

CFD Analysis of Passive Chemical Injection and Mixing Systems

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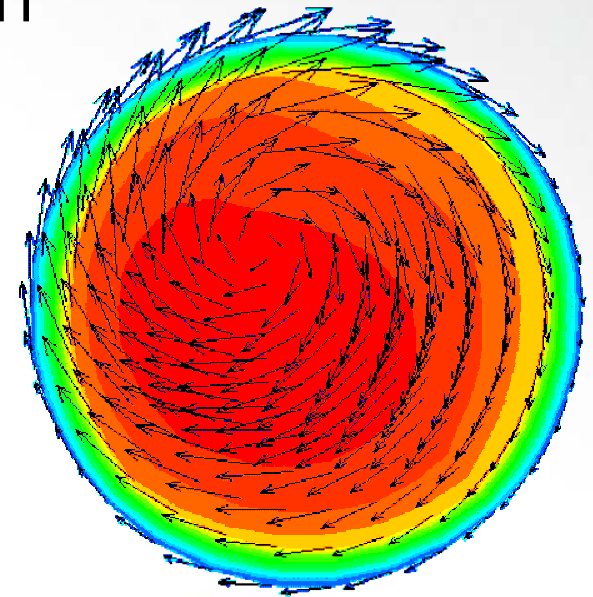
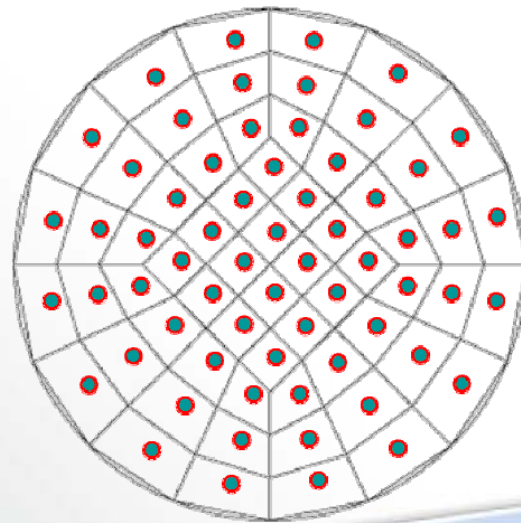
¹ Carollo Engineers

² City of Everett



CFD Modeling

1. Computational Fluid Dynamics (CFD) is:
 - a. Turbulent fluid motion, energy, reactions, etc
 - b. Graphics solution visualization



Water Treatment Mixing

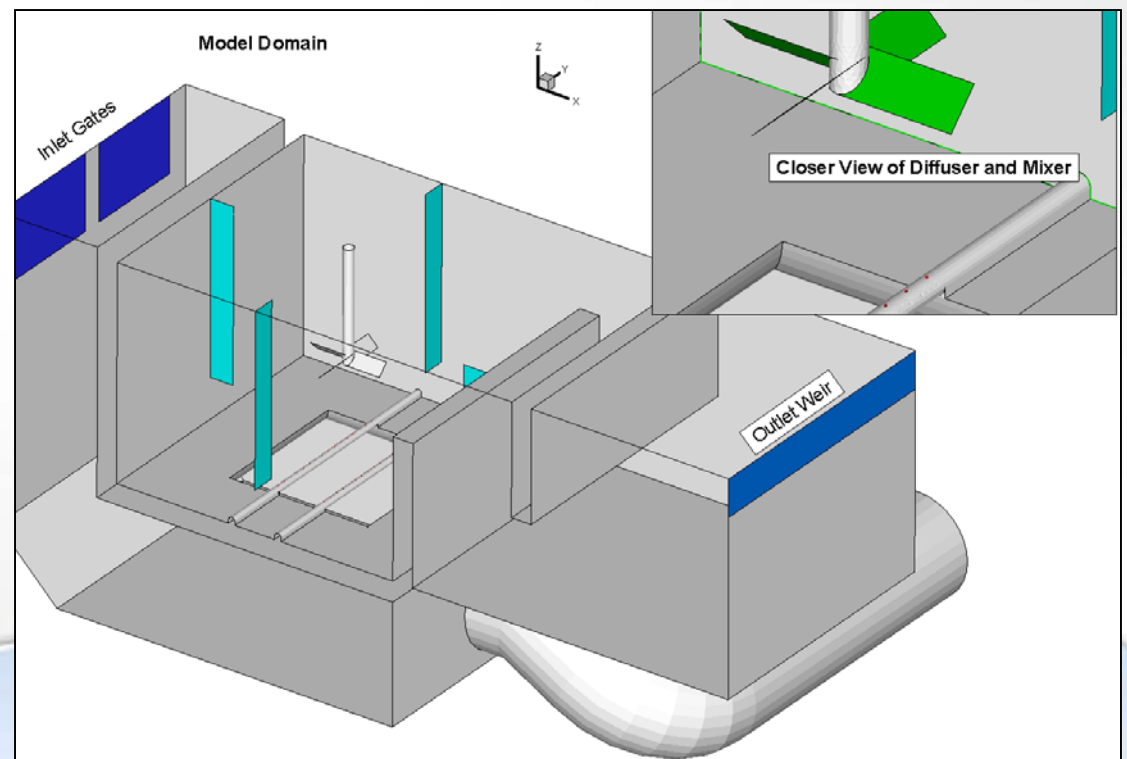
1. Lots of Mixing in Water Treatment
 - a. Flocculation
 - b. Softening
 - c. Disinfection
2. Methods
 - a. Mechanical
 - b. Passive turbulent

Why Model Mixing?

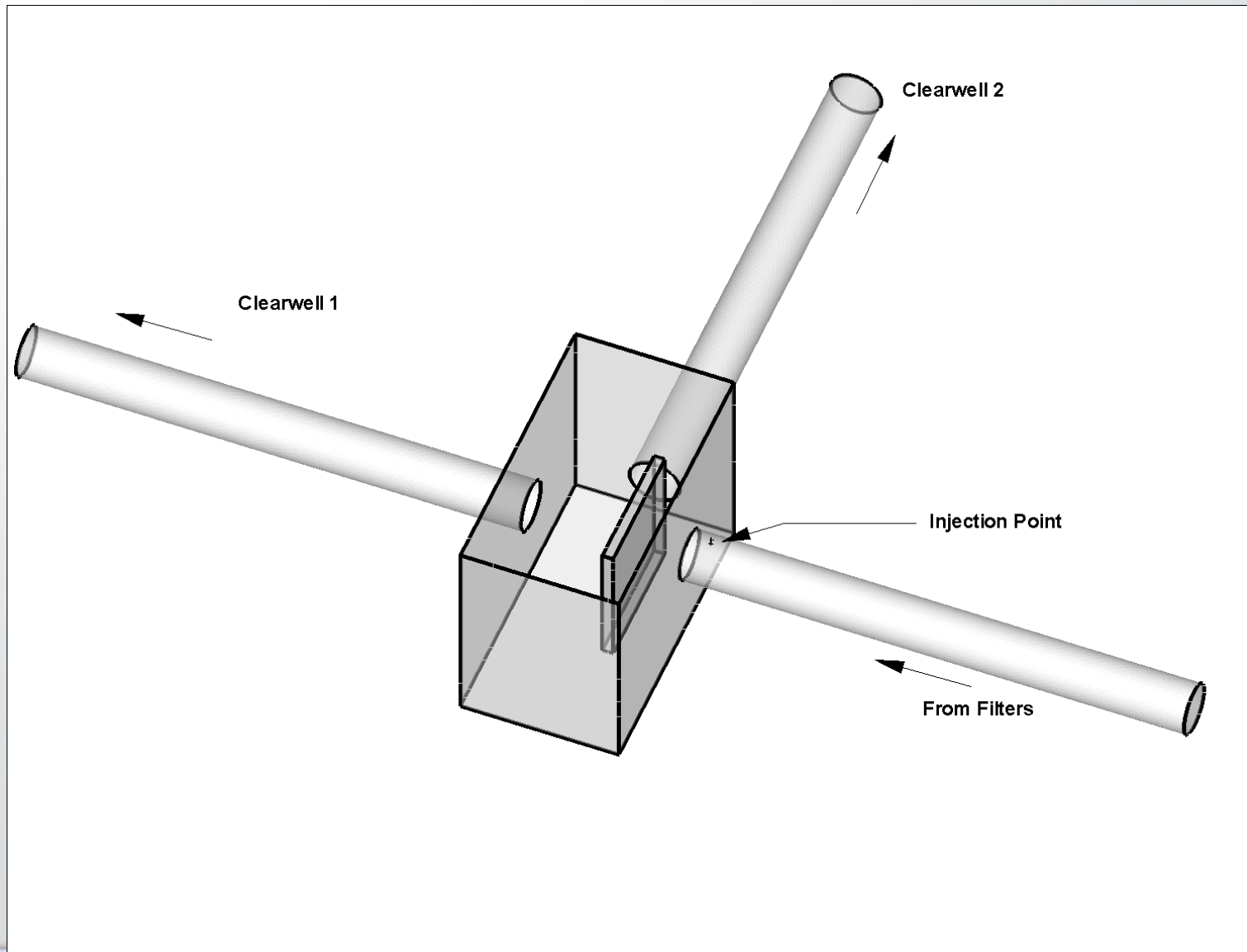
1. Verify and Optimize Design
 - a. Minimize chemical requirements
 - b. Minimize the footprint
2. Can Model Reaction and Decay

City of Everett WTP Expansion

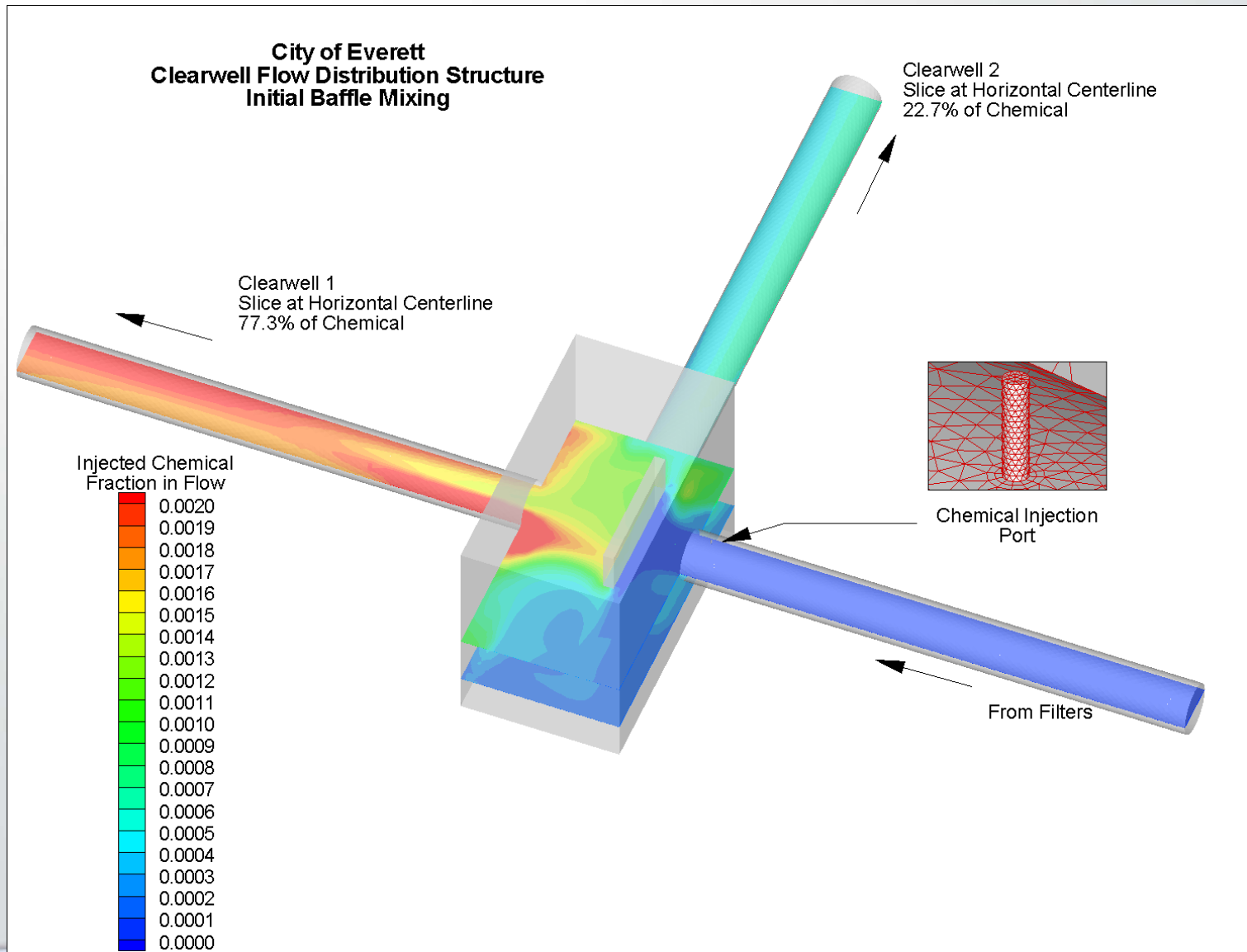
1. Second Clearwell Being Added
 - a. Non-symmetric layout
 - b. Split influent line in junction structure
2. Option for Additional Influent Later
3. Chlorine Mixing options
 - a. Passive
 - b. Active



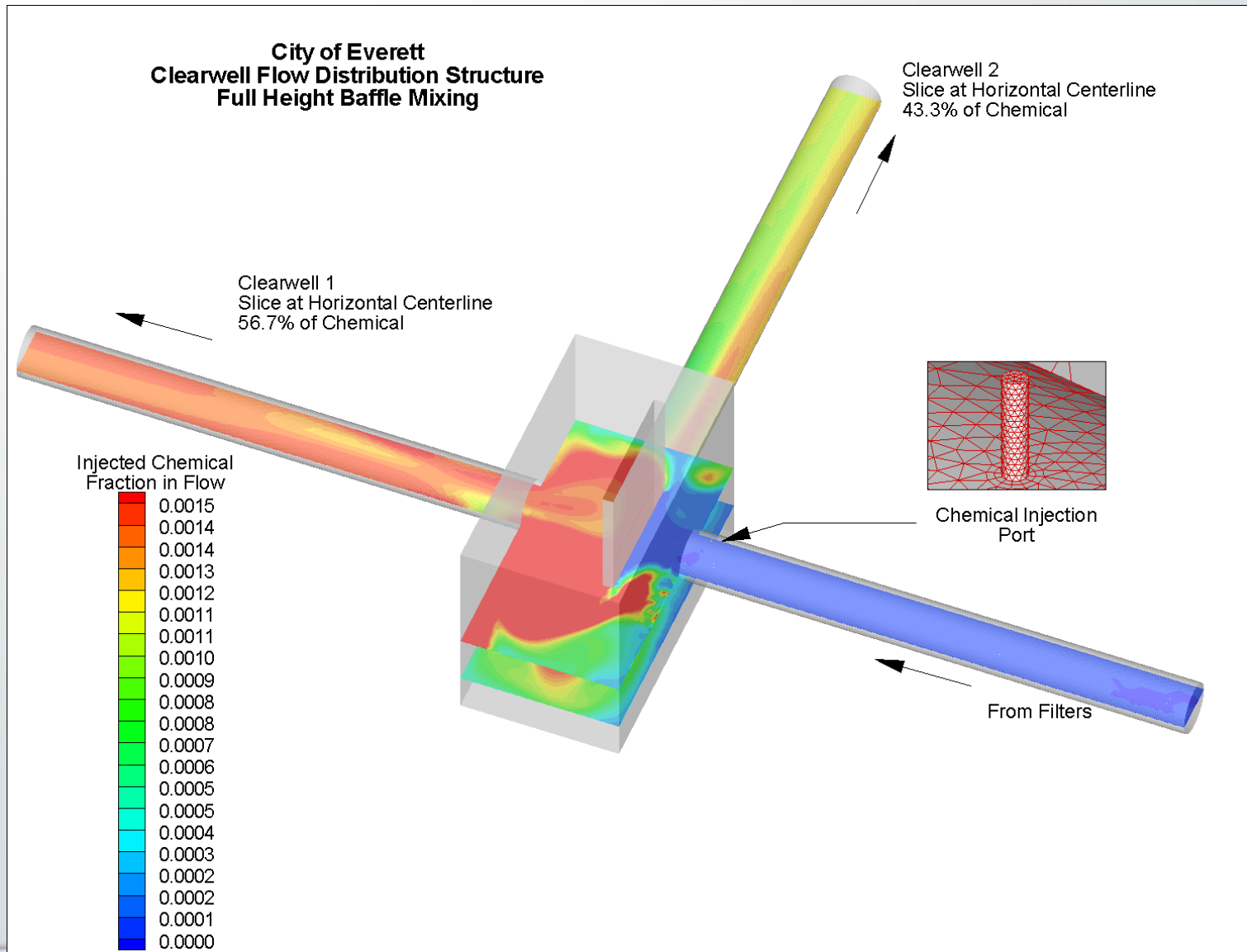
Junction Initial Layout



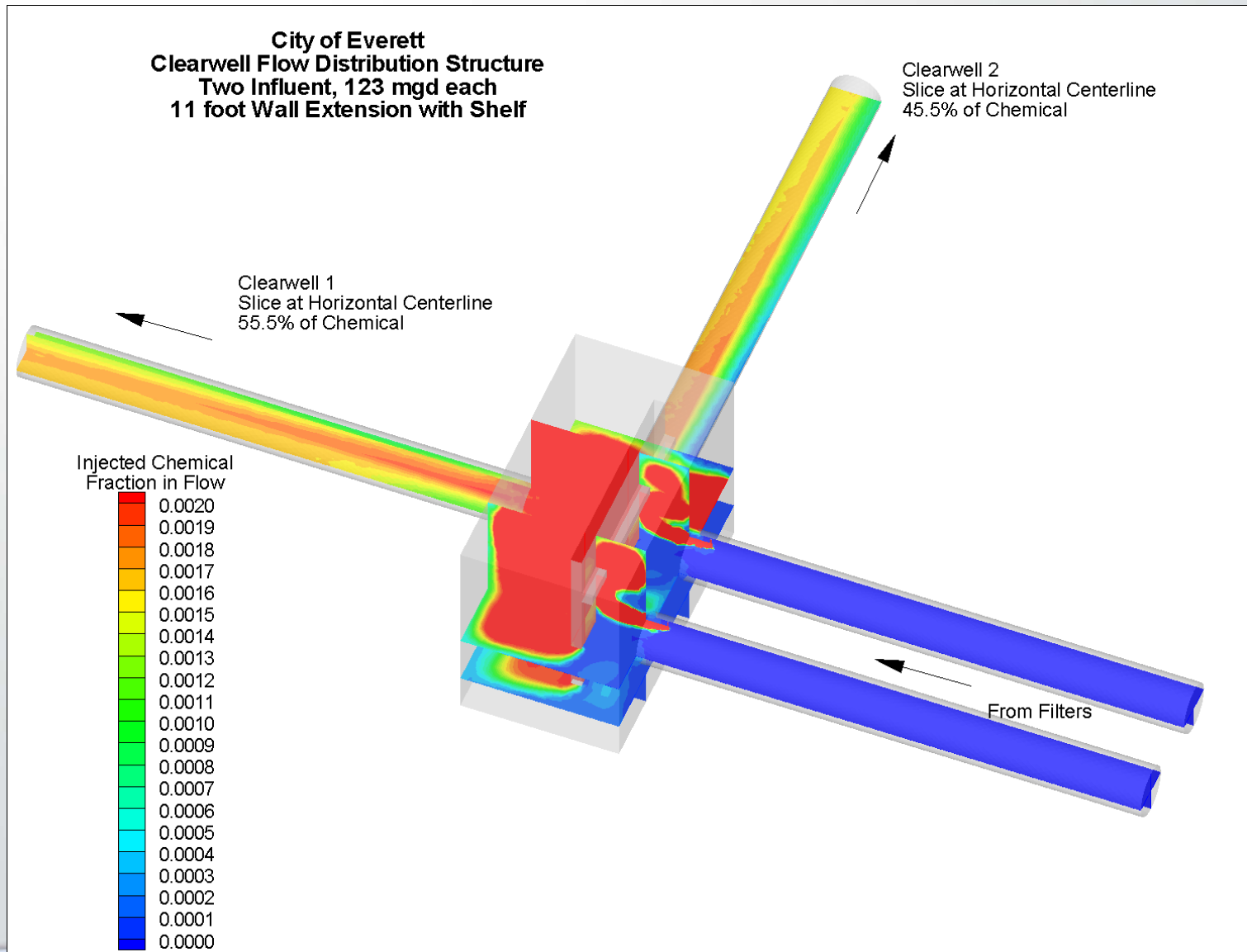
Initial Chlorine Split



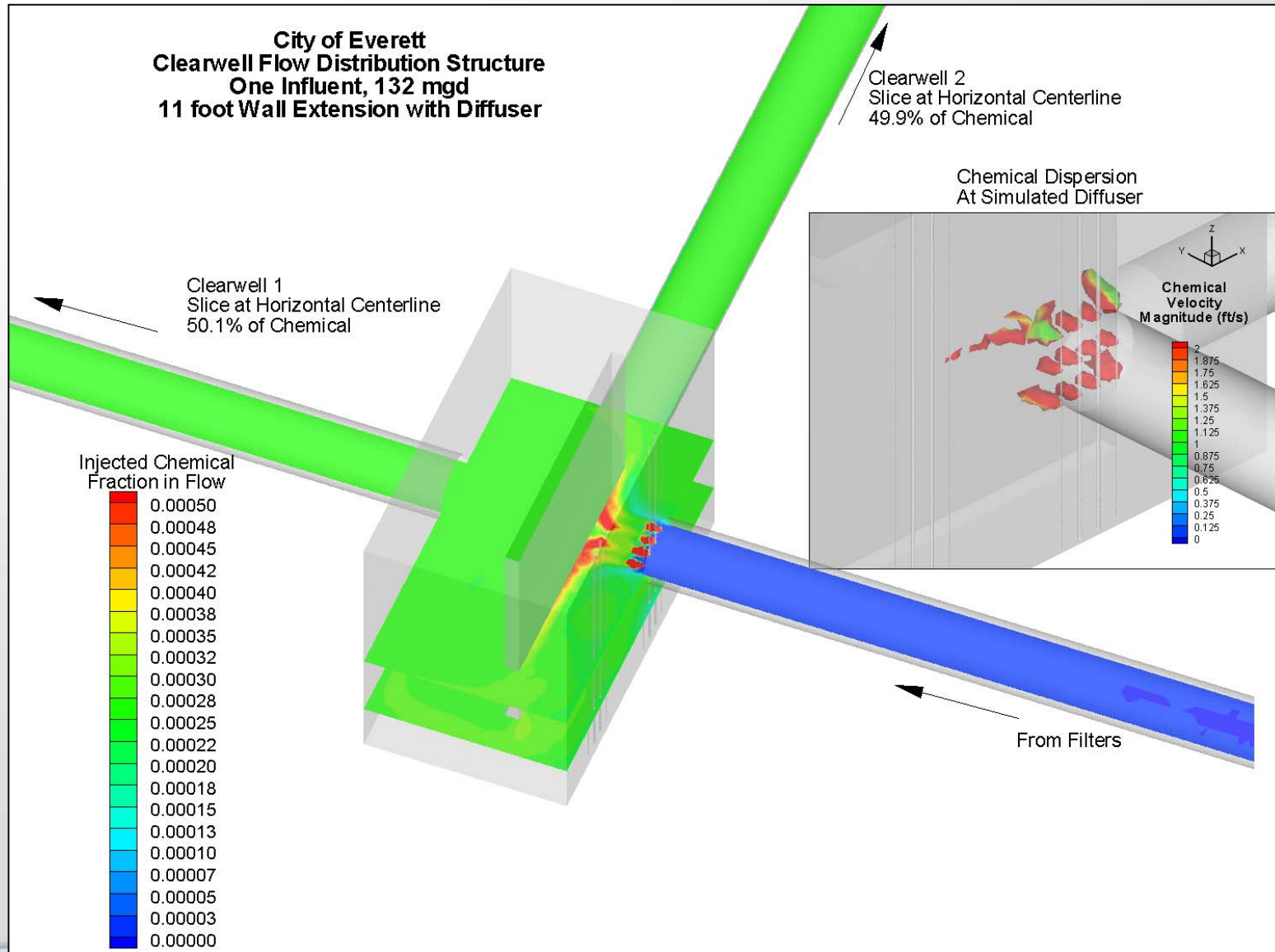
Full Height Baffle



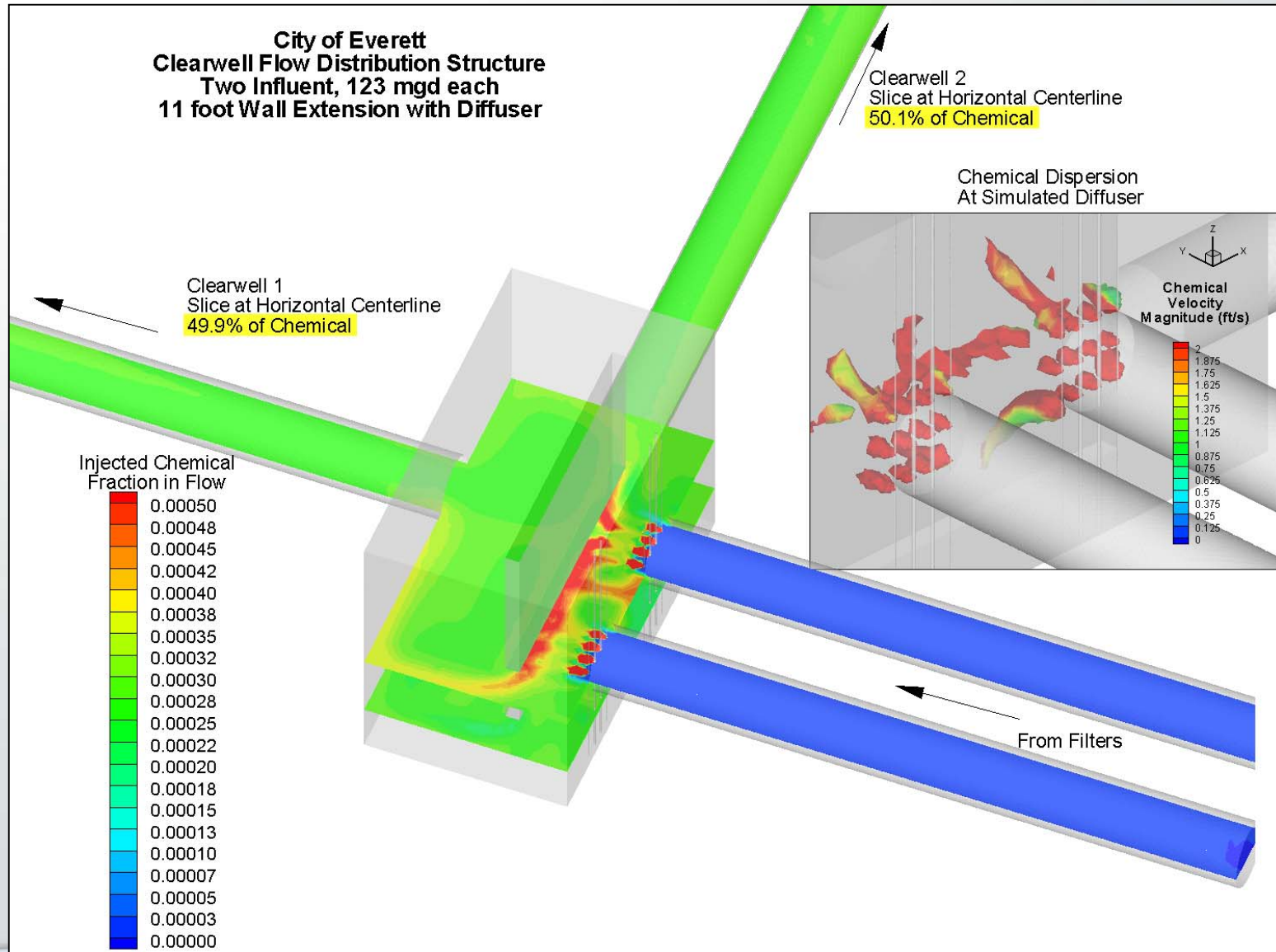
Second Influent, Wider Baffle



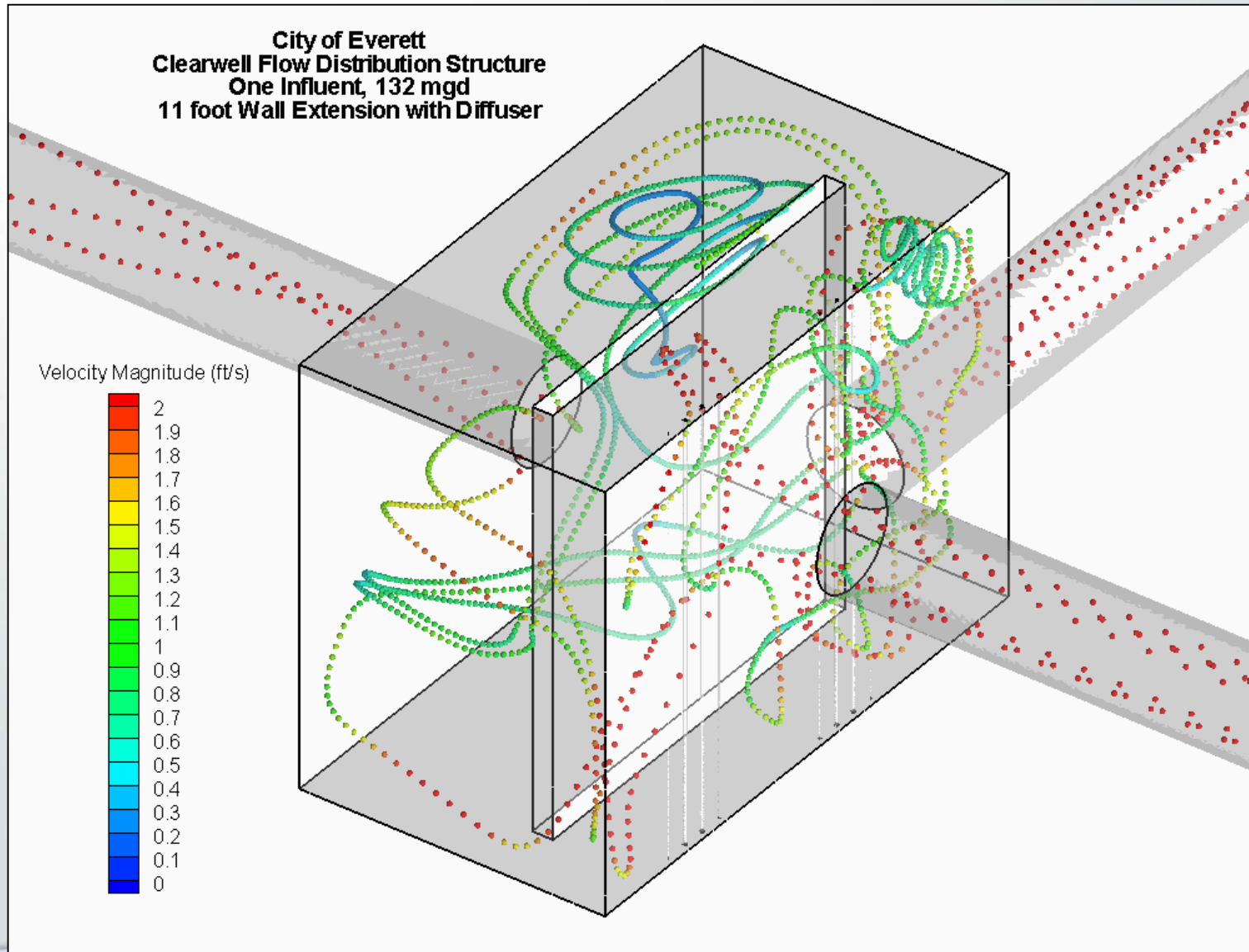
Diffuser and Wider Baffle



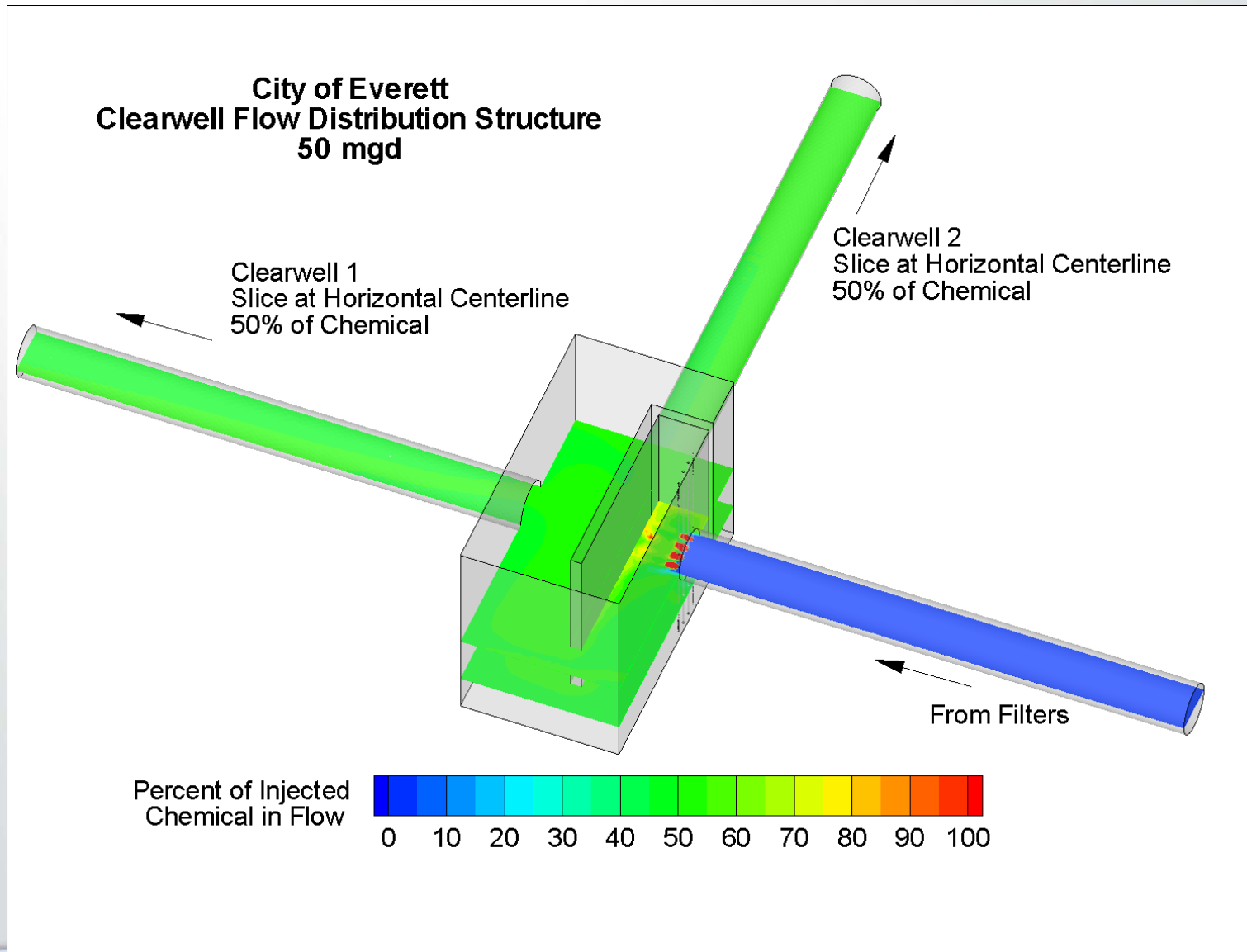
Second Influent, Diffuser



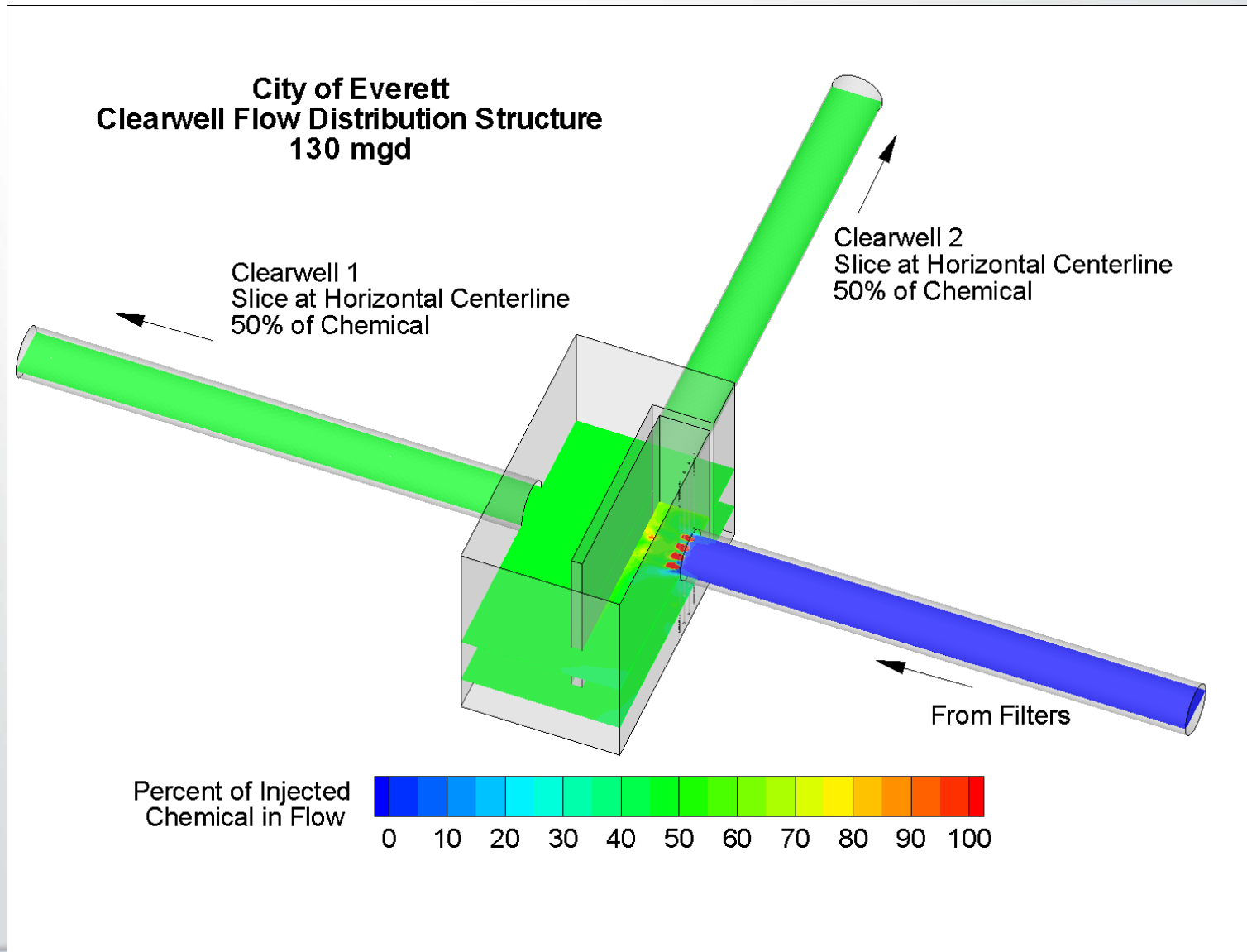
Flow Path



Final Baffle, Low Flow

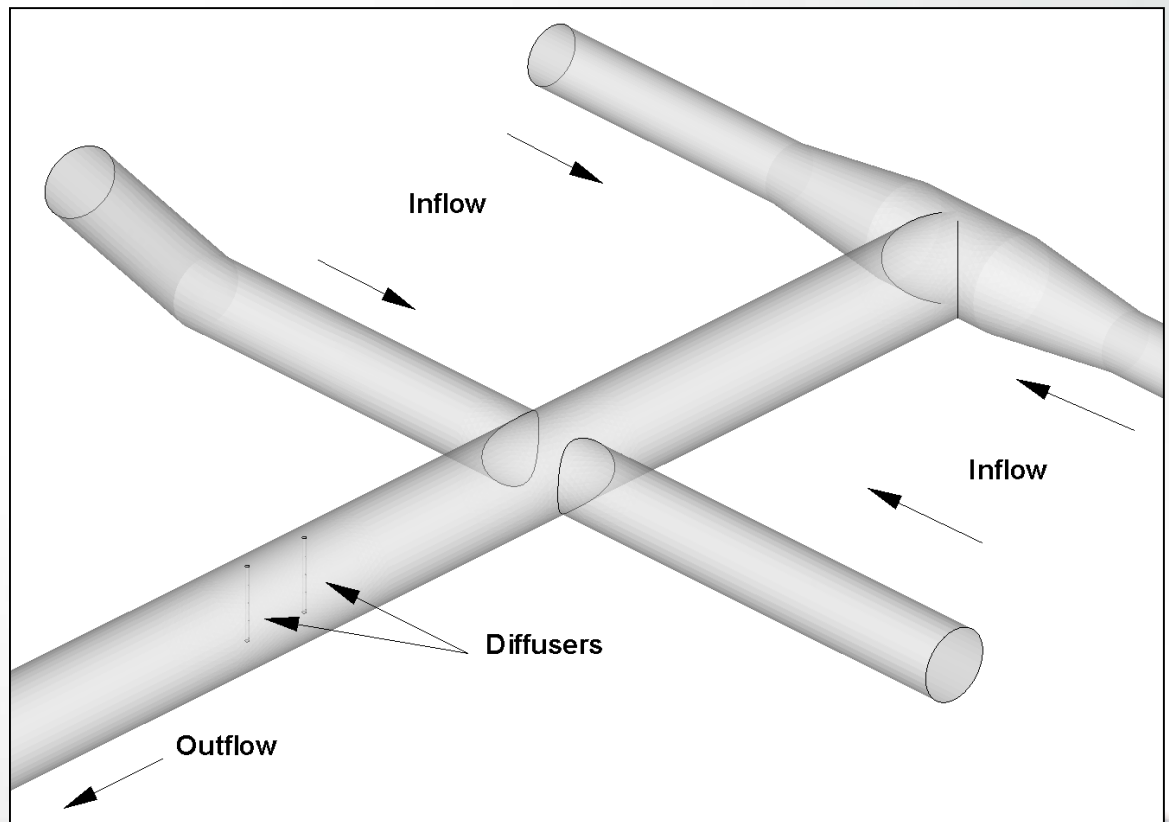


Final Baffle, High Flow

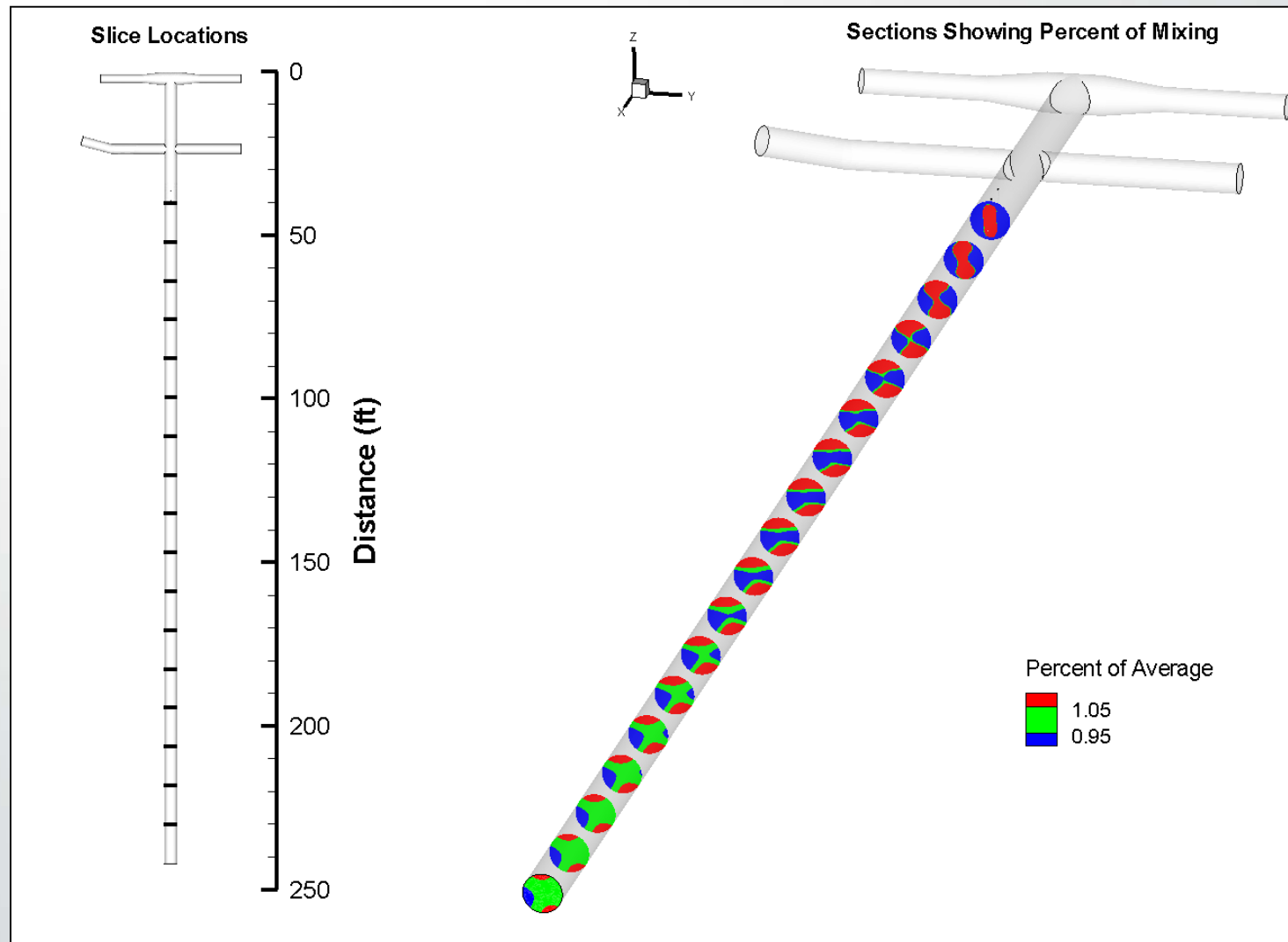


Combing Flows and Chemical Injection

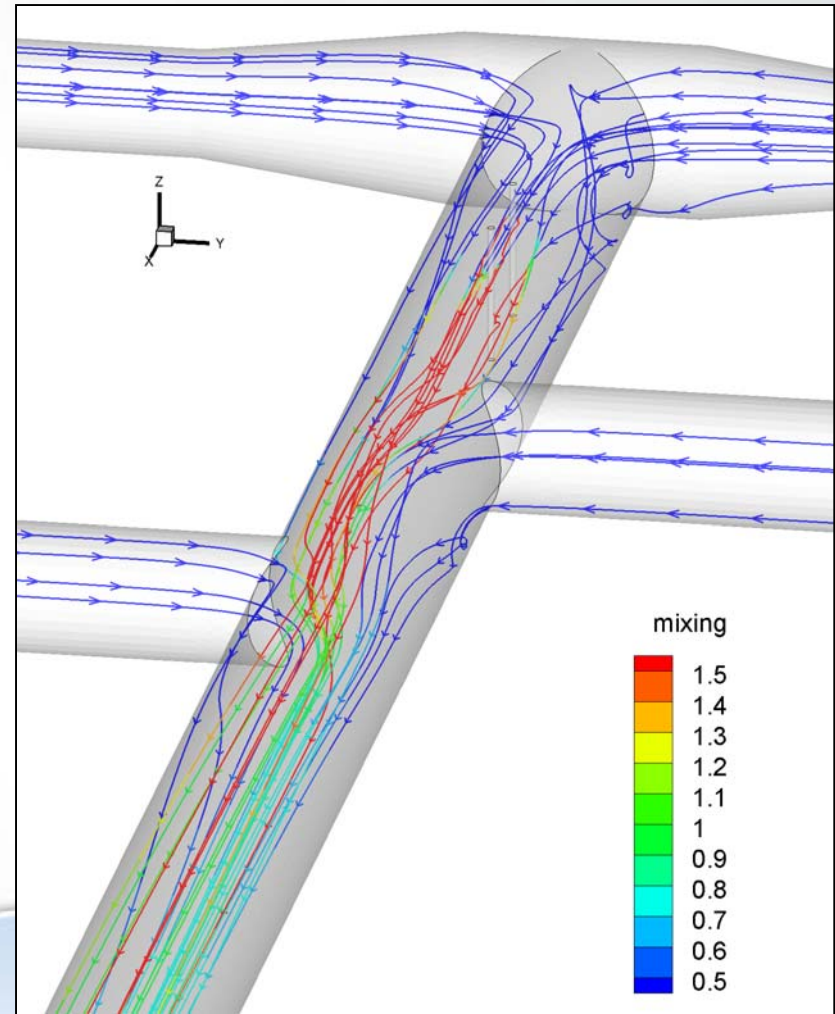
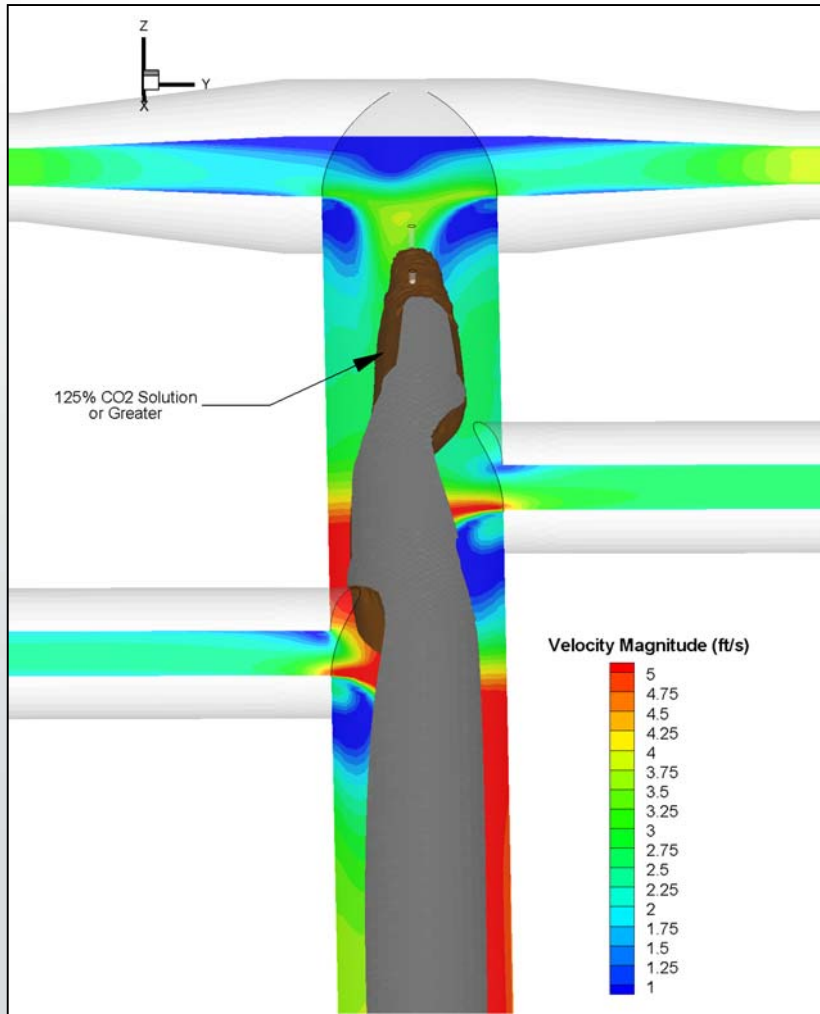
1. Four Pipes Combined
2. CO₂ Addition
3. How Long Until Mixed?



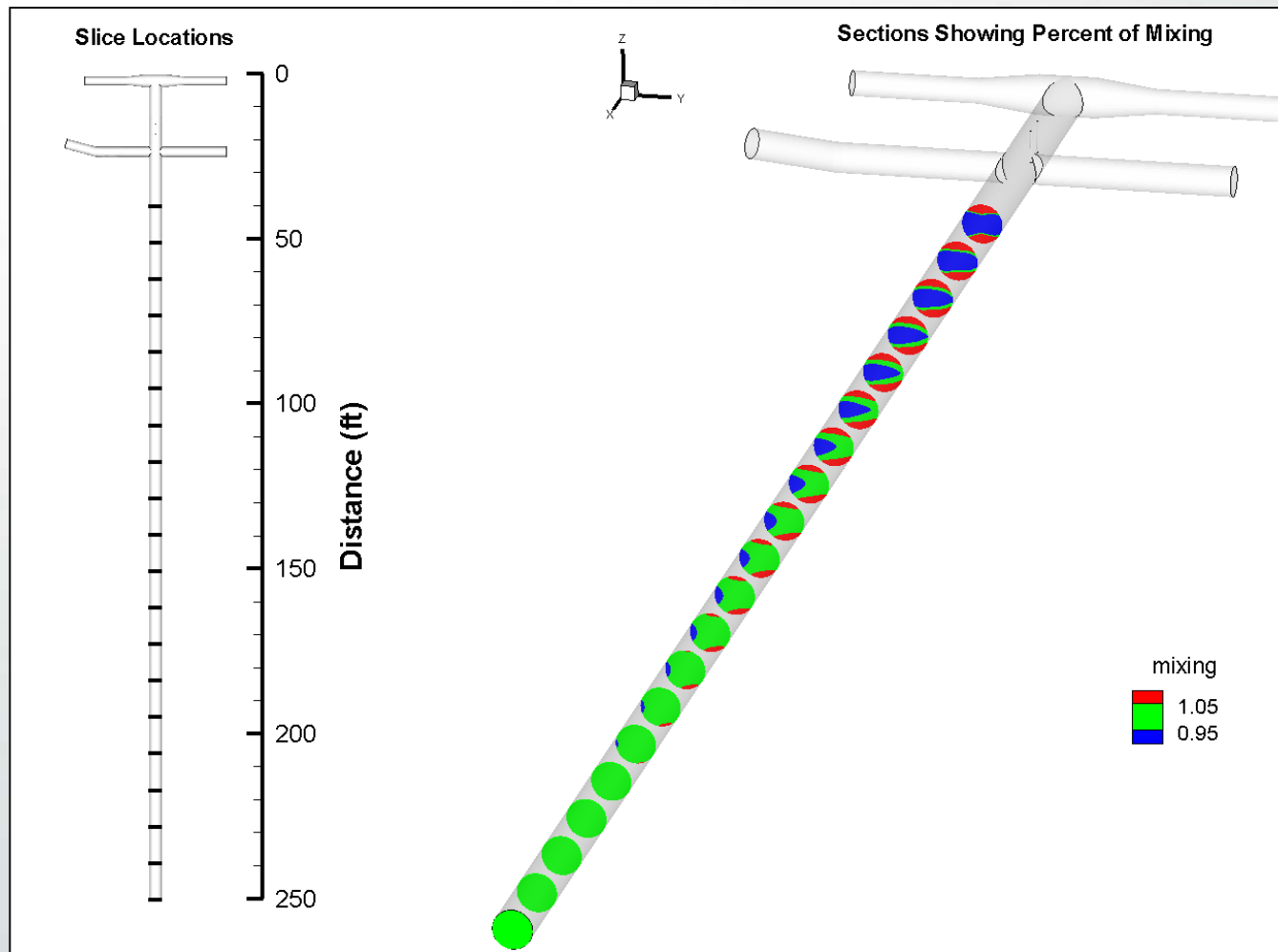
Initial Mixing



Mixing Limited By Configuration



Final Arrangement Reduced Mixing Length by 20%



CFD Summary

1. CFD Modeling is a Useful and Practical Tool for Complex Flow Mixing Problems
 - a. Test design prior to construction
 - b. Rapid design iteration
 - c. Model on shelf for later use