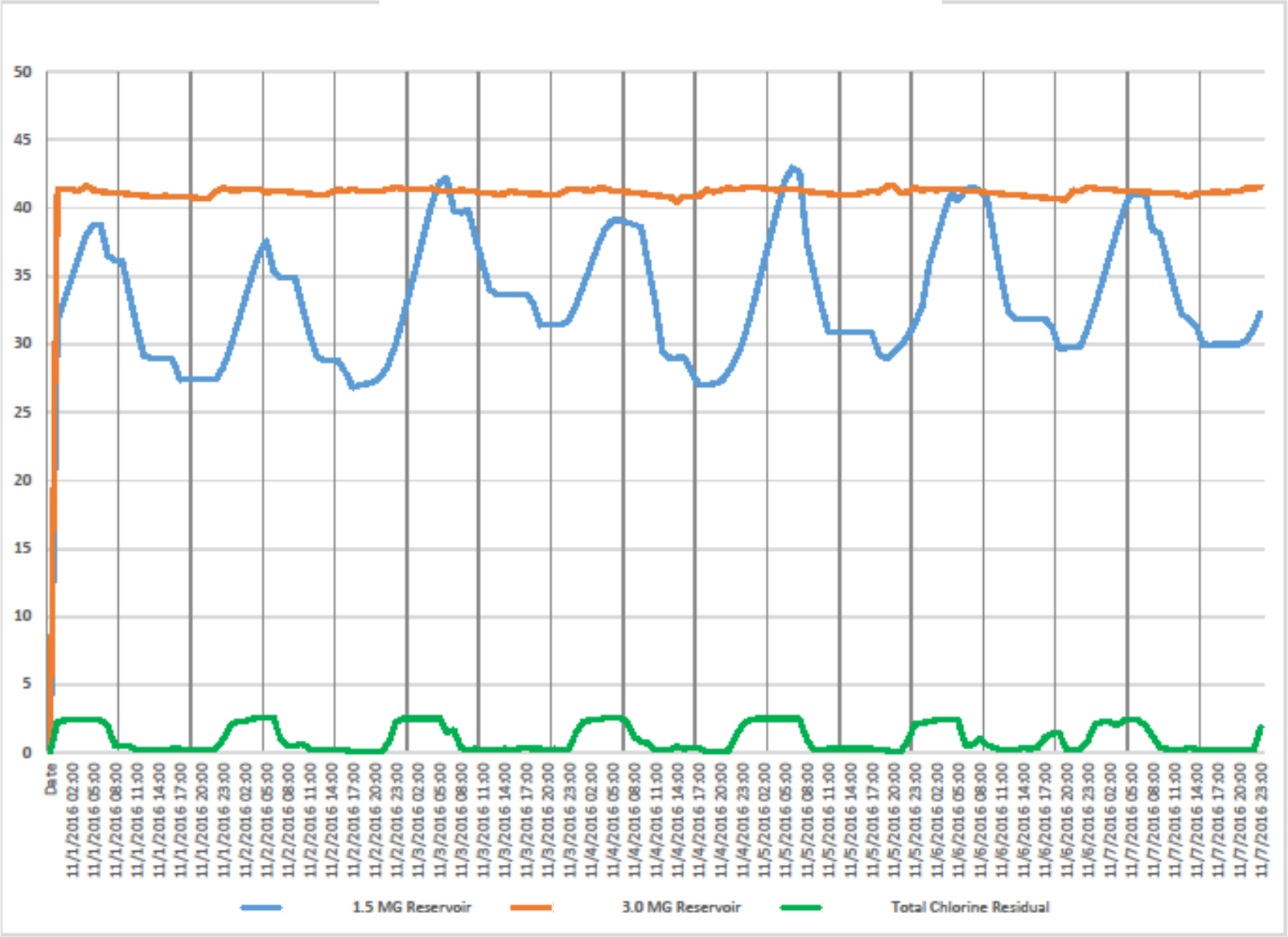
- Cycle the tanks more
- Varies for each tank
- Consider how and when pumps run to fill tanks
- Inspect tanks regularly
- Drain and clean out as needed

4. What is the Problem?

Start with Data

- Temperature, Chlorine Residual, pH
- Over time

1.5 MG and 3.0 MG Reservoirs

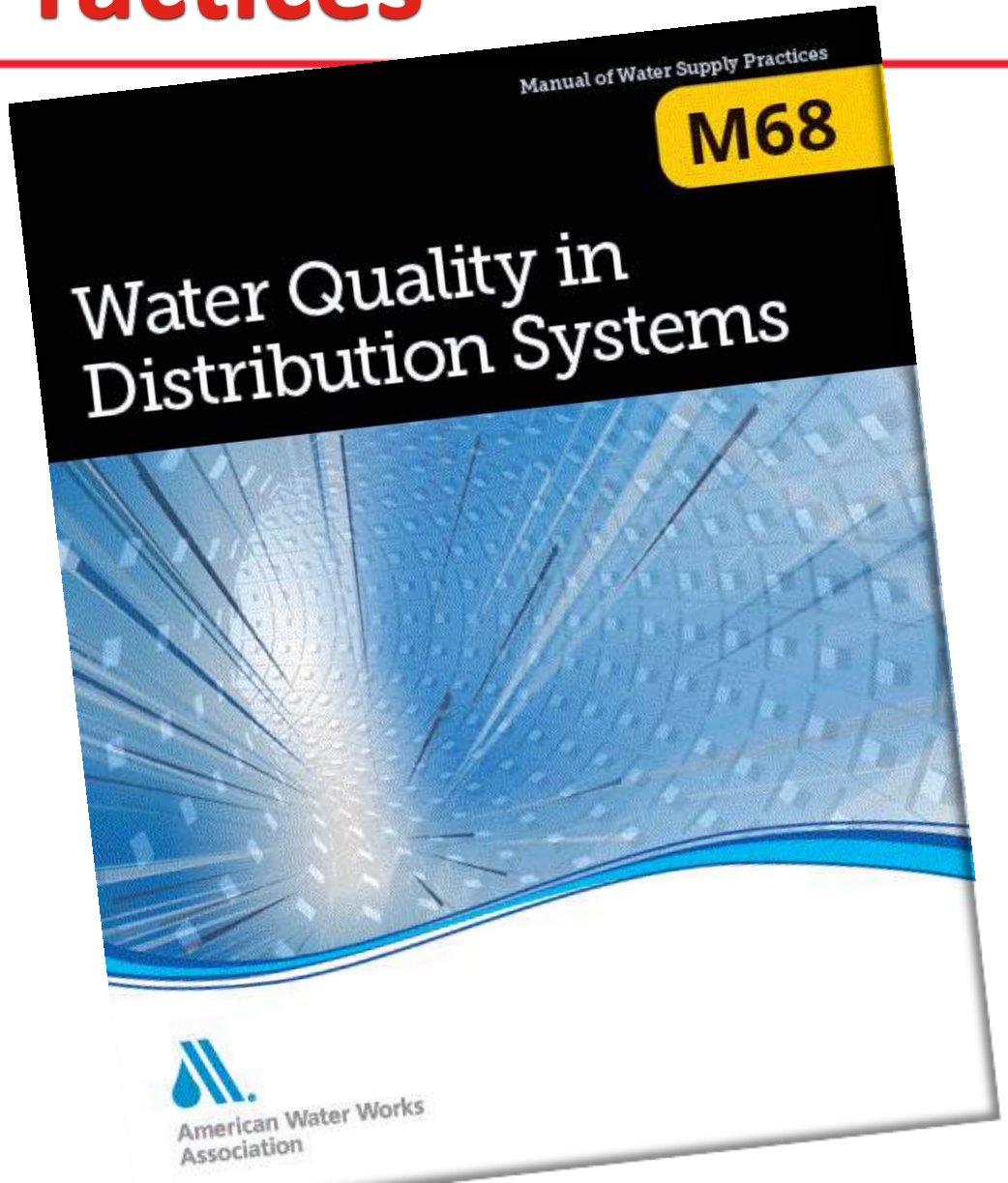

50
45
40
35
30
25
20
15
10
5
0
Date
11/1/2016 02:00
11/1/2016 05:00
11/1/2016 08:00
11/1/2016 11:00
11/1/2016 14:00
11/1/2016 17:00
11/1/2016 20:00
11/1/2016 23:00
11/2/2016 02:00
11/2/2016 05:00
11/2/2016 08:00
11/2/2016 11:00
11/2/2016 14:00
11/2/2016 17:00
11/2/2016 20:00
11/2/2016 23:00
11/3/2016 02:00
11/3/2016 05:00
11/3/2016 08:00
11/3/2016 11:00
11/3/2016 14:00
11/3/2016 17:00
11/3/2016 20:00
11/3/2016 23:00
11/4/2016 02:00
11/4/2016 05:00
11/4/2016 08:00
11/4/2016 11:00
11/4/2016 14:00
11/4/2016 17:00
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

2.0 MG Reservoir

Too Much Storage?

- Non-Consecutive System
- 300,000 gal. + 1,500,000 gal.
- Daily Usage: 300,000 gal.
- Need Data

Best Practices



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

Help from the PA DEP

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

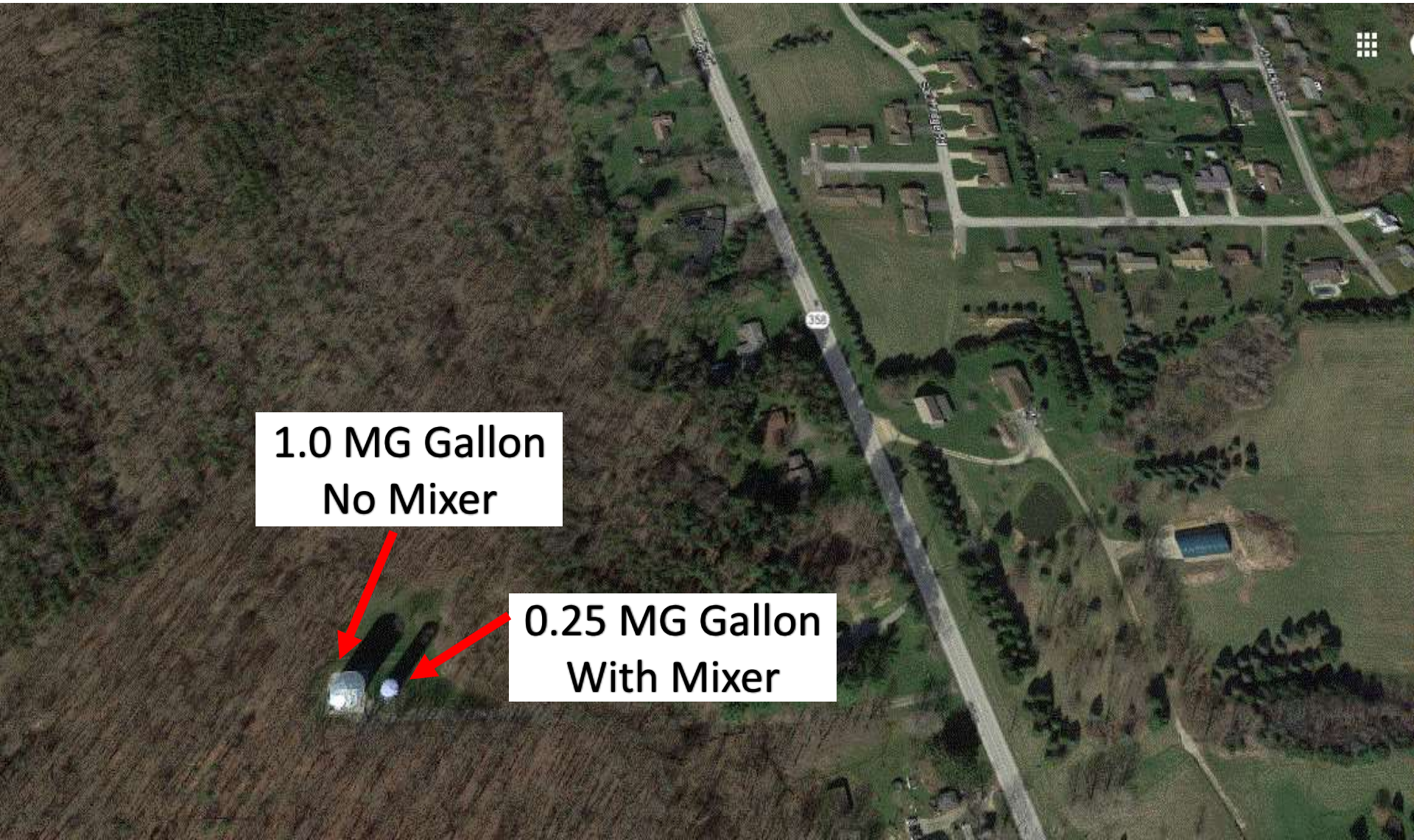
Data

- In-tank water quality & temperature loggers
- Continuous disinfectant residual monitoring

IT'S FREE!!!

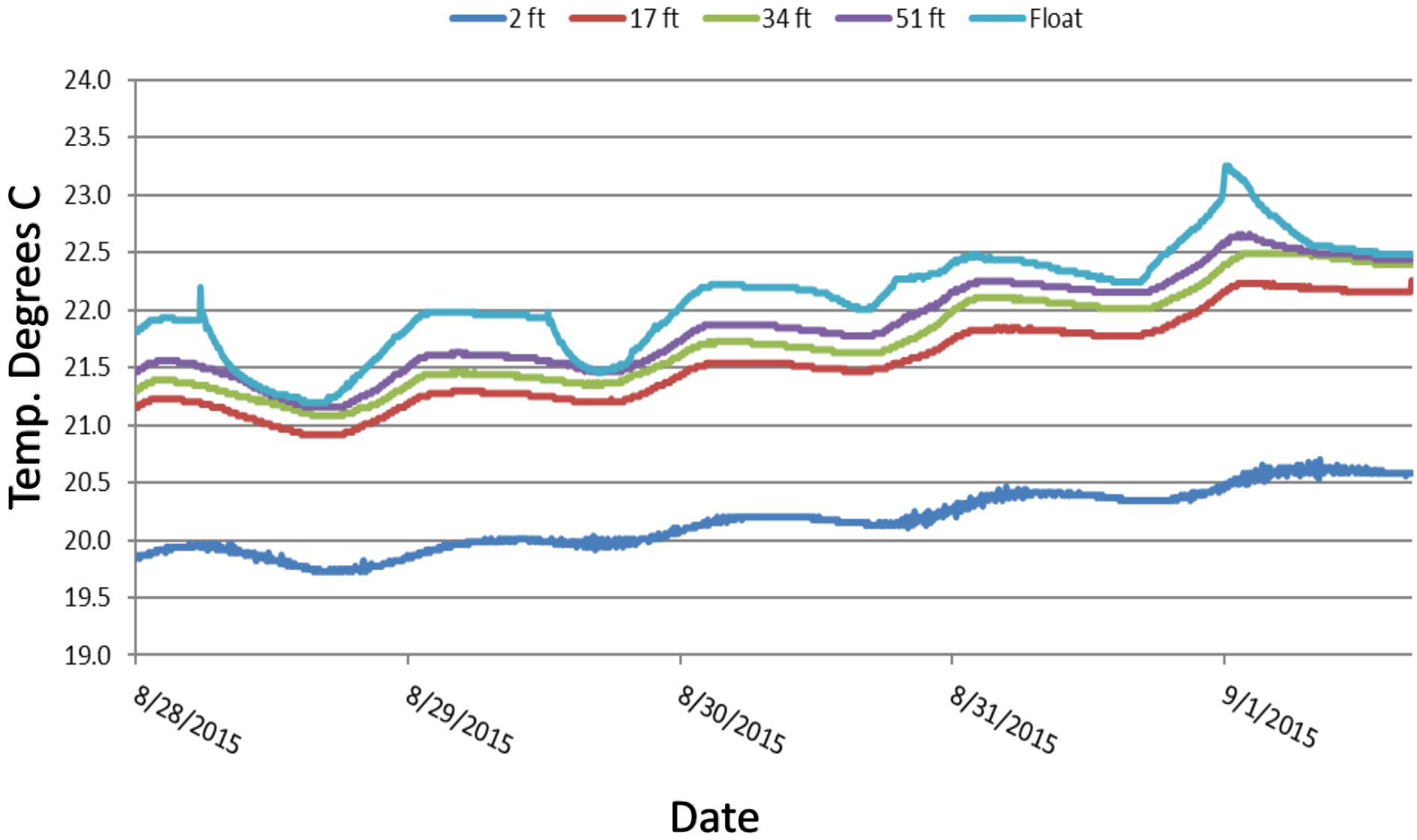
pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

5. Case Studies



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

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

Case Study #2

TTHM Issues

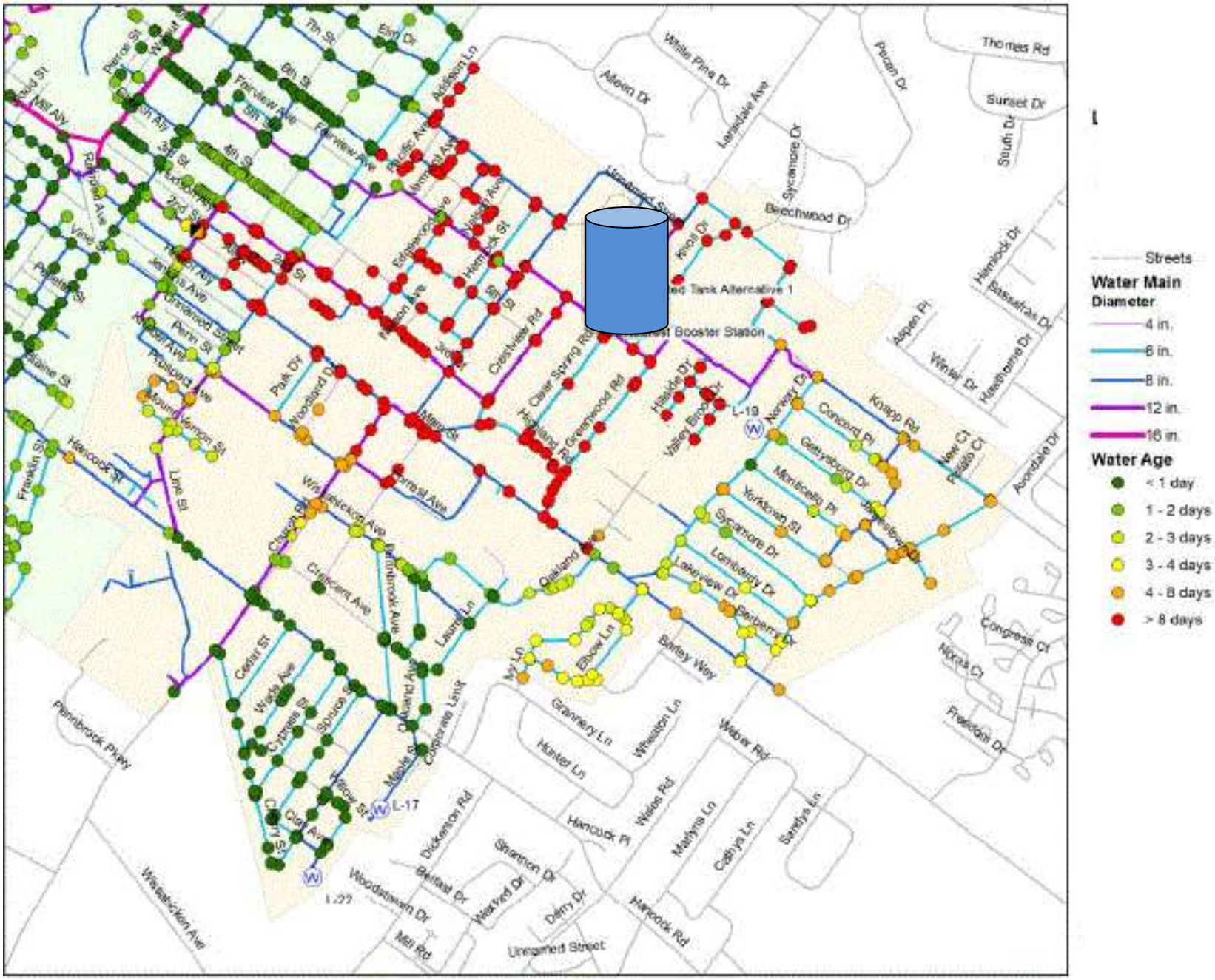
1. Obtain & Analyze Data
2. Hydraulic Modeling
3. Evaluate All Water Quality Issues
4. GridBee mixers with spray aeration
5. Multiple Owners report seeing more than 60% reduction
6. Make specification and contract Performance Based

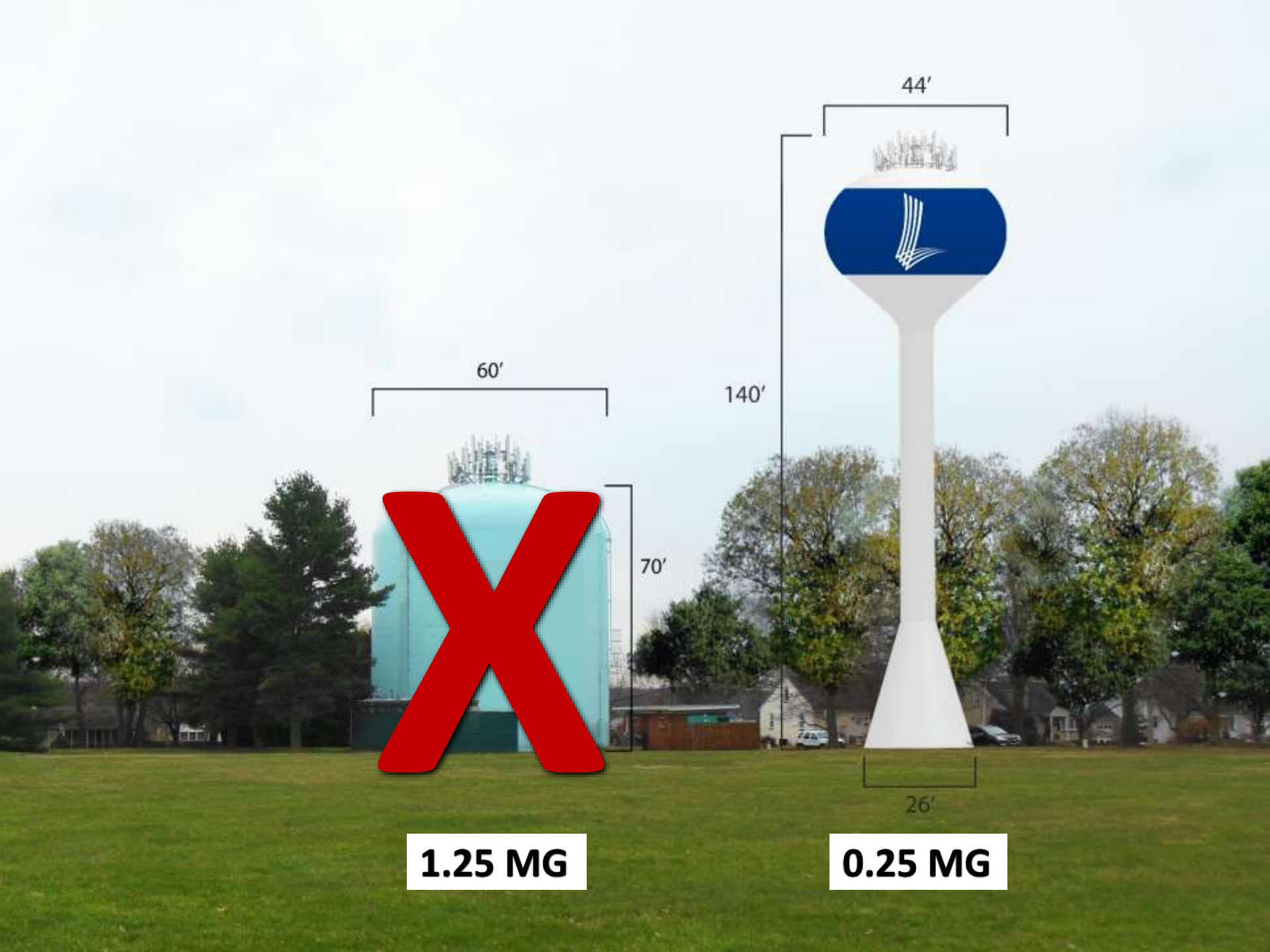
Case Study #3

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

Case Study #4

1.25 MG Standpipe


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
L-19
L-17
L-22
Thomas Rd
Sunset Dr
Pecan Dr
White Pine Dr
Aspen Dr
Lansdale Ave
Sycamore Dr
Beechwood Dr
Knoll Dr
Hemlock Dr
Passaic Dr
Aspen Pl
Winter Dr
Hawthorne Dr
Knapp Rd
Concord Pl
Gettysburg Dr
Monticello Pl
Yorktown St
Sycamore Dr
Lansdale Dr
Lakeview Dr
Barberry Dr
Norway Dr
Hillside Dr
Valley Brook Dr
Greenwood Rd
Crestview Rd
Park Dr
Woodland Dr
Mary Dr
Oakland
Elbow Ln
Bailey Way
Congress Ct
Nixrax Ct
Freedom Dr
Aconda Dr
Webster Rd
Granvery Ln
Hunter Ln
Wheaton Ln
Widdis Rd
Hancock Pl
Hancock Rd
Mathyns Ln
Cathyn Ln
Sandyn Ln
Dickenson Rd
Shannon Dr
Belfast Dr
Weatherd Dr
Derry Dr
Woodstown Dr
Mill Rd
Unnamed Street
Plymbrook Pkwy
Wissahickon Ave
Cedar St
Maple Ave
Cypress St
Spruce St
Willow St
Clay Ave
Cherry St
Maple St
Congress Lane
Laurel Ln
Crescent Ave
Berkinbrook Ave
Wissahickon Ave
Church St
Line St
Hancock St
Franklin St
Mound Vernon St
Prospect Ave
Perin St
Unnamed Street
Mill Ally
Fairview Ave
Pacific Ave
Addison Ln
Edgewood Ave
Hemlock St
Jones Ave
Elm Dr
7th St
6th St
5th St
4th St
3rd St
2nd St
1st St
Vine St
Pine St
Maine St
Reid St
Pierce St
Railroad Ave
Unnamed Street
Tank Alternative 1
Booster Station


60′
70′
1.25 MG
44′
140′
26′
0.25 MG

6. What's Everyone Else Doing?

Western P

- 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

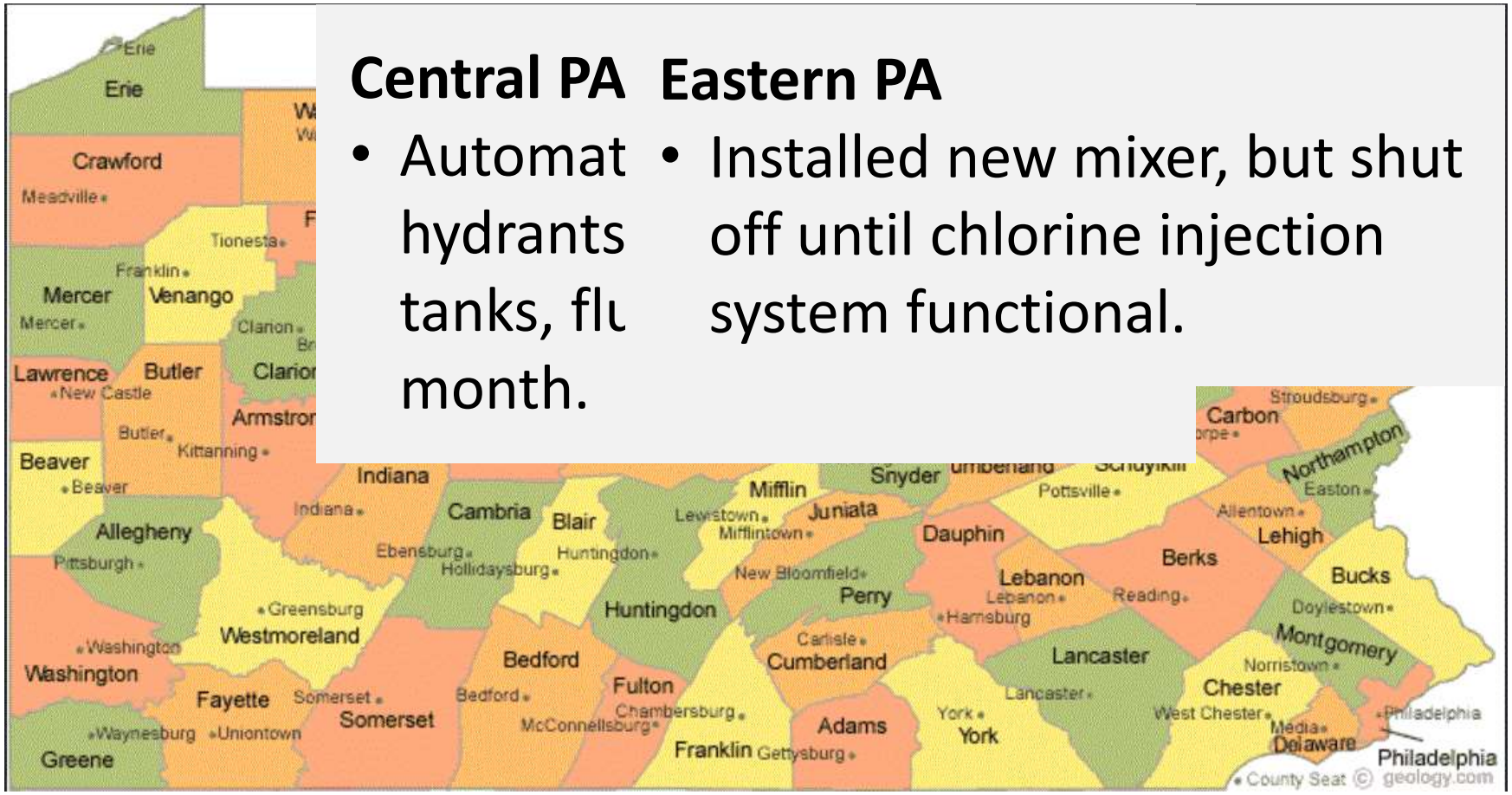
6. What's Everyone Else Doing?

Central PA

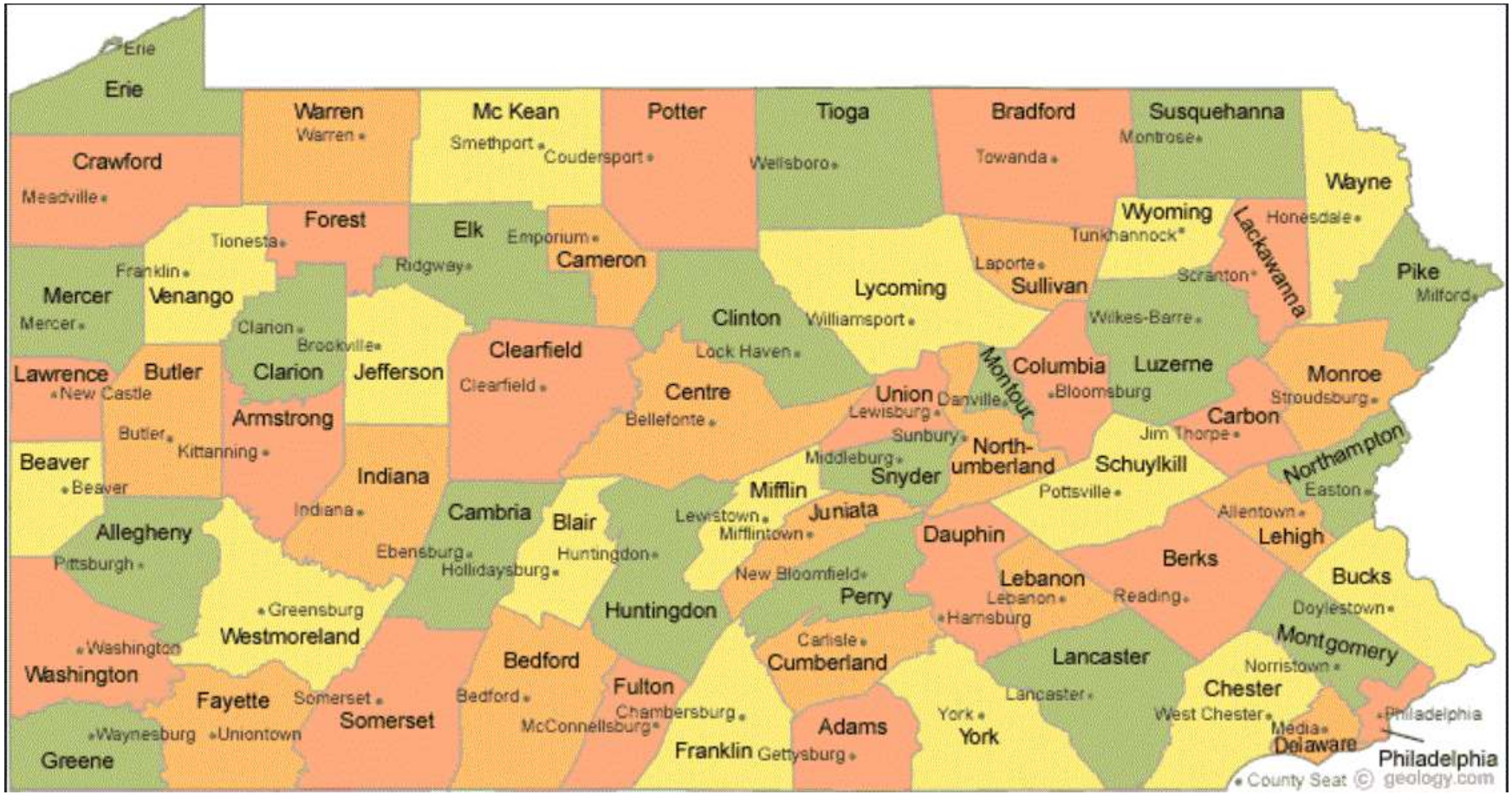
- Automat
  hydrants
  tanks, flu
  month.

Eastern PA

- Installed new mixer, but shut off until chlorine injection system functional.

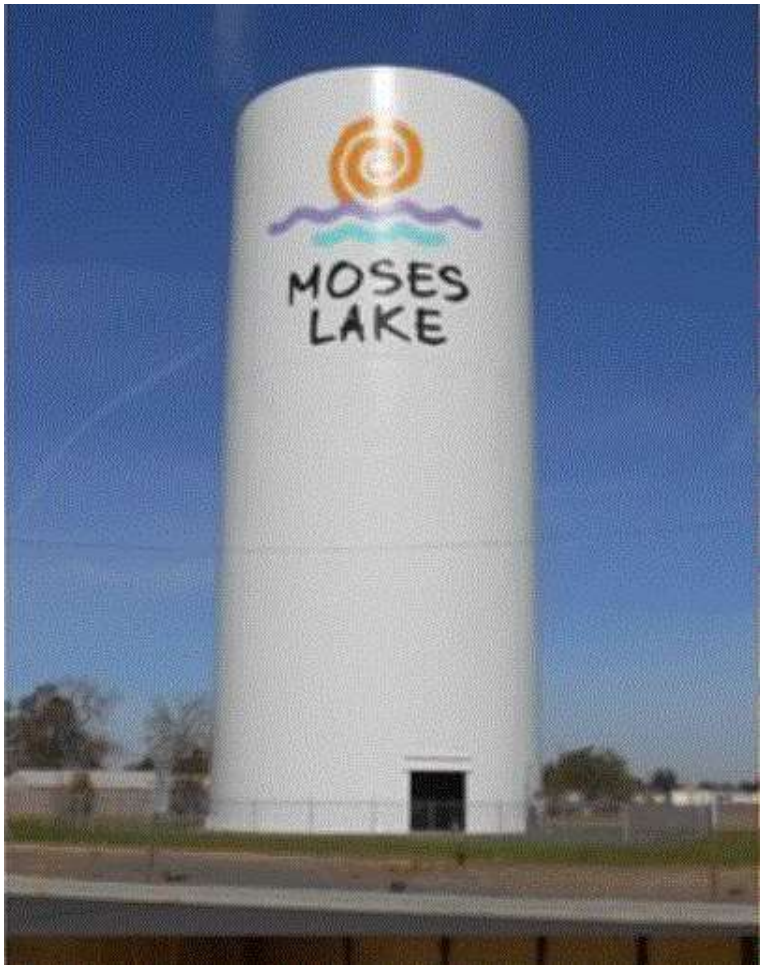


What Are YOU Doing?



What's Everyone Else Doing?

Turn a Standpipe Into an Elevated Tank



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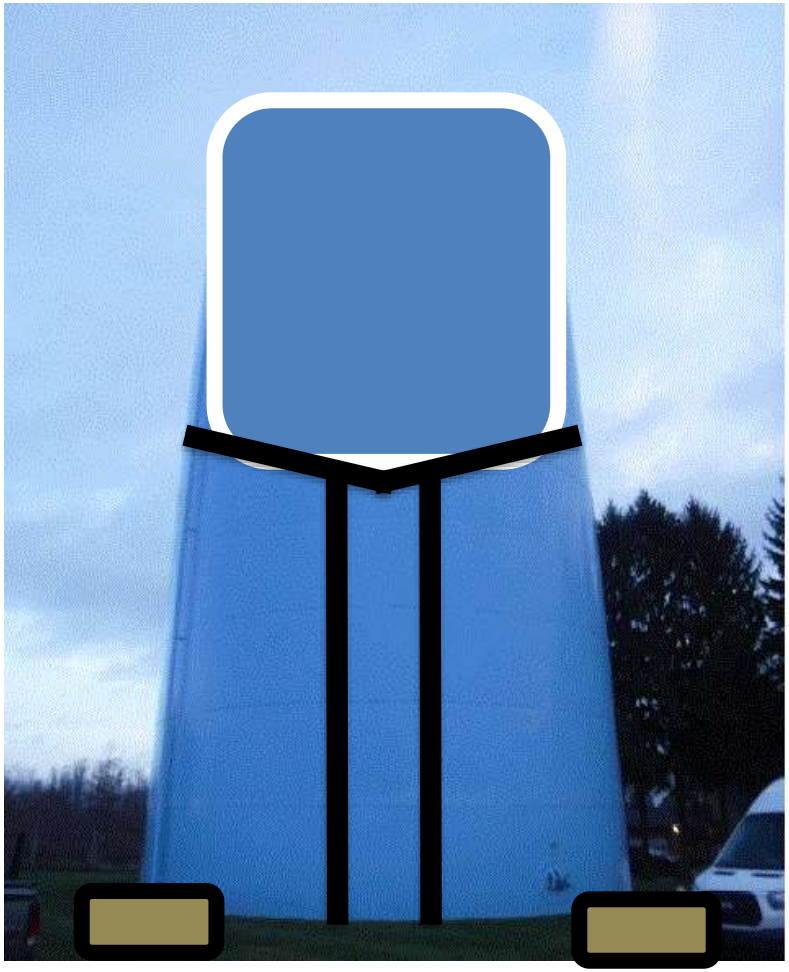

Conclusions

- Can’t design or operate tanks like we did 25 years ago.
- Know what problem you are solving.
- Get accurate data, over a period of time.
- Tank mixing on its own does not improve water quality.
- Help is out there
  - PA DEP – Justin Blashaw
  - AWWA M-68
  - Your colleagues

Check out our website:
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Questions?