



Tighe&Bond

Engineers | Environmental Specialists

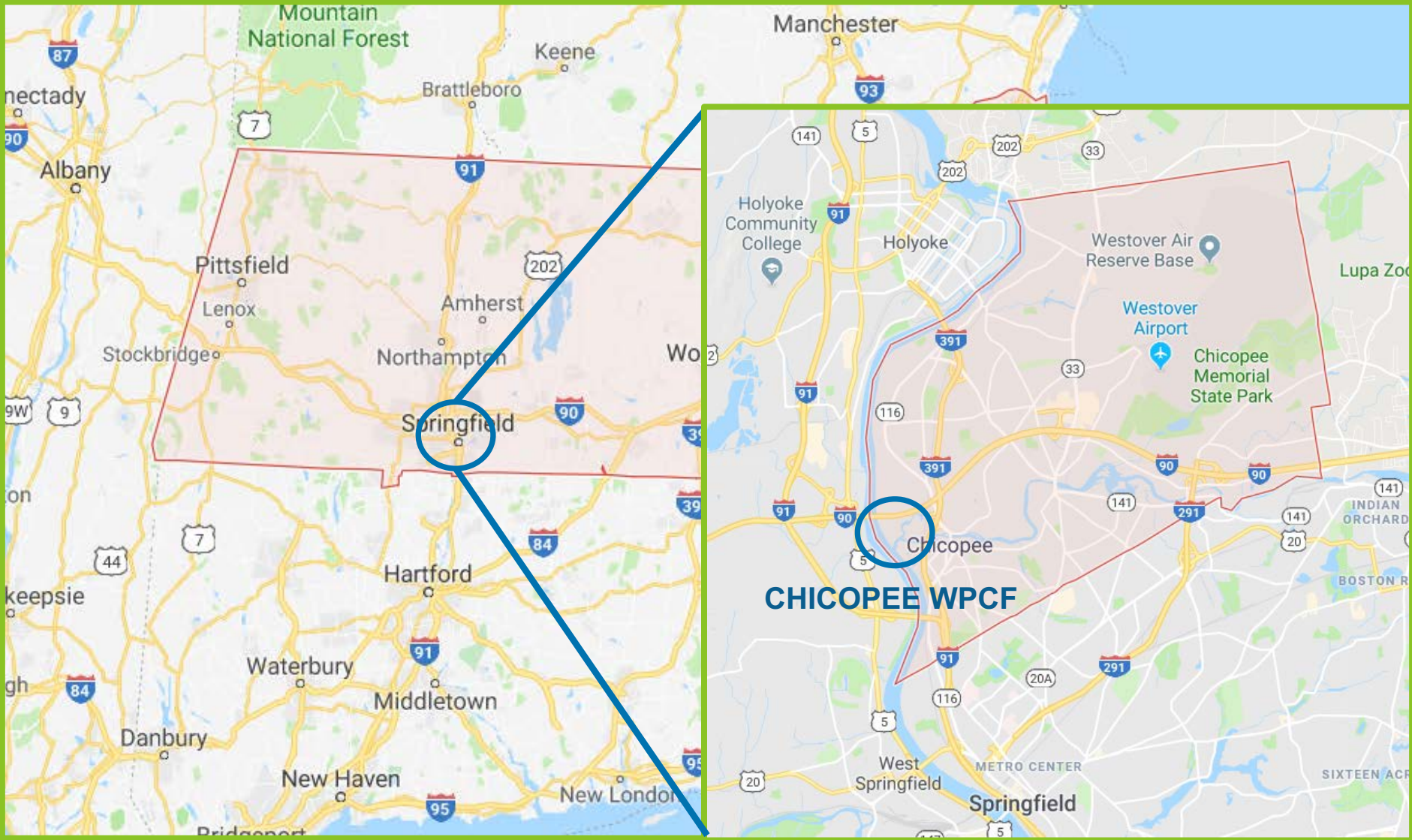


HYDRAULIC IMPROVEMENTS AND LESSONS LEARNED WITH UPGRADES TO TWO 75' SQUIRCLE SECONDARY CLARIFIERS IN CHICOPEE, MA

NEWEA 2019 Annual Conference

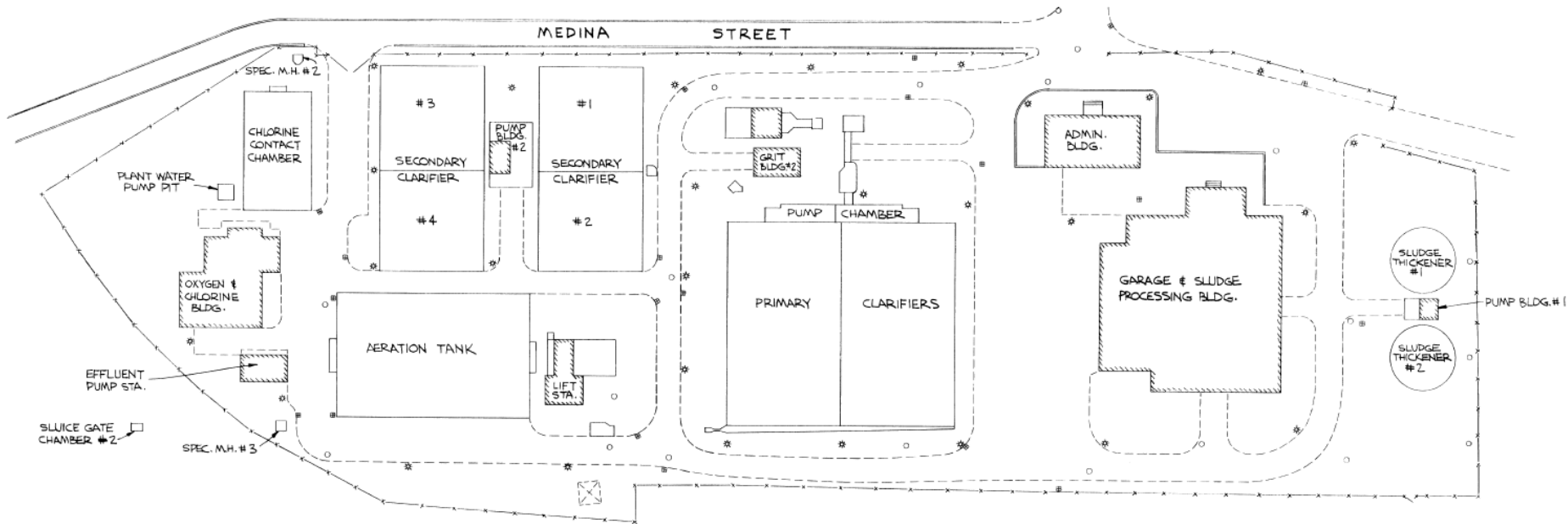
Jacob Weinrich, PE, Project Engineer, Tighe & Bond
Mike Williams, Project Manager, SUEZ

CHICOPEE, MA



CHICOPEE WPCF

- **Originally Constructed 1964**
 - Headworks
 - Primary Clarifiers
- **Secondary Treatment Added 1974**
 - Union Carbide UNOX system
 - Four 75-foot “squircle” secondary clarifiers
 - Disinfection



UNOX SYSTEM

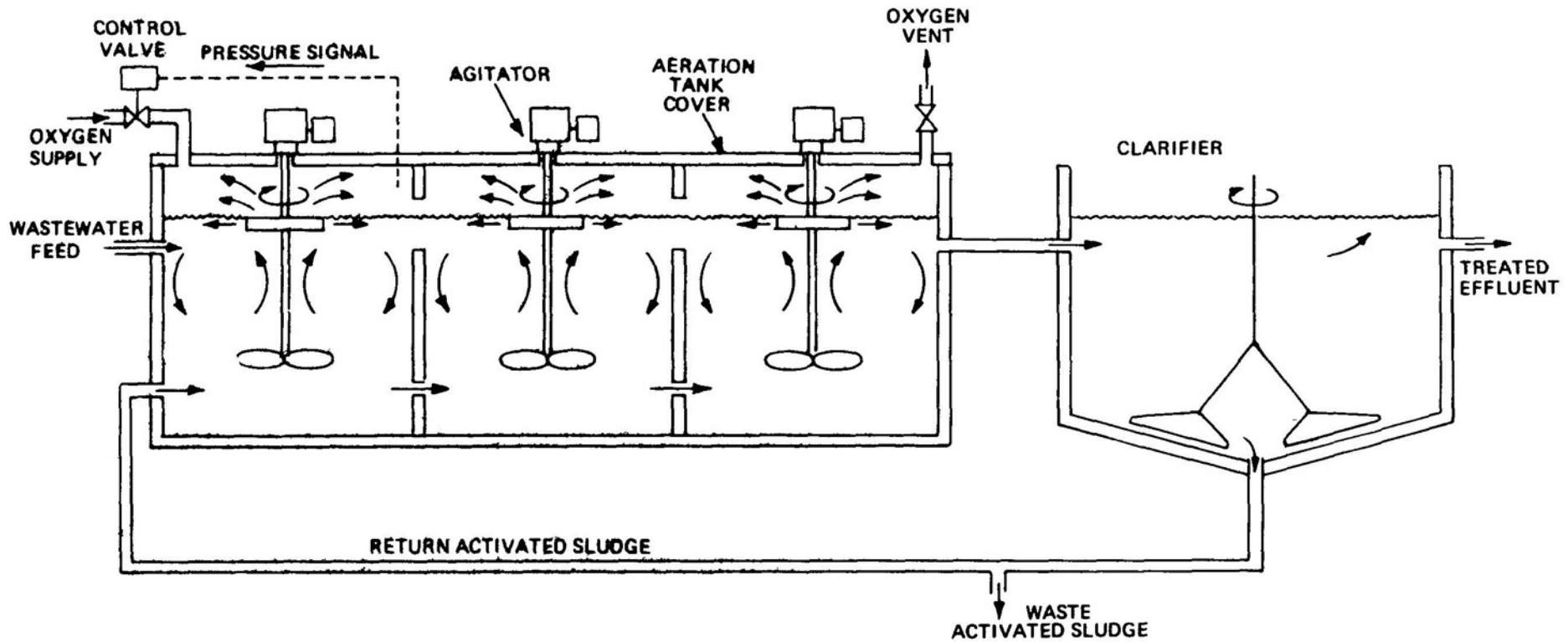
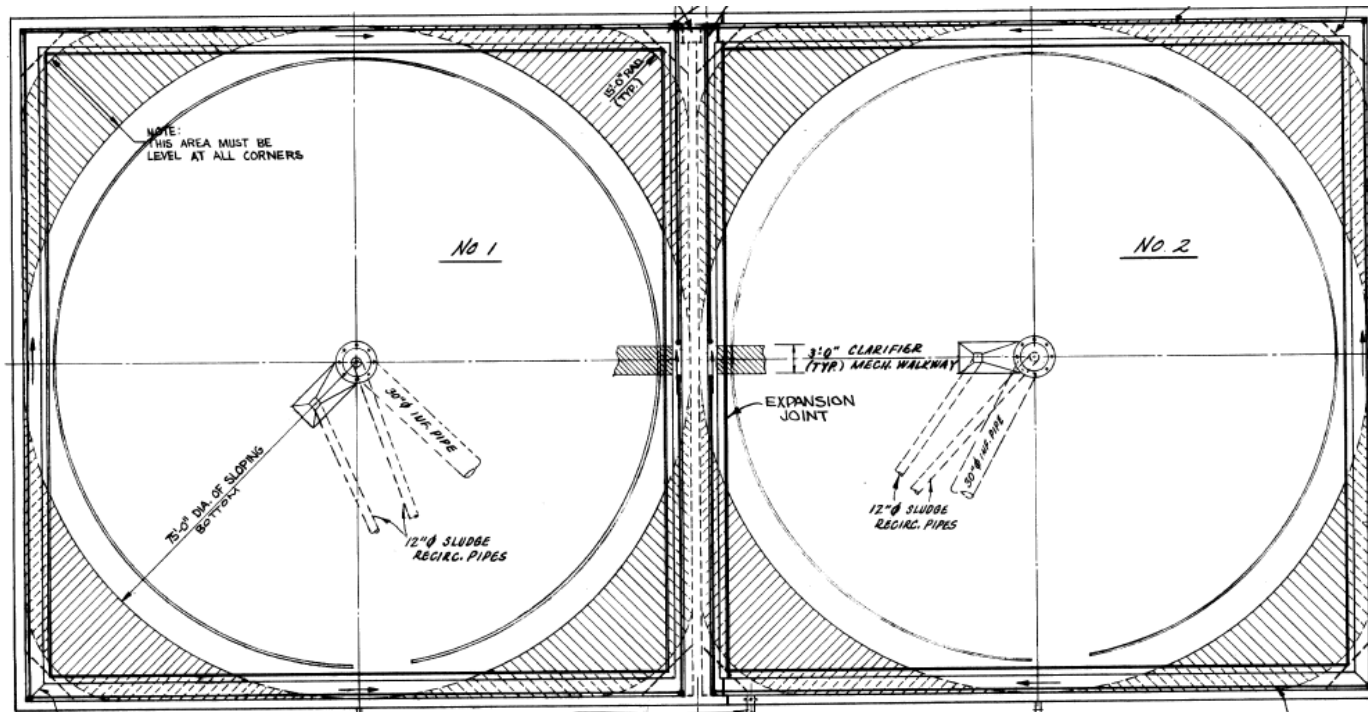


Image Courtesy "Oxygen Activated Sludge Wastewater Treatment Systems: Design Criteria and Operating Experience", USEPA, August 1973

SQUIRCLE CLARIFIERS

- Square tank with circular mechanism
- Open-bottom centerwell-fed
- Chamfered corners
- Inboard launders
- Effluent weirs along straight walls
- Corner-sweep mechanism to pull sludge from corners



CLARIFIER ISSUES

- **Issues with loss of solids**
 - Winter months
 - Wet weather events
- **Revised NPDES permit included Al limit**
 - Previously used alum coagulant to control solids loss
- **40+ year old clarifier mechanisms reaching end of useful life**



CLARIFIER EVALUATION

- Clarifier hydraulic evaluation performed by Clarifier Performance Evaluations (CPE)
 - Visual dye test
 - Drogue test
 - Sludge blanket profiles
 - Recommendations
 - Energy Dissipating Inlet (EDI) centerwells
 - Mid-radius baffles
 - Density current baffles



HYDRAULIC RECOMMENDATIONS



SCOPE OF IMPROVEMENTS

- **Upgrades to 2 of 4 clarifiers**
- **Replace clarifier mechanism**
- **New LA-Style EDI well**
- **Density current baffle**
- **Mid-radius baffle**
- **Launder covers**
- **FRP scum rings/weirs**
- **Scum beach w/ autoflush**
- **Structural improvements**
 - Concrete repair
 - Concrete coating



BEFORE/AFTER



BEFORE/AFTER



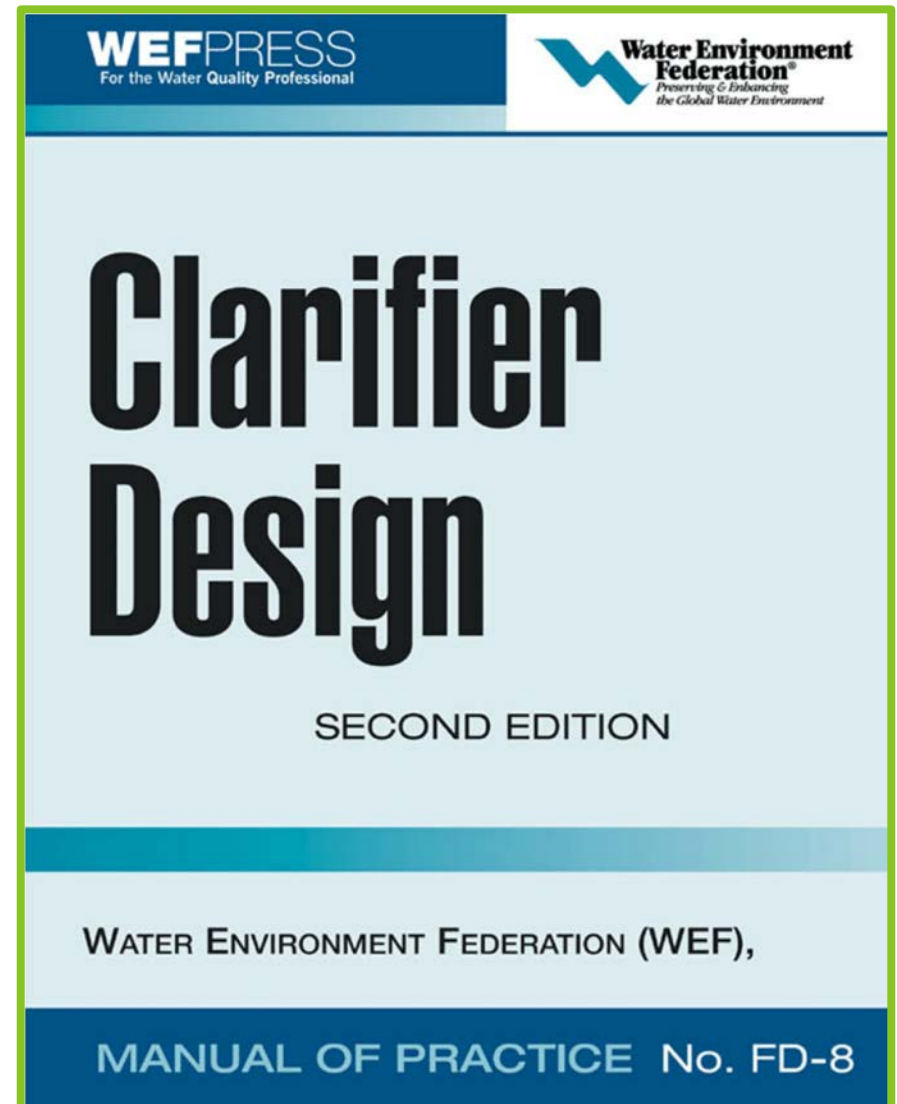
LESSONS LEARNED DURING CONSTRUCTION

- Scum Flushing Valve
- Concrete Crack Injection



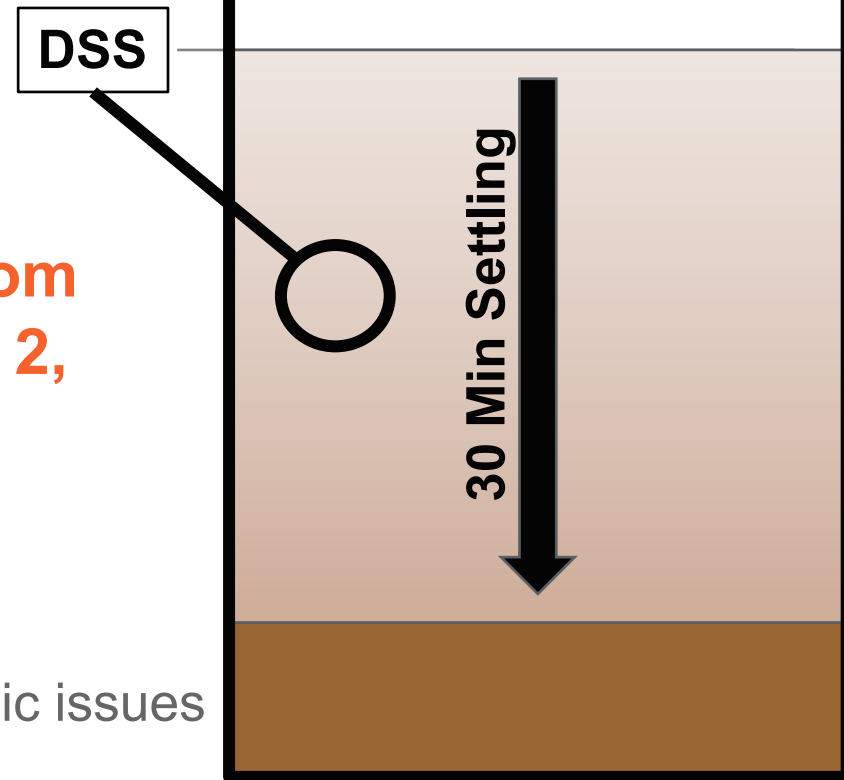
TSS/DSS PERFORMANCE TESTING

- **TSS/DSS Testing**
- **DSS**
 - Dispersed Suspended Solids
 - Supernatant of sample settled for 30 min
 - Estimates settling under “ideal” hydraulic conditions
 - Provides a benchmark of the maximum clarification hydraulically possible
 - Snapshot of flocculation



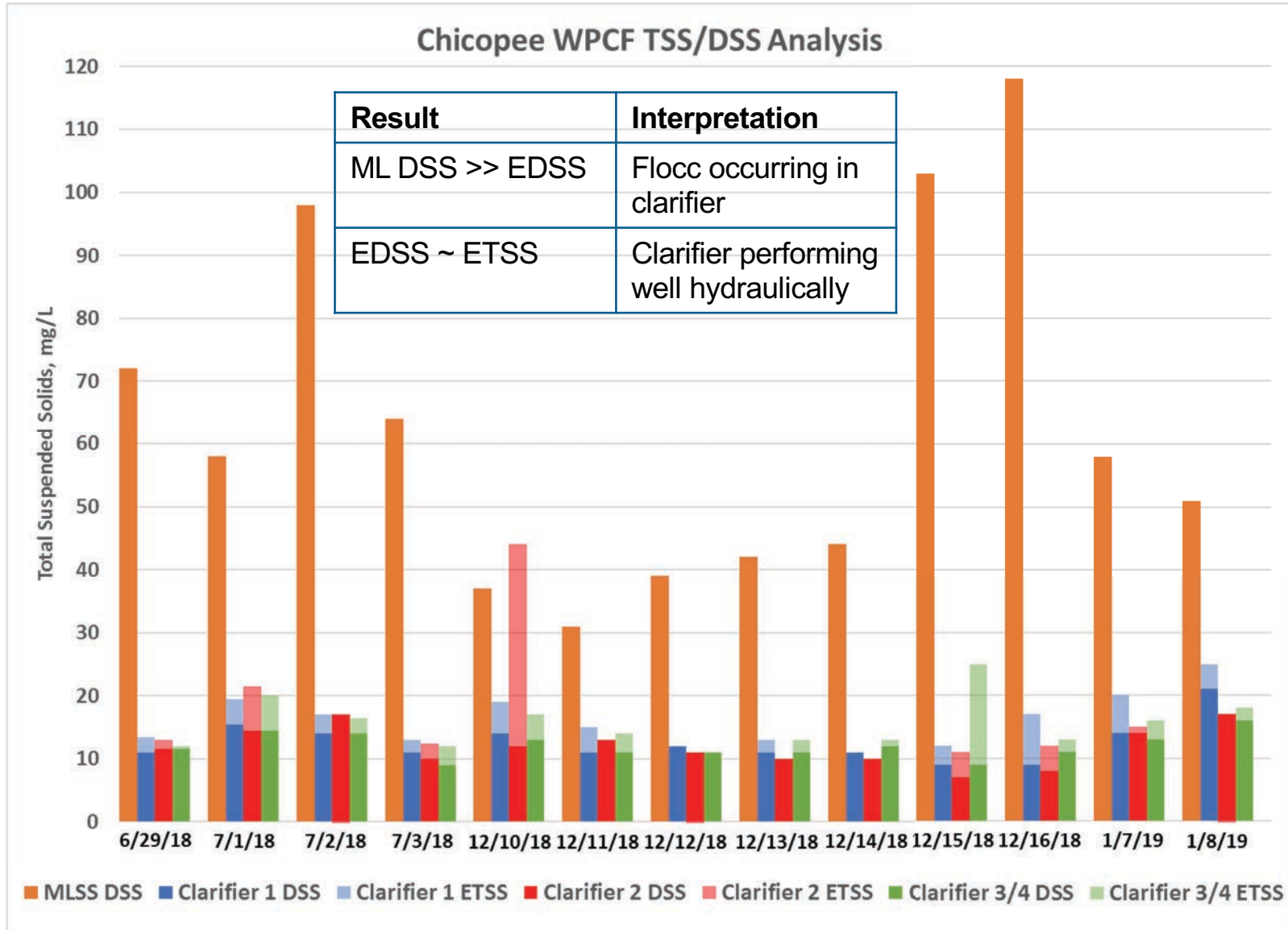
TSS/DSS SAMPLING PLAN

- **Sample of Mixed Liquor**
 - TSS (MLSS)
 - DSS (ML DSS)
- **Sample of Clarifier Effluent from Launderers: Clarifier 1, Clarifier 2, Clarifier 3/4 (Composite)**
 - TSS (ETSS)
 - DSS (EDSS)
- **Conclusions**
 - If ETSS >> EDSS, potential hydraulic issues
 - If ETSS ~ EDSS, good hydraulics
 - If EDSS >> ML DSS, potential floc issues
 - If EDSS << ML DSS, good floc in clarifier

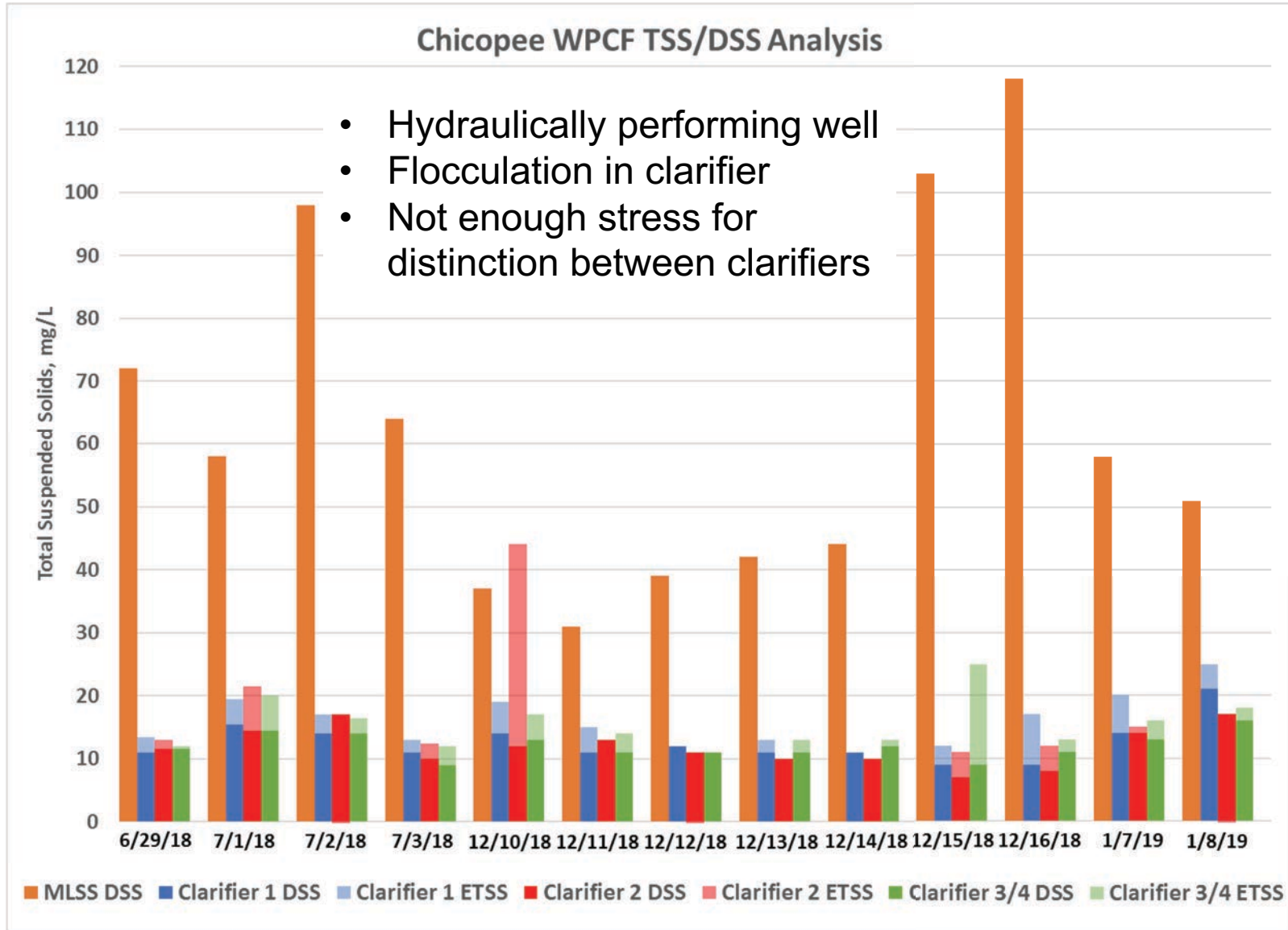


**Mixed Liquor or
Effluent Sample**

PERFORMANCE TESTING RESULTS-TSS/DSS

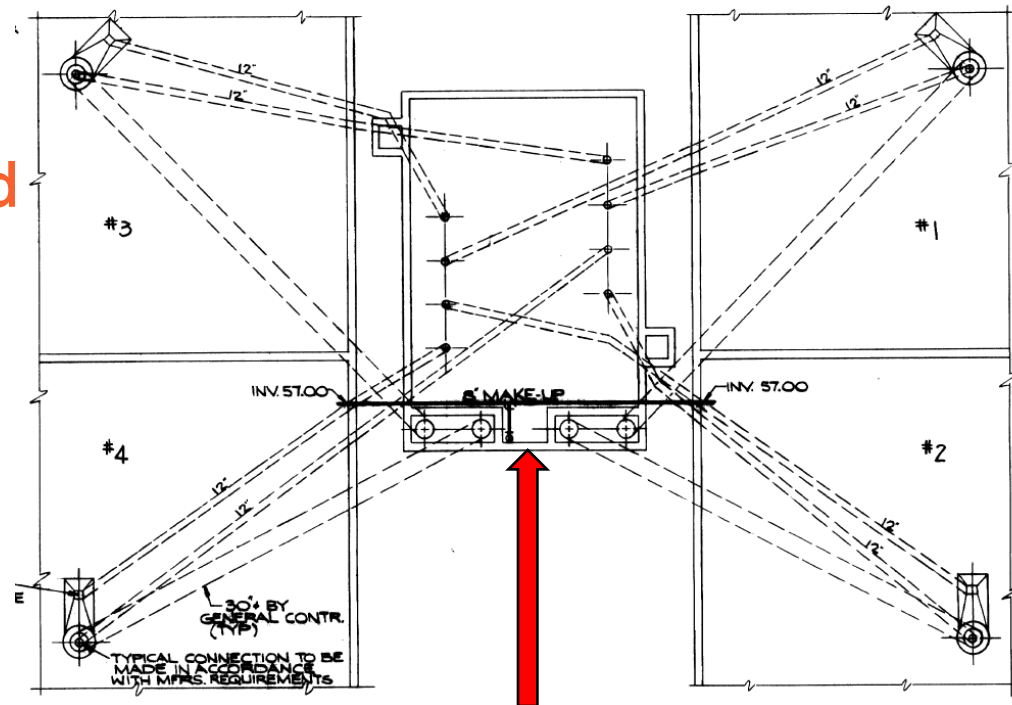


PERFORMANCE TESTING RESULTS-TSS/DSS



ADDITIONAL PERFORMANCE TESTING – DYE TEST

- Helps assess clarifier hydraulic performance
- Rhodamine WT dye added to common mixed liquor distribution box
- Effluent samples taken periodically to quantify dye through the clarifiers
- Dye testing performed by CPE



Dye added to
common mixed liquor
distribution box

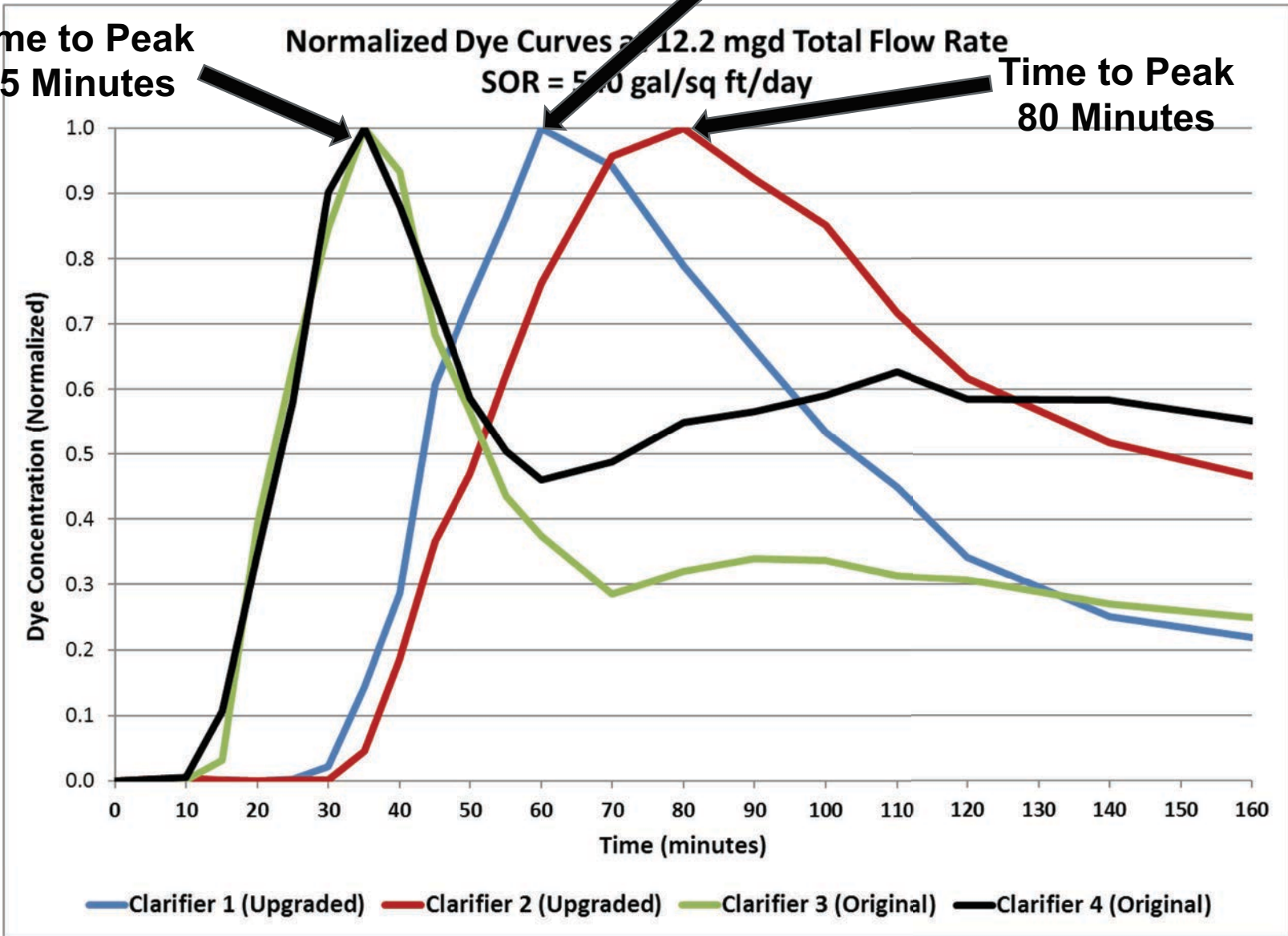
DYE TESTING RESULTS

Time to Peak
35 Minutes

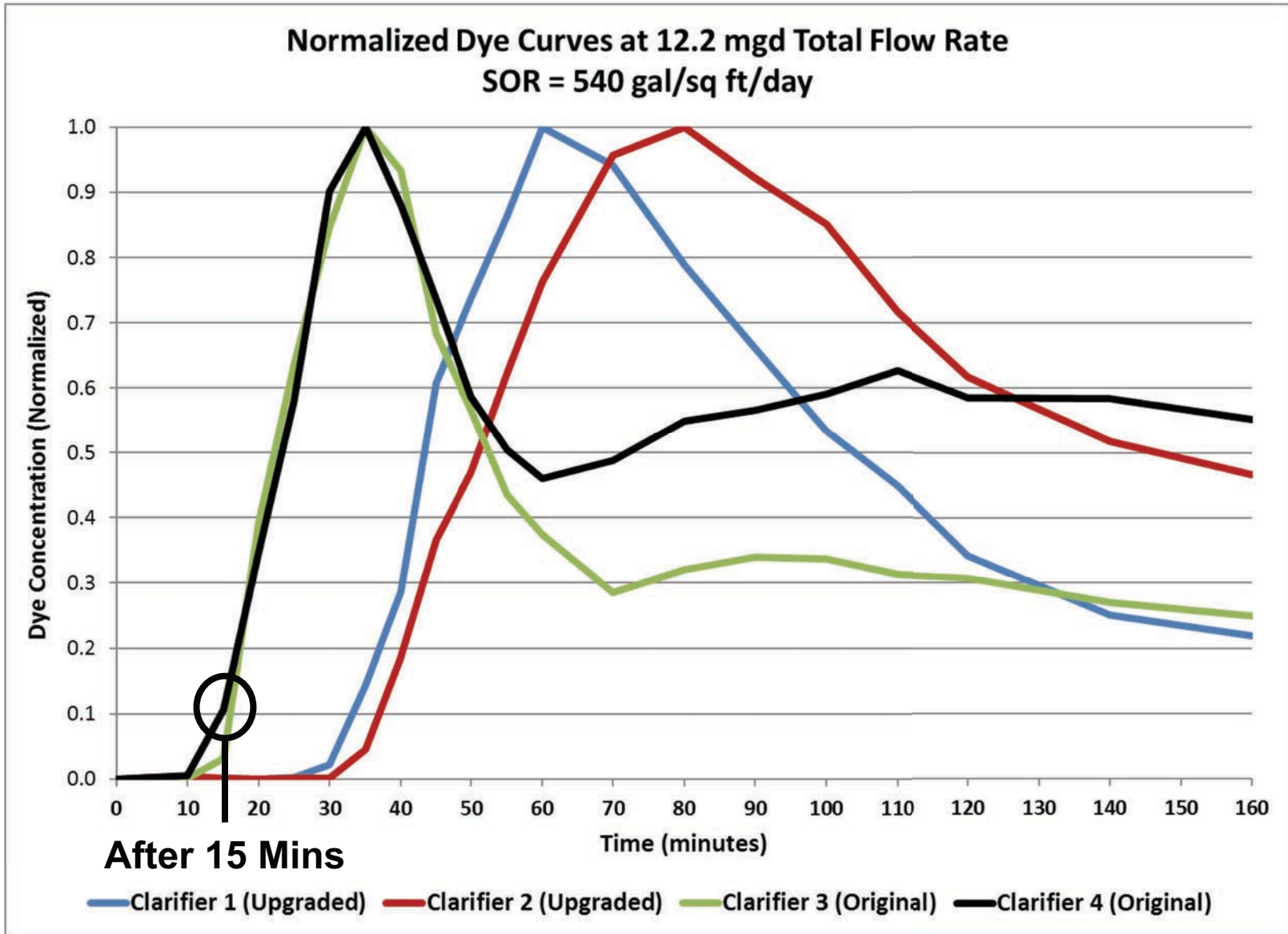
Normalized Dye Curves at 12.2 mgd Total Flow Rate
SOR = 5.0 gal/sq ft/day

Time to Peak
60 Minutes

Time to Peak
80 Minutes



DYE TESTING RESULTS



DYE TESTING RESULTS

After ~15 Minutes

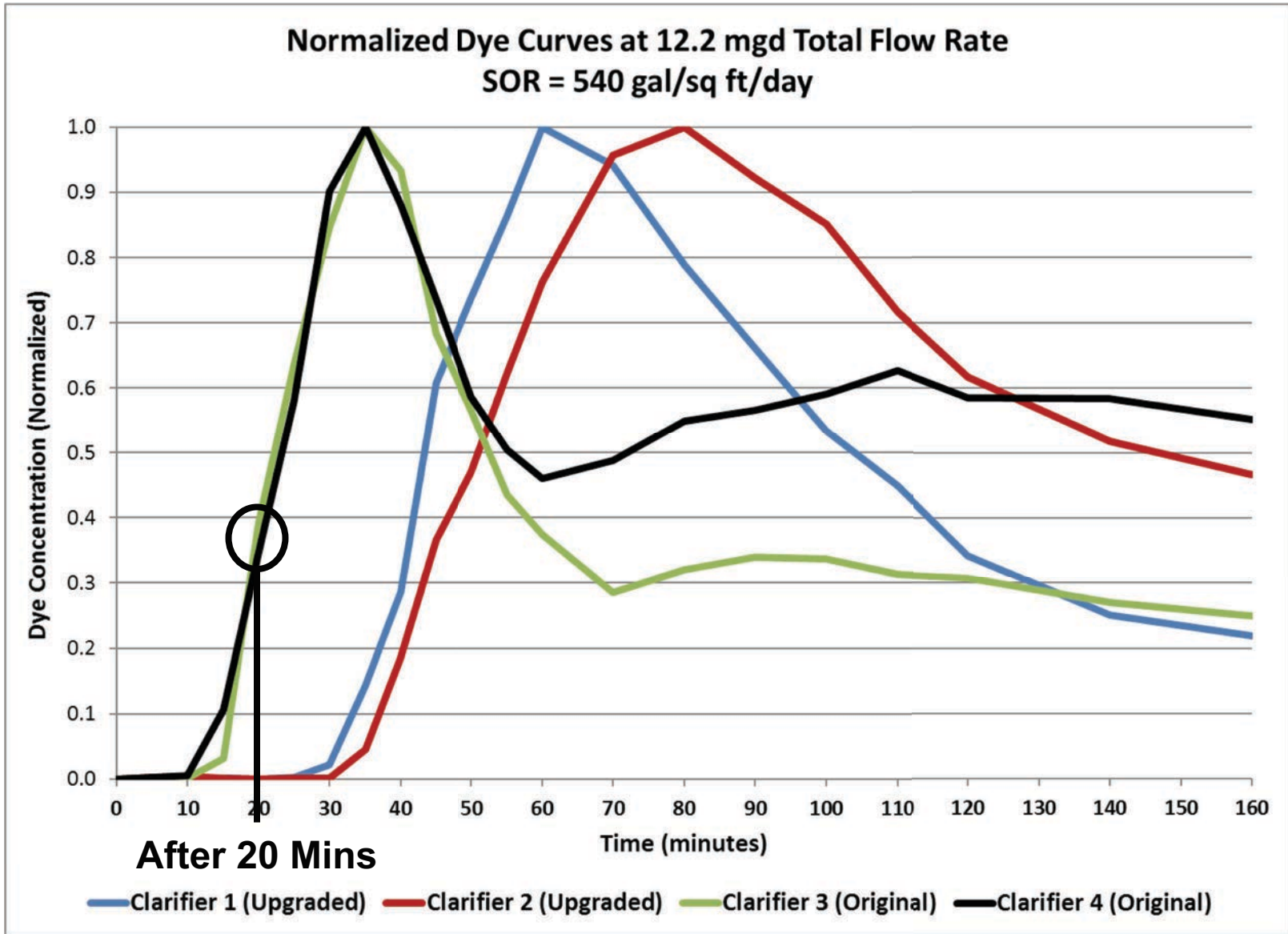


Upgraded



Original

DYE TESTING RESULTS

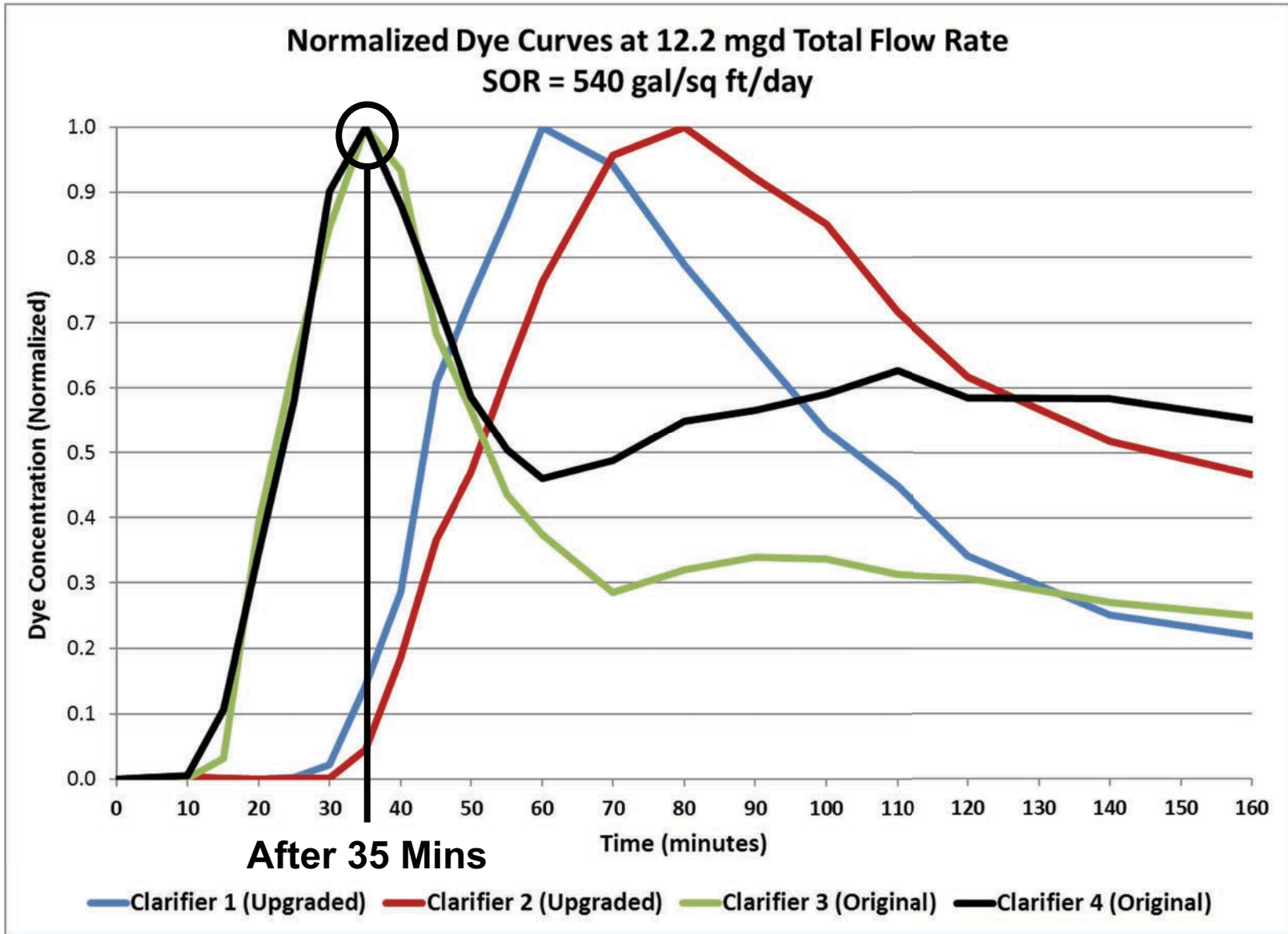


DYE TESTING RESULTS

After ~20 Minutes



DYE TESTING RESULTS



DYE TESTING RESULTS

After ~35 Minutes



Upgraded



Original

CURRENT AND FUTURE WORK

- **Further Clarifier Evaluation**

- Stress Test/SPA, DSS/FSS

- **Biological Improvements**

- Aeration Tank/VFD Improvements
- New Return Activated Sludge Meter
- Secondary Coagulant Addition (Ferric)
- SRT-Controlled Solids Wasting



ACKNOWLEDGEMENTS

- **City of Chicopee**
 - Bill Wood
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 - Tim Miller



QUESTIONS

